STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
HORACE R. COLLINS, Chief

BULLETIN 62
PART 3
(OF 4 PARTS)

PLEISTOCENE MOLLUSCA OF OHIO

by

Aurèle La Rocque

COLUMBUS
1968

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Chapter 7 will appear as part 4 of Bulletin 62 and will cover the detailed classification and description of the terrestrial Gastropoda. Part 4 will also include references and index.

Printed and Bound By
Columbus Blank Book Co.
Columbus, Ohio — 1968

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Chapter 6

FRESHWATER GASTROPODA

Class GASTROPODA

This is a class of Mollusca with distinct head, soled or more or less finlike foot, and undivided mantle, which secretes a simple spirally wound or saucer-shaped external shell, reduced in some land genera to an internal or partly internal slightly curved oval plate or, in still others, to a few granules within the mantle. The shell, when present, covers the intestinal sac and lung cavity, and the animal in most cases can withdraw completely into the shell. Body and shell are united by muscular attachment; in spiral shells the muscle is fastened to the columella, but in bowl-shaped forms to the inner surface of the shell.

The mouth is armed with a chitinous plate or plates, the jaw, which takes on a variety of shapes in various genera and families. Below the jaw, in the buccal sac, is the radula, a chitinous straplike organ which carries numerous rows of microscopic teeth placed in transverse or longitudinal rows. The jaw and radula are seldom preserved as fossils.

The vast majority of gastropods possess distinct organs of respiration called gills or lungs. The gills are lamellar or tuftlike, sometimes branched or feathered lobes of the integument, placed in the gill cavity below the mantle or, more rarely, projecting freely on the back or at the sides. In air-breathing snails, the gills are replaced by a saclike cavity covered with a network of blood vessels. Some groups possess both lungs and gills. The lung cavity opens outward through the breathing pore, which the animal can open or close at will.

Some gastropods have a horny (rarely calcareous) operculum attached to the foot. The operculum effectively closes the aperture when the snail has withdrawn into its shell and may be spiral, subspiral, or concentric, starting from a nucleus which is central or marginal in position. In the air-breathing freshwater snails there is no operculum. This structure is rarely preserved as a fossil.

The sexes in the gastropods may be separated or united in one individual. In some groups the eggs are laid singly, in others in clusters enclosed in a gelatinous mass; in still others, the eggs are developed within the body of the parent and the young are hatched and develop within that cavity, to emerge fully formed except for the growth of the postnuclear whorls.

These peculiarities of organization and habits strongly influence the capacity for dispersal of the respective groups and must be taken into account in the interpretation of fossil assemblages.

Subclass STREPTONEURA Spengel

These are gastropods in which the visceral commissures are crossed, producing an eight-shaped loop; sexes separate; heart behind the gill; a shell developed in almost all cases, and with few exceptions provided with an operculum.

The genera belonging to this subclass in the Ohio Pleistocene fauna all have a shell and an operculum.

Order CTENOBRANCHIATA Schweigger

Ctenobranchiata have the right cervical gill pectinate, very large, and generally transposed to the left side, owing to torsion of the body; the left gill atrophied; heart with but one auricle; radula small, variously constructed, but generally armed with few teeth, in a transverse series; shell coiled in a more or less elevated spiral, rarely cup- or cap-shaped.

Assignment of the Ohio genera included in this order must be made indirectly, by identification with living animals, for the characteristics of the order are not preserved in fossil material.

Suborder PLATYPODA Lamarck

Members of this suborder have the foot normally broad and flat, never finlike or winglike.

Superfamily TAENIOGLOSSA Bouvier

Teeth of the radula are seven, in a transverse row. These forms are mainly holostomate, but some genera have deeply notched apertures, as in the higher divisions.

These characteristics, except for the character of the aperture, are not visible in fossil specimens, but secondary characteristics, which identify the latter to genus and species, and comparison with living forms place all the families of Ohio operculates in this superfamily.

The classification followed in this superfamily is that of F. C. Baker (1928a, pt. I, p. xix), except for the family Amnicolidae, for which the classification of Berry (1943, p. 21) has been adopted, including the assignment of the genus *Pomatiopsis* to a separate family.

The Ohio forms of this superfamily are assigned to five families, the Valvatidae, Viviparidae, Amnicolidae, Pomatiopsidae, and Pleuroceridae.

Family VALVATIDAE Gray

Members of this family are small taenioglossates with an external gill; foot short, wide, rounded behind and distinctly bilobed in front; tentacles long, slender, cylindrical, the eyes sessile at their internal base; rostrum long, cylindrical, capable of considerable extension; gills external, the left featherlike and extended over the back and shell during locomotion, the right rudimentary and not featherlike.

Only one genus, *Valvata,* of the North American fauna belongs to this family; it is represented in Ohio by several species.

Genus *Valvata* Müller 1774

Valvata Mueller 1774, Verm. Terr. et Fluv. Hist., p. 198 (*fide* Neave).
Valvata Walker 1918, Synopsis and cat. fresh-water Moll., p. 27.
Valvata F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 7.
Valvata Henderson 1935, Fossil non-marine Moll., p. 189.

Type.—*Valvata cristata* Müller.

Diagnosis.—Shell small, spiral, dextral, turbinate, or subdiscoidal; whorls rounded or carinated; aperture entire, circular; lip simple, sharp; operculum orbicular, multispiral, whorls with a thin elevated edge (Walker, 1918).

Remarks.—This is a very old genus, with authentic records dating back at least to the Cretaceous (Henderson, 1935, p. 189). The genus is widespread in the fresh waters of the world at the present time. The type species is European and has not so far been found in North America where many other species occur, both in the Pacific and Atlantic drainages. To the north, in the Arctic drainage, species are fewer but individuals are abundant in ponds, lakes, and rivers.

In North America, the record of post-Wisconsin migration is somewhat obscured by introductions, both of European species through commerce and of native species through canals and inadvertent transportation.

Speciation.—At the present time, the genus is represented by more than twelve species distributed over the North American continent as follows. For each species, a key reference is given.

First, a western group, including *V. mergella* Westerlund (La Rocque, 1953, p. 263), *V. virens* Tryon (*ibid.*, p. 265), *V. humeralis* Say (W. G. Binney, 1865, p. 14), *V. humeralis californica* Pilsbry (Walker, 1918, p. 130), *V. utahensis* Call (*ibid.*, p. 132), and *V. utahensis horatii* Baily and Baily (1951, p. 50).

Second, a group living mainly east of the Rockies: *V. bicarinata* Lea (La Rocque, 1953, p. 262), *V. lewisi* Currier (*ibid.*, p. 263), *V. perdepressa* Walker (*ibid.*), *V. sincera* Say (*ibid.*, p. 264), *V. tricarinata* Say (*ibid.*), and *V. winnebagonensis* F. C. Baker (*ibid.*, p. 265).

Third, there is also an introduced group: *V. piscinalis* Müller (La Rocque, 1953, p. 264) and *V. obtusa* Draparnaud (Walker, 1918, p. 131).

Fossil species of this genus are numerous (see Henderson, 1935, p. 189 ff.) and date back at least to the Cretaceous, perhaps to the Jurassic (*V. scabrida* Meek and Hayden).

Several of the living species occur in Pleistocene deposits and some of them (*e.g.*, *V. humeralis* vars., and *V. virens* var.) occur also in Pliocene deposits (see Henderson, 1935, p. 189, 192).

Valvata bicarinata Lea 1841
Fig. 209

Valvata bicarinata Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 81, 83.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 399.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 130.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 18, pl. 1, fig. 6.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 298.
Valvata bicarinata bicarinata La Rocque 1953, Cat. Recent Moll. Canada, p. 262.

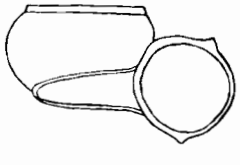


FIGURE 209.—*Valvata bicarinata,* magnified; after Walker (1906, Naut. 20, pl. 1, fig. 14).

Type locality.—Schuylkill River, Pennsylvania.

Diagnosis.—"Discoidal, flattened above, rather thick, shining; horn-colored or tinged with green; whorls

3½, shouldered, upper surface sloping downward from the carina to the suture, which is deeply impressed; spire greatly depressed, not rising above the carina of the body whorl when viewed from in front; lines of growth faintly marked; body whorl bicarinate, superior carina revolving nearly to the apex, periphery rounded or bluntly angulate; carinae sharp, elevated; aperture nearly circular, slightly flattened above and modified by the carinae; lip simple, sharp, appressed to the lower half of the body whorl; umbilicus wide, exhibiting all the whorls. L. 3.5; W. 6.5 mm. (Walker)" (F. C. Baker, 1928a, pt. I, p. 18-19).

Ecology.—Baker found this species in Oneida Lake in shallow and deep (3-10 feet) water, on exposed shores and in bays, on sand or mud bottom, in vegetation.

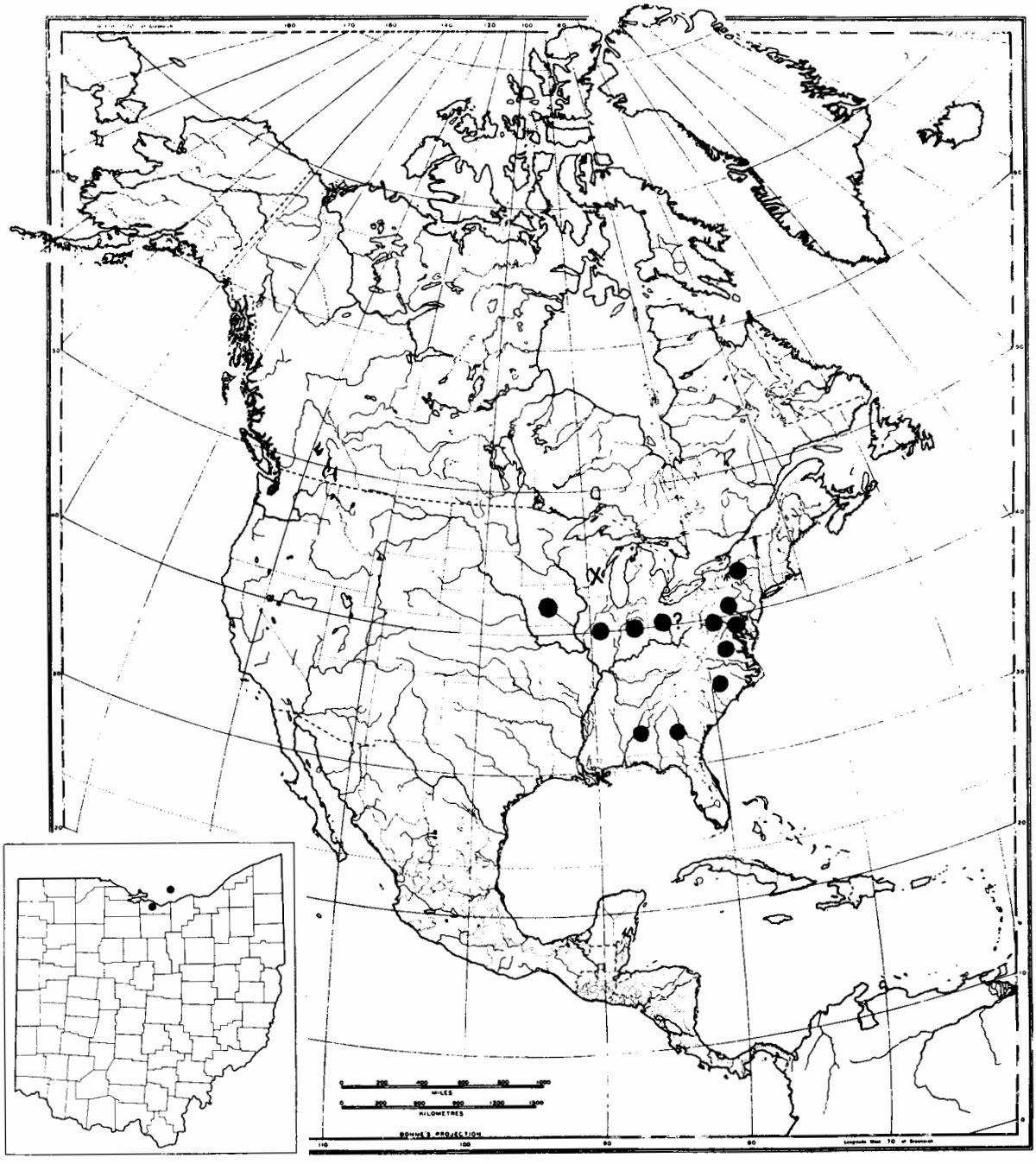


FIGURE 210.—Distribution of *Valvata bicarinata* in North America; *inset,* distribution in Ohio.

Associations.—Living: NEW YORK - 4b, 32, 37, 38, 43a.

General distribution (fig. 210).—Iowa east to New York and south to Alabama and Mississippi. The record for Wisconsin is erroneous and that for Ohio is doubtful.

Distribution in Ohio (inset, fig. 210).—Only one doubtful record for Lake Erie (Sterki, 1907a, p. 399).

Geologic range.—Baker (1920a, p. 386) gives Aftonian and "Wabash" (late Wisconsin). I have no other fossil record.

Valvata lewisi Currier 1868
Fig. 211

Valvata striata Lewis 1856, Acad. Nat. Sci. Philadelphia Proc. 1856, p. 269 (*non* Philippi, 1836).
Valvata lewisi Currier 1868, Kent Sci. Inst. Misc. Pub. no. 1, p. 9.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 123, fig. 94.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.
--- --- Johnson 1915, Fauna New England, p. 113.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 131.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 26, pl. 1, figs. 28-30.
--- --- Goodrich 1932, Moll. Mich., p. 77.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 298.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 83.
Valvata lewisi lewisi La Rocque 1953, Cat. Recent Moll. Canada, p. 263.

Type locality.—Little Lakes, New York.

Diagnosis.—"Turbinate, thin, shining; epidermis brownish, reddish-brown, or greenish-horn; whorls 3½, regularly convex, rapidly increasing in diameter, regularly striate, like the 'winding of thread on a spool;' sutures deeply impressed; spire depressed, apex flattened, nuclear whorl similar to that of *sincera,* spiral lines very fine, disappearing on second whorl; growth lines close together; aperture circular; lip simple, continuous, appressed to the body whorl above; umbilicus rather wide, deep, exhibiting interior whorls" (F. C. Baker, 1928a, pt. I, p. 27).

Ecology.—Baker (1928a, pt. I, p. 28) collected this species in shallow water, sand bottom, in vegetation, Prairie Lake; Lake Butte des Morts, 1 m., mud bottom, on plants. Apparently not found in as deep water as is *V. sincera.*

Associations.—Living: MANITOBA - 25; NEW YORK - 1; ONTARIO - 3, 5; WISCONSIN - 15, 69, 84, 85, 86, 93, 123. Fossil: N - 1; K - 1; Y - 8; W - 35, 53, 54, 55.

General distribution (fig. 212).—Mackenzie River south to the northern United States and east to the Atlantic. The variety *V. lewisi helicoidea* has been recorded for the Yukon Territory and British Columbia.

Distribution in Ohio (inset, fig. 212).—The only record known to me is Sterki's (1907a, p. 387) for Springfield Lake, Summit County.

Geologic range.—Baker (1920a) gives Yarmouth and "Wabash"(?). A. B. Leonard (1950, p. 11) gives "Yarmouth to Recent" and (1952, p. 8) the Sappa silts (late Kansan and early Yarmouthian) in the midcontinent region. Sheatsley (1960, p. 60) cites the species for the Aultman deposit in Ohio.

Remarks.—In my Catalogue (La Rocque, 1953, p. 263) I listed three subspecies or forms in addition to the type form. *V. lewisi helicoidea* Dall is distinguished by subdued, almost absent, sculpture; *V. lewisi mccolli* La Rocque and *V. lewisi ontariensis* F. C. Baker are characterized by uncoiling of the last whorl. All three forms may be expected in Ohio, either living or as Pleistocene fossils, but not much importance is attached to their differentiation as separate forms.

Valvata perdepressa Walker 1906
Fig. 213

Valvata bicarinata perdepressa Walker 1906, Nautilus, v. 20, p. 30, pl. 1, figs. 15-16.
Valvata bicarinata depressa Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.
--- --- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 130.
Valvata bicarinata perdepressa F. C. Baker 1920, Life of Pleistocene, p. 386.
--- --- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 21, pl. 1, figs. 15-18.
--- --- --- Goodrich 1932, Moll. Mich., p. 76.
--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 298.
--- --- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 82, pl. 10, figs. 6, 7.
Valvata perdepressa perdepressa La Rocque 1953, Cat. Recent Moll. Canada, p. 263.

Type locality.—Lake Michigan at Michigan City, Indiana.

Diagnosis.—" 'Broadly umbilicated, very much depressed, often planorboid. Ecarinate. Whorls regularly rounded, occasionally subangulated around the umbilicus or at the periphery, smooth or obsoletely striate, frequently obscurely malleated, especially on the lower half of the whorl, very pale horn colored or with the apical whorls more or less tinged with dull purple or red' (Walker). Nuclear whorls with the spiral and growth lines much finer than in *bicarinata* or *normalis*" (F. C. Baker, 1928a, pt. I, p. 21).

Ecology.—"Apparently a lake form and not recorded from other places" (Baker, 1928a, pt. I, p. 22).

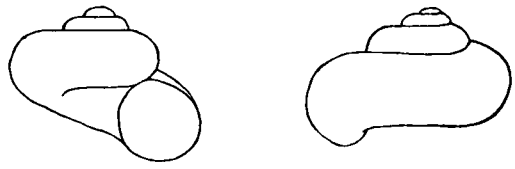


FIGURE 211.—*Valvata lewisi,* magnified; after Walker (1906, Naut. 20, pl. 1, figs. 12, 13).

General distribution (fig. 214).—Wisconsin east to New York; Lakes Michigan, Erie, and Ontario. Little Lakes, New York.

Distribution in Ohio (inset, fig. 214).—Sterki (1907a, p. 387) gives "Lake Erie at Sandusky and Vermilion (St.)." It is common in Lake Erie drift material from Sandusky and elsewhere.

Geologic range.—Baker (1920a, p. 386) lists it for

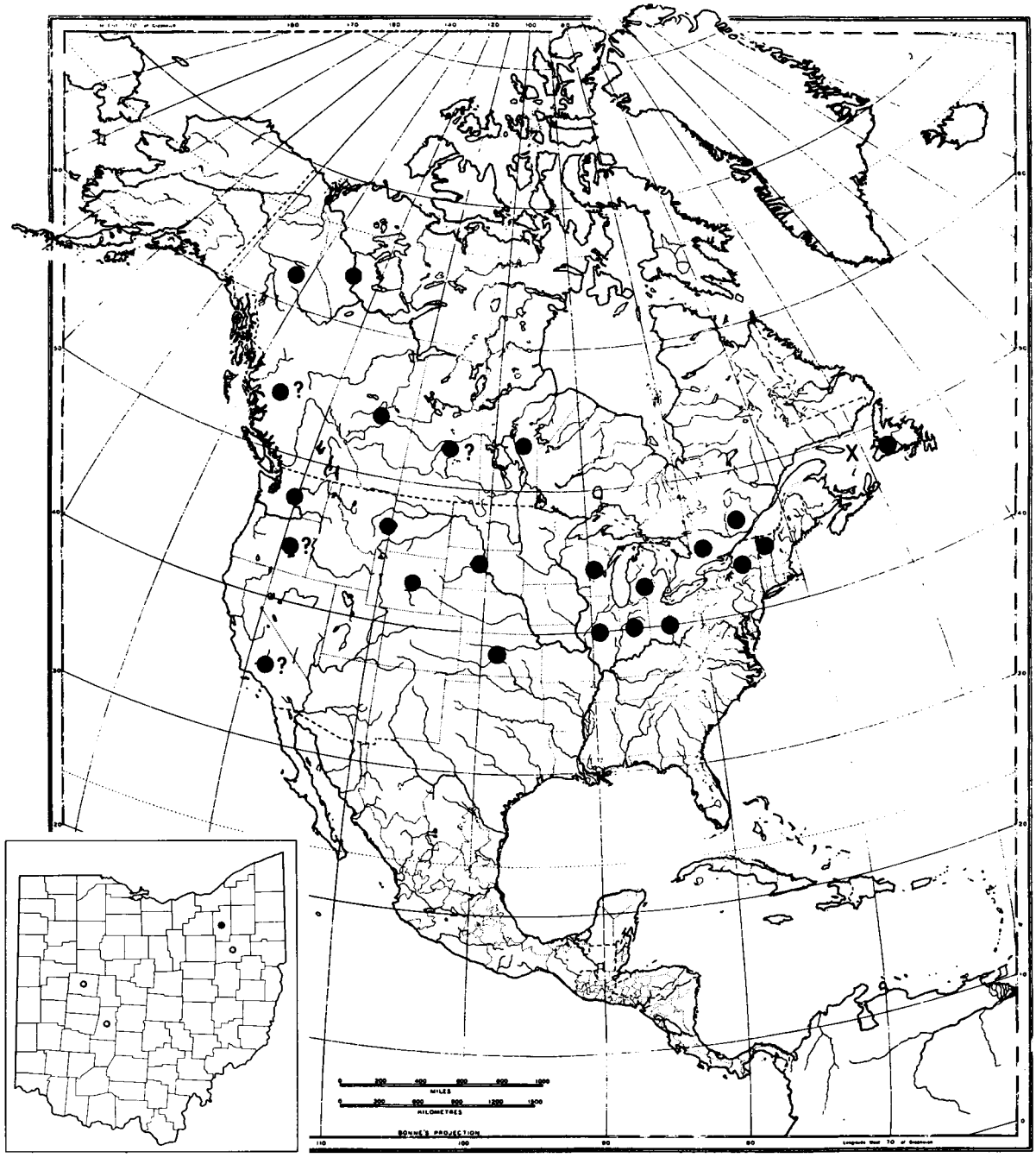


FIGURE 212.—Distribution of *Valvata lewisi* in North America; *inset,* distribution in Ohio.

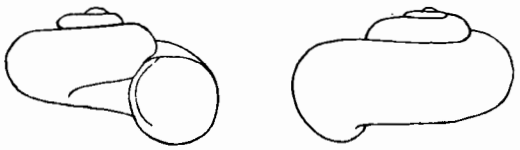


FIGURE 213.–*Valvata perdepressa,* magnified; after Walker (1906, Naut. 20, pl. 1, figs. 15, 16).

Sangamon only. Pleistocene of Illinois, in the Chicago region; to be expected in the Pleistocene deposits around Lake Erie in Ohio.

Remarks.–Baker (1930c, p. 188) makes a good case for considering this a distinct species, with *V. p. walkeri* as a variety. The assignment of this species to *V. bicarinata* does not seem valid.

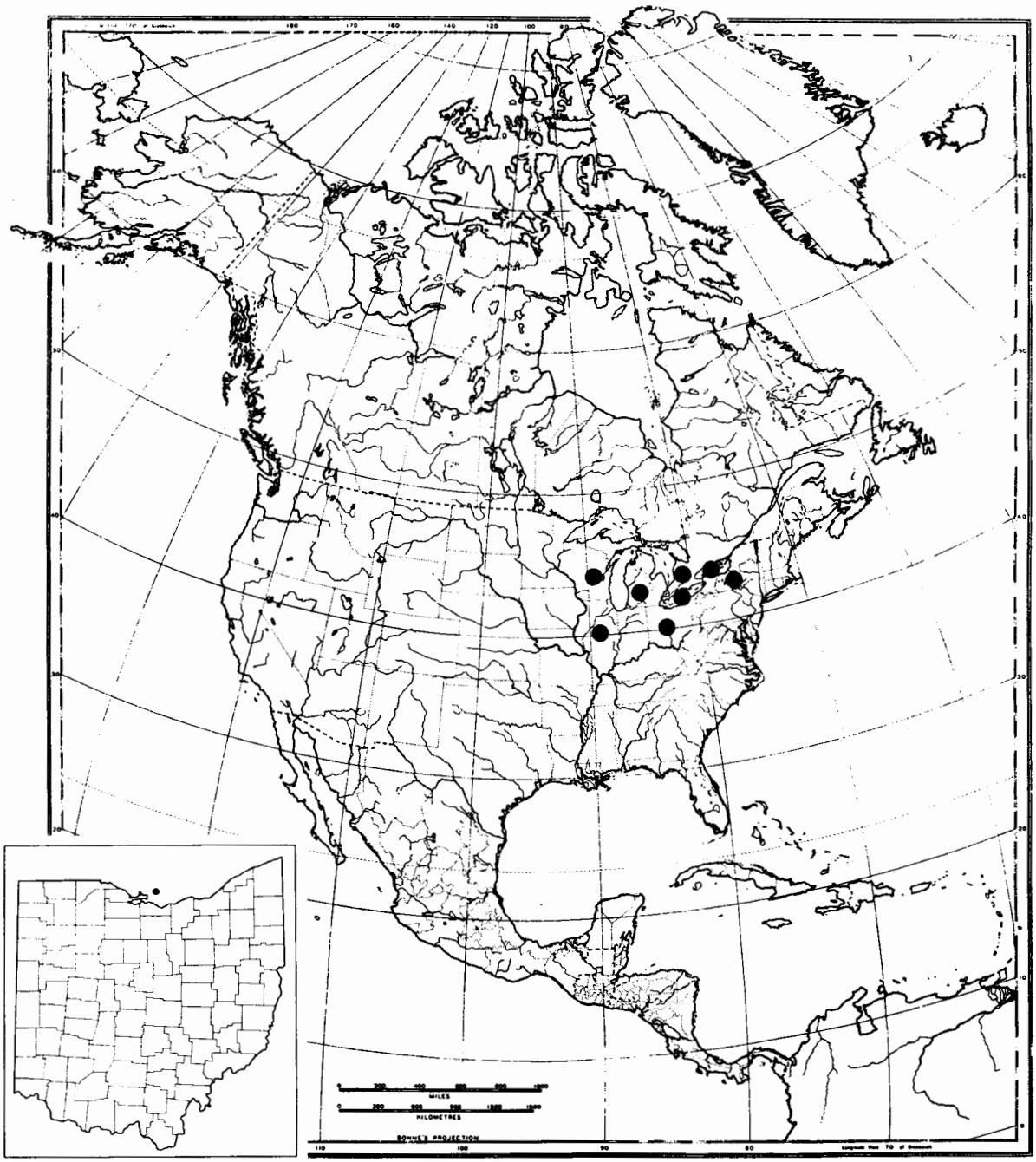


FIGURE 214.–Distribution of *Valvata perdepressa* in North America; *inset,* distribution in Ohio.

Valvata perdepressa walkeri F. C. Baker 1930
Fig. 215

Valvata perdepressa walkeri F. C. Baker 1930, Ill. Acad. Sci. Trans., v. 22, p. 188, fig. 1.
Valvata bicarinata perdepressa walkeri Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 83.
Valvata perdepressa walkeri La Rocque 1953, Cat. Recent Moll. Canada, p. 264.

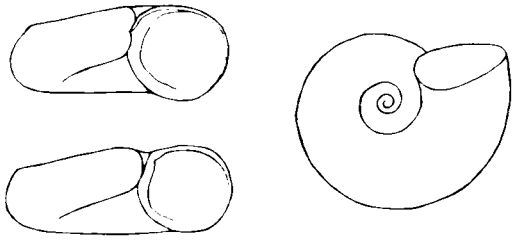


FIGURE 215.—*Valvata perdepressa walkeri,* magnified; after F. C. Baker (1930c, p. 190).

Type locality.—Lake Michigan, at the foot of Division Street, Chicago, Illinois.

Diagnosis.—Shell flattened, planorboid, spire commonly depressed below the level of the body whorl; central tooth of radula 65 μ wide, with radular formula 11-1-11.

Ecology.—A Great Lakes form, probably modified to withstand the buffeting of wave action in the Great Lakes.

General distribution (fig. 216).—Pleistocene and Recent, southern part of Lake Michigan. Lake Erie and probably all the Great Lakes.

Distribution in Ohio.—Known at present only for Lake Erie.

Geologic range.—Pleistocene of Illinois, vicinity of Chicago; to be expected in the Pleistocene deposits around Lake Erie in Ohio.

Valvata piscinalis (Müller) 1774
Fig. 217

Nerita piscinalis Müller 1774, Verm. Terr. et Fluv. Hist., p. 172.
Valvata obtusa F. C. Baker 1898, St. Louis Acad. Sci. Trans., v. 8, p. 94.
Valvata piscinalis Latchford 1914, Nautilus, v. 28, p. 10.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 131.
?"*Valvata obtusa Drap.*" F. C. Baker 1920, Life of Pleistocene, p. 386.
Valvata piscinalis Ellis 1926, British snails, p. 87.
--- --- Germain 1931, Faune de France, no. 22, p. 669.
--- --- Oughton 1938, Nautilus, v. 52, p. 30-32, 60-62.
--- --- Robertson 1945, Nautilus, v. 59, p. 36.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 83, pl. 10, fig. 17.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 264.

Type locality.—Europe.

Diagnosis.—Similar to *Valvata sincera* but with a much higher spire and a very small umbilicus; in appearance, resembles a large *Amnicola;* aperture circular in outline and entire.

Ecology.—Thrives in protected sites in Lake Ontario as it does in its European haunts; near Toronto it is especially abundant in the lee of breakwaters (Oughton, 1938, p. 60).

General distribution (fig. 218).—Europe. Introduced: Cornwall, Toronto, Port Weller, Port Dalhousie, and Niagara-on-the-Lake, Ontario; Lake Erie, Erie County, and Lake Ontario, Monroe County, New York.

Distribution in Ohio.—This introduced species has apparently not reached Ohio as yet. It is established in the eastern end of Lake Erie and its spread to other parts of this lake appears to be only a matter of time. Dennis (1928) and Ahlstrom (1930) did not note it for the Bass Islands region, Goodrich (1932) did not include it in the Michigan list, and in Ontario the records are all for the eastern end of the lake. Recent collecting in Sandusky Bay, although based on large collections of drift shells, did not turn it up.

Geologic range.—In North America, none, unless F. C. Baker's (1920a, p. 386) record is really this species, which seems very doubtful.

Remarks.—This species should be watched for in Lake Erie but chances of finding it in Pleistocene deposits are practically nonexistent.

Valvata sincera Say 1824
Fig. 219

Valvata sincera Say 1824, Rept. Long's Exped., v. 2, p. 264, pl. 15, fig. 11.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 122.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.
--- --- Johnson 1915, Fauna New England, p. 113.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 23, pl. 1, figs. 19-22.
--- --- Goodrich 1932, Moll. Mich., p. 76.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 298.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 83, pl. 10, figs. 12, 13.
Valvata sincera sincera La Rocque 1953, Cat. Recent Moll. Canada, p. 264.

Type locality.—"Northwest Territory" (Say).

Diagnosis.—Shell nearly as high as it is wide, without any carinae, usually black when found in nature; whorls 4, covered with fine regularly spaced crowded riblets; these are crossed in early whorls by minute revolving lines; aperture round; outer lip thin; umbilicus open; H. 4.25, W. 4.75 mm. (modified from Goodrich, 1932, p. 76).

Ecology.—A lake species, found in deep water in Lake Michigan and Lake Superior. It has also been found in cold shaded brooks.

Associations.—Living: WISCONSIN-98 (var. *ny-*

FIGURE 216.—Distribution of *Valvata perdepressa walkeri* in North America.

FIGURE 217.—*Valvata piscinalis*, X3; after Locard (1893, p. 123, fig. 125).

landeri). Fossil: W-27, 29, 33, 34, 72.

General distribution (fig. 220).—The type form ranges from Newfoundland, Quebec, and Maine west to western Ontario and Manitoba, south to southern Michigan and northern New York. Variety *danielsi* Walker has been found living in Minnesota and as a Pleisto-

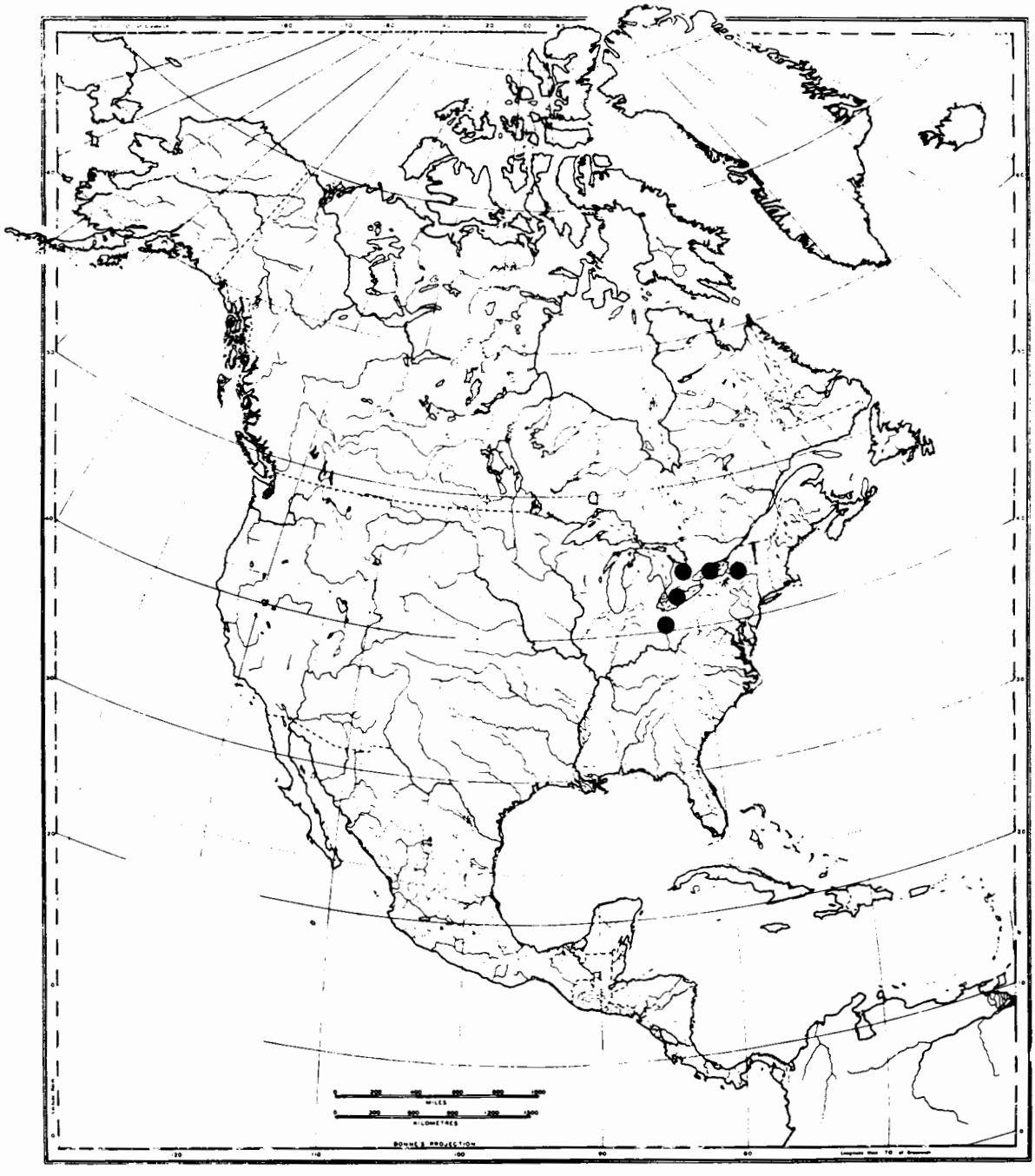


FIGURE 218.—Distribution of *Valvata piscinalis* in North America.

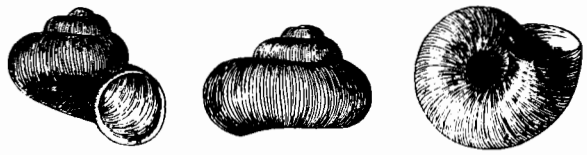


FIGURE 219.–*Valvata sincera,* magnified; after Walker (1906, Naut. 20, pl. 1, figs. 4-6).

cene fossil in Wisconsin and Illinois; variety *nylanderi* occurs living in Maine, Ontario, Michigan, New York, and Wisconsin.

Distribution in Ohio (inset, fig. 220).–Sterki (1907a, p. 387) gives merely "Ohio."

Geologic range.–F. C. Baker (1920a, p. 386) gave Yarmouth(?), Sangamon, and "Wabash." This species, especially variety *danielsi,* is found in many Pleisto-

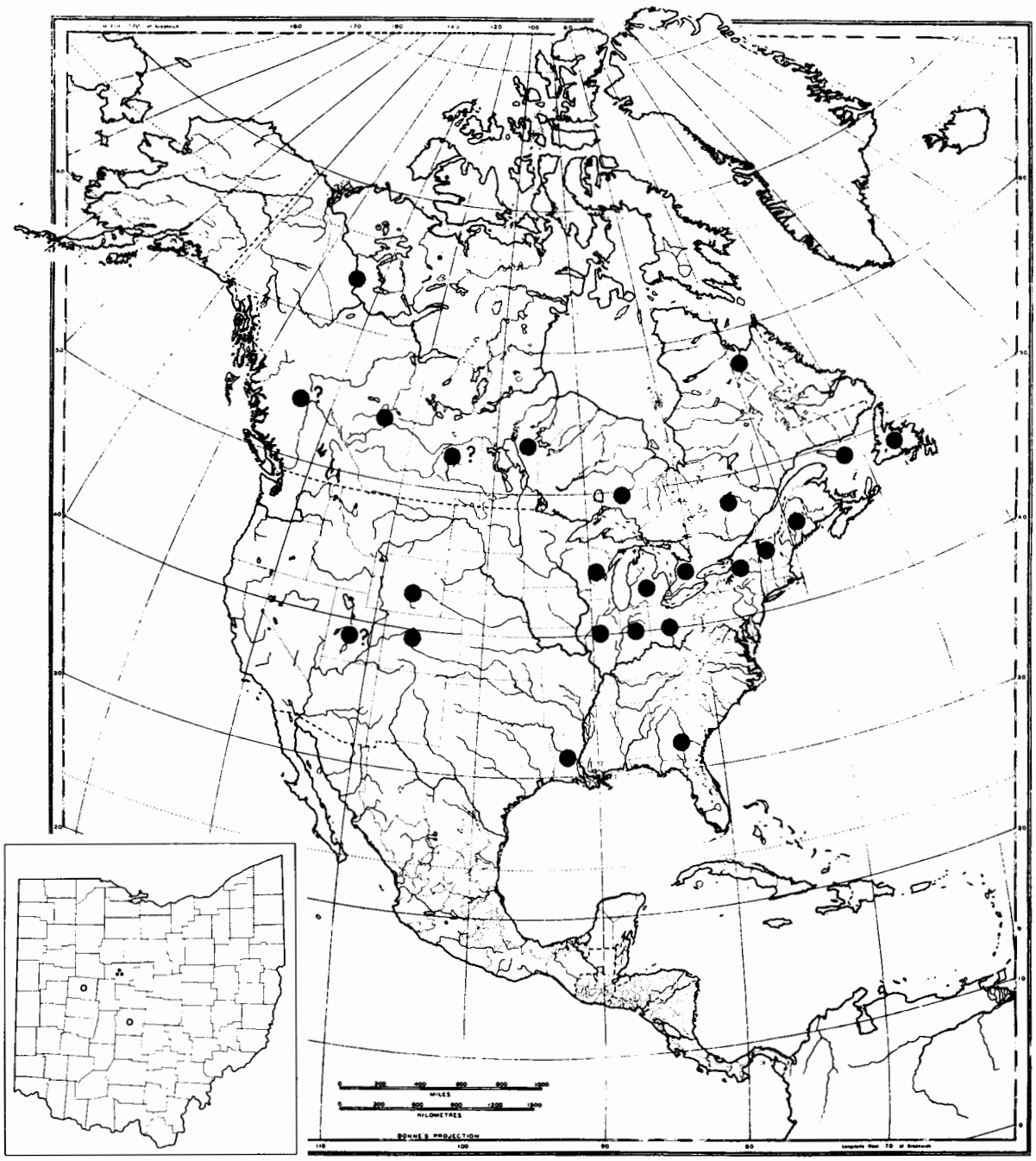


FIGURE 220.–Distribution of *Valvata sincera* in North America; *inset,* distribution in Ohio.

cene deposits. Zimmerman (1960, p. 20) has identified it from the Newell Lake deposit and Aukeman (1960, p. 48) from the Oakhurst deposit, both in Ohio.

Remarks.—This species is easily confused with *V. lewisi* and its varieties. Walker (1906, Naut. 20, p. 26) was the first to state the differences between the two in clear and unmistakable terms with adequate figures. The characteristics are incorporated in Baker's (1928a, pt. I, p. 10) key and should be studied carefully before a specimen is identified. In brief, *V. sincera* has an elevated spire, accurately and regularly rounded whorls, and a narrow and deep umbilicus, whereas *V. lewisi* has a depressed spire, rapidly enlarging whorls, and a wide and shallow umbilicus.

Valvata tricarinata (Say) 1817
Pl. 9, figs. 14, 15

Cyclostoma tricarinata Say 1817, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 13.
Valvata tricarinata Call 1900, Moll. Ind., p. 417, pl. 8, fig. 17.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 121, fig. 93.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.
Valvata tricarinata simplex Sterki 1907, *ibid.*
Valvata tricarinata Johnson 1915, Fauna New England, p. 112.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 132.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 11, pl. 1, figs. 1-3.
Valvatia tricarinata Dennis 1928, Aquatic gastr. Bass Is. region, p. 4.
Valvata tricarinata Goodrich 1932, Moll. Mich., p. 75.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 297.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 81, pl. 10, figs. 1, 2.
Valvata tricarinata tricarinata La Rocque 1953, Cat. Recent Moll. Canada, p. 264.
Valvata tricarinata La Rocque 1956, Nautilus, v. 70, p. 13-14.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 48.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 79.

Type locality.—Delaware River.

Diagnosis.—Shell small, about two and a half times as broad as long, of a golden yellow color; whorls 3½, with three sharp carinae, one at the top, one in the center, and one on the base; any one or all of these carinae may be obsolete in some or all of the postnuclear whorls but their position is generally indicated by a spiral angulation on the whorl; suture channelled; umbilicus open; aperture round, entire; operculum spiral; H. 2.5, W. 4.5 mm. (modified from Goodrich, 1932, p. 75).

Ecology.—Found in shallow water to depths exceeding 9 m.; in lakes and streams, with or without vegetation; on sand, sand and gravel, rock, clay, and mud bottom.

Associations.—Living: MANITOBA - 12, 23, 32, 33; MINNESOTA - 9, 10, 11b, 13b, 14a, 15, 16, 17, 18; NEW YORK - 3b, 21; OHIO - 20, 29, 43; ONTARIO - 9; QUEBEC - 8; WISCONSIN - 15, 51, 59, 75, 79, 86, 89, 97, 98, 123, 124, 128. Fossil: N - 1, 2; K - 1, 2, 4, 7; Y - 1, 7, 8, 11, 16; S - 1, 6; W - 27, 29, 30, 31, 32, 33, 34, 36, 37, 38, 39, 40, 41, 42, 45, 46, 47, 48, 49, 50, 51, 54, 55, 72.

General distribution (fig. 221).—Great Slave Lake and the Mackenzie River south and east to New England and Virginia.

Distribution in Ohio (inset, fig. 221).—Sterki (1907a, p. 387) gives "Over the state, common in all kinds of waters." Detailed distribution of the species is imperfectly known but there is no doubt of its widespread occurrence in the State both as a living form and as a Pleistocene fossil.

Geologic range.—A. B. Leonard (1950, p. 11) gives its distribution as "Yarmouth to Recent." F. C. Baker (1920a, p. 386) gave "Preglacial," Aftonian, Yarmouth, Sangamon, and "Wabash" for the typical form; he listed the varieties for "Wabash" only. It has been found in the following Ohio deposits: Humboldt (Reynolds, 1959, p. 155), Newell Lake (Zimmerman, 1960, p. 20), Jewell Hill (Mowery, 1961, p. 8), Souder Lake (Cornejo, 1961, fig. 11), Oakhurst (Aukeman, 1960, p. 52), and Aultman (Sheatsley, 1960, p. 62).

Variation.—I have elsewhere pointed out (La Rocque, 1956) that the presence or absence of carinae in this species is extremely variable, not only from one individual to another but also on the shell of the same individual. There may be some advantage in recognizing the pattern of carination in populations of this species but it is doubtful that these variations should be accorded varietal or subspecific rank. In the past, the pattern has been indicated by seven trinomials (see La Rocque, 1953, p. 264-265) whose value is far from established. I have suggested (La Rocque, 1956) a method of indicating carination pattern similar to that used for banding pattern in land snails and have used it to advantage in Pleistocene studies. The two systems are compared in the following list:

Present method (varieties or mutations)	Proposed method
Valvata tricarinata tricarinata (Say)	*Valvata tricarinata* (Say) 111
V. tricarinata perconfusa Walker	*V. tricarinata* (Say) 101
V. tricarinata mediocarinata F. C. Baker	*V. tricarinata* (Say) 010
V. tricarinata basalis Vanatta	*V. tricarinata* (Say) 110
V. tricarinata infracarinata Vanatta	*V. tricarinata* (Say) 001
V. tricarinata unicarinata De Kay	*V. tricarinata* (Say) 100
V. tricarinata simplex Gould	*V. tricarinata* (Say) 000

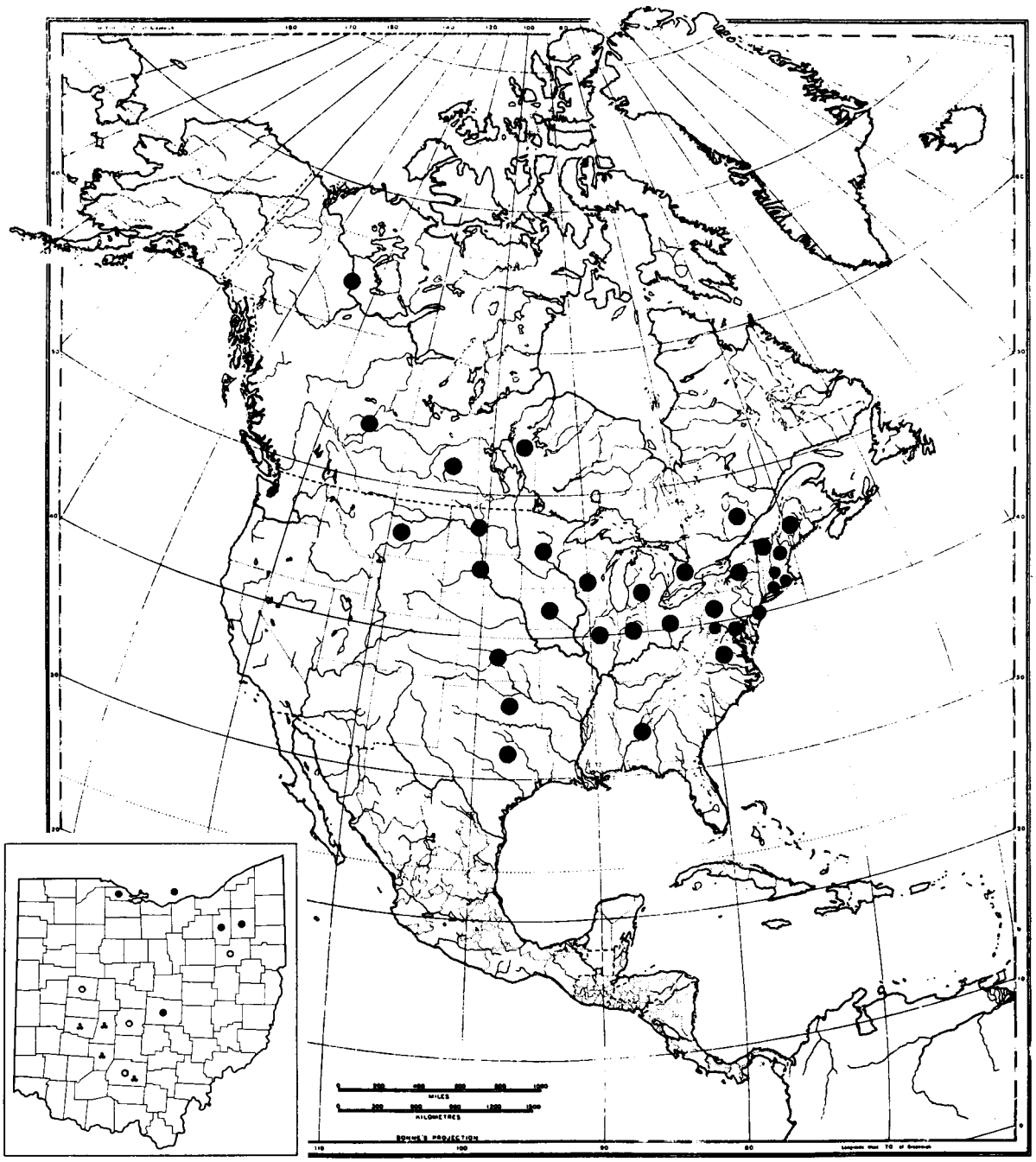


FIGURE 221.—Distribution of *Valvata tricarinata* in North America; *inset*, distribution in Ohio.

Family VIVIPARIDAE (Gray 1857) Gill 1863

Shells of the Viviparidae are moderately large, turbinate, imperforate or subperforate; whorls convex, in many cases carinated; aperture entire, subcircular or somewhat angled above; lip simple; operculum convex, concentric, nucleus subcentral, spiral in one genus.

The Ohio fauna includes three genera distributed into two subfamilies, Viviparinae and Lioplacinae. The subfamilies are distinguished mainly on soft parts but the Pleistocene species are so close to the living ones that no difficulty is encountered in placing them in their proper genera and subfamilies.

The Viviparidae are an ancient group, with representatives certainly known in the Lower Cretaceous, perhaps even in the Jurassic. During Cretaceous and Tertiary time, they were a prominent element of the freshwater fauna in the western part of North America. The fossil record for eastern North America is not extensive but it is probable that representatives of the group lived in that part of the continent also. The majority of the American species are concentrated in the southeastern United States but a few hardy species range north of the glacial boundary and at least one species has penetrated into Canada. The family is also represented in the living fauna of North America by two, possibly more, introduced species from Asia.

Subfamily VIVIPARINAE (Gill 1871) F. C. Baker 1926

Shells of this subfamily are generally large with rounded or carinated whorls; operculum wholly concentric, the inner margin folded in some groups; foot not much larger than the shell, not extending beyond the end of the tentacles; cervical lappets large, forming tubular conduits for respiratory purposes, the right lappet the larger; radula with broad central tooth, the reflection broad and multicuspid, the center cusp usually wide and blunt; lateral and marginal teeth longer than wide, the reflections wide and multicuspid.

As will be seen by the above description, the subfamily is distinguished from the Lioplacinae mainly on the basis of the soft parts. It is represented by a single genus, *Viviparus*, in the Ohio fauna and by a very few others in the living fauna of North America. In Ohio, a single native species, *V. contectoides*, and one introduced species, *V. malleatus*, represent this subfamily.

Genus *Viviparus* Denys de Montfort 1810

Viviparus Montfort 1810, Conch. Syst., v. 2, p. 247 (*fide* Neave).
Vivipara Binney 1865, Land and fresh water shells N. America, pt. 3, p. 16.
Viviparus Walker 1918, Synopsis and cat. fresh-water Moll., p. 24.
Viviparus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 32.
Viviparus Goodrich 1942, Nautilus, v. 55, p. 82 ff. (American species).
Viviparus La Rocque 1953, Cat. Recent Moll. Canada, p. 265.

Type.—*Helix vivipara* Linnaeus.

Diagnosis.—Shell dextral, spiral, subconoidal; rather thin, smooth, imperforate or slightly umbilicate; light or olivaceous green, unicolored or banded with brown or tinged with purple; whorls convex, aperture entire, subcircular; lip simple, acute; columellar and parietal margins not usually thickened; operculum concentric, inner margin simple, not reflected.

Remarks.—If the fossil species (Henderson, 1935, p. 165 ff.) are correctly assigned, this is a very old genus, dating back at least to the early Cretaceous. It is almost worldwide in distribution although there is some argument as to the limits of the genus and several species formerly assigned to this genus have been removed to other genera. F. C. Baker (1920a, p. 386) has recorded *V. intertextus* (Say) and *V. subpurpureus* (Say) as fossils in beds of "Wabash" (late Wisconsin) age but so far no species of the genus *Viviparus* has been found in Pleistocene deposits in Ohio.

FIGURE 222.—*Viviparus contectoides*, X1; after Call (1900, pl. 9, figs. 13, 13a).

Viviparus contectoides Binney 1865
Fig. 222

Limnea vivipara Say 1817, Nicholson's Encycl., 1st ed., pl. 2, fig. 5.
Paludina vivipara Say 1830, Am. Conchology, pl. 10, outer fig.
Vivipara contectoides Binney 1865, Land and fresh water shells N. America, pt. 3, p. 23, figs. 41-44.
--- --- Call 1900, Moll. Ind., p. 418, pl. 9, figs. 13, 13a.
--- --- Sterki 1914, Ohio Naturalist, v. 14, p. 271; Sandusky Bay, one specimen, possibly an error for *V. malleatus*, which lives there now.
Viviparus contectoides Walker 1918, Synopsis and cat. fresh water Moll., p. 124.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 35, pl. 2, figs. 12-17.
--- --- Goodrich 1942, Nautilus, v. 55, p. 84 ff.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 295.
--- --- Robertson and Blakeslee 1948, Moll. Niag-

ara Frontier, p. 80, pl. 9, figs. 16, 17.
Viviparus contectoides La Rocque 1953, Cat. Recent Moll. Canada, p. 265.

Type locality.—Not specified by Say.

Diagnosis.—Shell of 5 to 6 whorls, ordinarily thin, deeply sutured, with four revolving bands which may be obsolete; umbilicus a mere chink or covered by columellar fold (condensed from Goodrich, 1942, p. 84).

Ecology.—"Found in both lakes and rivers on a mud bottom in shallow water. In Oneida Lake, N. Y., this species was collected from a mud bottom in water about 3 m. deep, and on a sand bottom in shallow water in protected situations" (F. C. Baker, 1928a, pt. I, p. 37).

Associations.—Living: NEW YORK - 3b, 42.

General distribution (fig. 223).—Eastern United

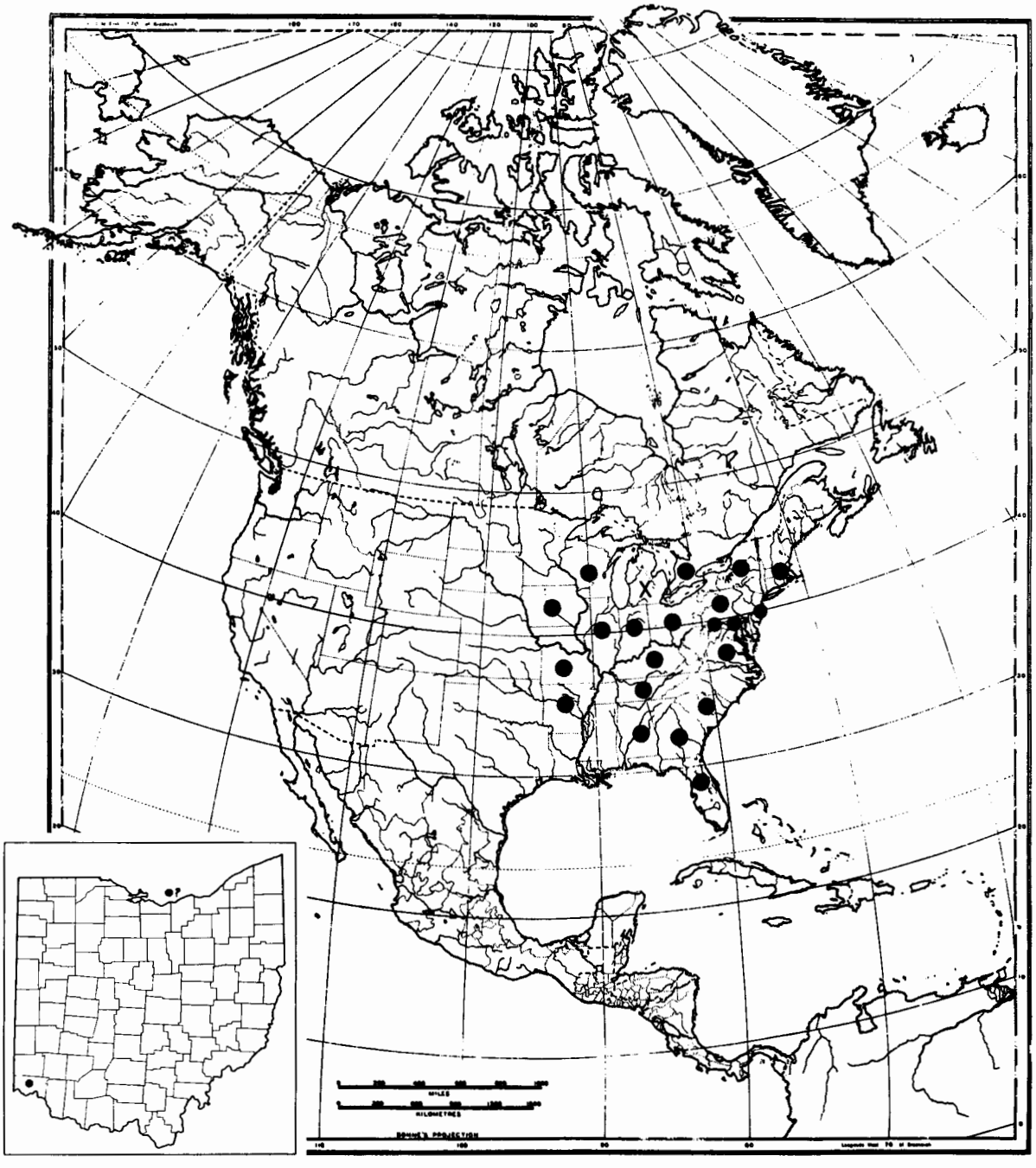


FIGURE 223.—Distribution of *Viviparus contectoides* in North America; *inset,* distribution in Ohio.

States, from Michigan to New York, Ontario (Grand River), south to Florida and west to Arkansas, Illinois, and Wisconsin.

Distribution in Ohio (inset, fig. 223).—Sterki did not list this species in his 1907 Catalogue but listed it, somewhat doubtfully, in his Additions (1914, p. 271) stating that "a specimen is said to have been found in Sandusky Bay." This may have been an error for *V. malleatus*, which has been collected in that region from time to time, probably inadvertently introduced.

Geologic range.—Unknown.

Viviparus malleatus Reeve 1863

Paludina malleata Reeve 1863, Conch. Iconica, *Paludina*, pl. 5, species 25.
Viviparus malleatus Johnson 1915, Fauna New England, p. 112.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 295.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 80, pl. 9, fig. 15.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 266.

Type locality.—Japan.

Diagnosis.—Similar to the American species, but larger and of a brownish color.

Ecology.—Similar to that of *V. contectoides*.

General distribution (fig. 224).—Asia. Introduced, Niagara River, shore of Cayuga Island, Niagara Falls, New York (Schmeck, 1942); Ottawa, Ontario, Canada; British Columbia. In the United States, California to Massachusetts. Mississippi River. Lake Erie.

Distribution in Ohio (inset, fig. 224).—So far, the species has been recorded only for Lake Erie. It is common in places in the Bass Islands and may be expected in protected situations everywhere in the lake. In addition, it may be expected in any of our inland waters as specimens are sold by pet shops for goldfish tanks and are often released, intentionally or accidentally, by their owners.

Geologic range.—None in North America.

Subfamily LIOPLACINAE (Gill 1871) F. C. Baker 1926

Shells of this subfamily are turreted, whorls rounded or subcarinated; aperture subangulated, sinuous or incurved at the base; operculum wholly concentric or with subspiral nucleus; cervical lappets small; foot very large, truncated before, rounded behind; radula with narrower teeth than in the Viviparinae, the reflection with sharp cusps, none being wide and blunt, the marginals very long and narrow, wide at the base.

The shell characteristics, although rather subtle and certainly variable, may be used to separate this subfamily from the Viviparinae. The main identifying characteristics are those of the soft parts.

The subfamily is represented in the living Ohio fauna by two genera, *Campeloma* and *Lioplax*. The genus *Lioplacodes*, probably closely allied to *Lioplax*, ranges from the Jurassic into the Tertiary. *Campeloma* is represented in the Cretaceous fauna. The subfamily is therefore a very old one, whose main area of distribution was the interior of North America during Mesozoic and Tertiary time. In late Tertiary or Pleistocene time, genera of the subfamily disappeared from that area so that now their focus of distribution seems to be the southeastern United States; from this focus, a few hardy species have crossed the glacial boundary and spread as far north as Canada and as far west as Iowa and Nebraska.

Genus *Lioplax* Troschel 1857

Lioplax Troschel 1857, Gebiss Schneck., v. 1, p. 100.
Lioplax Walker 1918, Synopsis and cat. fresh-water Moll., p. 26.
Lioplax F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 45.

Type.—*Limnaea subcarinata* Say.

Diagnosis.—Shell dextral, spiral, thin, ovate, turreted, imperforate; spire produced; whorls rounded or carinated; olivaceous green or dark brown; aperture oval, subcircular; lip thin, continuous; operculum concentric, with a subspiral nucleus (Walker, 1918).

Lioplax subcarinata (Say) 1817
Fig. 225

Limnea subcarinata Say 1817, Nicholson's Encycl., 1st ed., no pagination.
Lioplax subcarinata Call 1900, Moll. Ind., p. 419, pl. 9, figs. 14, 14a, 15.
Lioplax subcarinatus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
Lioplax subcarinata Walker 1918, Synopsis and cat. fresh-water Moll., p. 26.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 49.

Type locality.—Delaware River.

Distribution (fig. 226).—See under *L. subcarinata occidentalis*.

Remarks.—The species has been recorded for Ohio but Pilsbry (1935, Naut. 48, p. 143) makes a good case for separation of the western subspecies from the typical eastern one. According to him, the Atlantic drainage form is the typical one and he has differentiated the western form as a distinct subspecies, *Lioplax subcarinata occidentalis* Pilsbry, whose description follows.

Lioplax subcarinata occidentalis Pilsbry 1935

Lioplax subcarinata Call 1900, Moll. Ind., p. 419, pl. 9, figs. 14, 14a, 15.
Lioplax subcarinatus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
Lioplax subcarinata F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 49.
Lioplax subcarinata occidentalis Pilsbry 1935, Nautilus, v. 48, p. 135.
--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 296.

Type locality.—Cincinnati, Ohio.

Diagnosis.—Shell larger, more acutely conic than *L. subcarinata,* the apex perfect or nearly so, and the

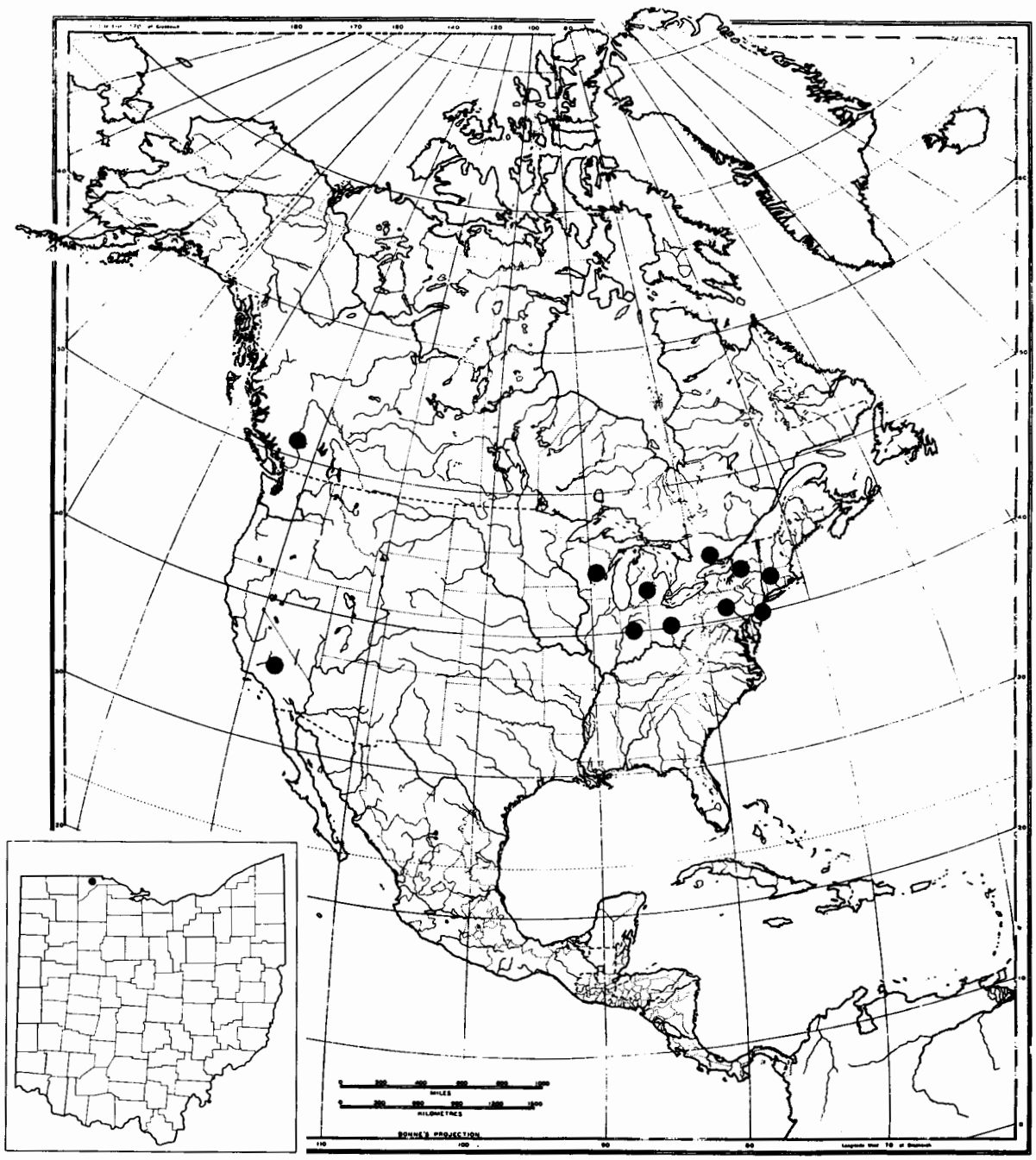


FIGURE 224.—Distribution of *Viviparus malleatus* in North America; *inset,* distribution in Ohio.

FIGURE 225.—*Lioplax subcarinata,* X1; after Call (1900, pl. 9, figs. 14, 14a).

spiral striation weaker; the umbilicus is larger in many cases; L. 20, W. 14 mm., 5 whorls (+one lost).

Ecology.—No subspecific data available.

General distribution.—This is "a common snail in Indiana, Illinois and Iowa" (Pilsbry, Naut. 48, p. 135).

Distribution in Ohio.—Pilsbry (1935, Naut. 48, p. 143) did not mention Ohio in giving the distribution, but his type came from Cincinnati, probably from the

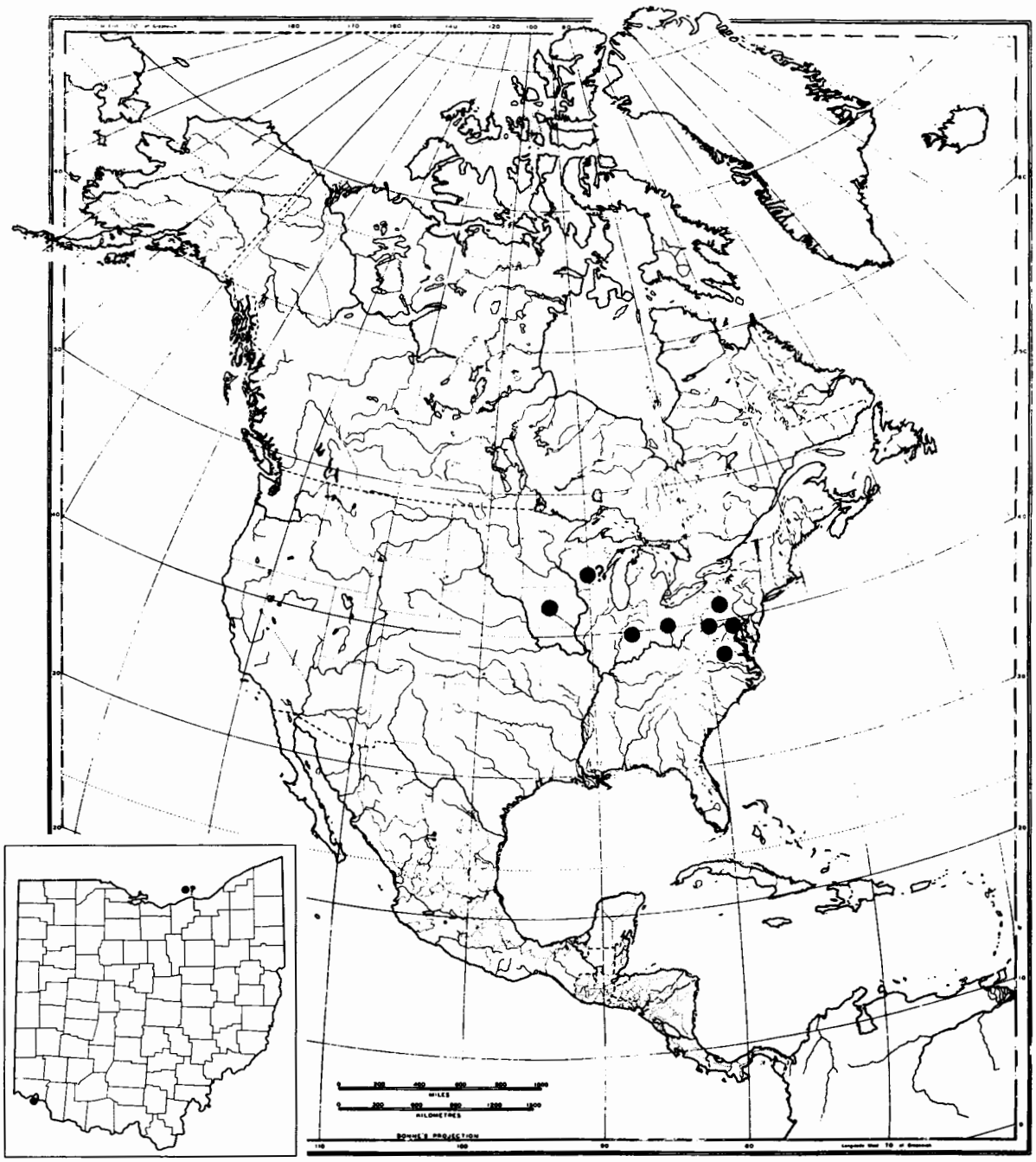


FIGURE 226.—Distribution of *Lioplax subcarinata* in North America; *inset,* distribution in Ohio.

Ohio River. Sterki (1907a, p. 385) mentions this species for the Ohio River and adds "Lake Erie, – tributaries?" This is a rather doubtful record which has not been substantiated by later workers.

Genus *Campeloma* Rafinesque 1819

Campeloma Rafinesque 1819, Jour. Physique, v. 88, p. 423 (*fide* Neave).
Campeloma Walker 1918, Synopsis and cat. fresh-water Moll., p. 25.
Campeloma F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 52.
Campeloma La Rocque 1953, Cat. Recent Moll. Canada, p. 266.

Type.–*C. crassula* Rafinesque.

Diagnosis.–Shell dextral, spiral, imperforate, thick and solid, olivaceous green, unicolored; spire produced; whorls smooth, rounded or shouldered; aperture oval; lip simple, columella and parietal wall usually callusly thickened; operculum concentric, inner margin simple.

Remarks.–No monographic study of this genus has appeared in recent years and the older works are unsatisfactory because of their reliance on shell characters to differentiate the species. The species are numerous, even after rejection of a host of synonyms, but even as late as 1940 it was possible to describe two new species (Mattox, 1940). The species are all found east of the Rockies, the majority of them east of the Mississippi River, although that river harbors several species of the genus. The genus probably originated in the southeastern United States and spread westward and northward as far as the upper reaches of the Mississippi and, through the Great Lakes, into the St. Lawrence and its tributaries. It has not penetrated into the Hudson Bay or Mackenzie drainages, as did so many other freshwater mollusks, and its distribution in the states west of the Mississippi has not yet been fully worked out. One species (*C. rufum*) has been recorded for interglacial beds at Toronto, Ontario, Canada.

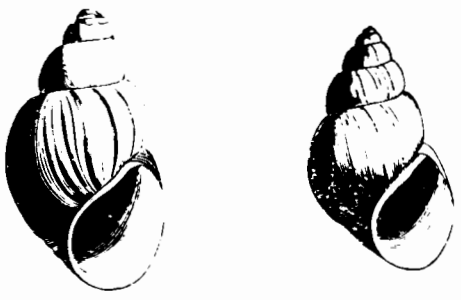


FIGURE 227.–*Campeloma decisum*, X1; after Call (1900, pl. 10, figs. 2, 3).

Campeloma decisum (Say) 1817
Fig. 227

Limnaea decisa Say 1817, Nicholson's Encycl., 1st. ed., pl. 3, fig. 6; 1818, 2d ed., pl. 3, fig. 6.
Paludina decisa Say 1817, *ibid.*, corrections to 1st ed., pl. 3, fig. 6.
Campeloma decisum Call 1900, Moll. Ind., p. 422, pl. 10, figs. 1-3.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 125, fig. 96.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.
--- --- Johnson 1915, Fauna New England, p. 111.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 57, pl. 5, figs. 1-7.
--- --- Goodrich 1932, Moll. Mich., p. 74.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 296.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 81, pl. 9, figs. 19-21.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 266.

Type locality.–Not stated; Delaware River (Binney).

Diagnosis.–Shell elongate-ovate, subfusiform, thin; color dark green to brownish; surface shining, lines of growth fine, crowded, commonly raised into ridges in spots and broken irregularly by black marks of former peristomes; upper whorls and body whorl above periphery covered with heavy brown revolving striae which are epidermal; apex flat topped, sutures deeply impressed; spire long and pointed, sharply conic; whorls 6, flatly rounded, the upper ones generally eroded; sutures well impressed; aperture elongately ovate, rounded below, acutely angled above, bluish-white within; peristome acute, simple, generally bordered by a dark band; umbilicus closed or very narrowly open (condensed from F. C. Baker, 1928a, pt. I, p. 58).

Ecology.–Found in rivers and creeks, on a bottom of sand, mud, gravel and sand, or clay; in shallow water a foot or more deep; generally more abundant in rapid current, but not in riffles or rapids.

Associations.–Living: MANITOBA - 26, 35; MICHIGAN - 40 (drift); NEW YORK - 19, 20; ONTARIO - 1, 5, 7, 9; QUEBEC - 1, 2, 3, 4; WISCONSIN - 1, 6, 7, 17, 19, 25, 38, 39, 42, 46, 47, 52, 57, 60, 62, 73, 75, 79, 80, 81, 83, 87, 100, 117, 118, 120, 123, 129, 132, 133.

General distribution (fig. 228).–Eastern North America, Rio Grande to Nova Scotia, Minnesota, and Saskatchewan, south to Tennessee and Virginia. Some of the records on the northern and southern margins of this range are somewhat doubtful as the species has

been confused with *C. milesii* in the north and with other species in the south.

Distribution in Ohio (inset, fig. 228).—Sterki (1907a) recorded it for the Mahoning River and Lake Erie, and for the Miami River in Butler County. The nearly related, if not identical, form *C. decisum fecundum* (Lewis) is recorded for Franklin and Hamilton Counties. Eggleston (ms. records) has collected it in Miami and Clark Counties and in Lake Erie, Lucas, and Ottawa Counties. Ahlstrom (1930, p. 46) confirms the Lake Erie record with specimens from "Alligator bar off Gibraltar Island."

Geologic range.—Baker (1920a, p. 386) records the species for Sangamon, Peorian, and "Wabash" deposits.

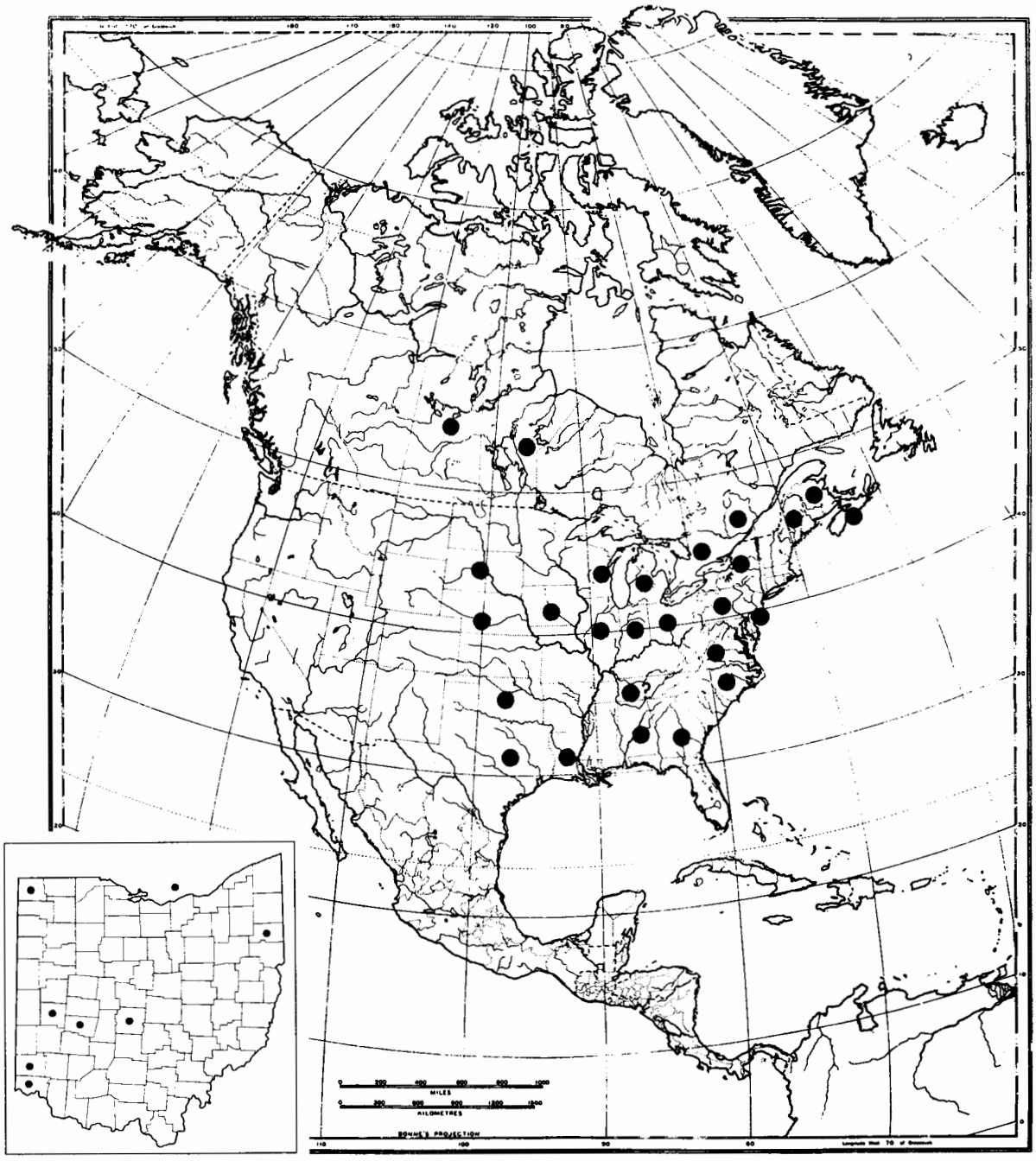


FIGURE 228.—Distribution of *Campeloma decisum* in North America; *inset,* distribution in Ohio.

[*Campeloma decisum fecundum* (Lewis) 1868]

Melantho fecunda Lewis 1868, Am. Jour. Conchology, v. 4, p. 135.
--- --- Lewis 1869, Am. Jour. Conchology, v. 5, p. 34.
Campeloma decisum fecundum Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.
Melantho fecunda Walker 1918, Synopsis and cat. fresh-water Moll., p. 127, 128; a synonym of *C. decisum.*

Remarks.—This supposed variety of *C. decisum* is mentioned here because of Sterki's listing. It has been generally disregarded by workers in recent years as most of them agree with Walker's (1918, p. 127) statement that it "does not seem to be separable from *decisum,* judging from the author's original specimens," which Walker had acquired for his collection. The specimens are now in the Museum of Zoology, University of Michigan, which received the Walker collection by gift after Walker's death.

From the standpoint of the Ohio record, this trinomial should be dropped from the Ohio list. Sterki placed the specimens in the correct species but he was led astray by his tendency to recognize minute variations when he used Lewis' trinomial for these specimens.

Campeloma integrum (Say) 1821
Fig. 229

Paludina integra Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 174.
Campeloma integrum Call 1900, Moll. Ind., p. 425, pl. 11, figs. 10-12.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.
Campeloma decisum integrum Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Campeloma integrum Walker 1918, Synopsis and cat. fresh-water Moll., p. 128.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 63, pl. 3, figs. 10-18; pl. 4, figs. 1-8, 10.
--- --- Goodrich 1932, Moll. Mich., p. 74.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 296.

Type locality.—Waters of the Missouri.

Diagnosis.—Shell rather solid, spire longer than aperture in adult; color light to dark olivaceous green, rarely with longitudinal reddish streaks; surface dull, rarely shining, lines of growth coarse, raised into more or less conspicuous ridges, especially on the last two whorls, which bear several old peristome marks; spiral lines present and more or less distinct; apex blunt, rounded, of 3 whorls, with deep sutures, hyaline; spire long, conic, of about 6 whorls, flat sided, almost perpendicular in some specimens, with a rounded shoulder bordering the very deep sutures; aperture ovate, rounded and somewhat effuse below, bluntly rounded above, slightly sinuous on the columellar margin, light bluish white or whitish within, some specimens tinged with dark purple; inner lip forming a rather heavy white callus on the parietal wall and a wide expansion below which completely closes the umbilicus (modified from F. C. Baker, 1928a, pt. I, p. 64).

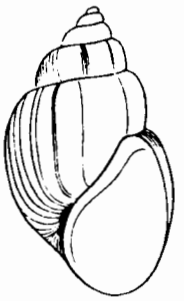


FIGURE 229.—*Campeloma integrum,* X1; after W. G. Binney (1965, pt. III, p. 48, fig. 96).

Ecology.—These snails prefer a mud bottom, near shore, in shallow water. They are able to live in large rivers, *e.g.,* the Mississippi, and in medium-sized rivers, *e.g.,* the Wisconsin, and smaller streams as well, as Sterki (1907a) found it "over the state" in Ohio, which implies that it colonizes streams of every size.

Associations.—Living: NEW YORK - 4b, 4c, 5a, 10, 11, 15b, 22, 24, 32, 40a, 42; OHIO - 43.

General distribution (fig. 230).—Mississippi River from Red Wing, Minnesota, south to Fairport, Iowa, and west to Missouri and Nebraska; some of the rivers of Illinois and probably Indiana. Baker saw no authentic specimens from eastern localities.

Distribution in Ohio (inset, fig. 230).—Sterki (1907a) recorded this species "over the state, common." Eggleston (ms. record) identifies it only for Portage County. It is curious that a Mississippi River species, probably coming into the State by way of the Ohio River, should not be specifically recorded for the many tributaries of the Ohio, especially the southward-flowing ones. Perhaps this is due to mistaken identity on the part of earlier workers who may have lumped this species with other species of *Campeloma.*

Geologic range.—Recorded by Baker (1920a, p. 386) only for beds of "Wabash" (late Wisconsin) age.

Campeloma integrum obesum ("Lewis" Binney) 1865
Fig. 231

Paludina obesa "Lewis" Binney 1865, Land and fresh water shells N. America, pt. 3, p. 47, fig. 95.
Melantho obesa Lewis 1868, Am. Jour. Conchology, v. 4, p. 134.

Vivipara obesa "Lewis" Tryon 1870, Mon. fresh water Moll. U.S., p. 25, pl. 13, fig. 6.

Melantho obesus Lewis 1875, Acad. Nat. Sci. Philadelphia Proc. 1875, p. 336, pl. 23, figs. 4-5.

Campeloma integrum obesum Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.

--- --- --- Walker 1918, Synopsis and cat. freshwater Moll., p. 128.

--- --- --- F. C. Baker 1920, Life of Pleistocene, p. 386.

--- --- --- Goodrich 1932, Moll. Mich., p. 75.

--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 296.

Type locality.—Ohio Canal, Columbus, Ohio, and Michigan.

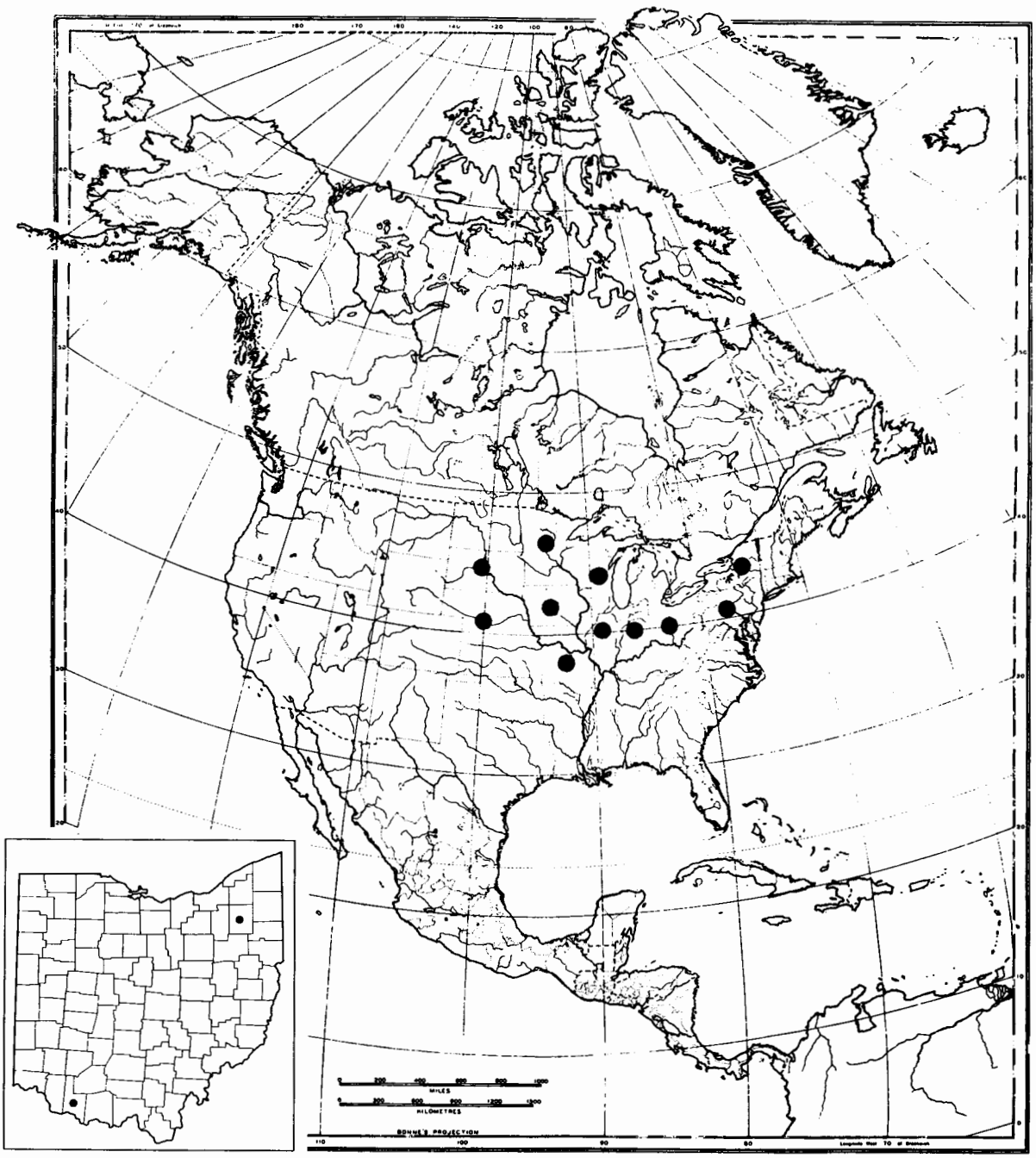


FIGURE 230.—Distribution of *Campeloma integrum* in North America; *inset,* distribution in Ohio.

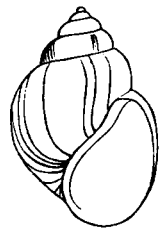


FIGURE 231.—*Campeloma integrum obesum,* X1; after W. G. Binney (1865, pt. III, p. 47, fig. 95).

Diagnosis.—"Readily distinguished by its very ventricose, rounded form and dark olive green color" (W. G. Binney, 1865, p. 47).

Ecology.—No precise data available. The type locality suggests that the species prefers shallow water, with mud bottom and slow current.

General distribution (fig. 232).—Not well ascertained. Lewis identified it from New York, Ohio, and

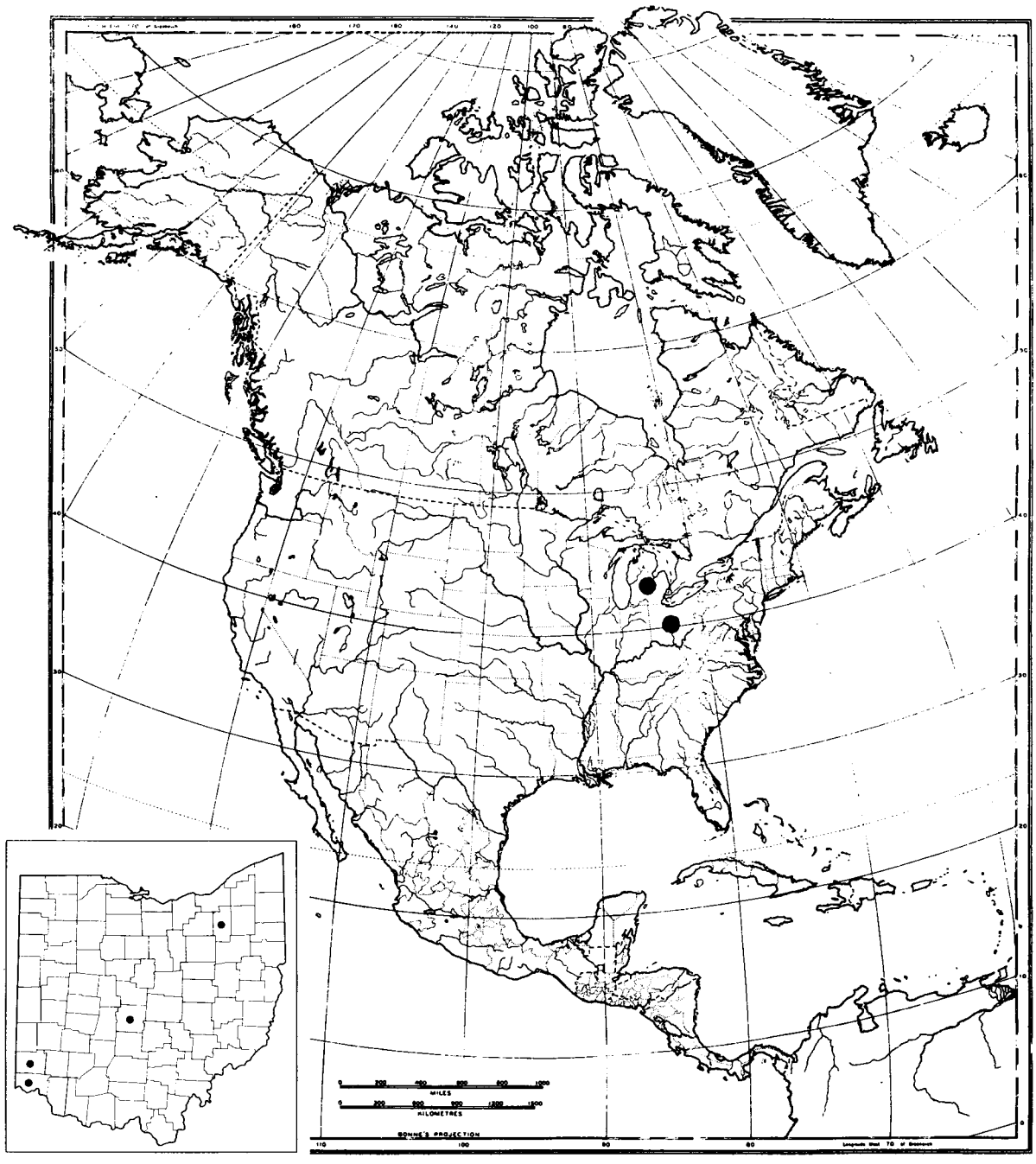


FIGURE 232.—Distribution of *Campeloma integrum obesum* in North America; *inset,* distribution in Ohio.

Michigan; Goodrich and van der Schalie (1944) added Indiana to the list of states where it is present but they do not attach much significance to it as the name has been applied to "mollusks that were senile or distorted by trematode infection."

Distribution in Ohio (inset, fig. 232).—The only source for Ohio records, other than the type locality, is Sterki (1907a, p. 384), who records it for the Miami Canal at Middletown, the Ohio Canal at Columbus, and Hudson, Summit County. If Sterki's records are correct, the species occupies both drainages in the State but it was probably introduced into the Lake Erie drainage by way of canals. The map of Ohio canals shows one from Akron to Cleveland, passing through Summit County, but far to the west of Hudson according to the Cleveland quadrangle (1903, 1:62,500), which shows the Ohio Canal closely following the valley of the Cuyahoga River from south of Boston (SE rect.) to Lake Erie. The Akron quadrangle (1905, same series and scale) shows the Ohio Canal as far as Akron and Barberton. This canal formerly continued southwestward and south to Portsmouth with a branch to Columbus in Franklin County.

Geologic range.—F. C. Baker (1920a, p. 386) records this only for beds of "Wabash" (late Wisconsin) age.

Campeloma ponderosum (Say) 1821
Fig. 233

Paludina ponderosa Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 173.
Melantho ponderosa Binney 1865, Land and fresh water shells N. America, pt. 3, p. 36, fig. 71; extensive synonymy.
Campeloma ponderosum Call 1900, Moll. Ind., p. 420, pl. 10, figs. 4, 5, 6.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.
--- --- Walker 1915, Nautilus, v. 28, p. 121-127; deals specifically with *C. ponderosum coarctatum* but gives important references to the typical form.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 296.

Type locality.—Ohio River (Say).

Diagnosis.—Shell imperforate, globosely ovate, very thick and heavy, growth striae very fine, some specimens with spiral striae; greenish horn, with irregular dark streaks marking rest stages; spire short, conic, apex uneroded, convex; whorls 5 or 6, rapidly increasing, the body whorl very large; aperture oval, narrowed above, slightly oblique, about one-half the shell length; peristome acute, extremely sinuous, columellar callus very much thickened; L. 33, W. 27, Ap. L. 28, Ap. W. 19 mm.

Ecology.—Numerous in muddy bottoms, crawling on the bottom and half hidden in the mud (Call, 1900, p. 421).

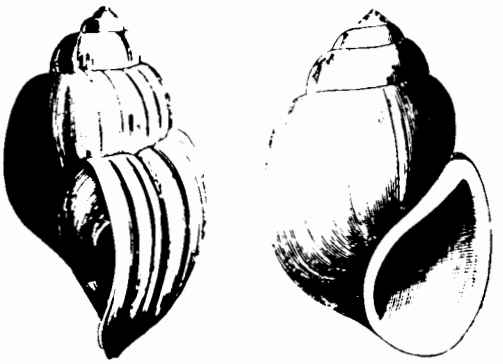


FIGURE 233.—*Campeloma ponderosum,* X1; after Call (1900, pl. 10, figs. 5, 6).

General distribution (fig. 234).—Imperfectly known. W. G. Binney (1865, p. 37) gives Ohio, Indiana, Illinois, Michigan near Lake Superior, Tennessee, and Alabama. Walker (1915, Naut. 28, p. 125) refers the southern forms to *C. ponderosum coarctatum* (Lea) and considers the type form to be that of the Mississippi River system. The Michigan record from near Lake Superior is doubtful. F. C. Baker (1928a, pt. I, p. 64) refers a Wisconsin River record of this species to *C. integrum.*

Distribution in Ohio (inset, fig. 234).—Sterki (1907a) listed the species only for the Ohio River. Eggleston (ms. records) adds Tuscarawas River (Tuscarawas County), Muskingum River (Morgan and Washington Counties), and Scioto River (Pike County). Some of these records may be introductions from the Ohio River through canals.

Geologic range.—Baker (1920a, p. 386) records this species for beds of Yarmouth age only.

Campeloma rufum (Haldeman) 1841
Fig. 235

Paludina rufa Haldeman 1841, Mon. Limniades N. America, pt. 3, p. 3 of wrapper, pl. 3, fig. 1.
Campeloma rufum Call 1900, Moll. Ind., p. 423, pl. 11, figs. 8, 9.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
--- --- Johnson 1915, Fauna New England, p. 112.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 128.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 68, pl. 4, figs. 9, 11-22.
--- --- Dennis 1928, Aquatic gastr. Bass Is. region, p. 3.
--- --- Goodrich 1932, Moll. Mich., p. 74.
--- --- Goodrich and van der Schalie 1944, Revis.

Moll. Ind., p. 297; invalid.

Campeloma rufum La Rocque 1953, Cat. Recent Moll. Canada, p. 267.

Campeloma cf. C. rufum Reynolds 1959, Ohio Jour. Sci., v. 59, p. 155.

Campeloma cf. C. rufum La Rocque 1960, Internat. Geol. Cong., pt. 4, p. 136.

Type locality.—Ohio.

Diagnosis.—Shell more or less solid, thick, not fragile, spire whorls generally present; radula with central tooth as wide as or wider than high; spire acute, longer than aperture, central tooth of radula 50-55μ wide; whorls rounded, body whorl rounded or obese; shell usually pinkish beneath epidermis; embryonic shell globose, apical whorl sunk below second whorl (F. C. Baker, 1928a, pt. I, p. 57; characters given in key to species of *Campeloma*).

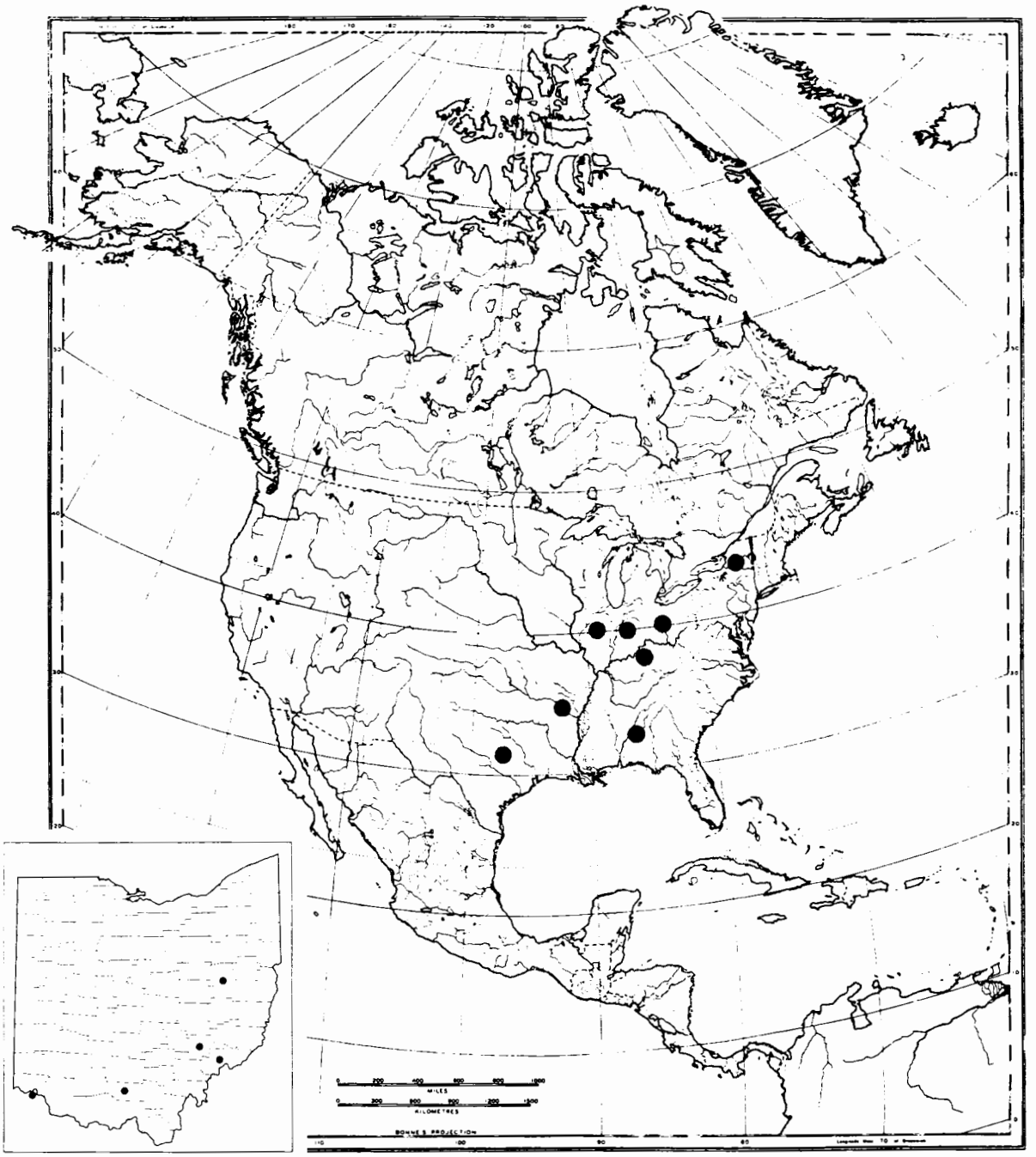


FIGURE 234.—Distribution of *Campeloma ponderosum* in North America; *inset,* distribution in Ohio.

FIGURE 235.–*Campeloma rufum*, X1; after W. G. Binney (1865, pt. III, p. 49, fig. 102).

Ecology.–Occurs in both lakes and rivers, on sand, mud, and boulder bottom, in water 0.5-2.1 m. deep, with or without vegetation.

Associations.–Living: MINNESOTA-22a; WISCONSIN-138. Fossil: W-31 (*cf.*), 32 (*cf.*).

General distribution (fig. 236).–Imperfectly known as many other species have been confused with it. Mississippi River above Red Wing, Minnesota; Wiscon-

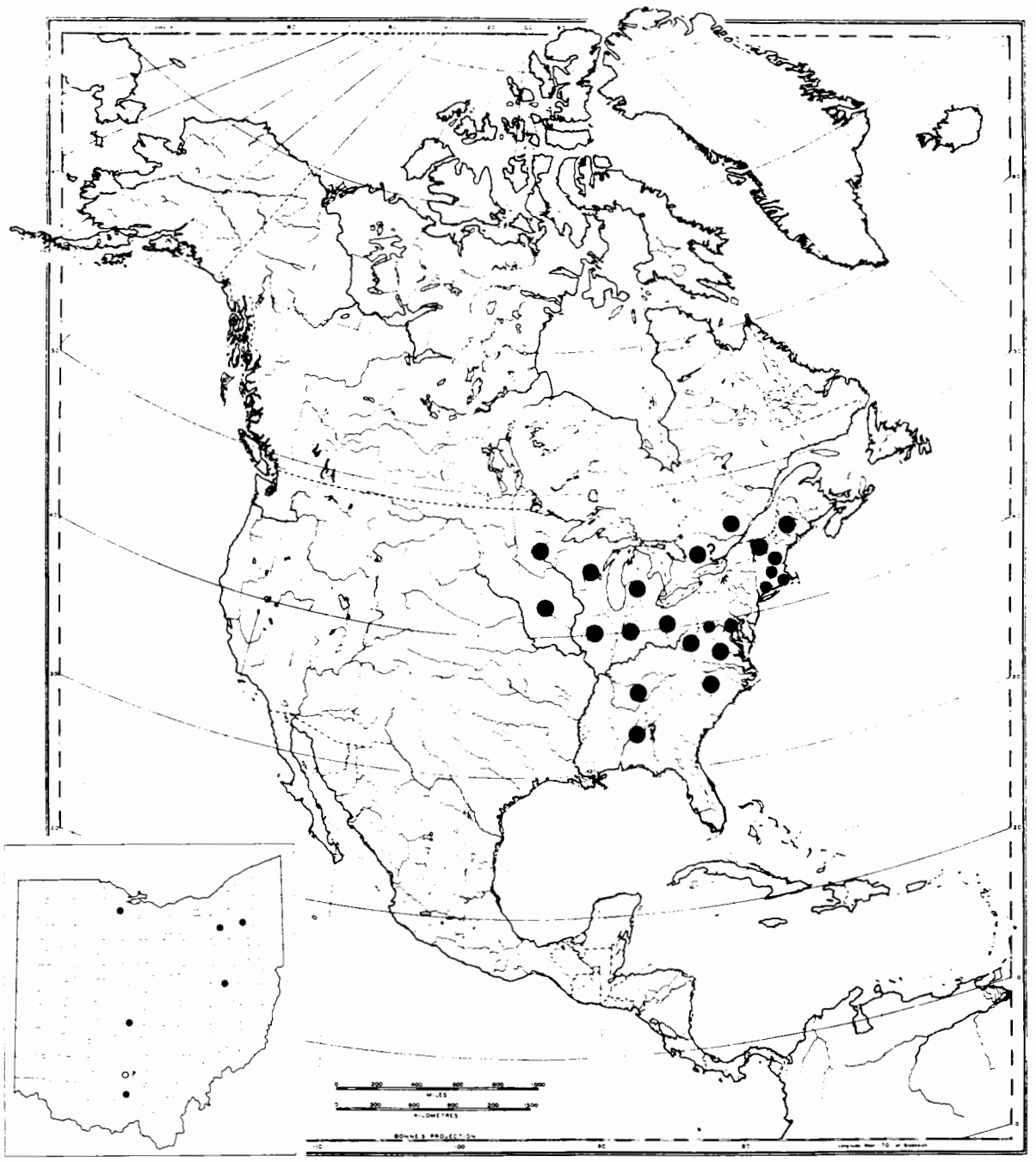


FIGURE 236.–Distribution of *Campeloma rufum* in North America; *inset*, distribution in Ohio.

sin River above Kilbourn dam; also in the Fox, Rock, Fox of Illinois, and Lake Michigan drainages in Wisconsin. In my Catalogue (1953, p. 267) I recorded the distribution of this species as "New England west to Iowa, Michigan, and Wisconsin, south to Alabama. Interglacial, Toronto, Ontario." There is no doubt that much of this distribution is based on erroneous records, *i.e.*, eroded and red-stained specimens of other species, but, in general, it appears that the species is northern in distribution. The eastern records are not impossible even for a species originating in the Mississippi drainage. Still, there is no doubt that a re-examination of the range is in order.

Distribution in Ohio (inset, fig. 236).—Sterki (1907a, p. 385) gives "Canal at Columbus (Call); Summit and Tuscarawas Counties (St.). Sandusky River (St.). Possibly not distinct from *integrum*." Eggleston (ms. records) adds Portage and Pike Counties to the list and confirms Sterki's Tuscarawas County record. Dennis (1928) records it for Squaw Harbor, South Bass Island, Ottawa County, but Ahlstrom (1930, p. 46) gives only *C. decisum.*

Geologic range.—If the Toronto record for interglacial deposits is correct, this species managed to reach the northern shores of Lake Ontario some time before the Wisconsin. I know of no other fossil record.

Remarks.—Goodrich and van der Schalie (1944, p. 297) are certain that this species is invalid. There is no doubt that they are correct for a great many records based merely on a *Campeloma* with eroded nuclear whorls and a reddish color caused by iron stain, but the studies begun by Baker (1928a, pt. I) on the central tooth of the radula in *Campeloma* may, if confirmed, lead to a revision of the species of the genus and recognition of this species.

Mattox (1935, 1936, 1937, 1938) and Van Cleave and Altringer (1937) have studied the anatomy and life history of specimens of *Campeloma* identified by Baker, Walker, and Pilsbry (Mattox, 1938, p. 246) as *C. rufum,* which lends weight to the possibility that the species might be recognizable. Goodrich and van der Schalie (1944) present a good argument for considering this species invalid. On the other hand, if Haldeman had a really distinct species when he described *C. rufum,* it should be possible to find out what he had by elimination. A form with eroded apex and reddish epidermis should be recognizable from the type locality (Ohio) by eliminating the species in which the apex does not normally erode away and which develop a reddish tinge to the epidermis not by chance iron staining but as a regular feature of the shell.

To summarize, the validity of this species is in doubt; Mattox and others who worked on Illinois material may not have had *C. rufum;* the key to the problem is a thorough re-examination of Ohio material with particular attention to the constancy of the characteristics mentioned by Anthony (1860) related to anatomical features of the living animal.

Campeloma subsolidum (Anthony) 1860
Fig. 237

Paludina subsolida Anthony 1860, Acad. Nat. Sci. Philadelphia Proc. 1860, p. 71.
--- --- Binney 1865, Land and fresh water shells N. America, pt. 3, p. 50, fig. 104; as a synonym of *Melantho (=Campeloma) decisa.*
Campeloma subsolidum Call 1900, Moll. Ind., p. 421, pl. 11, figs. 1-7.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 129.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
--- --- Dennis 1928, Aquatic gastr. Bass Is. region, p. 3.
--- --- Goodrich 1932, Moll. Mich., p. 75.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 297.

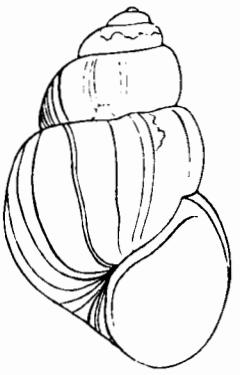


FIGURE 237.—*Campeloma subsolidum,* X1; after W. G. Binney (1865, pt. III, p. 50, fig. 104).

Type locality.—Illinois (Anthony).

Diagnosis.—Shell ovate, very thick; light green to greenish brown; spire high, of 6 to 7 inflated whorls; sutures distinct; aperture broad-ovate, about one-third the length, white within; lip curved forward and forming a very conspicuous subacute tip near its base; columella well rounded, callus deposit thick, covering the umbilicus; L. 49 mm., W. 27.5 mm.; Ap. L. 25.4 mm., Ap. W. 17.3 mm. (condensed from W. G. Binney, 1865, p. 50).

Ecology.—Similar to that of *C. ponderosum, i.e.,* found half-buried in muddy bottoms, crawling half-hidden in the mud. Dennis (1928, p. 32, 33) gives some details but his identification of the species is in doubt.

Associations.—Living: OHIO - 18.

General distribution (fig. 238).—Imperfectly known. Anthony (1860) gave only Illinois; Call (1900) added Ohio River and some tributaries in Indiana; Sterki

(1907a) added Ohio, though not on firm basis; F. C. Baker (1928a, pt. I, p. 67) mentioned the species as not found in Wisconsin; Dennis (1928) gave East Harbor, Lake Erie, but his identifications are also under suspicion; Goodrich (1932, p. 75) recorded it for southwestern Michigan, and finally Goodrich and van der Schalie (1944) confirmed the Indiana record. It appears to be an Ohio River species, penetrating into some Ohio River tributaries in Indiana and Illinois, and perhaps also into the Mississippi near its junction with the Ohio.

Distribution in Ohio (inset, fig. 238).—Sterki's record is for Cuyahoga County, Eggleston (ms. record) has identified it from Portage County, and Dennis (1928) has noted it for East Harbor, Lake Erie. It should be expected in the Ohio tributaries of the Ohio

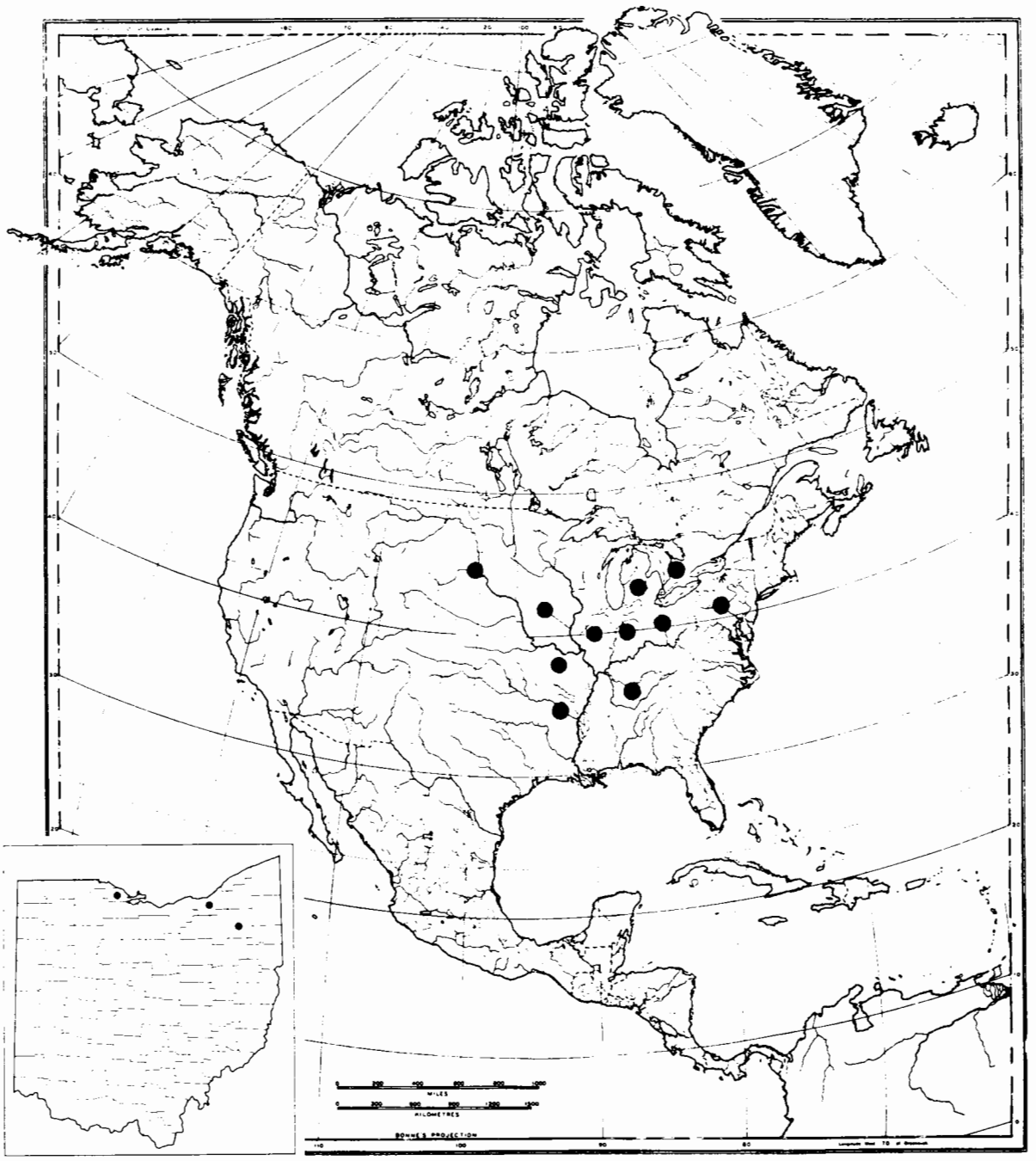


FIGURE 238.—Distribution of *Campeloma subsolidum* in North America; *inset,* distribution in Ohio.

River, but I have no records, nor do I for the Ohio itself. Its status on the State list must remain doubtful for the moment. Certainly the Lake Erie and northeastern Ohio records are out of normal range and may possibly be based on extra large specimens of *C. decisum.*

Geologic range.—Baker (1920a, p. 386) records this species for beds of Yarmouth and Sangamon age.

Family AMNICOLIDAE (Tryon 1862) Gill 1863

Shells of Amnicolidae are small, dextral, conical, or attenuated, of 4 to 8 whorls, apex elevated above the following whorls, or truncated; aperture entire, peristome generally continuous, acute and simple; umbilicus perforate or imperforate; periostracum without color markings; foot longer than wide, generally auriculated anteriorly, rounded posteriorly; operculigerous lobe well developed, wider than the foot; rostrum long; tentacles 2, long and commonly cylindrical, eyes at their outer base; gills generally concealed beneath the mantle lobe, the right, or principal, gill pectinate, with 20 to 50 laminae, the left simple, nonfunctional, and inconspicuous; oviparous or ovoviviparous; eggs laid singly or in clusters.

The family is worldwide in distribution. In the Ohio fauna, it is represented by three native subfamilies and one introduced from Europe. The Michigan representatives of the family were studied by Berry (1943) and the results of his careful work have been followed here, save for a few changes made necessary by later work.

Much has been written since Berry's Michigan paper on the classification of this family. The whole group seems to be in a state of confusion, because of uncertainties concerning the types of several species. Morrison (1947) and Hibbard and Taylor (1960, p. 83-84) have pointed out some of the difficulties that prevent satisfactory solution. In the circumstances, I have followed Berry (1943) in most cases as the safest, though possibly not the best, course until the confusion has cleared, and given references pertinent to each species discussed in this report.

Subfamily AMNICOLINAE Gill 1871

Shells of this subfamily are less than 6 mm. in height, conical or attenuated; whorls 4 to 6, apex elevated above the following whorls or truncated; peristome continuous, acute and simple; umbilicus perforate or imperforate; operculum corneous, spiral; central tooth of radula wider than high with fewer than 4 basal denticles.

The subfamily includes the following genera represented in the living Ohio fauna: *Amnicola, Pyrgulopsis,* and *Hydrobia.* The first of these is represented in the Pleistocene fauna of the State and the other two may be expected in it; their absence from the Pleistocene record may be due rather to lack of collecting than to actual absence.

Genus *Amnicola* Gould and Haldeman 1841

Amnicola Gould and Haldeman (1840) (Jan.), *in* Haldeman, Mon. Limniades N. America, pt. 3, p. 3 (*fide* Neave).
Amnicola Walker 1918, Synopsis and cat. fresh-water Moll., p. 28.
Amnicola F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 90.
Amnicola Berry 1943, Amnicolidae Mich., p. 22.
Amnicola La Rocque 1953, Cat. Recent Moll. Canada, p. 267.

Type.—*Paludina limosa* Say.

Diagnosis.—Shell small, oval-conic, rather short, spire subacute; whorls 4 to 6, convex; aperture oval; peritreme continuous; lip simple, sharp; columella not thickened; operculum thin, corneous, paucispiral.

Remarks.—Berry (1943) has shown that the shell characters in this genus, taken by themselves, are in many instances unreliable for species determination. The large number of described species and forms, both from the Pleistocene and from living faunas of North America, being based on shell characteristics alone, must be accepted with the greatest caution. It is quite possible that many of the forms presently given specific rank by paleontologists will eventually prove to be only subspecies or local forms of other species.

Subgenus *Amnicola sensu stricto*

Amnicola s.s. Berry 1943, Amnicolidae Mich., p. 23.

Type.—*Paludina limosa* Say.

Diagnosis.—Shell between 2 and 5 mm. in height, conical, 4 to 5 whorls; apex obtuse or planorboid; whorls rounded, shouldered, sutures well impressed; peristome continuous, lip thin; aperture subcircular, mainly basal; umbilicus perforate, deep.

Amnicola limosa (Say) 1817
Pl. 10, fig. 1

Paludina limosa Say 1817, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 125.
Paludina porata Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 174.
Amnicola pallida Haldeman 1841, Mon. Limniades N. America, pt. 4, cover p. 3, 4.
Amnicola orbiculata Lea 1844, Am. Philos. Soc. Trans., v. 9, p. 16.
Amnicola limosa Call 1900, Moll. Ind., p. 416, pl. 8, fig. 23.

Amnicola porata Call 1900, *ibid.*, pl. 8, fig. 21.
Amnicola limosa Dall 1905, Harriman-Alaska Exped., v. 13, p. 117, fig. 84.
Amnicola pallida Dall 1905, *ibid.*, fig. 85.
Amnicola limosa Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386.
Amnicola limosa porata Sterki 1907, *ibid.*
Amnicola limosa Johnson 1915, Fauna New England, p. 114.
Amnicola pallida Johnson 1915, *ibid.*
Amnicola limosa Walker 1918, Synopsis and cat. freshwater Moll., p. 134.
Amnicola limosa porata Walker 1918, *ibid.*
Amnicola limosa F. C. Baker 1920, Life of Pleistocene, p. 385.
Amnicola limosa porata F. C. Baker 1920, *ibid.*
Amnicola limosa F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 93, pl. 6, figs. 1-6.
Amnicola limosa porata F. C. Baker 1928, *ibid.*, p. 98, pl. 6, figs. 7-8, 18; pl. 8, figs. 1-3.
Amnicola limosa Dennis 1928, Aquatic gastr. Bass Is. region, p. 4.
--- --- Goodrich 1932, Moll. Mich., p. 78.
--- --- Berry 1943, Amnicolidae Mich., p. 23; extensive synonymy.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 299.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 84, pl. 10, fig. 8.
Amnicola limosa limosa La Rocque 1953, Cat. Recent Moll. Canada, p. 267.
Amnicola limosa porata La Rocque 1953, *ibid.*

Type locality.—Delaware and Schuylkill Rivers, Pennsylvania.

Diagnosis.—Shell broadly conic, about 4.5 mm. high, 3 mm. wide, of 4½ whorls; apex blunt, nuclear whorl planorboid, later whorls round and somewhat shouldered, increasing gradually in size; body whorl round; peristome continuous, joined to the body whorl by a thin callus; aperture subrotund, mostly basal (1.52 mm. wide by 1.88 mm. high); umbilicus deeply perforate (modified from Berry, 1943, p. 23).

Ecology.—A species with a wide range of environmental preference; it is found in creeks, rivers, and fresh- and brackish-water lakes. It is most abundant where there are thick beds of *Chara, Potamogeton, Vallisneria,* and *Elodea.* These plants are not used as food by the amnicolid, but they harbor rich colonies of diatoms on which the snail feeds (Berry, 1943, p. 26).

Associations.—Living: MANITOBA-19, 23; MINNESOTA-9, 10, 11b, 13a, 13b, 14a, 14b, 15, 16, 17, 18, 22a; NEW YORK-21, 36; OHIO-18, 19, 29, 43; ONTARIO-3, 9; QUEBEC-2; WISCONSIN-11, 14, 15, 16, 17, 27, 28, 29, 32, 37, 38, 39. 42, 45, 46, 47, 48, 51, 52, 55, 56, 59, 60, 65, 68, 69, 70, 79, 80, 85, 86, 87, 88, 89, 90, 92, 93, 94, 95, 97, 98, 106, 113, 116, 123, 133. Fossil: W-27. (See also fossil records for *A. limosa parva.*)

General distribution (fig. 239).—New England and New Jersey west to Utah, Manitoba south to Texas.

Distribution in Ohio (inset, fig. 239).—Probably all over the State, judging from county records, which range from Lake and Portage Counties in the north to Hamilton and Fairfield in the south, and from records for neighboring states.

Geologic range.—F. C. Baker (1920a, p. 385) recorded the typical form for the Sangamon and "Wabash" but the form *porata* (here considered a synonym of *A. limosa*) for the Yarmouth, Sangamon, and "Wabash."

Remarks.—Baker (1928a, pt. I, p. 97) has pointed out that this species has been used as a catchall for the globose *Amnicolae.* As understood by Berry, the species is easily recognizable. In spite of separation of many species of globose *Amnicolae* from the Pleistocene, *A. limosa* remains one of the most abundant species of marl deposits, in Ohio and elsewhere.

The validity of the varieties or subspecies described for this species remains in doubt. *A. limosa porata* was placed in the synonymy of the typical form by Berry (1943, p. 23) but he expresses no opinion on the other forms, especially *A. limosa parva* Lea and *A. limosa superiorensis* F. C. Baker (1928a, pt. I, p. 101). Judging from Baker's descriptions and the variability of *A. limosa* in many collections examined, it might be advisable to drop the last two varietal names recognized by Baker.

Amnicola limosa parva Lea 1841

Amnicola parva Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 34.
--- --- Binney 1865, Land and fresh water shells N. America, pt. 3, p. 87, fig. 171.
--- --- Pilsbry 1898, Nautilus, v. 12, p. 44.
Amnicola limosa parva Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386.
Amnicola parva Walker 1918, Synopsis and cat. freshwater Moll., p. 135.
Amnicola limosa parva F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 102, pl. 6, figs. 12-14.
--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 299.
--- --- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 12, pl. 1, fig. E.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 267.

Type locality.—Springfield, Clark County, Ohio.

Diagnosis.—Shell somewhat smaller than *A. limosa,* with obtuse apex and narrow umbilicus; the whorls are tumid below the suture, producing a distinct shouldered appearance; the aperture is like that of *A. limosa,* the

inner lip not forming a callus on the parietal wall, hence not continuous.

Ecology.—In general, the same as for *A. limosa*, from which it may not be sufficiently distinct for recognition. Pilsbry states: "Whether it is a stunted form of *limosa* due to unfavorable station, or is constantly distinguishable I have not ascertained, but it is at all events recognizable." It lives in rivers, creeks, quiet ponds, and small lakes. It is remarkable in that it seems to be indifferent to the presence or absence of vegetation, as compared with *A. limosa (q.v.)* which distinctly favors thick vegetation.

Associations.—Fossil: K-2, 8, 23.

General distribution (fig. 240).—Recorded certainly

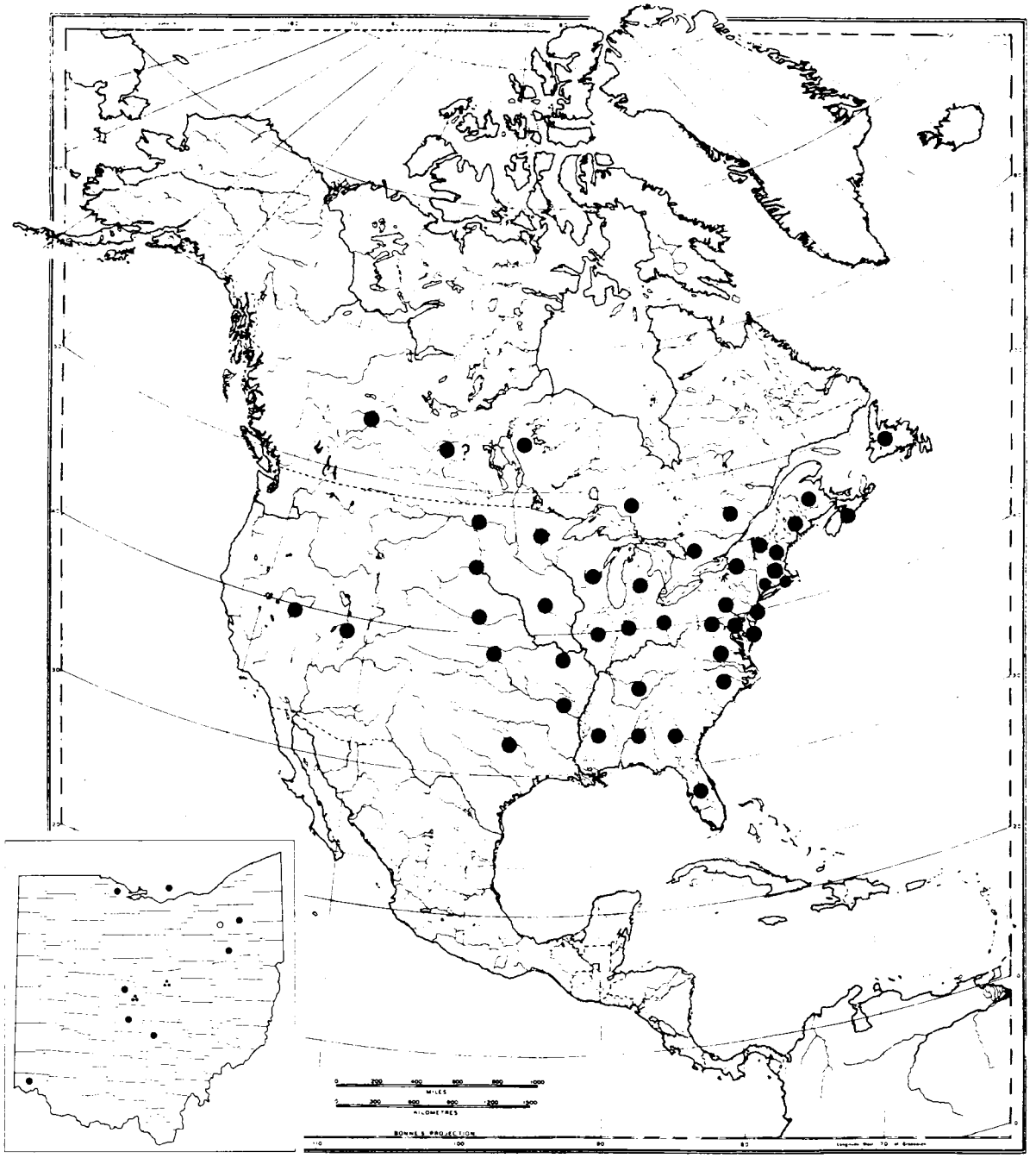


FIGURE 239.—Distribution of *Amnicola limosa* in North America; *inset*, distribution in Ohio.

from Ohio, Indiana, Illinois, Iowa, and Missouri. Baker thinks its distribution may be coincident with that of *A. limosa.*

Distribution in Ohio (inset, fig. 240).—The only record for the variety or form is Tuscarawas County (Sterki, 1907a). Small forms of *A. limosa* have been recognized in several collections but in each case the intergradation with the type form seemed to be so complete that differentiation was not useful.

Geologic range.—"Yarmouth to Recent, but recorded from the midcontinent region only from the Yarmouthian interglacial deposits and sparingly from the Recent of this region" (A. B. Leonard, 1950, p. 12).

Remarks.—Berry (1943) does not mention the vari-

FIGURE 240.—Distribution of *Amnicola limosa parva* in North America; *inset,* distribution in Ohio.

ety, possibly because he did not feel that it was entitled to recognition any more than *A. limosa porata*, possibly because it had not been recorded for Michigan. The form is of doubtful validity at present but is included here on the chance that it may turn out to be recognizable and to have limited value for Pleistocene forms.

Amnicola walkeri Pilsbry 1898
Pl. 10, figs. 2, 3

Amnicola walkeri Pilsbry 1898, Nautilus, v. 12, p. 43.
--- --- Walker 1906, Nautilus, v. 19, p. 117, pl. 5, fig. 12.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 136.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 448; Rush Lake.
Amnicola (Marstonia) walkeri F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 114, pl. 7, figs. 1-4; text fig. 47, 3-5.
Amnicola walkeri Goodrich 1932, Moll. Mich., p. 78.
--- --- Mozley 1934, Geol. Mag., v. 71, p. 375.
Amnicola (Amnicola) walkeri Berry 1943, Amnicolidae Mich., p. 26, pl. 1, figs. 2, 3.
Amnicola walkeri Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 299.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 84, pl. 9, fig. 18.
Amnicola (Amnicola) walkeri La Rocque 1953, Cat. Recent Moll. Canada, p. 268.

Type locality.—Lake Michigan at High Island Harbor, Beaver Island, Charlevoix County, Michigan.

Diagnosis.—Shell small, thin, conic, translucent; color yellowish-corneous; surface smooth, shining, growth lines very faint, crowded; spire broadly conic, longer than aperture; whorls 4, very convex, regularly and rapidly increasing in diameter; sutures deeply impressed; apex obtuse, the nuclear whorl small, rounded, granular in texture, light corneous or waxy, elevated above the second whorl; aperture almost circular, very slightly angled above; peristome continuous, in contact with the body whorl for but a short distance; base rounded, umbilicus wide and deep.

Ecology.—F. C. Baker (1928a, pt. I) found it in Lake Winnebago and Lake Butte des Morts, Wisconsin, in water 0.3-2.6 m. deep, on gravel, sand, mud, sandy mud, and sand-gravel bottom; in vegetation, mostly; also in a protected pond behind a beach.

Associations.—Living: MANITOBA - 23; MICHIGAN - 10; MINNESOTA - 17; OHIO - 43; WISCONSIN - 28, 42, 81, 98, 124. Fossil: W - 29, 53, 54, 55.

General distribution (fig. 241).—Upper St. Lawrence drainage from Ottawa, Ontario, Canada, to Lake Michigan. Mississippi drainage. Manitoba.

Distribution in Ohio (inset, fig. 241).—As a living species, *A. walkeri* occurs in Cuyahoga County (Sterki, 1907a) but has not been recorded elsewhere. It has also been found (Baker, 1920a, b) as a fossil.

Geologic range.—Baker (1920a, p. 385) records this species for "Wabash" beds. It has been definitely recorded for the Pleistocene marl of Rush Lake, Logan Ohio (Baker 1920b, p. 448), and for the Aultman deposit (Sheatsley, 1960, p. 67).

Remarks.—Baker (1928a, pt. I, p. 116) has described a variety, *A. walkeri foxensis*, from Fox River, Columbia County, Wisconsin, which he considers a distinct river form of the species. A closely allied form, described as a species, *A. precursor*, by Baker, is recorded for Illinois and Wisconsin. Baker thinks it should occur in the Pleistocene of Michigan and Indiana; if so, it may be expected also in western and northern Ohio, but its validity is not certain.

Subgenus *Marstonia* F. C. Baker 1926

Marstonia F. C. Baker 1926, Wis. Acad. Arts, Sci., Letters Trans., v. 22, p. 195.
Marstonia F. C. Baker 1928, Fresh water Moll. Wis., pt. 1, p. 103.
Marstonia Berry 1943, Amnicolidae Mich., p. 29.

Type.—*Amnicola lustrica* Pilsbry.

Diagnosis.—Shell attenuated, almost twice as high as wide; apex elevated and acute; aperture ovate or subovate; peristome continuous; umbilicus narrow, perforate.

Amnicola lustrica Pilsbry 1890
Pl. 10, figs. 4, 5, 6

Amnicola lustrica Pilsbry 1890, Nautilus, v. 4, p. 53.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 134.
--- --- "Pilsbry, variety" F. C. Baker 1920, Jour. Geology, v. 28, p. 448.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 175.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 385.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 104, pl. 6, figs. 16, 17, 26, 27; text fig. 45.
--- --- Goodrich 1932, Moll. Mich., p. 78.
Amnicola (Marstonia) lustrica Berry 1943, Amnicolidae Mich., p. 29.
Amnicola lustrica Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 299.
Amnicola (Marstonia) lustrica Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 84, pl. 10,

fig. 11.

Amnicola lustrica La Rocque 1953, Cat. Recent Moll. Canada, p. 268.

Marstonia decepta Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 51.

Type locality.—Not specifically given: "New York to Illinois and Minnesota" (Pilsbry). To my knowledge, there has been no attempt as yet to designate a more specific type locality for this species.

Diagnosis.—Shell small, thin, turreted, translucent; color varying from greenish to light brownish, in many cases waxy; surface smooth; spire conic, somewhat longer than aperture; whorls 5, rather convex, regularly but not rapidly increasing in diameter; sutures well impressed; nucleus small, minutely granular, of about

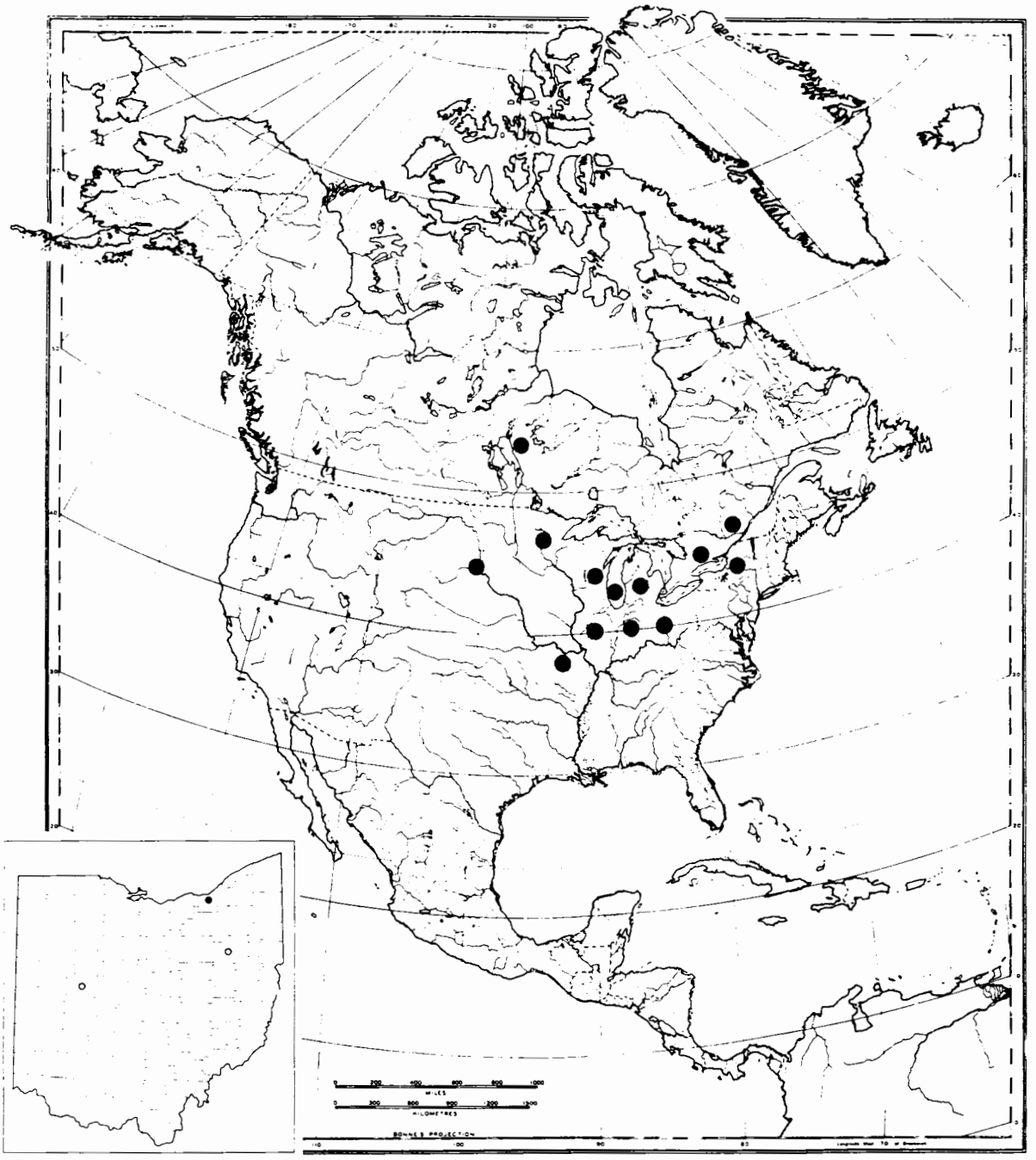


FIGURE 241.—Distribution of *Amnicola walkeri* in North America; *inset,* distribution in Ohio.

one whorl, waxy or greenish, sometimes stained reddish; the postnuclear whorl immediately begins to descend; aperture roundly ovate, more or less distinctly angled above, waxy inside; peristome continuous, thin, appressed to the body whorl for a short distance near the upper terminations; base of shell broadly rounded, with a small, narrow umbilical chink.

Ecology.—On stones in rivers and lakes and on vegetation such as *Vallisneria, Potamogeton,* and *Chara;* particularly abundant in filamentous algae. It inhabits both large and small lakes and is in many places associated with *Amnicola limosa.*

Associations.—Living: NEW YORK - 2b, 4b, 4c, 11, 12, 21, 23, 25, 32, 37, 40a; MINNESOTA - 9, 10, 11b, 15, 16; OHIO - 43; ONTARIO - 9; WISCONSIN - 15, 16, 28, 29, 47, 51, 52, 55, 59, 79, 84, 85, 86, 88, 89, 90, 98, 116, 123, 128; fossil: W - 27, 29, 33, 34, 36, 37, 38, 39, 40, 41, 42, 45, 46, 47, 48, 49, 50, 51. *A. lustrica aff. A. precursor,* fossil: W - 33, 34. *A. precursor,* fossil: W - 33, 34.

General distribution (fig. 242).—New York to Minnesota; southern Ontario. Authentically reported from Indiana, Illinois, New York, Minnesota, Wisconsin, Michigan, Ohio, Pennsylvania, and southern Ontario.

Distribution in Ohio (inset, fig. 242).—For the living species, the records for Ohio are for the northeastern part of the State, in Cuyahoga, Summit, and Tuscarawas Counties. These are Sterki's records; it is very probable that the species would now be found in all parts of the State as the environmental requirements of the species are rather broad and can be met in every county of Ohio. The species occurs in several Pleistocene marl deposits in the State.

Geologic range.—The species has been recorded in numerous marl deposits of Wisconsin age, including the following in Ohio: Newell Lake (Zimmerman, 1960, p. 20), Oakhurst (Aukeman, 1960, p. 61), Souder Lake (Cornejo, 1961, fig. 11), and Jewell Hill (Mowery, 1961, p. 8); in addition, a form which may be *"A. precursor"* F. C. Baker or close to it has been identified by Aukeman (1960, p. 64) from the Oakhurst deposit.

Remarks.—F. C. Baker (1928a, pt. I, p. 108) describes a small-lake form *(A. lustrica decepta)* and a Great Lakes form *(A. lustrica perlustrica)* and notes the relationship of this species with his *A. gelida* of the Pleistocene (see next species). Recognition of these forms would considerably alter the manner of stating the geologic and present distribution, but their validity is not generally accepted. Berry (1943, p. 32) rejects the lake form (the context indicates that *A. lustrica perlustrica* is certainly meant, perhaps *A. l. decepta*). In the course of practical identification of large lots of this species from Lake Erie (living) and Pleistocene deposits, I have come to the conclusion that the forms of this species are too variable and intergrade too completely with each other to deserve recognition or to serve a useful purpose if they are distinguished as separate entities. In dealing with Ohio material in this report, I have therefore referred all forms to the typical one and the distribution map (inset, fig. 242) includes all forms recorded for the State.

Amnicola gelida F. C. Baker 1921
Fig. 243

Amnicola lustrica var. F. C. Baker 1920, Jour. Geology, v. 28, p. 448.
Amnicola lustrica gelida F. C. Baker 1921, Nautilus, v. 35, p. 22.
Amnicola gelida F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 110, pl. 6, figs. 19-23, text fig. 45.

Type locality.—Morris, Grundy County, Illinois, in Pleistocene deposits.

Diagnosis.—Shell rather solid, elongated, narrow; spire elongated, turreted, twice as long as aperture; whorls 6, convex, separated by deep, almost channelled sutures; body whorl comparatively small; aperture roundly ovate, slightly angled above, generally thickened within; peristome continuous, in many cases completely separating the aperture from the body whorl; umbilicus narrow but distinct (F. C. Baker, 1928a, pt. I, p. 110).

Ecology.—No precise data available.

General distribution (fig. 244).—The species is not known living, unless Baker's (1928a, pt. I, p. 111) record is for living shells. From the context it would appear that these are fossil specimens, although Baker does not state this specifically.

Geologic range.—Pleistocene of Wisconsin, Illinois, and Ohio; the Wisconsin record somewhat doubtful; see above under "General Distribution."

Amnicola pilsbryi Walker 1906
Fig. 245

Amnicola parva Marsh 1888, Conch. Exch., v. 2, p. 91 (*non* Lea 1841).
Amnicola pilsbryi Walker 1906, Nautilus, v. 19, p. 116, pl. 5, figs. 11, 16.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387, 399.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 135.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 118, pl. 7, figs. 6-8, text fig. 47, no. 10.

Type locality.—Rockford, Illinois.

Diagnosis.—Shell small, globosely conic; color light or brownish; surface dull to shining, lines of growth fine; sutures well impressed, whorls 4 to 4½, rounded, somewhat globose and slightly shouldered; spire broadly conic, body whorl large; apex flattened,

the first two whorls similar to those of *A. limosa;* sculpture of nuclear whorls as in *A. limosa;* aperture subcircular, slightly angled above; peristome thin, continuous, appressed to the body whorl only for a very short distance; base rounded, umbilicus well marked, round, deep.

Ecology.—"In quiet lakes and sloughs" (F. C. Baker, 1928a, pt. I, p. 119).

General distribution (fig. 246).—Wisconsin east to New Philadelphia, Ohio, south to northern Illinois.

Distribution in Ohio (inset, fig. 246).—The only records are Sterki's (Stark and Tuscarawas Counties) and Eggleston's (unpublished record for Franklin County). Judging from the general distribution of the species, it should be found over most, if not all, of the State, since its ecologic preferences are wide enough

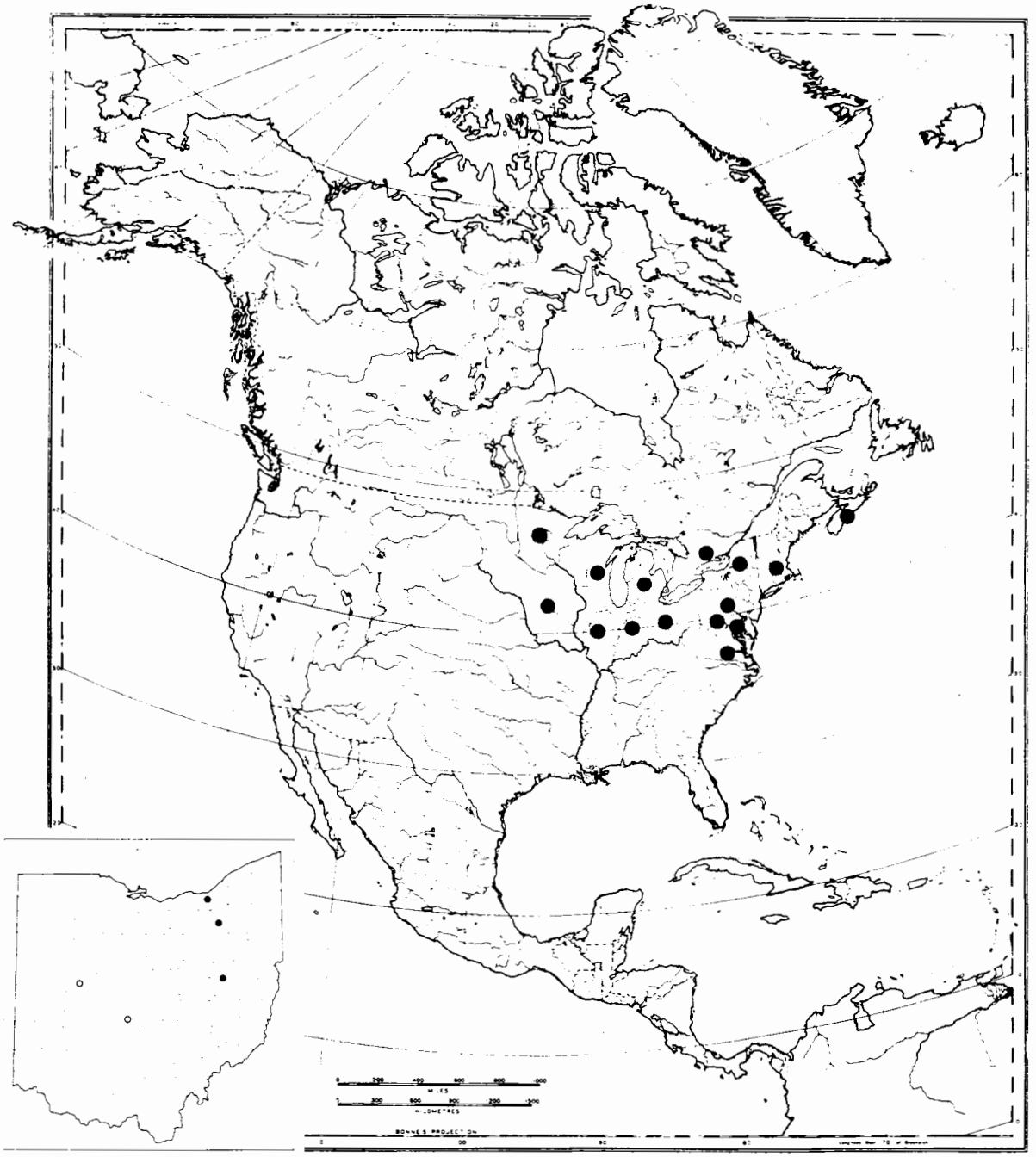


FIGURE 242.—Distribution of *Amnicola lustrica* in North America; *inset,* distribution in Ohio.

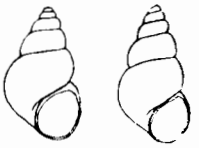


FIGURE 243.—*Amnicola gelida*, magnified outline of shell; after F. C. Baker (1928a, pt. I, p. 104, fig. 45).

to be met with almost anywhere in Ohio.

Geologic range.—So far I have been unable to find mention of this species from Pleistocene or other deposits.

Remarks.—The range as given by Baker (1928a, pt. I, p. 119) would include Michigan, but Berry (1943) does not mention this species in his treatment of the Amnicolidae of that State. Either the species is absent

FIGURE 244.—Distribution of *Amnicola gelida* in North America.

FIGURE 245.—*Amnicola pilsbryi,* magnified outline of shell; after F. C. Baker (1928a, pt. I, p. 106, fig. 47, no. 10).

from the area of the State or else Berry did not consider the species valid. If the first alternative is correct, the presence of the species in Ohio, Illinois, and Wisconsin may have some significance in the interpretation of Pleistocene migrations of the species. At present, our information is too fragmentary to do more than speculate about this point.

FIGURE 246.—Distribution of *Amnicola pilsbryi* in North America; *inset,* distribution in Ohio.

Subgenus *Cincinnatia* Pilsbry 1891

Cincinnatia Pilsbry 1891, Acad. Nat. Sci. Philadelphia Proc. 1891, p. 327.
Cincinnatia Walker 1918, Synopsis and cat. fresh-water Moll., p. 29.
Cincinnatia F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 121.
Cincinnatia Berry 1943, Amnicolidae Mich., p. 52.
Cincinnatia La Rocque 1953, Cat. Recent Moll. Canada, p. 269.

Type.—*Paludina cincinnatiensis* Anthony 1841 (=*P. integra* Say 1821).

Diagnosis.—Whorls rounded, shouldered, sutures deep; aperture roundly ovate, peristome continuous; umbilicus wide and deep; shell wide, heavy; spire acute, elevated, never depressed.

Amnicola integra (Say) 1821
Pl. 10, fig. 7

Paludina integra Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 174.
Paludina cincinnatiensis Anthony 1841, Boston Jour. Nat. History, v. 3, pt. 1-2, p. 279, pl. 3, fig. 3.
Amnicola (Cincinnatia) cincinnatiensis Pilsbry 1891, Acad. Nat. Sci. Philadelphia Proc. 1891, p. 327.
Amnicola cincinnatiensis Call 1900, Moll. Ind., p. 416, pl. 8, fig. 22.
Amnicola (Cincinnatia) cincinnatiensis Walker 1902, Nautilus, v. 16, p. 35.
Amnicola cincinnatiensis Dall 1905, Harriman-Alaska Exped., v. 13, p. 118, fig. 87.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 136.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 385.
Cincinnatia cincinnatiensis F. C. Baker 1928, Freshwater Moll. Wis., pt. I, p. 122, pl. 6, figs. 40, 41; pl. 7, figs. 15-17.
Amnicola cincinnatiensis Goodrich 1932, Moll. Mich., p. 78.
Amnicola (Cincinnatia) integra Berry 1943, Amnicolidae Mich., p. 32.
Amnicola integer Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 300.
Amnicola (Cincinnatia) integra Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 85, pl. 10, fig. 15.
Amnicola integra La Rocque 1953, Cat. Recent Moll. Canada, p. 269.

Type locality.—Not definitely known. "Inhabits the waters of the Missouri" (Say).

Diagnosis.—Shell about 5 mm. high, 3.5 mm. wide, heavy, spire acute, the nuclear whorl elevated above the other whorls; the second, third, and fourth whorls very shouldered, the body whorl round; aperture 2.1 mm. high, 1.8 mm. wide, roundly ovate, angled above; basal part not as convex as the rest of the aperture; basal part of columella thickened, somewhat straight; upper part arched; interior of aperture generally white; peristome continuous, attached to the body whorl from the angle of the umbilicus; umbilicus wide, deep; epidermis light horn color, growth lines fine (modified from Berry, 1943).

Ecology.—Found crawling on soft muddy ooze in Stony Creek, Monroe County, where current was slow, aquatic vegetation practically absent; other species of Amnicolidae were present above and below this station, in places where vegetation grew in extensive patches and the current was faster; in Lake St. Clair, on a sandy bottom; the food of this species consists mostly of diatoms (modified from Berry, 1943, p. 35).

Associations.—Living: WISCONSIN - 3.

General distribution (fig. 247).—New York to Utah; Texas to Hudson Bay.

Distribution in Ohio (inset, fig. 247).—This species is widespread in the State, as county records indicate, but it is not collected often.

Geologic range.—Recorded from interglacial beds, Toronto, Ontario, Canada, and the Pleistocene of Wisconsin. F. C. Baker (1920a, p. 385) gives only Sangamon.

Subgenus *Probythinella* Thiele 1928

Probythinella Thiele 1928, Zool. Jahrb., Syst., v. 55, p. 378.
Probythinella Berry 1943, Amnicolidae Mich., p. 36.

Type.—*Cincinnatia binneyana* Hannibal 1913.

Diagnosis.—Shell subcylindrical, apex blunt or truncate, about 4 whorls, 3 mm. high, 2 mm. wide; first, and in some specimens second, whorls planorboid, depressed below the following whorl; aperture subovate, peristome continuous, adnate to the body whorl for a very short distance and occasionally unattached; umbilicus perforate and narrow; radula very minute, much smaller than the radula of members of the subgenus *Cincinnatia,* although the teeth bear some resemblance to those of this subgenus; animal with very elongated rostrum; foot slender, auriculated.

Amnicola (Probythinella) lacustris (F. C. Baker) 1928
Pl. 8, figs. 1, 2, 5, 6; pl. 10, figs. 8-12

Paludina obtusa Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 34 (*non* Troschel, 1837).
Paludina emarginata Küster 1852, Conch. Cab., *Paludina,* p. 50, pl. 10, figs. 3, 4.

Bythinella obtusa Call 1900, Moll. Ind., p. 414, pl. 8, fig. 18.

Cincinnatia emarginata Walker 1901, Nautilus, v. 15, p. 30.

Amnicola emarginata Dall 1905, Harriman-Alaska Exped., v. 13, p. 118, fig. 86.

--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.

Cincinnatia binneyana Hannibal 1912, Malac. Soc. London Proc., v. 10, p. 190.

Amnicola emarginata Walker 1918, Synopsis and cat. fresh-water Moll., p. 136.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 385.

Cincinnatia emarginata F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 126, text fig. 54, nos. 1, 2.

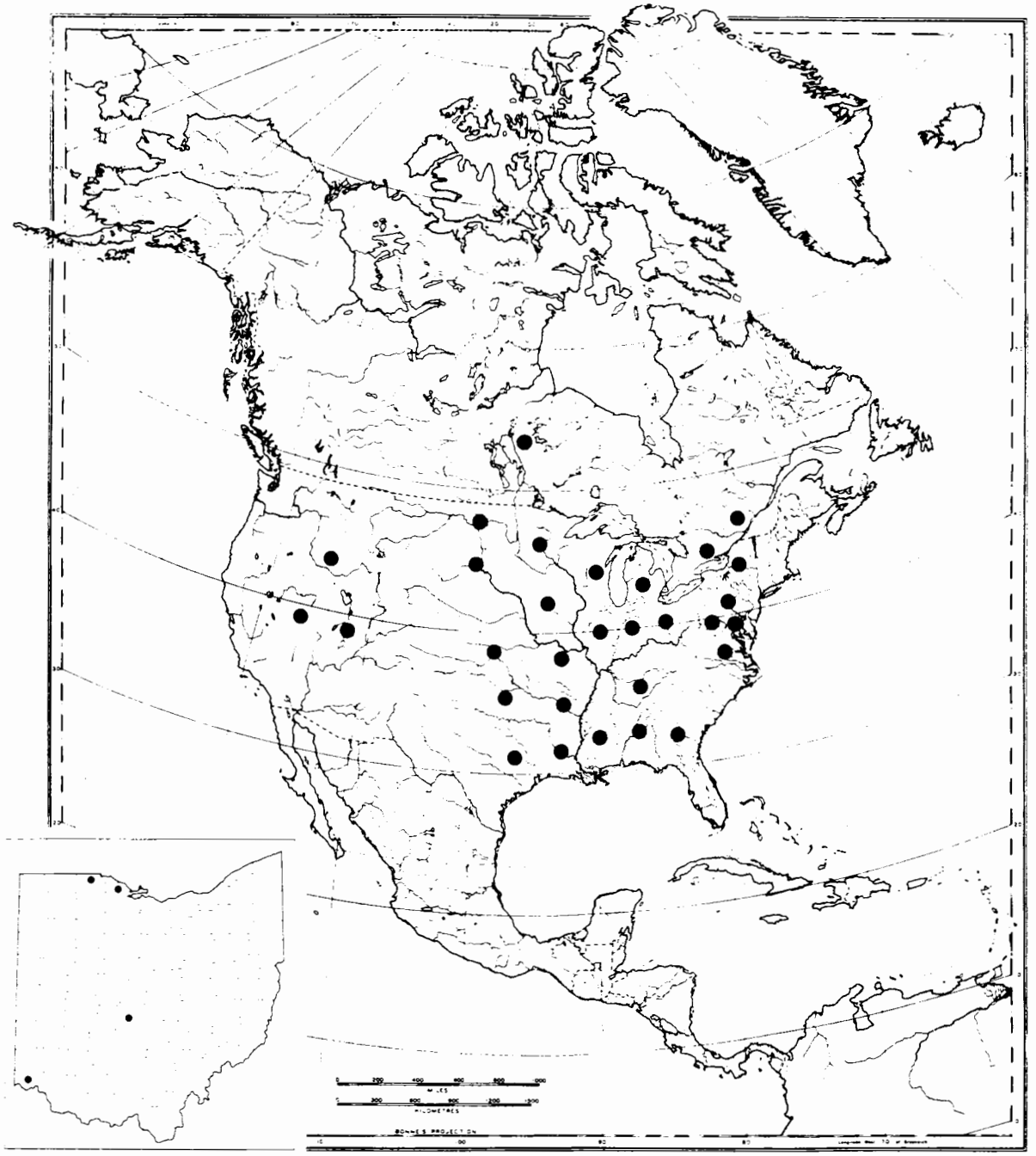


FIGURE 247.–Distribution of *Amnicola integra* in North America; *inset,* distribution in Ohio.

Cincinnatia emarginata lacustris F. C. Baker 1928, *ibid.*, p. 127, pl. 7, figs. 20-21; text figs. 55, 56a, 59, nos. 3-5.
Cincinnatia (Probythinella) emarginata Thiele 1928, Revis. syst. Hydrob. und Melaiiden, p. 369-370.
Hoyia (Probythinella) emarginata Thiele 1929, Handb. syst. Weichtierkunde, p. 140, fig. 115.
Vancleaveia emarginata F. C. Baker 1930, Ill. Acad. Sci. Trans., v. 22, p. 191, fig. 2, nos. 1, 2, 9.
Amnicola emarginata Goodrich 1932, Moll. Mich., p. 78.
Probythinella binneyana Pilsbry 1934, Acad. Nat. Sci. Philadelphia Proc., v. 86, p. 562.
Amnicola (Probythinella) binneyana Berry 1943, Amnicolidae Mich., p. 36.
Amnicola emarginata Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 300.
Amnicola (Probythinella) binneyana Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 85, pl. 10, fig. 16.
Amnicola binneyana La Rocque 1953, Cat. Recent Moll. Canada, p. 269.
Amnicola emarginata La Rocque 1953, *ibid.*, p. 270 (including var. *canadensis*).
Probythinella lacustris Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 80.

Type locality.—Ohio (Lea's *P. obtusa*).

Diagnosis.—Shell subcylindrical, apex blunt or truncate, about 4 whorls, 3 mm. high, 2 mm. wide; first and second whorls planorboid, sunken below the third whorl; sutures well impressed; spire slightly longer than the body whorl; aperture subovate, mainly basal, 1.44 mm. high, 1.36 mm. wide; columella reflected, peristome continuous, adnate to the body whorl for a very short distance and occasionally detached; umbilicus perforate, very narrow; periostracum light tan, gray, or white; growth lines very fine (Berry, 1943, p. 37).

Ecology.—Found on *Potamogeton* and on sandy bottom, Lake St. Clair, only at depths greater than 5 feet; La Plaisance Beach, Lake Erie, at a depth of 18 feet, no plants, bottom marl and coarse sand; most abundant in water more than 10 feet deep, perhaps at depths of 60 feet or more as it was found in the stomach contents of the whitefish; its food consists primarily of diatoms (adapted from Berry, 1943, p. 39).

Associations.—Living: OHIO-43. Fossil: S-6; W-27.

General distribution (fig. 248).—The Great Lakes and their immediate vicinity.

Distribution in Ohio (inset, fig. 248).—So far known only for Lake Erie and four northern counties: Ottawa, Erie, Stark, and Tuscarawas.

Group of *Amnicola leightoni*

F. C. Baker (1928a, pt. I, p. 119) separated this species from the other groups of *Amnicola* but did not erect a subgenus for it. Berry (1943) does not mention this species as it is outside the scope of his work. Baker's remarks seem to indicate that this species should be in a subgenus separate from the others mentioned here but at the present time data available are insufficient to warrant the erection of a formal subgenus.

Amnicola leightoni F. C. Baker 1920
Fig. 249

Amnicola winkleyi leightoni F. C. Baker 1920, Nautilus, v. 33, p. 125.
Amnicola leightoni F. C. Baker 1921, Nautilus, v. 35, p. 23.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 120, pl. 6, figs. 34-39.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 84.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 267.

Type locality.—Pleistocene marl, near Rush Lake, Logan County, Ohio.

Diagnosis.—"Bulbous, conic, turreted, widely umbilicated; surface shining, with fine and crowded lines of growth; sutures deeply impressed; whorls 4½ to 5, inflated, turbinate, well rounded, rapidly increasing in diameter, body whorl large and quite globose; the whorls are frequently somewhat flat-sided just below the suture and this feature is especially marked on the last whorl of some specimens; spire more or less sharply conic, usually elevated and considerably longer than the aperture; nucleus of one whorl, rather flat-topped, but well elevated above the second whorl; aperture roundly ovate, rounded acutely above and broadly below, peristome continuous, sharp, simple, only slightly thickened within the edge; inner lip rather sharp, erect, forming a heavy callus on the parietal wall, from which it is sometimes completely separated; base of shell well rounded; umbilicus widely open" (F. C. Baker, 1928a, pt. I, p. 120).

Ecology.—Probably a lake species, according to Baker (1928a, pt. I, p. 120), who records it on marl bottom at depths of 3, 7, 10, 15, and 39 m. from deposits washed into a lake underlain by marl deposits. The type locality is undoubtedly a lake deposit and it has been recorded elsewhere in Ohio from small-lake deposits, in marl.

Associations.—Fossil: W-29, 30, 31, 32, 33, 34, 38, 39, 40, 41, 42, 45, 46, 47, 48, 49, 50, 51.

General distribution (fig. 250).—The species is apparently extinct, so its distribution is confined to fossil records.

Distribution in Ohio (inset, fig. 250).—Known in the State only as a fossil from three counties: Logan, Franklin, and Ross.

Geologic range.—Marl deposits in Ohio, Indiana,

Michigan, Wisconsin, Illinois, and, doubtfully, Ontario. In Ohio, it has been recorded for the following deposits: Humboldt (Reynolds, 1959, p. 155), Newell Lake (Zimmerman, 1960, p. 20), Oakhurst (Aukeman, 1960, p. 57), Jewell Hill (Mowery, 1961, p. 8), and Souder Lake (Cornejo, 1961, fig. 11).

Genus *Pyrgulopsis* Call and Pilsbry 1886

Pyrgulopsis Call and Pilsbry 1886, Davenport Acad. Sci. Proc., v. 5, p. 9 (*fide* Neave).
Pyrgulopsis Walker 1918, Synopsis and cat. fresh-water Moll., p. 29, 139.

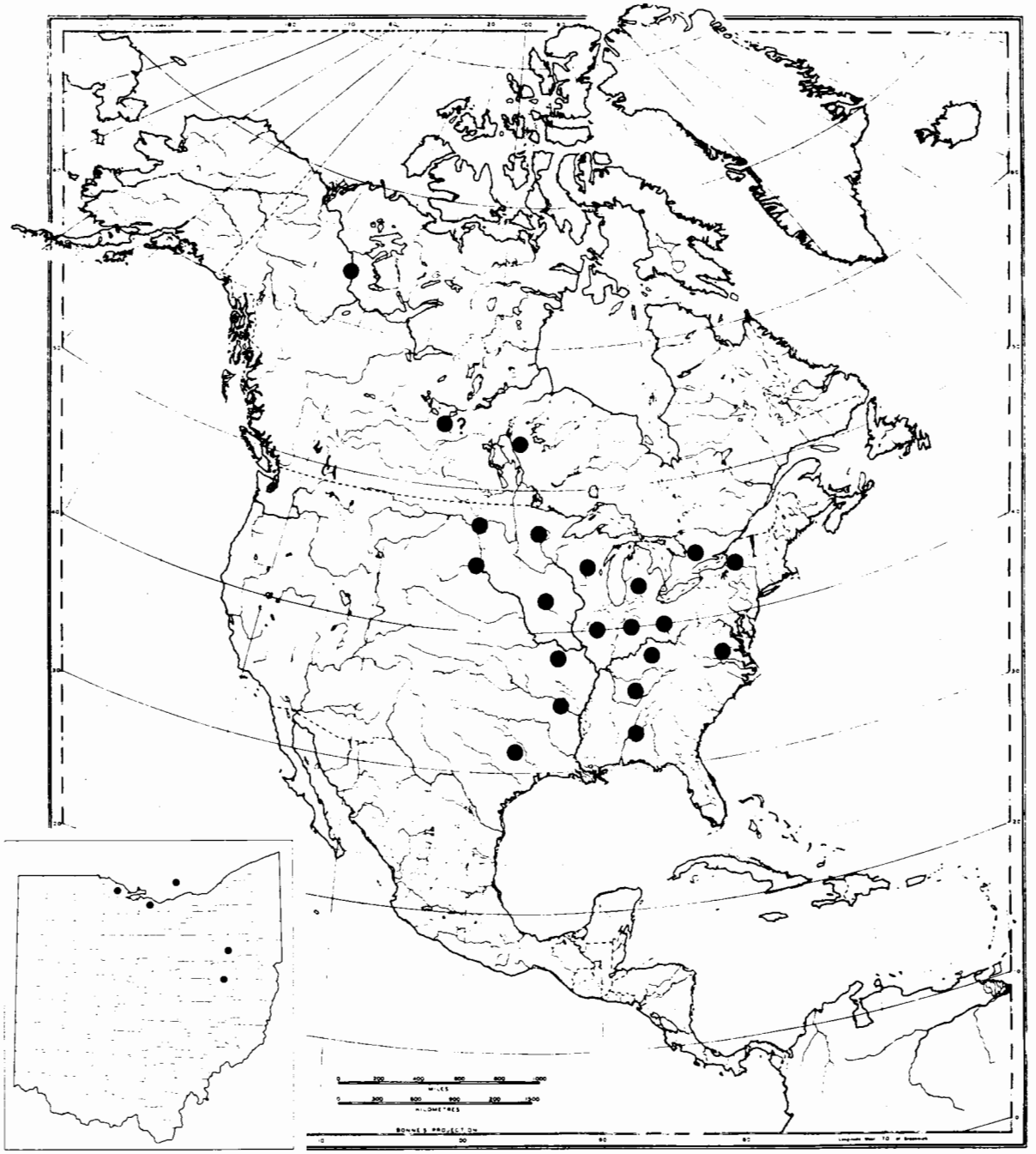


FIGURE 248.–Distribution of *Amnicola lacustris* in North America; *inset,* distribution in Ohio.

FIGURE 249.–*Amnicola leightoni,* magnified; after F. C. Baker (1928a, pt. I, pl. 6, figs. 34, 39).

Pyrgulopsis F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 137.
Pyrgulopsis Berry 1943, Amnicolidae Mich., p. 41.
Pyrgulopsis La Rocque 1953, Cat. Recent Moll. Canada, p. 270.

Type.–*Pyrgula nevadensis* Stearns.

Diagnosis.–Shell ovate-conical or turreted, imperforate, whorls having a single strong carina at the pe-

FIGURE 250.–Distribution of *Amnicola leightoni* in North America; *inset,* distribution in Ohio.

riphery, which may or may not be concealed on the spire; apex acute; whorls 4½ to 6; aperture ovate, peristome continuous.

Remarks.—This is a genus of predominantly western American distribution, represented by numerous Pleistocene species. It is incompletely known and new species have been described quite recently (*e.g.*, D. W. Taylor, 1950). East of the Mississippi it is represented by only a few species listed by Walker (1918, p. 139). A late Wisconsin species, *P. scalariformis* Wolf, is recognized by F. C. Baker (1920a, p. 385) but has not, so far, been recorded for Ohio.

Pyrgulopsis letsoni (Walker) 1901
Pl. 10, fig. 13, pl. 11, fig. 7

Amnicola letsoni Walker 1901, Nautilus, v. 14, p. 113.
--- --- Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Pyrgulopsis letsoni Walker 1918, Synopsis and cat. fresh-water Moll., p. 139.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 140, pl. 7, figs. 28, 29.
--- --- Goodrich 1932, Moll. Mich., p. 79.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 85, pl. 10, fig. 14.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 270.

Type locality.—Goat Island, Niagara River, New York, Pleistocene.

Diagnosis.—"Shell rather solid for so small a mollusk, elongate, smooth; brown before the epidermis has worn away and white and transparent after that has occurred. Whorls 4.5, upper ones a little flattened, the apex blunt; body whorl convex. Aperture nearly round. The outer lip is thickened and without any reflected portion. The type of this species measured 3.5 mm. in height and 2.2 mm. in width. Operculum and animal unknown" (Goodrich, 1932, p. 79).

Ecology.—A species of running water in large and medium-sized rivers.

General distribution (fig. 251).—New York (living and Pleistocene); Michigan, Ontario, Ohio; Pleistocene, Chicago, Illinois.

Distribution in Ohio (inset, fig. 251).—Goodrich first found this species near Toledo, as noted by Sterki (1914, p. 271). F. C. Baker (1928a, pt. I, p. 140) also gives Sandusky Bay. It has not so far been found as a fossil in Ohio.

Geologic range.—Pleistocene of Goat Island, New York, and Chicago, Illinois. Baker (1920a, p. 385) lists its age as "Wabash" (late Wisconsin).

Remarks.—This species is the northernmost in range of a genus that is mainly western in distribution. All the records are within the glaciated area of the midwestern states and it is rather remarkable that it has not been found, at least so far, south of the glacial boundary, either living or as a fossil. This curious situation may be due to the fact that the living animal is small and inconspicuous and that the shell, in living or fossil specimens, is small and easily confused with other Amnicolidae. The species certainly must have existed south of the glacial boundary in Pleistocene time and its habitat is such that it could exist at present, in Ohio at least, far to the south of the glacial boundary. This is a point well worth investigating in Ohio and Pennsylvania.

Genus *Hydrobia* Hartmann 1821

Hydrobia Hartmann 1821, N. Alpina, 1, p. 258; 1821, *in* Sturm, Dtschl. Fauna, v. 6, no. 5, p. 47 (*fide* Neave).
Paludestrina d'Orbigny 1840, Amér. Mérid. (Moll.), p. 381 (*fide* Neave).
Stimpsonia Clessin 1878, Malak. Blätter, v. 25, p. 151; *non* Girard 1854, *nec* Bate and Westwood 1862.
Paludestrina Walker 1918, Synopsis and cat. fresh-water Moll., p. 29.
Paludestrina F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 131, 136, 144.
Fontigens Pilsbry 1933, Nautilus, v. 47, p. 12; type: *Paludestrina nickliniana* Lea.
Hydrobia Berry 1943, Amnicolidae Mich., p. 44.
Hydrobia La Rocque 1953, Cat. Recent Moll. Canada, p. 270.

Type.—*Hydrobia ventrosa* Mont.

Diagnosis.—Shell dextral, small, elongate, conical, subacute; whorls 5 to 8, slightly convex; sutures impressed; aperture oval; lip simple, sharp; ornamentation of fine, crowded axial striae; umbilicus slightly open.

Remarks.—Many different names have been applied to the North American representatives of this group of which only one is represented in our fauna. Berry (1943, p. 44) gives a more extensive synonymy which is useful for the specialist but need not be reproduced here.

Hydrobia nickliniana (Lea) 1839
Pl. 10, fig. 16

Paludina nickliniana Lea 1839, Am. Philos. Soc. Trans., v. 6, p. 92, pl. 22, fig. 109.
Amnicola nickliniana Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.
Paludestrina nickliniana Walker 1918, Synopsis and cat. fresh-water Moll., p. 138.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
Stimpsonia nickliniana F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 132, pl. 7, figs. 9-12.
Paludestrina nickliniana Goodrich 1932, Moll. Mich.,

p. 80.

Hydrobia nickliniana Berry 1943, Amnicolidae Mich., p. 44.

Paludestrina nickliniana Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 300.

Hydrobia nickliniana Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 88, pl. 10, fig. 3.

--- --- LaRocque 1953, Cat. Recent Moll. Canada, p. 270.

Type locality.—Hot Springs, Virginia.

Diagnosis.—"Very small, slender, usually black in nature and of a bright brown or green color after cleaning. Michigan specimens at hand have 4.5 whorls. Sutures are deep and with a correspondingly noticeable convexity of the whorls. Aperture nearly round. Outer lip sharp-edged. Umbilical region slightly indented. Operculum thin, spiral, reddish. Altitude 3.5 to 4, diameter 2 to 2.5 mm." (Goodrich, 1932, p. 80).

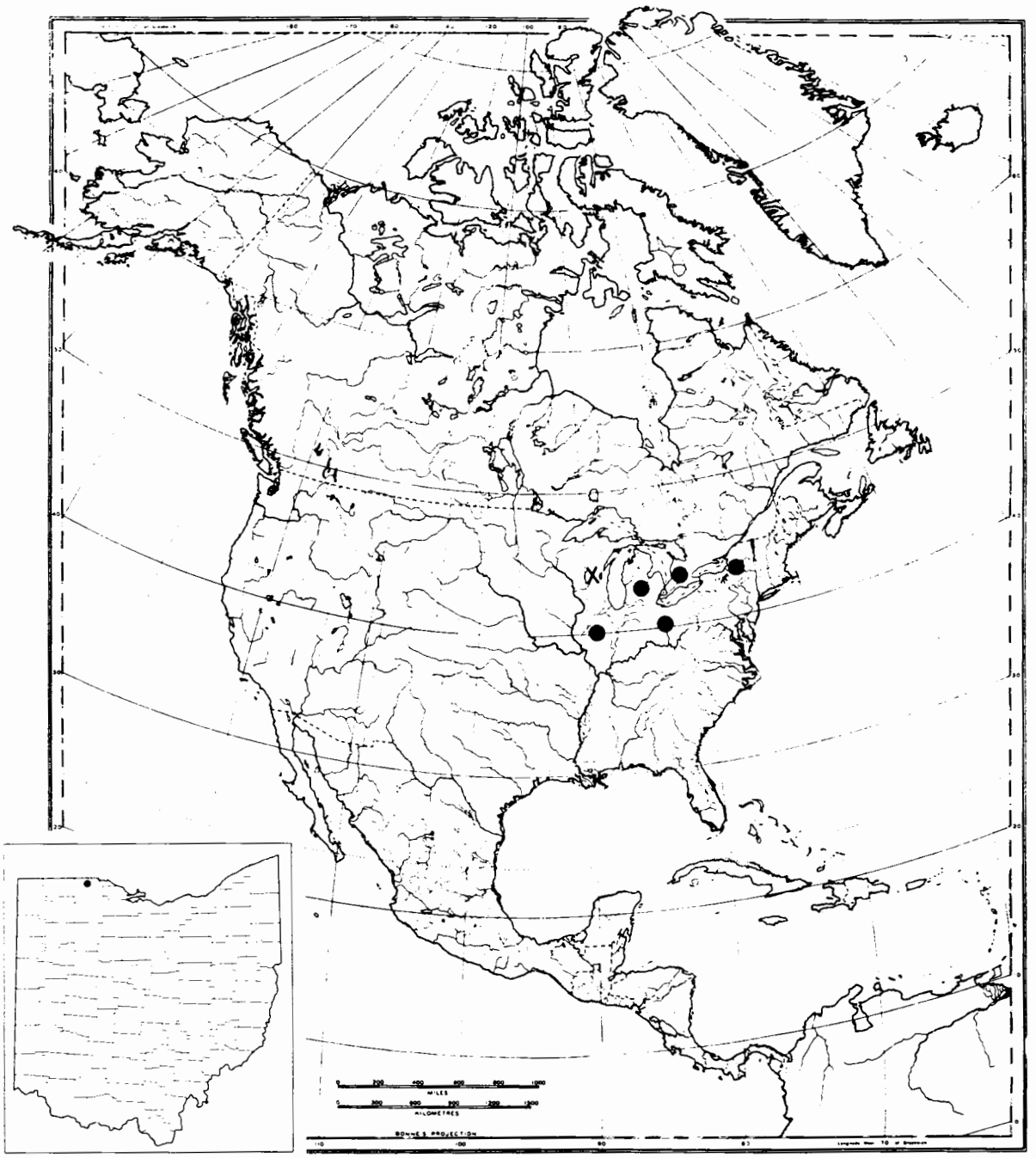


FIGURE 251.—Distribution of *Pyrgulopsis letsoni* in North America; *inset,* distribution in Ohio.

Ecology.—Found in small slow-moving streams, and cool, shallow springs where water cress grows in a thick mat; optimum conditions are water an inch or so deep. Under these conditions, the snail is so abundant that it blackens the stems of the cress. Berry (1943, p. 47) took as many as 20 specimens from a small sprig of water cress from a spring in Michigan.

General distribution (fig. 252).—Pennsylvania to Wisconsin and Ontario to Alabama. The range also includes western New York (Robertson and Blakeslee, 1948, p. 88).

Distribution in Ohio (inset, fig. 252).—Sterki (1907a, p. 387) lists the species only for Summit County. Dennis (1928) did not find it in the Bass Islands region nor did Ahlstrom (1930). Eggleston has no records either. It may be much more common in the State than the records indicate and should be looked for wherever water cress grows.

FIGURE 252.—Distribution of *Hydrobia nickliniana* in North America; *inset,* distribution in Ohio.

Geologic range.—F. C. Baker (1920a, p. 386) lists this species for "Wabash" (late Wisconsin) beds. No fossil record exists for this species for Ohio but it should occur in some of our Pleistocene deposits. The distribution in Michigan is anomalous in that there is a concentration of records in the southwestern part of the State (Berry, 1943, map 7, p. 46) and a single one for the Saginaw Bay region. Berry points out that this may be due to introduction with water cress but he also advances the possibility that the species may have migrated to the Saginaw Bay region by way of the Grand River outlet of Lake Warren. Fossil records are desirable to throw some light on the history of this species.

Subfamily LITHOGLYPHINAE Fischer 1885

Lithoglyphinae F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 146.
Lithoglyphinae Berry 1943, Amnicolidae Mich., p. 21, 48.

Shells of this subfamily are small *(Cochliopa)* to comparatively large *(Fluminicola),* spiral, dextral; spire short, body whorl large, forming most of the shell; columella usually callusly thickened; operculum corneous, subspiral; animal with simple foot, without sinuses; central tooth of radula with several basal denticles; verge bifid or simple, compressed.

This subfamily is represented in the Ohio fauna by a single genus, *Somatogyrus,* with three species. One of these, *S. subglobosus,* was formerly placed in a separate genus, *Birgella,* which is considered as a synonym of *Somatogyrus* by Berry (1943, p. 48). Elsewhere in North America, the genera mentioned in the description are represented by numerous species. The fossil record of this genus includes at least the Pleistocene; older species may exist but if so they are placed at present in other genera.

Genus *Somatogyrus* Gill 1863

Somatogyrus Gill 1863, Acad. Nat. Sci. Philadelphia Proc. 1863, p. 34 (*fide* Neave).
Somatogyrus Walker 1918, Synopsis and cat. fresh-water Moll., p. 32, 142.
Somatogyrus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 146.
Somatogyrus Berry 1943, Amnicolidae Mich., p. 48.
Somatogyrus La Rocque 1953, Cat. Recent Moll. Canada, p. 271.

Type.—*Amnicola depressa* Tryon.

Diagnosis.—Shell dextral, spiral, generally rather thick and solid, smooth, imperforate or narrowly perforate; spire generally short; apical whorl spirally punctate or lirate; body whorl large, more or less inflated; aperture very oblique; lip sharp, projecting above; columella callusly thickened; operculum corneous, subspiral, whorls small, rapidly increasing (Walker, 1918).

Remarks.—The majority of the species of this genus inhabit the southeastern states, in particular Tennessee, Georgia, and Alabama, but a few of them have found their way into the Mississippi drainage, thence—or perhaps directly—into the Ohio River and its tributaries. A single species has found its way into the Great Lakes, probably from the Mississippi River in Pleistocene time, and is now found at least as far down as the Montreal area in the St. Lawrence River and in the Ottawa River where it may have spread from the St. Lawrence or directly, in late Wisconsin time, by means of the Ottawa River outlet of the Great Lakes.

Somatogyrus integer (Say) 1829
Fig. 253

Melania integra Say 1829, New Harmony Disseminator, v. 2, no. 18, p. 276.
Anculotus pumilus Conrad (*fide* Binney, 1865).
Paludina fontinalis Philippi 1846, Conch., v. 2, no. 5, p. 2, pl. 2, fig. 9.
Somatogyrus integer Binney 1865, Land and fresh water shells N. America, pt. 3, p. 79, fig. 156.
--- --- Call 1900, Moll. Ind., p. 415, pl. 8, fig. 19.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 144.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 385.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 88.

FIGURE 253.—*Somatogyrus integer,* X1; after Call (1900, pl. 8, fig. 19).

Type locality.—Ohio River.

Diagnosis.—"Subglobose, horn-color; volutions rather more than three, rounded, obsoletely wrinkled; spire very short, less than half the length of the aperture; suture rather deeply impressed; body whirl large, aperture dilated ovate, acute above; columella flattened, polished; labrum regularly rounded; base regularly rounded, without any undulations or sinus; umbilicus none; operculum obviously spiral. Length nearly one-fifth of an inch. Animal, foot longer than wide, rounded behind, with the anterior angles a little excurved; eyes black, conspicuous; tentacula rather long and slender" (Binney, 1865, p. 79).

Ecology.—No specific information available.

General distribution (fig. 254).—Ohio River drainage, but not completely known, at least to me. The New York record appears to be erroneous (Robertson and Blakeslee, 1948). W. G. Binney (1865) gives only Ohio and Flemington, Centre County, Pennsylvania. It should be found in Michigan and Indiana, judging by the Ohio records, but Goodrich (1932) and Goodrich and van der Schalie (1944) do not list this species.

Distribution in Ohio (inset, fig. 254).—Sterki (1907a) records it "over the state." Eggleston (ms. records) has it for Ottawa, Delaware, and Highland Counties, indicating a very wide distribution in Ohio, in both the Ohio and Maumee(?) drainages.

Geologic range.—Recorded by F. C. Baker (1920a,

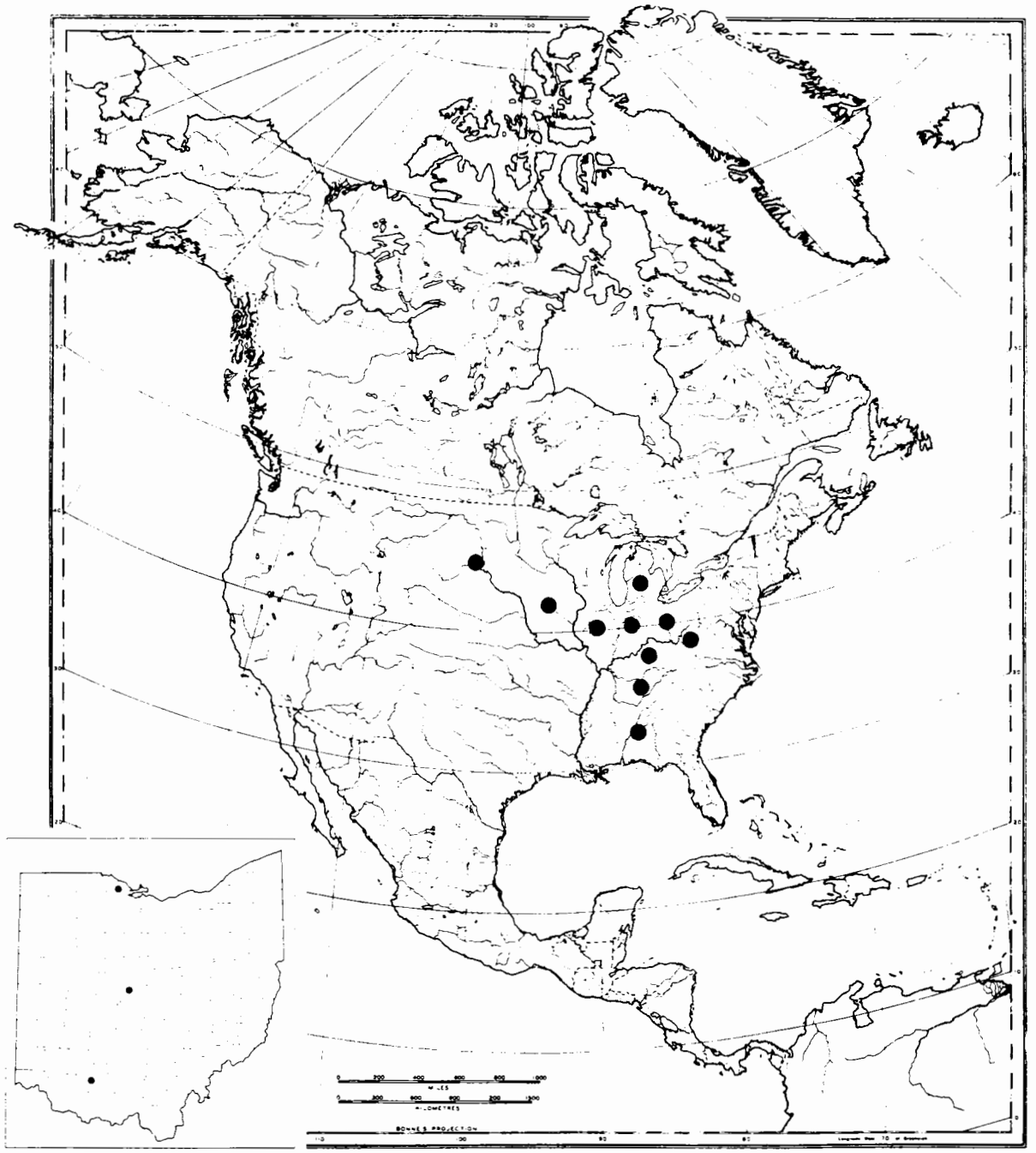


FIGURE 254.—Distribution of *Somatogyrus integer* in North America; *inset,* distribution in Ohio.

p. 385) for beds of "Wabash" (late Wisconsin) age.

Somatogyrus subglobosus (Say) 1825
Pl. 11, figs. 1, 3

Paludina subglobosa Say 1825, Acad. Nat. Sci. Philadelphia Jour., v. 5, p. 125.
Melania isogona Say 1829, New Harmony Disseminator, v. 2, p. 227; Bear Grass Creek, near Louisville, Kentucky.
Somatogyrus isogonus Call 1900, Moll. Ind., p. 415, pl. 8, fig. 20.
Somatogyrus subglobosus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386.
Somatogyrus isogonus Sterki 1907, *ibid.*
Somatogyrus subglobosus Johnson 1915, Fauna New England, p. 115.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 145.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 385.
Birgella subglobosa F. C. Baker 1928, Fresh water Moll., pt. I, p. 155, pl. 8, figs. 4-9; pl. 7, figs. 40, 41.
Birgella subglobosa isogona F. C. Baker 1928, *ibid.*, p. 159, pl. 7, figs. 10, 12.
Somatogyrus subglobosus Goodrich 1932, Moll. Mich., p. 79.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 301; *S. isogonus* included as a synonym.
Somatogyrus subglobosus isogonus Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 88, pl. 10, fig. 18.
Somatogyrus subglobosus La Rocque 1953, Cat. Recent Moll. Canada, p. 271.

Type locality.—"Northwestern Territory" (Say).

Diagnosis.—Shell "nearly as wide as it is high, thick, yellow to brown in living individuals, of a bright transparent white to chalky-white color in drift specimens. Whorls 3-4, the last one large and ending in a thin outer lip. Aperture almost round. Umbilicus small.... 9 mm. in height, 7.5 mm. in diameter. Operculum spiral, having about three volutions" (Goodrich, 1932, p. 79).

Ecology.—F. C. Baker (1928a, pt. I, p. 159) gives the following habitats for the typical or lake form in inland lakes of Wisconsin: on boulder, mud, sand, sand and gravel, and gravel bottom, in water 0.4-3.4 m. deep. For the river and creek form *(S. subglobosus isogonus)* he gives: "living on a muddy bottom in Illinois and in the Fox River of Wisconsin."

Associations.—Living: NEW YORK-3b, 14, 15b, 32; OHIO-43; ONTARIO-1.

General distribution (figs. 255, 256).—Baker gives for the type form: "Probably confined to the Great Lakes region. Typical *subglobosa* has been seen only from Lake Michigan, Lake Erie, Lake Ontario, Oneida Lake, and Lake Winnebago." He recognizes the river and creek form from "Ohio west to Iowa, Michigan south to Alabama and Arkansas." To this must be added the Ottawa and St. Lawrence Rivers, in the Ottawa and Montreal regions.

Distribution in Ohio (insets, figs. 255, 256).—Sterki (1907a) gives "over the state." A form from the Ohio River, at Cincinnati (St.), is rather different and may represent a variety. Eggleston (ms. records) records the river and creek form from Licking, Franklin, Fairfield, and Hamilton Counties.

Geologic range.—Baker (1920a, p. 385) gives Sangamon and "Wabash" (late Wisconsin). The species has been recorded for the interglacial beds at Toronto, Ontario, Canada.

Somatogyrus trothis Doherty 1878

Somatogyrus trothis Doherty 1878, Quart. Jour. Conchology, v. 1, p. 341, pl. 4, fig. 1.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 146.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 301.

Type locality.—Ohio River, Campbell County, Kentucky (opposite Clermont County, Ohio).

Diagnosis.—"Shell globosely ovate, rather heavy, yellowish-green; spire conical, elevated for the genus, nearly as long as the aperture; suture deeply impressed; whorls four, rapidly increasing, with fine lines of growth, last year's growth somewhat dilated at its junction with that of the previous year; last whorl constricted near peristome, forming an obliquely-impressed scar above, and at the base below the closed umbilicus, a deep impression which sometimes indents the peristome; aperture, broadly ovate, obtusely rounded below; peristome somewhat shouldered above, slightly angulated below at its union with the rounded columella" (Doherty, 1878, original description).

Ecology.—"Found on stones in the Ohio River, above the mouth of the Five-mile Creek, Campbell County, Kentucky; also on leaves in Five-mile Creek" (Doherty, 1878, p. 341).

General distribution (fig. 257).—Ohio River and one tributary, probably more, but not well known at present. The only localities I know of are those mentioned by Doherty.

Distribution in Ohio (inset, fig. 257).—Imperfectly known. It certainly occurs in the Ohio River in the area of Clermont County, but it has not been recorded, to my knowledge, by any worker since Doherty.

Geologic range.—Unknown.

Remarks.—Doherty illustrated his species with a back and front view, giving also a scale indicating

natural size. In the right-hand figure, the operculum is indicated; it is paucispiral and has, apparently, widely spaced radiating striae. The figures do not permit identification of this species with any other now living in the Ohio. Doherty states: "Specimens are in the cabinet of the Philadelphia Academy of Sciences, and in those of Prof. A. G. Wetherby and Dr. James Lewis, as well as in my own." Perhaps the mystery surrounding the nature of this species can be solved by examination of the Philadelphia Academy specimens, if they still exist.

Subfamily LYOGYRINAE Pilsbry 1916

Lyogyrinae Pilsbry 1916, Nautilus, v. 30, p. 84.
Lyogyrinae Berry 1943, Amnicolidae Mich., p. 57.

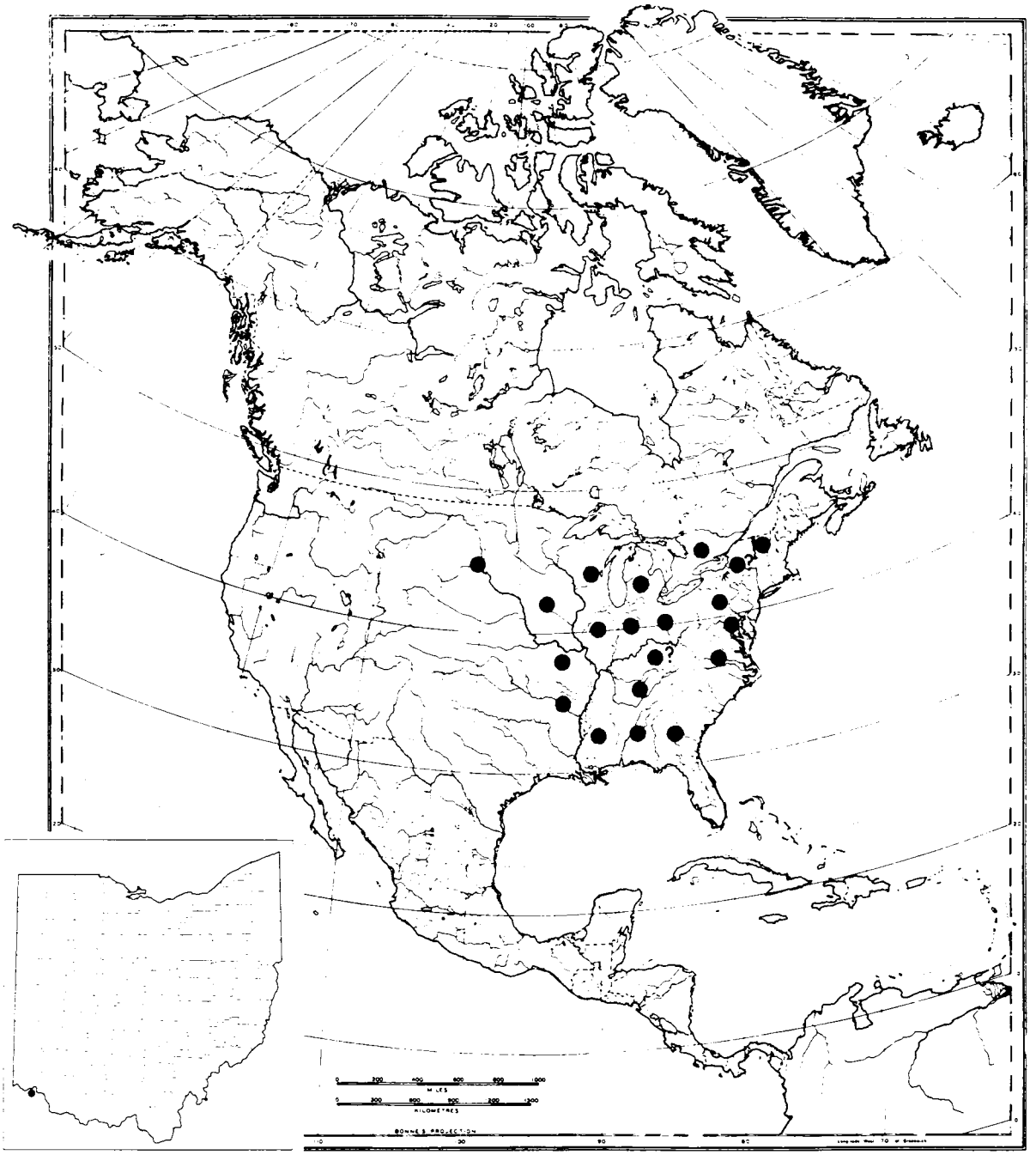


FIGURE 255.–Distribution of *Somatogyrus subglobosus* in North America; *inset*, distribution in Ohio.

Shells of this subfamily are minute, conical, turreted or subdepressed; operculum spiral; radula comparatively long, central tooth with 1 or 2 basal denticles.

In the living Ohio fauna, the subfamily is represented by a single genus, *Lyogyrus*.

Genus *Lyogyrus* Gill 1863

Lyogyrus Gill 1863, Acad. Nat. Sci. Philadelphia Proc. 1863, p. 34 (*fide* Neave).

Lyogyrus Walker 1918, Synopsis and cat. fresh-water Moll., p. 33.

Lyogyrus Berry 1943, Amnicolidae Mich., p. 57.

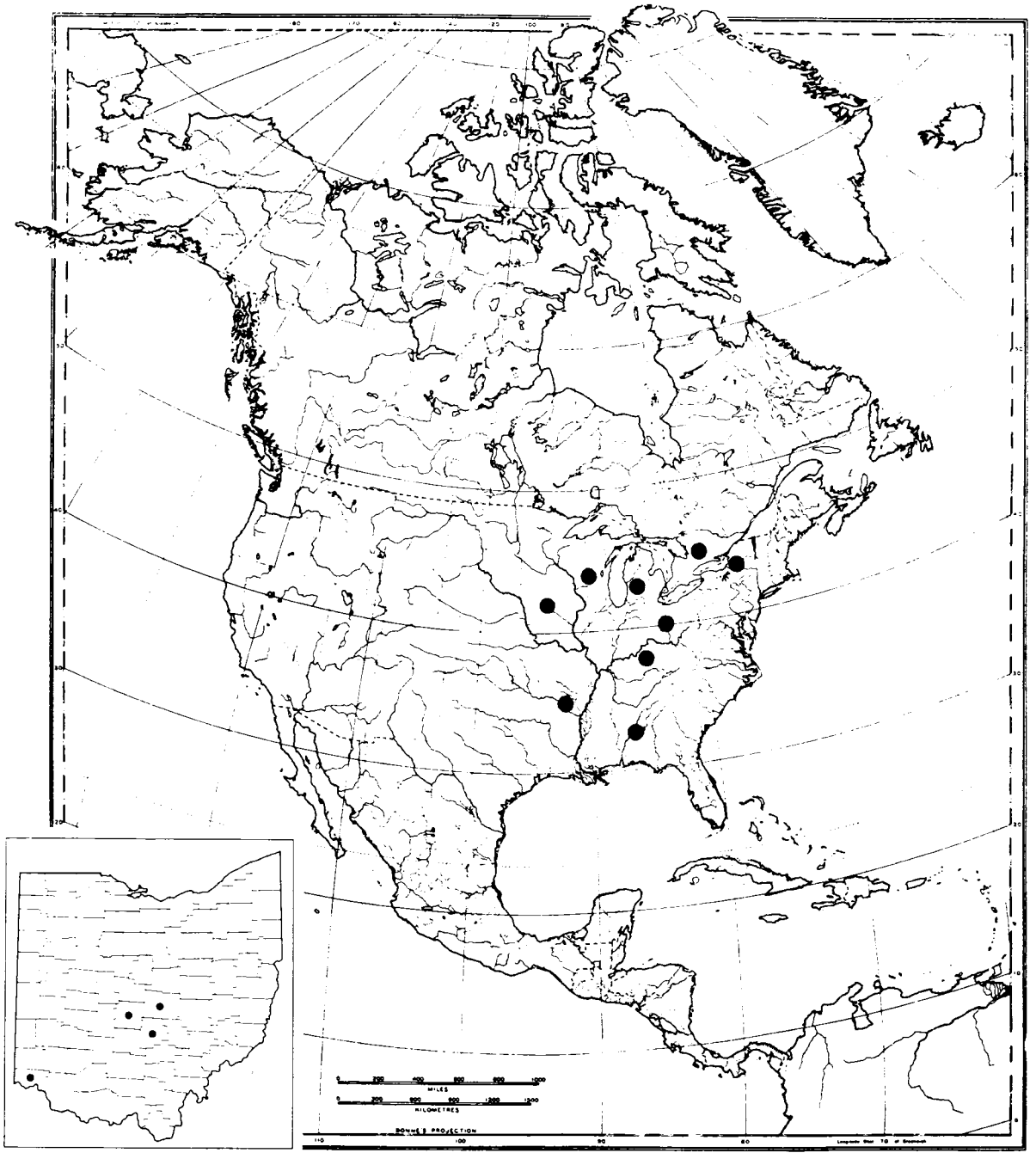


FIGURE 256.–Distribution of *Somatogyrus subglobosus isogonus* in North America; *inset*, distribution in Ohio.

Type.—*Valvata pupoidea* Gould.

Diagnosis.—Shell very small, spiral, dextral, smooth, umbilicate; globose-turbinate or elongate-ovate; aperture nearly circular; peritreme continuous, frequently quite separated from the body-whorl; operculum corneous, circular, multispiral (Walker, 1918).

Remarks.—The record of this genus *(L. brownii)* as far north as Michigan is questioned by Berry (1943, p. 57) but the record of Sterki (1907a) for *L. pupoideus* (Gould) appears to be reliable.

Lyogyrus pupoideus (Gould) 1840
Pl. 10, fig. 14; pl. 11, fig. 4

Valvata pupoidea Gould 1840, Am. Jour. Sci., 1st ser., v. 38, p. 196.

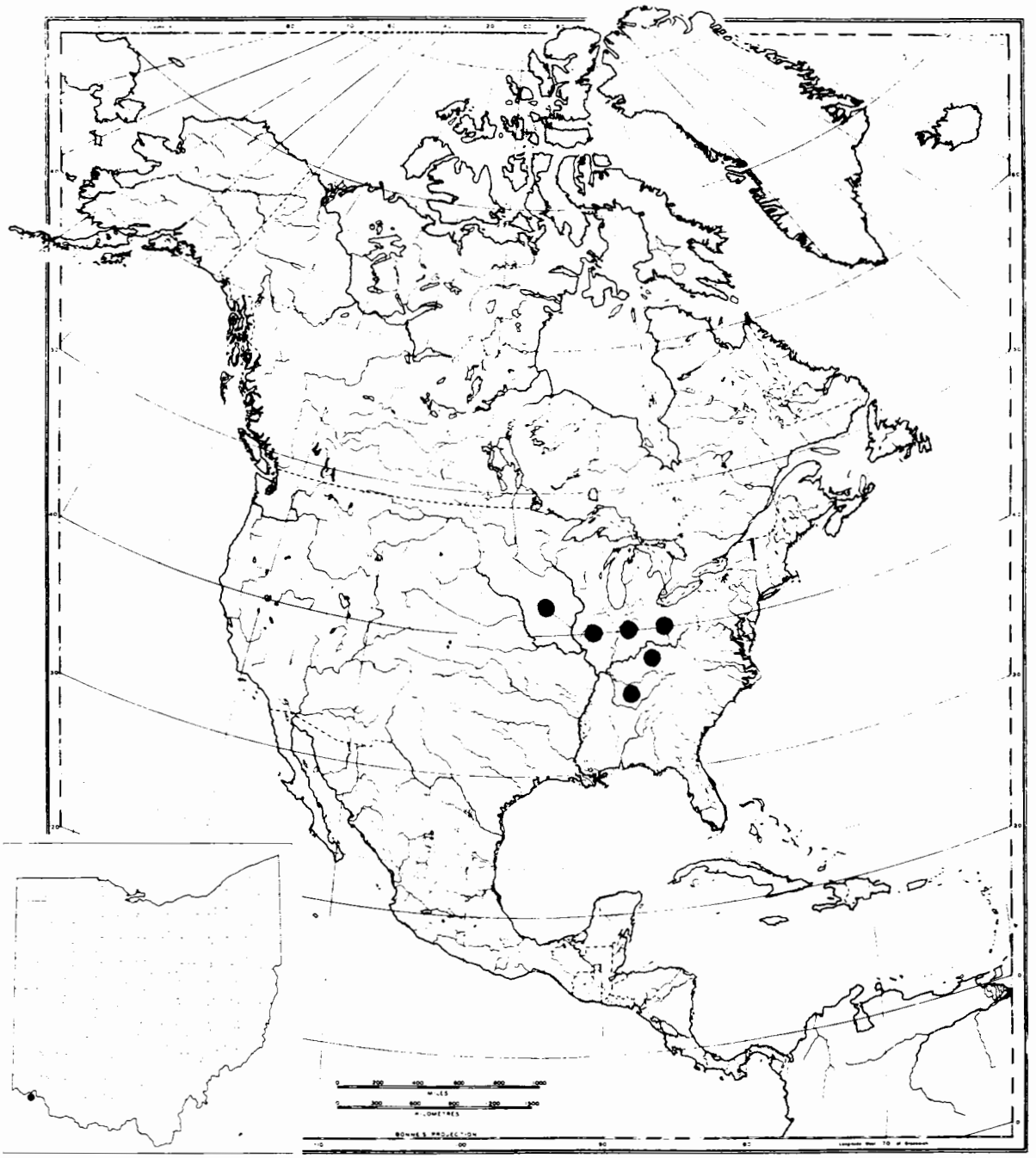


FIGURE 257.—Distribution of *Somatogyrus trothis* in North America; *inset,* distribution in Ohio.

Valvata pupoidea Binney 1865, Land and fresh water shells N. America, pt. 3, p. 13, fig. 19; p. 113, fig. 223.
Lyogyrus pupoides Pilsbry 1892, Nautilus, v. 6, p. 61, 83.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 387.
Lyogyrus pupoidea Johnson 1915, Fauna New England, p. 114.

Type locality.—Cambridge, Massachusetts.

Diagnosis.—"Shell small, elongate-ovate, opaque, chestnut-colored, when divested of the rough, dirty pigment which usually adheres closely to it; whirls four or five, minutely wrinkled, the posterior one small and flattened so as to form an obtuse apex; the others cylindrical, and so partially in contact as to expose about one-half of the cylinder; the last entirely disjoined from the preceding one for at least the half of a revolution; aperture circular, lip simple and sharp; on looking at the shell from below, no umbilical opening is found; operculum horny, apex central, elements concentric. Length .1, breadth 3.40 inch" (Gould, quoted by W. G. Binney, 1865, p. 14).

Ecology.—No data available.

General distribution (fig. 258).—Massachusetts, Connecticut, District of Columbia, Maine, and Canada (erroneously, I think); Ohio (Sterki, 1907a).

Distribution in Ohio (inset, fig. 258).—Only one record, for Summit County (Sterki, 1907a, p. 387), exists for the State, but the species should be found elsewhere in the Lake Erie drainage.

Subfamily BULIMINAE Hannibal 1912

Buliminae Hannibal 1912, Malac. Soc. London Proc., v. 10, p. 190.
Buliminae F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 81.
Buliminae Berry 1943, Amnicolidae Mich., p. 52.

Shells of this subfamily are ovate, comparatively large (10 mm.), spiral, conical or turbinate; spire produced; operculum calcareous, spiral when young, concentric when adult; animal with simple foot; right cervical lobe well developed, forming water conduit; central tooth of the radula with several basal denticulations; tentacles long, pointed, tapering.

The subfamily is represented in the living Ohio fauna by a single genus and species, *Bulimus tentaculatus*, introduced from Europe. F. C. Baker (1928a, pt. I, p. 88) has pointed out that some specimens of this species, collected in Pleistocene deposits, are in place, which would mean that the species was an inhabitant of North America at the time. See below for discussion of this point.

Genus *Bulimus* Scopoli 1777

Bulimus Scopoli 1777, Introd. Hist. Nat., p. 392 (*fide* Neave).
Bithynia Leach 1818, *in* Abel, Narr. Journ. China, p. 362 (*fide* Neave).
Bithinia Walker 1918, Synopsis and cat. fresh-water Moll., p. 28.
Bulimus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 81.
Bulimus Berry 1943, Mich. Univ. Mus. Zoology Misc. Pub., no. 57, p. 52.
Bulimus La Rocque 1953, Cat. Recent Moll. Canada, p. 271.

Type.—*Helix tentaculata* Linnaeus.

Diagnosis.—Shell large for the family, spiral, elevated, subperforate; aperture oval; peristome thin, continuous; lip simple, sharp; operculum calcareous, concentric.

Remarks.—The genus is easily identifiable if the operculum is preserved. Its calcareous concentric character distinguishes it from all other North American operculates of the same size, including young shells of *Campeloma* and mature shells of *Somatogyrus*. When the operculum is not preserved, the size of the shell immediately eliminates from consideration *Amnicola* on the one hand because it is much smaller and *Campeloma* on the other because it is much larger. The proportions in *Anculosa* and *Nitocris* are different (compare figs. 276, 282) and the shell in *Somatogyrus* is constantly wider in proportion to the diameter.

Bulimus tentaculatus (Linnaeus) 1767
Pl. 11, figs. 2, 5

Helix tentaculata Linnaeus 1767, Syst. Nat., 12th ed., v. 1, p. 1249.
Bithynia tentaculata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386.
Bythinia tentaculata Johnson 1915, Fauna New England, p. 115.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 132.
Bulimus tentaculatus magnalacustris F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 81, pl. 5, figs. 22, 23, 26-31.
Bythinia tentaculata Goodrich 1932, Moll. Mich., p. 77.
Bulimus tentaculatus Berry 1943, Amnicolidae Mich., p. 53.
Bithynia tentaculata Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 299.
Bulimus tentaculatus Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 89, pl. 10, figs. 19, 20.
Bulimus tentaculatus tentaculatus La Rocque 1953, Cat. Recent Moll. Canada, p. 271.

Bulimus tentaculatus magnalacustris La Rocque 1953, *ibid.*, p. 272.

Type locality.—Europe.

Diagnosis.—Shell large for the family (about 11 mm. high, 6.5 mm. wide); spire of 5.75 whorls, somewhat flattened, sutures shallow, nuclear whorl prominent and well above succeeding whorls; aperture oval (4.5 mm. high, 3.3 mm. wide), peristome continuous, lip somewhat thickened; umbilicus imperforate; periostracum horn color (modified from Berry, 1943).

Ecology.—F. C. Baker (1928a, pt. I, p. 87) says that this species is an inhabitant of the large lakes, as a rule, living in vegetation in depths of less than 1 m. to as much as 4.6 m. It feeds on filamentous algae and is commonly abundant in suitable situations. It

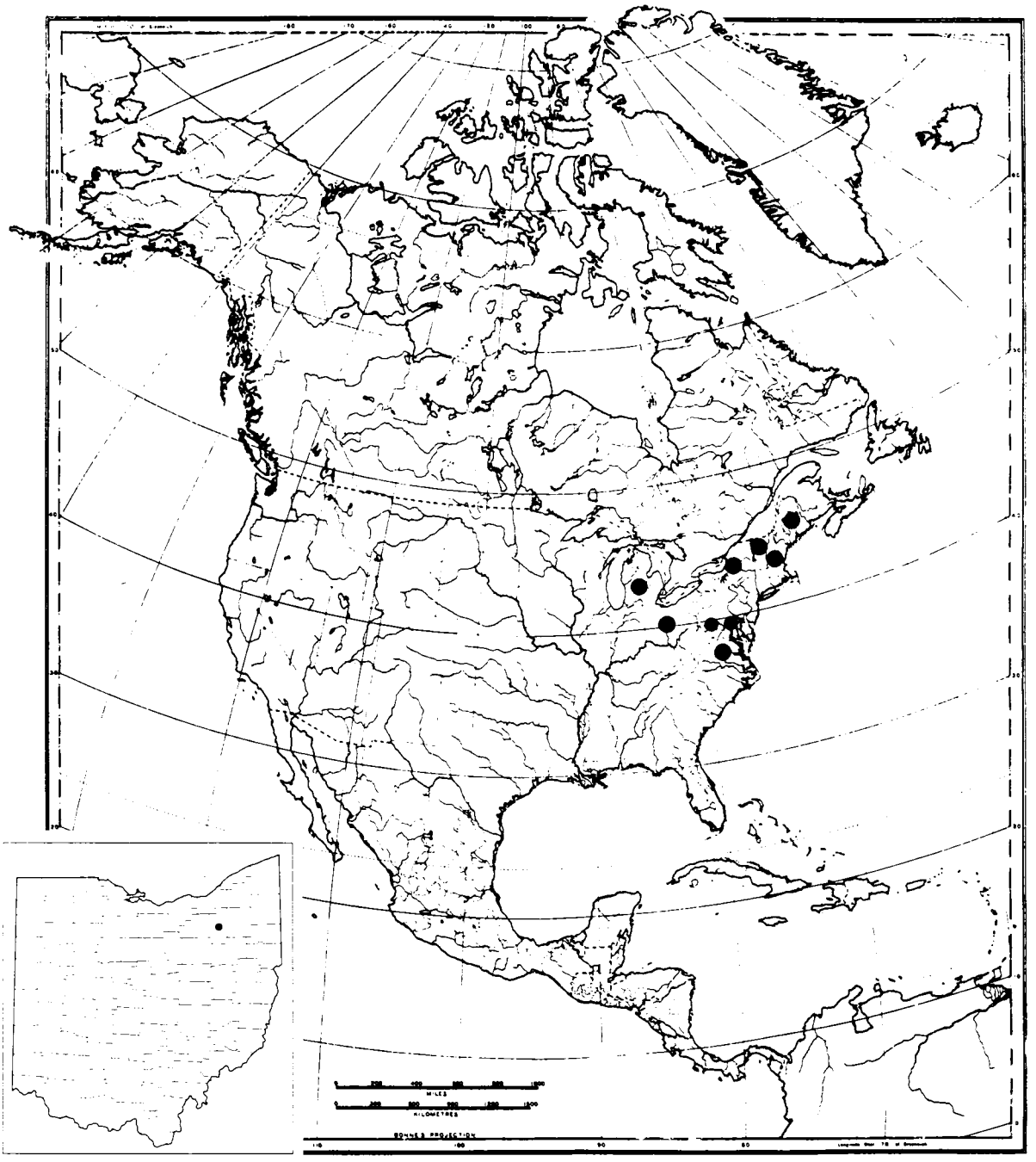


FIGURE 258.—Distribution of *Lyogyrus pupoideus* in North America; *inset*, distribution in Ohio.

can also thrive in environments where algae, but not vegetation in the strict meaning of waterweeds such as *Elodea* and *Vallisneria,* are present. I have collected it on canal walls and timbers in the Rideau Canal, near Ottawa, and in the same situations at Cornwall, Ontario, Canada, where the surface was thick with filamentous algae but the water clear of vegetation. It is one of the most prolific species of the Great Lakes drainage, in which it has spread from the late nineteenth century to the present until it occupies a variety of situations in the lakes themselves, their tributaries, and the smaller lakes connecting with them.

Associations.—Living: NEW YORK - 3b, 10, 14, 15b, 21, 22, 31, 32, 36, 37, 38, 40a, 42, 43; ONTARIO - 1, 3.

General distribution (fig. 259).—Europe. Introduced, Great Lakes region; Ontario, Quebec, New York, and District of Columbia, to Wisconsin.

Distribution in Ohio (inset, fig. 259).—Sterki (1907a) records it for Lake Erie and for the Ohio Canal in Stark County. I have no further records but would not be surprised to find it in any of Ohio's inland waterways. To my knowledge, it has not invaded the Ohio River drainage.

Geologic range.—One record only, Pleistocene, probably Toleston stage, Chicago, Illinois. Baker (1928a, pt. I, p. 88) gives the circumstances of the collecting which would indicate that the shells were not introduced into the deposit by human activity.

Family POMATIOPSIDAE Stimpson

Pomatiopsidae F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 161.
Pomatiopsidae Berry 1943, Amnicolidae Mich., p. 59.

Shells of the Pomatiopsidae are elongated, turreted, thin to thick, smooth, umbilicate; aperture expanded; peristome continuous, thin or slightly reflected; operculum corneous, subspiral, with spiral sculpture; animal shorter than the shell, foot broad, truncated before, rounded behind, with a transverse sulcus at about its anterior third; verge simple; central tooth of radula with but one large basal denticle; denticles of the lateral and marginal teeth very large and few in number, proportionally much larger than in Amnicolidae.

In the Ohio fauna, this family is represented by a single genus, *Pomatiopsis,* and two species. These may at first be mistaken for *Amnicola* but their size and shape are such as to permit distinction from that genus. The fundamental differences are, of course, in the soft parts of the animal.

Genus *Pomatiopsis* Tryon 1862

Pomatiopsis Tryon 1862, Acad. Nat. Sci. Philadelphia Proc. 1862, p. 452 (*fide* Neave).
Pomatiopsis Walker 1918, Synopsis and cat. fresh-water Moll., p. 34.
Pomatiopsis F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 162.
Pomatiopsis Berry 1943, Amnicolidae Mich., p. 58.

Type.—*Cyclostoma lapidaria* Say.

Diagnosis.—Shell dextral, spiral, thin, smooth, long, turreted, umbilicate; aperture somewhat expanded; lip simple or slightly reflected; operculum corneous, subspiral (Walker, 1918, p. 34).

Remarks.—Two species, one of them the type of the genus, occur in the Ohio fauna and both of them have been found in Pleistocene deposits. The genus is rather old, geologically speaking, as it has been recorded from the Oligocene, according to A. B. Leonard (1950, p. 13).

Pomatiopsis cincinnatiensis (Lea) 1840
Pl. 11, fig. 8

Cyclostoma cincinnatiensis Lea 1840, Am. Philos. Soc. Proc., v. 1, p. 289.
Pomatiopsis cincinnatiensis Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 148.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 168, pl. 7, figs. 18, 19.
--- --- Berry 1943, Amnicolidae Mich., p. 58.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 301.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 13, pl. 1, fig. F.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 8.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 272.
--- --- van der Schalie and Dundee 1955, Am. Micros. Soc. Trans., v. 74, p. 119-133.
--- --- van der Schalie and Dundee 1956, Mich. Univ. Mus. Zoology Occas. Papers, no. 579, p. 1-16, 7 pls.

Type locality.—Vicinity of Cincinnati, Ohio.

Diagnosis.—"Shell conical, turreted, elongated; color greenish or brownish horn; surface more or less shining, lines of growth crowded, distinct; apex somewhat flattened; nuclear whorls 1½, rounded, hyaline, with fine granular texture; spire shorter than in *lapidaria,* wider in the male than in the female; sutures deeply impressed and whorls well rounded, rather more than five in number, the body quite ventricose in the male; aperture orbicular; peristome continuous, thickened, slightly reflected; base well rounded; umbilicus rather wide, deep" (F. C. Baker, 1928a, pt. I, p. 168).

Ecology.—The best account is by van der Schalie and Dundee (1956). The snail is amphibious and confined to wet marginal regions; it has gills and can withstand submergence in water during high water periods; it can seal itself in its shell and remain alive over extended periods during drought and winter. Muddy stream banks are the most common habitat for this species. It seems to require a creek or a river where the mud or matted root system on which the animal lives retains a considerable amount of moisture.

Associations.—Fossil: K-14, 17, 23.

General distribution (fig. 260).—"Indications are that it is confined to the Mississippi drainage. It occurs in the southern corners of Michigan and in Ohio, Indiana, Illinois, eastern Iowa, northern Kentucky and West Virginia" (van der Schalie and Dundee, 1955, p.

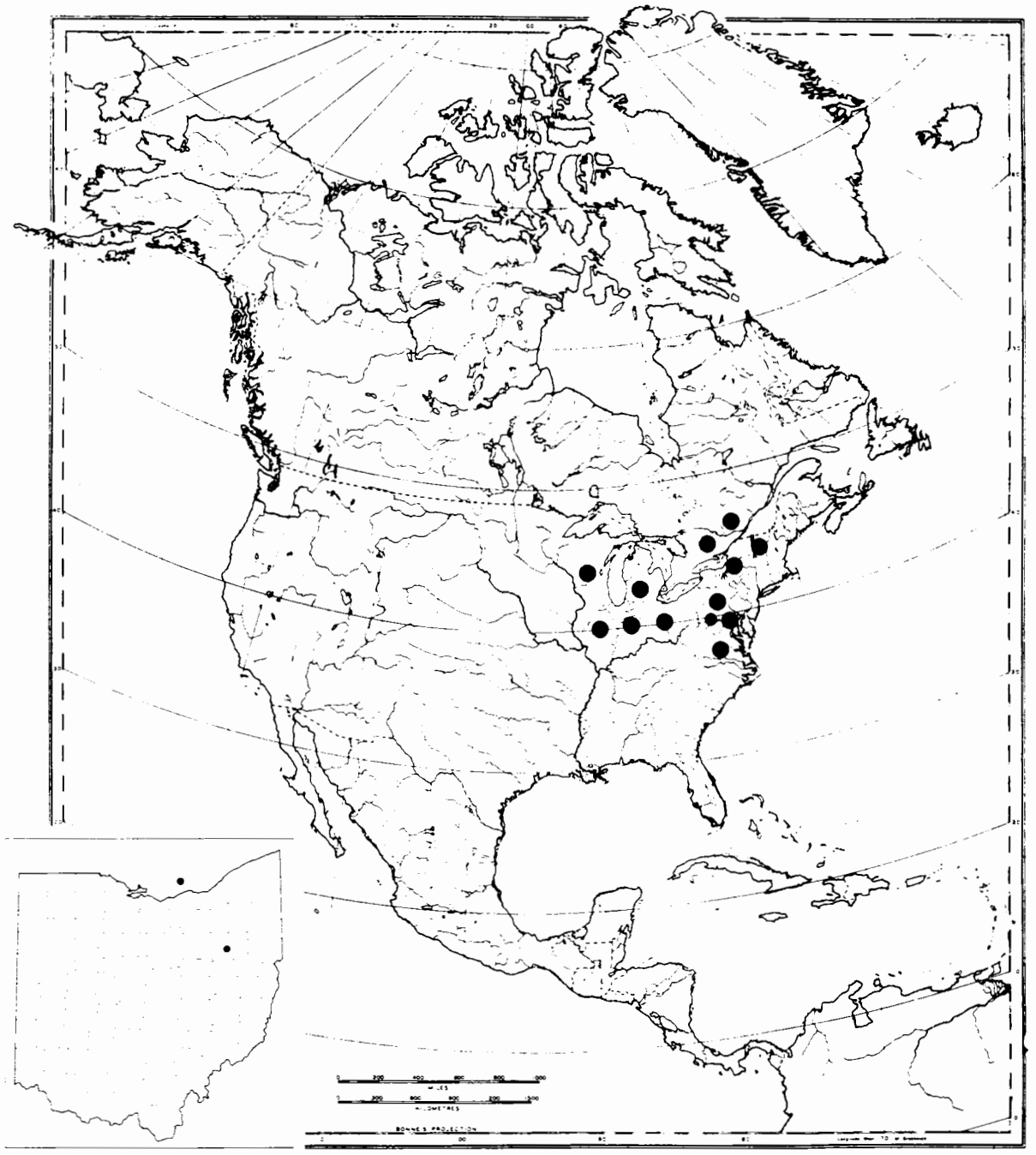


FIGURE 259.—Distribution of *Bulimus tentaculatus* in North America; *inset,* distribution in Ohio.

119).

Distribution in Ohio (inset, fig. 260).—Sterki (1907a, p. 386) records the species as "over the state." Eggleston (ms. records) has specimens from Clark and Washington Counties.

Geologic range.—"Yarmouth to Recent, but unknown in the midcontinent region except from deposits of Yarmouthian age" (A. B. Leonard, 1950, p. 13). It has recently been found in the Pleistocene Newell Lake deposit in Logan County, Ohio, by Zimmerman (1960, p. 20).

Pomatiopsis lapidaria (Say) 1817
Pl. 11, fig. 6

Cyclostoma lapidaria Say 1817, Acad. Nat. Sci. Phila-

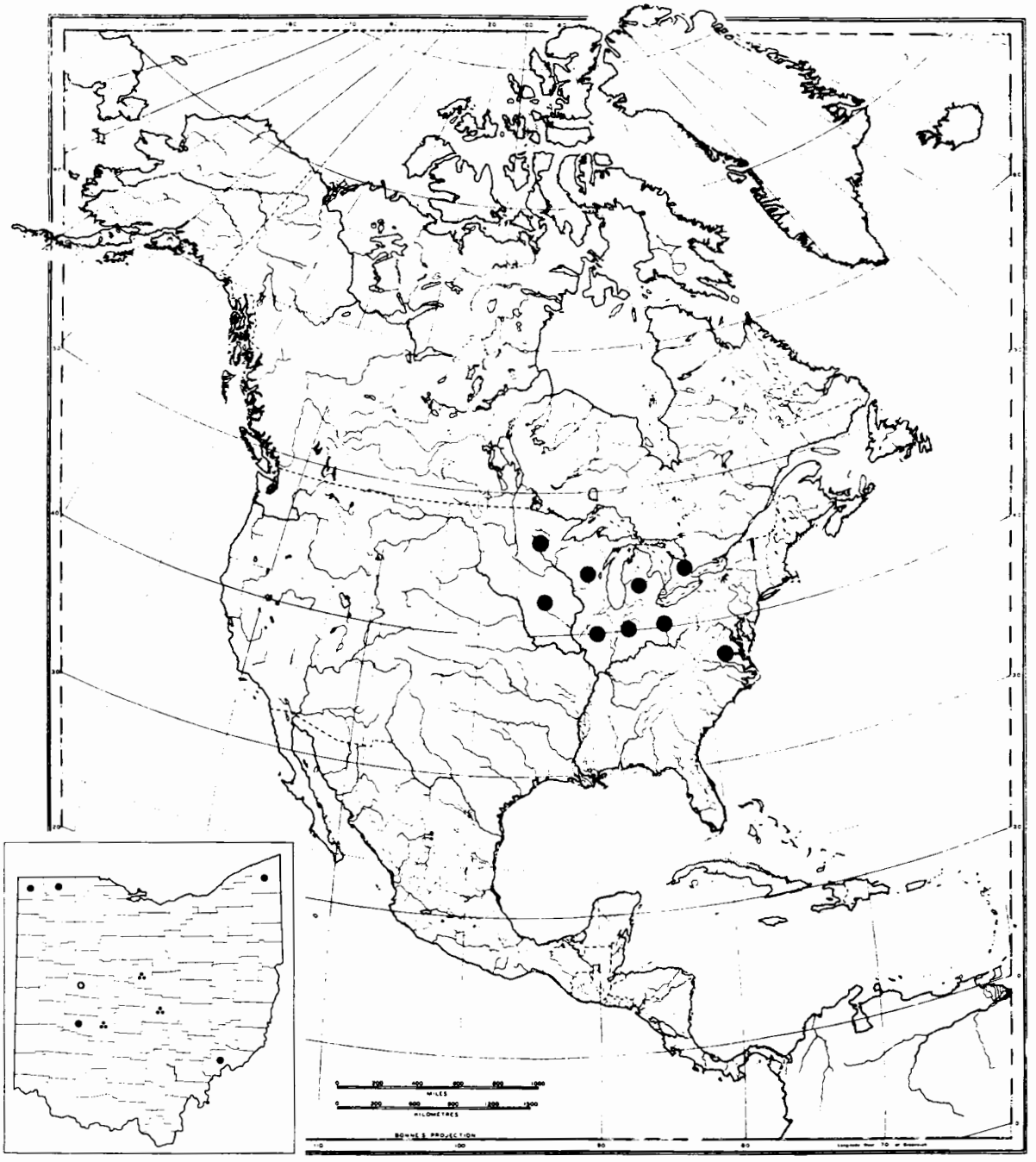


FIGURE 260.—Distribution of *Pomatiopsis cincinnatiensis* in North America; *inset,* distribution in Ohio.

delphia Jour., v. 1, p. 13.
Paludina lustrica Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 175.
Pomatiopsis lapidaria Call 1900, Moll. Ind., p. 416, pl. 8, fig. 16.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 120, fig. 92.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386, 402.
--- --- Johnson 1915, Fauna New England, p. 116.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 148.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 385.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 162, pl. 7, figs. 42-45.
--- --- Goodrich 1932, Moll. Mich., p. 81.
--- --- Ameel 1938, Am. Midland Naturalist, v. 19, p. 702-705.
--- --- Berry 1943, Amnicolidae Mich., p. 58.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 301.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 89, pl. 9, fig. 22.
--- --- Berry and Rue 1948, Jour. Parasitology, v. 34, p. 15.
--- --- De Witt 1952, Jour. Parasitology, v. 38, p. 321-326.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 272.
--- --- Dundee 1957, Mich. Univ. Mus. Zoology Misc. Pub., no. 100, 37 p., 14 pls., 1 fig., 2 maps.

Type locality.—None given by Say for *P. lapidaria;* Cayuga Lake was the locality given by him for *"Paludina lustrica."*

Diagnosis.—"Shell about twice as high as it is wide, thin, translucent, red or brown. Whorls 6-7, convex, smooth, ending in an unreflected outer lip that is thickened within. Aperture ovate, slightly angled at the top. Umbilicus open. Altitude 6.75, diameter 3.5 mm. Operculum spiral" (Goodrich, 1932, p. 81).

Ecology.—"*Pomatiopsis lapidaria,* in contrast to *P. cincinnatiensis,* seems to require a much wetter environment. It can be found in abundance in certain marshy areas; for example, those occurring along the Huron River near Ann Arbor. It may also live in various other habitats such as the wooded flood plains of small creeks; for example, the one found at the Hogback station considered here. Occasionally, it may be observed in the same habitat as *P. cincinnatiensis*" (van der Schalie and Dundee, 1955). *P. lapidaria* "... has also been reported from the banks of a few lakes .... [it] appears not to be limited by stream size, since it has been reported from bodies of water varying from temporary streams, which may be dry part of the year, to rivers as large as, or larger than, the Grand River in Michigan" (condensed from Dundee, 1957, p. 8). Teskey (1954, Naut. 68, p. 25) found this species in Brown County, Wisconsin, on a baked forest floor during a long summer drought. In West Virginia, Wurtz (1948, Naut. 61, p. 83) found it along the Monongahela River. Dawley (1955, Naut. 69, p. 62) collected it in wet places in Houston, Winona, and Hennepin Counties, Minnesota.

Associations.—Living: OHIO - 43; WISCONSIN - 138, 140. Fossil: W - 24, 25, 26, 28, 56, 58, 59.

General distribution (fig. 261).—Minnesota, Kansas, and New Mexico, east to New York, New Jersey, Maryland, Virginia, North Carolina, Florida, northern Georgia, Alabama (Dundee, 1957, p. 7).

Distribution in Ohio (inset, fig. 261).—Sterki (1907a, p. 386) merely gives "over the state" which is substantiated in part by Eggleston (ms. records), who collected it in Erie, Clark, Scioto, and Washington Counties. There are also specimens in the University of Michigan collections from Fulton and Hamilton Counties. Eggleston (ms. records) has collected it from the Castalia marl, in Erie County, a record confirmed by later collecting by Clark (1961, p. 22). Sterki (1907a, p. 402) also records it from the "Old Forest Bed" of the Ohio River and from "a sandy deposit (loess?), forming the north bank of the Maumee River, at the state dam" in Defiance County. Dundee (1957, p. 8) adds Little Miami River, Greene County, and, since it occurs also in Michigan, Indiana, Pennsylvania, West Virginia, and Kentucky, as well as Ontario north of Lake Erie, it is probable that it will eventually be found in every part of the State of Ohio.

Geologic range.—Yarmouth to present (Dundee, 1957, p. 6). F. C. Baker (1920a, p. 385) gave Yarmouth, Sangamon, and "Wabash." Clark (1961, p. 22) found it in the Castalia deposit, Erie County, Ohio.

Family PLEUROCERIDAE

Shells of the Pleuroceridae are dextral, elongated or globose, thick and solid; aperture entire or more or less canaliculate below; operculum corneous, subspiral; animal with a large rostrum, small, squarish foot, elongated, tapering tentacles with the eyes placed on swellings at the outer base; edge of mantle smooth; no external verge, genital duct composed of two laminae forming a closed canal; oviparous; rhachidian tooth of radula large, broader than long, rounded below, 7-9 cuspid, the central cusp very large; laterals subrhomboidal, 4-6 cuspid, one cusp very large; marginal teeth elongated, more or less sole-shaped, multicuspid.

This family is represented in the living Ohio fauna by five genera but three of them, *Lithasia, Anculosa,* and *Nitocris,* are mainly southern in distribution; the other two, *Pleurocera* and *Goniobasis,* are represented

by fewer species in the northern part of the State than in the southern. This pattern of distribution is characteristic of the family as a whole at the present time. The focus of abundance of the family seems to be in the southeastern United States whence species and genera become progressively fewer to the north and west. In the Pacific slope rivers there is an isolated group of species which has probably been separated from the southeastern group since Tertiary time. In Mesozoic and Tertiary times the main area of distribution of the family was in the central interior region of North America. Geologic events whose exact nature is not yet known caused the extinction of the genus in the central interior region but did not affect the two groups of species found at present on the east and west coasts.

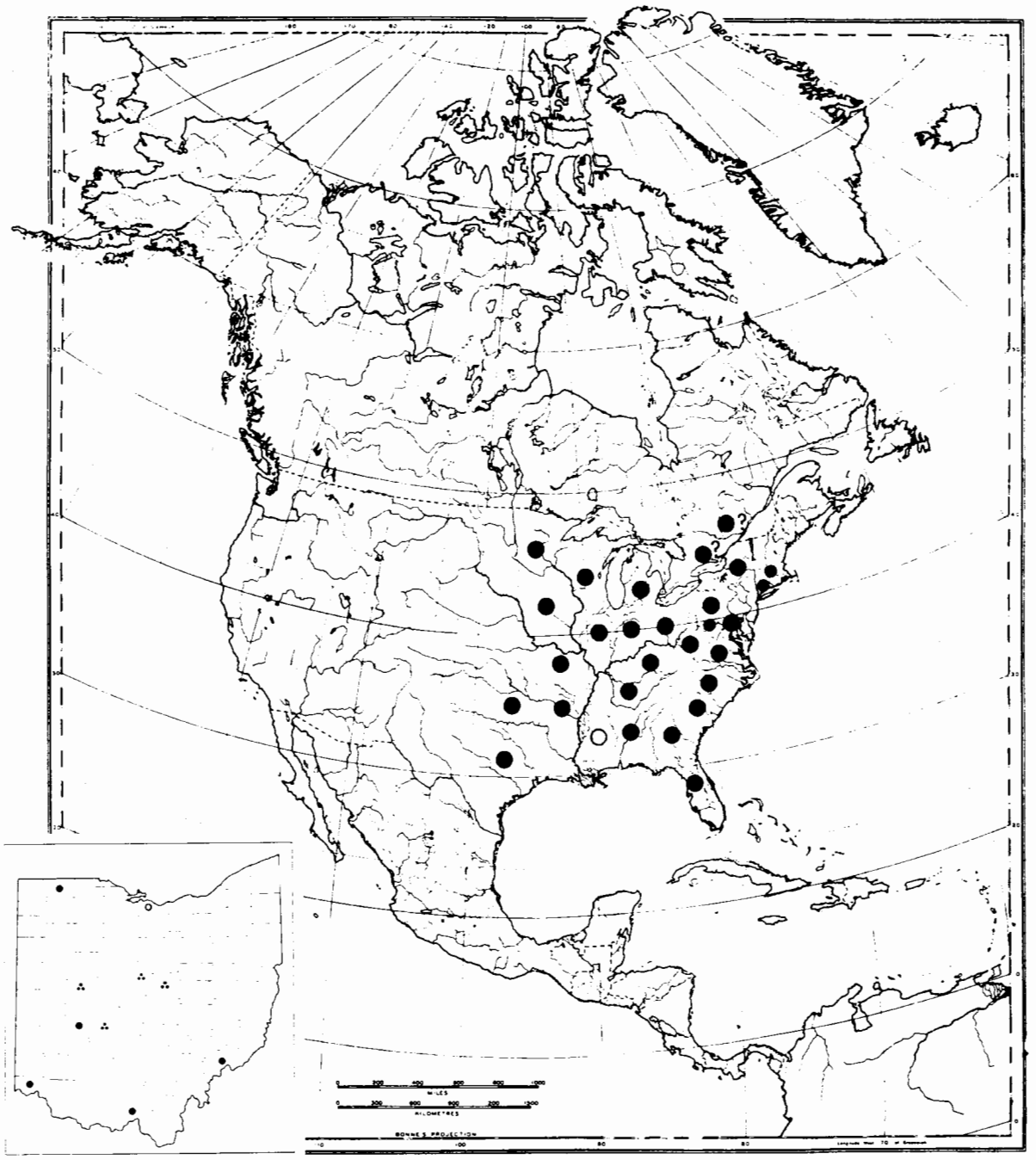


FIGURE 261.–Distribution of *Pomatiopsis lapidaria* in North America; *inset,* distribution in Ohio.

Genus *Pleurocera* Rafinesque 1818

Pleurocera Rafinesque 1818, Am. Monthly Mag., v. 3, no. 5, p. 355 (*fide* Neave).
Pleurocera Rafinesque 1819, Jour. Physique, v. 88, p. 423 (*fide* Tryon, 1873).
Pleurocera Tryon 1873, Land and fresh-water shells N. America, pt. 4, p. 49.
Pleurocera Walker 1918, Synopsis and cat. fresh-water Moll., p. 36, 151.
Pleurocera F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 171.
Pleurocera Goodrich 1939, Pleuroceridae St. Lawrence, pt. 2.
Pleurocera Goodrich 1939, Pleuroceridae Mississippi R. basin, p. 2.
Pleurocera Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 7.

Type.—*Pleurocera acutum* Rafinesque.

Diagnosis.—Shell elongate, conic, or cerithiform, spiral, dextral, imperforate; smooth, tuberculate, spirally striate or carinate; aperture moderate, subrhomboidal, prolonged into a short canal below; columella smooth, twisted, not callusly thickened; lip simple, sharp, sinuous, somewhat expanded.

Remarks.—The date of the genus is generally given as 1819, following Tryon (1873), but it is actually 1818, as pointed out by Neave and others. The reference is to an article in the "American Monthly Magazine and Critical Review" published in New York. The title is given in its entirety by Fitzpatrick (1911, p. 96, no. 270) and noted here because Tryon erroneously dated the genus 1819.

An amazingly large number of species have been described either under this genus or under its many synonyms. Tryon (1873, p. 49 ff.) lists and describes 84 species; many more, some of which are listed by Walker (1918, p. 151), were described after that date. The late Calvin Goodrich undertook the tremendous task of revising the species of the genus. Before he died, he had relegated to synonymy a large number of species (see Goodrich, 1939a, b, 1940b, for Ohio species) and had achieved a more rational classification for at least some of the forms of the genus. His classification is followed in this report.

Only one fossil species of *Pleurocera* is listed by Henderson (1935, p. 214) and it is far from certain that the assignment of this Cretaceous species is correct. Two others are eliminated as errors. On the other hand, the same author gives a long catalogue of fossil species of *Goniobasis* (*ibid.*, p. 215), some of which may belong under *Pleurocera*. There is no doubt that the genus dates at least from the Pleistocene and that during that period it flourished in the southeastern states and became differentiated into a host of species and forms. The Ohio representatives of the genus are migrants that penetrated into the Ohio River drainage in late Pleistocene time and the specimens of Lake Erie and its drainage belong to the northernmost species of the genus.

Pleurocera acutum Rafinesque 1831
Fig. 262

Pleurocera acuta Rafinesque 1831, Enum. and acct., p. 3.
Melania subularis Lea 1834, Am. Philos. Soc. Trans., v. 4, p. 100, pl. 15, fig. 30.
Melania neglecta Anthony 1854, N.Y. Lyceum Nat. History Annals, v. 6, p. 128; Dayton, Ohio.
Melania intensa Anthony, Reeve 1860, Conch. Icon., *Melania*, pl. 49, fig. 371.
Trypanostoma pallidum Lea 1862, Acad. Nat. Sci. Philadelphia Proc. 1862, p. 174.
Pleurocera subulare Tryon 1873, Land and fresh-water shells N. America, pt. 4, p. 88.
--- --- Call 1900, Moll. Ind., p. 429.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
Pleurocera neglectum Sterki 1907, *ibid.*
Pleurocera acuta Walker 1918, Synopsis and cat. fresh-water Moll., p. 151.
Pleurocera subulare F. C. Baker 1920, Life of Pleistocene, p. 385.
Pleurocera acuta F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 171, pl. 9, fig. 14.
--- --- Goodrich 1932, Moll. Mich., p. 81.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 302.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 90, pl. 9, fig. 7.
Pleurocera acutum La Rocque 1953, Cat. Recent Moll. Canada, p. 272.

FIGURE 262.—*Pleurocera acutum*, X1; after Walker (1918, p. 36, fig. 128).

Type locality.—Lake Erie.

Diagnosis.—"Elongate, not very heavy, apex eroded and having 14 remaining whorls. Spire stoutly carinate, the carina becoming a line that may be traced to the periphery of the body whorl. Suture bordered by a yellow band contrasting with the dark brown color of the rest of the shell. Body whorl angled at the base, upon which are three or four more or less distinct folds. Outer lip incurved from suture to periphery. Aperture a little extended at the base. Altitude 31, diameter 10 mm. Operculum spiral, small, thin" (Goodrich, 1932, p. 82).

Ecology.—In rivers, this snail prefers riffles in shallow water; in the Great Lakes it has been taken in exposed situations where it bears the full force of the waves and seems to thrive in spite of the buffeting to which it is subjected. F. C. Baker (1928a, pt. I, p. 178) gives several descriptions for small lakes and rivers under the subspecies *P. acutum tractum,* which is not recognized in this report.

Associations.—Living: OHIO - 17, 18, 21.

General distribution (fig. 263).—"Ohio River headstreams and tributaries. Great Lakes and tributaries; Mississippi River and westward to Nebraska and Kansas; through the Erie Canal into the basin of the Hudson River" (Goodrich, 1940b, p. 13).

Distribution in Ohio (inset, fig. 263).—Sterki (1907a, p. 385) gives Lake Erie only but for *P. neglectum* he

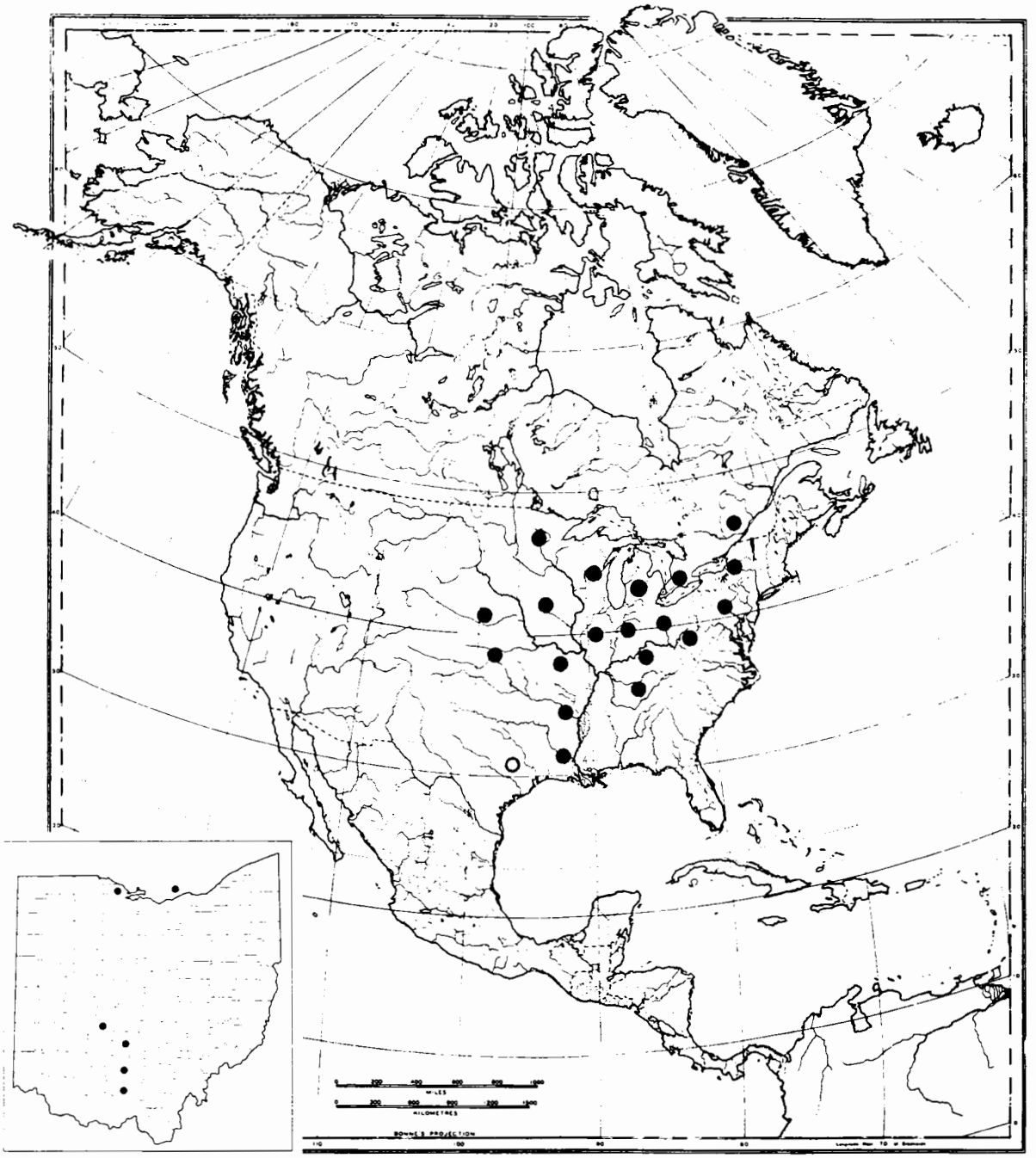


FIGURE 263.—Distribution of *Pleurocera acutum* in North America; *inset,* distribution in Ohio.

has records for the Ohio River at Cincinnati, the Great Miami River, and the Ohio Canal at Circleville. The Eggleston records extend this to Ottawa, Madison, Pickaway, Ross, and Pike Counties.

Geologic range.—Baker (1920a, p. 385) lists this species from Sangamon and "Wabash" (late Wisconsin) beds. Clark (1961, p. 22) has listed *P. acutum tractum* (Anthony) from the Castalia deposit, Erie County, Ohio.

Pleurocera canaliculatum (Say) 1821
Fig. 264

Melania canaliculata Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 175.
Melania conica Say 1821, *ibid.*, p. 176; Ohio River.
Melania elevata Say 1821, *ibid.*
Trypanostoma troosti Lea 1862 (part), Acad. Nat. Sci. Philadelphia Proc. 1862, p. 171.
Trypanostoma simplex Lea 1862, *ibid.*, p. 174.
Pleurocera canaliculatum Call 1900, Moll. Ind., p. 428, pl. 12, figs. 19, 21, 23, 26, 27.
Pleurocera elevatum Call 1900, *ibid.*, p. 429, pl. 12, fig. 20.
Pleurocera canaliculata Dall 1905, Harriman-Alaska Exped., v. 13, p. 116.
Pleurocera canaliculatum Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
Pleurocera conicum Sterki 1907, *ibid.*
Pleurocera elevatum Sterki 1907, *ibid.*
Pleurocera troostii Sterki 1907, *ibid.*
Pleurocera simplex Sterki 1907, *ibid.*
Pleurocera canaliculatum F. C. Baker 1920, Life of Pleistocene, p. 385.
Pleurocera elevatum F. C. Baker 1920, *ibid.*
Pleurocera elevatum lewisii F. C. Baker 1920, *ibid.*
Pleurocera canaliculatum Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 9.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 302.

FIGURE 264.—*Pleurocera canaliculatum*, X1; after Call (1900, pl. 12, figs. 21-23).

Type locality.—Ohio River.

Diagnosis.—"Shell tapering, horn-color; volutions about seven, slightly wrinkled; spire towards the apex much eroded, whitish; body, with a large obtuse groove, which is obsolete upon the whorls of the spire in consequence of the revolution of the suture on its inferior margin; this arrangement permits the superior margin of the groove only, to be seen on the spire, in the form of of an obtuse carina on each of the volutions; aperture bluish-white within with one or two obsolete revolving sanguineous lines; labrum slightly undulated by the groove and with a distinct sinus at the base of the columella.... Breadth three-fifths of an inch; length, one inch and one tenth. Greatest transverse diameter more than two-fifths (Say, 1821, original description).

Ecology.—No precise data located.

General distribution (fig. 265).—Ohio River from vicinity of Pittsburgh, Pennsylvania, to Illinois; Wabash River and its tributaries; aberrantly in the Tennessee River system; the Walker collection contains specimens from Omaha, Nebraska (Goodrich, 1940b, p. 9).

Distribution in Ohio (inset, fig. 265).—Sterki (1907a) records this species for the Tuscarawas River and for the Ohio River; I have two additional records for Adams and Scioto Counties (Eggleston, ms. records); for *P. conicum*, Sterki (1907a) gives the Ohio River at Cincinnati; Say's *Melania elevata* came from the Ohio River and Sterki (1907a) gives no further information; the variety *P. c. undulatum* (Say) also occurs in Ohio; see under that subspecies.

Geologic range.—F. C. Baker (1920a, p. 385) lists this species under three names, for beds as old as Yarmouth: *P. canaliculatum*, Yarmouth; *P. elevatum*, here considered a synonym, Sangamon and "Wabash"; and *P. elevatum lewisii*, Sangamon.

Pleurocera canaliculatum undulatum (Say) 1829
Fig. 266

Melania undulata Say 1829, New Harmony Disseminator, v. 2, no. 17, p. 261.
Pleurocera undulatum Tryon 1873, Land and freshwater shells N. America, pt. 4, p. 54, fig. 105.
--- --- Pilsbry and Rhoads 1896, Acad. Nat. Sci. Philadelphia Proc. 1896, p. 487.
--- --- Call 1900, Moll. Ind., p. 427, pl. 12, fig. 24.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385 (=*moniliferum* Lea?).
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 153.
Pleurocera canaliculatum undulatum Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 9.
--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 303.

Type locality.—Ohio River.

Diagnosis.—"Shell large, elevated, conic, brownish, with a broad, equally impressed band; inferior boundary of the band elevated and deeply crenate; superior boundary elevated and sometimes nodulous; volutions at least eight, not convex; suture not impressed, hardly obvious, undulated by revolving on the inferior crenate boundary of the impressed band; labrum near

the base, much protruded; sinus very obtuse .... Length one inch and four-tenths" (Say, 1829, original description).

Ecology.—No precise data located.

General distribution (fig. 267).—Illinois east to Ohio, south to Tennessee and, doubtfully, Alabama.

[*Pleurocera ellipticum* Anthony]

Pleurocera ellipticum Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.

Remarks.—This species(?), ascribed by Sterki to Anthony, is not mentioned by Goodrich in either of his papers on Ohio Pleuroceridae. I have searched the Binney Bibliography for mention of this name without success. I conclude therefore either that the species was described after 1860 or that Sterki put it down incorrectly. The name "*ellipticum* Anthony" does not appear in Tryon's (1873) treatment of the family Pleuroceridae (Strepomatidae) or in Walker's (1918) Synopsis and Catalogue. It is noted here for the sake of com-

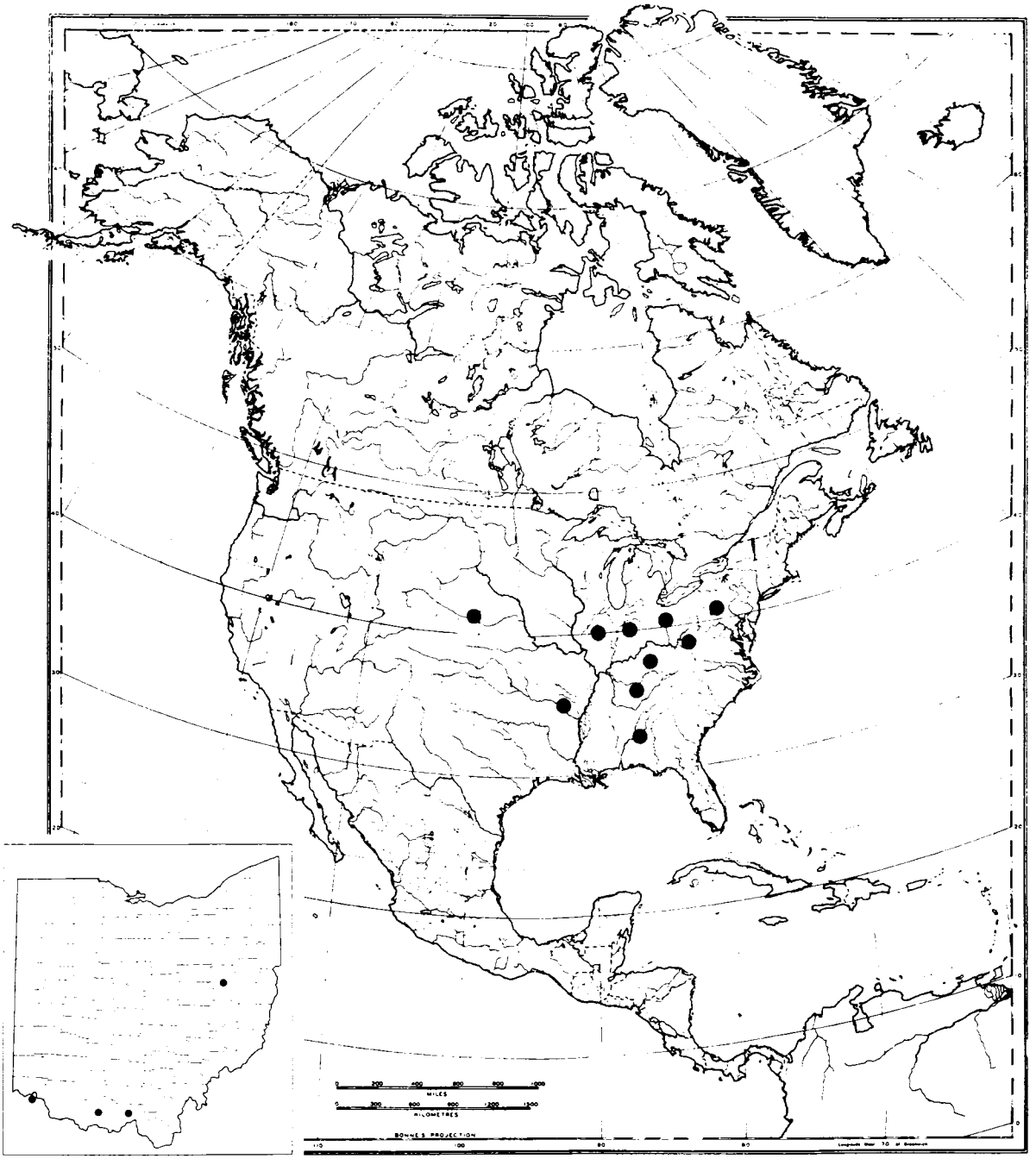


FIGURE 265.—Distribution of *Pleurocera canaliculatum* in North America; *inset,* distribution in Ohio.

pleteness but I am at a loss to know just what Sterki meant by this entry.

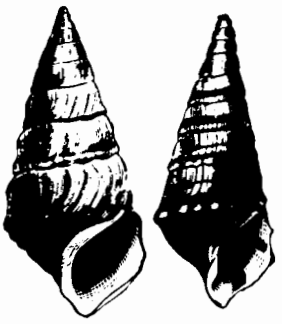


FIGURE 266.—*Pleurocera canaliculatum undulatum*, X1; after Call (1900, pl. 12, figs. 24, 25).

[*Pleurocera labiatum* (Lea) 1862]

Trypanostoma labiatum Lea 1862, Acad. Nat. Sci. Philadelphia Proc. 1862, p. 173.
Pleurocera labiatum Tryon 1873, Land and fresh-water shells N. America, pt. 4, p. 111, figs. 210, 211.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385 (=var. of *neglectum*?).

Type locality.—"Big Miami River," Ohio.

Remarks.—This name does not appear, either as a valid species or as a synonym, in Goodrich's (1939a, 1940b) papers on the Pleuroceridae of Ohio. Tryon gives a description and figure but they are not reproduced here as it is probable that they represent one of the species recognized by Goodrich, perhaps *Pleurocera canaliculatum* or *P. canaliculatum undulatum*. *P. labiatum* is noted here for the sake of completeness but I am not at present able to pass on its validity.

Genus *Goniobasis* Lea 1862

Goniobasis Lea 1862, Acad. Nat. Sci. Philadelphia Proc. 1862, p. 262 (*fide* Neave).
Goniobasis Walker 1918, Synopsis and cat. fresh-water Moll., p. 36.
Goniobasis F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 179 ff.
Goniobasis Goodrich 1939, Pleuroceridae St. Lawrence, p. 3.
Goniobasis Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 13 ff.

Type.—*Goniobasis osculata* Lea.

Diagnosis.—Shell of medium size, dextral, imperforate; smooth, longitudinally plicate, transversely striate or tuberculate; thick, solid, ovate-conic to elongate-turreted; aperture subrhomboidal, subangular at the base but not canaliculate; columella smooth, not twisted; lip simple, acute.

Remarks.—The species described under this genus or assigned to it from other genera, *e.g.*, *Melania*, are so numerous that a biologist at first sight has the impression either that the forms have been overdescribed or that the genus is an extremely plastic one. Both these impressions are correct but the unraveling of the synonymy is extremely difficult. The late Calvin Goodrich died before he had completed the task but fortunately he published two papers relating particularly to Ohio in which he brought some order out of chaos insofar as the two drainages of this State are concerned. According to Goodrich (1939a, 1940b), Ohio has four valid species of this genus with a host of synonyms and several species that should be referred to other genera. The names listed by Sterki are included in the synonymy of the four valid species in the descriptions that follow but in view of the complexity of the group, they are given below together with their equivalents according to Goodrich.

Ohio *Goniobases* according to Sterki	Correct assignment according to Goodrich
G. brevispira Anthony	=*G. semicarinata* (Say)
G. elata Anthony	=*G. livescens* (Menke)
G. exilis Haldeman	=*G. semicarinata* (Say)
G. gibbosa Lea	=*Anculosa subglobosa* (Say)
G. gracilior Anthony	*G. livescens gracilior* (Anthony)
G. haldemani Tryon	*G. haldemani* Tryon
G. infantula Lea	=*Lithasia obovata* (Say)
G. laqueata Say	*G. laqueata* (Say)
G. lithasioides Lea (=var. of *livescens*?)	=*G. livescens* (Menke)
G. livescens (Menke)	*G. livescens* (Menke)
G. livescens depygis Say	=*Lithasia obovata* (Say)
G. ohioensis Lea	=*G. semicarinata* (Say)
G. pulchella Anthony	=*G. semicarinata* (Say)
G. semicarinata (Say)	*G. semicarinata* (Say)
G. vicina Anthony	=*Lithasia obovata depygis* (Say)

Goniobasis haldemani Tryon 1865
Fig. 268

Goniobasis haldemani Tryon 1865, Am. Jour. Conchology, v. 1, p. 38, pl. 1, fig. 8.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386.
--- --- Johnson 1915, Fauna New England, p. 126.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 385.
--- --- Goodrich 1939, Pleuroceridae St. Lawrence, p. 4.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 90, pl. 9, fig. 5.

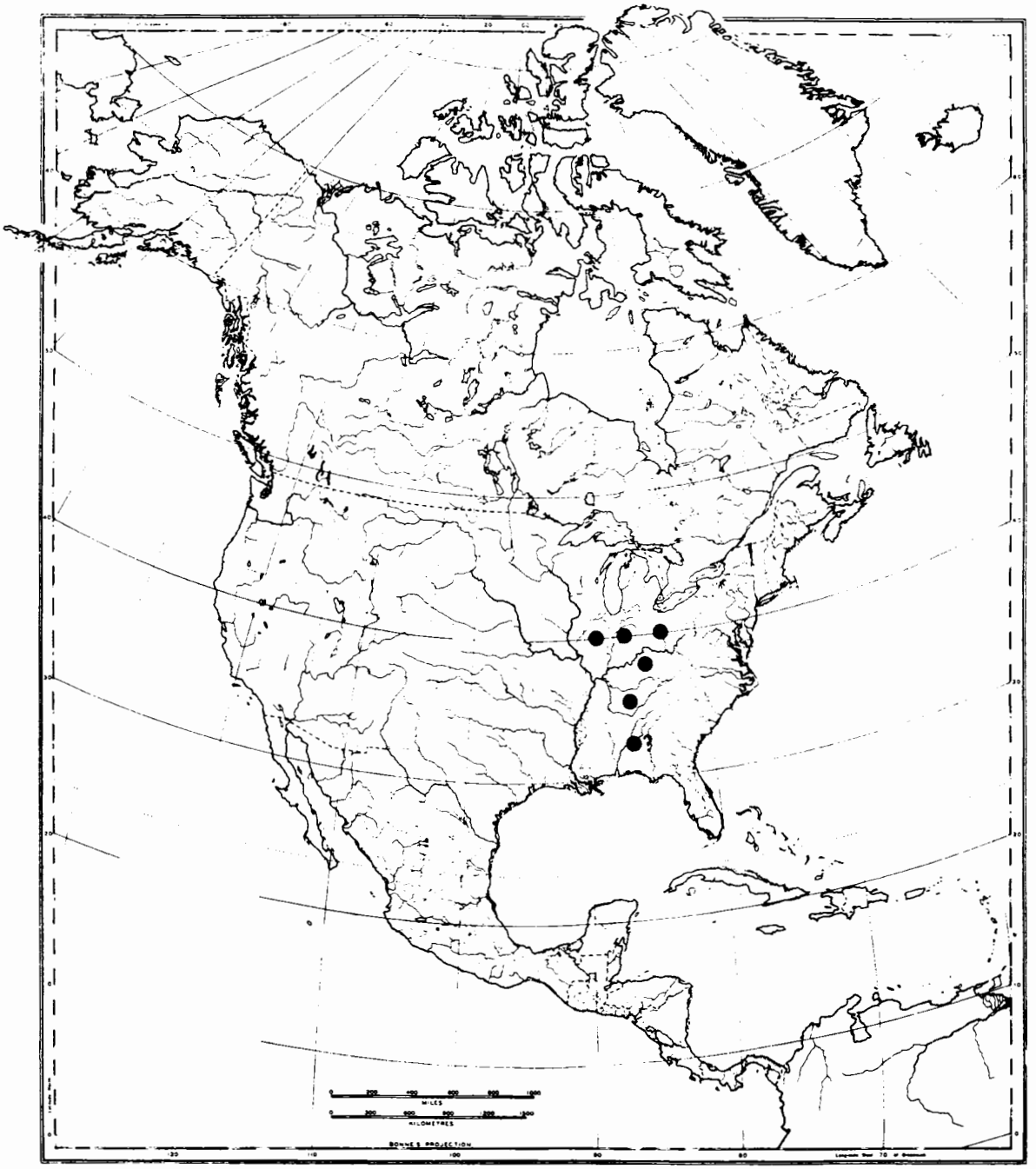


FIGURE 267.–Distribution of *Pleurocera canaliculatum undulatum* in North America.

FIGURE 268.—*Goniobasis haldemani*, X1; after Tryon (1873, p. 282, fig. 547a).

Type locality.—"Lake Erie, Lake Champlain."

Diagnosis.—Shell much elongated and very slender, almost as much as in *Pleurocera;* whorls very flat sided and never so wide as in *Pleurocera* at the base; many specimens banded with dark reddish brown and white; whorls 15 or 16, increasing very gradually.

Ecology.—Generally assumed to live in deep water, but Goodrich (1939a, p. 4) has taken a single living

FIGURE 269.—Distribution of *Goniobasis haldemani* in North America; *inset,* distribution in Ohio.

specimen in "an inch or two of water in a sheltered marsh of Sandusky Bay, Ohio."

General distribution (fig. 269).—Probably confined to Lake Erie at present; Goodrich (1939a, p. 4) doubts the Lake Champlain record, which apparently has never been confirmed.

Distribution in Ohio (inset, fig. 269).—Sterki simply lists this species under "Other species(?) listed from Ohio." Goodrich (1939a, p. 4) took one living specimen in a sheltered marsh of Sandusky Bay, Ohio; there are no further records for the State although Robertson and Blakeslee (1948, p. 91) give Lake Erie records in the vicinity of Buffalo, New York.

Geologic range.—Reported from Pleistocene Goat Island gravels, near Buffalo, Niagara County, New York. F. C. Baker (1920a, p. 385) lists the species for Sangamon and "Wabash" beds.

Goniobasis laqueata (Say) 1829
Fig. 270

Melania laqueata Say 1829, New Harmony Disseminator, v. 2, no. 18, p. 275.
Goniobasis laqueata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 158.
--- --- Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 14.

FIGURE 270.—*Goniobasis laqueata,* three specimens, X1; after Tryon (1873, p. 176, figs. 340-342).

Type locality.—Cumberland River (Say).

General distribution (fig. 271).—Ohio, Kentucky, and Tennessee.

Goniobasis livescens (Menke) 1830
Fig. 272

Melania livescens Menke 1830, Syn. Meth., p. 135.
Melania niagarensis Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 12.
Melania napella Anthony 1850, Boston Soc. Nat. History Proc., v. 3, p. 362.
Melania elata Anthony 1850, *ibid.*
Melania milesii Lea 1863, Acad. Nat. Sci. Philadelphia Proc. 1863, p. 154.
Goniobasis lithasioides Lea 1863, *ibid.*
Goniobasis livescens Call 1900, Moll. Ind., p. 433, pl. 12, fig. 11.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
Goniobasis elata Sterki 1907, *ibid.*
Goniobasis lithasioides Sterki 1907, *ibid.*, p. 386.
Goniobasis livescens Krecker 1924, Ohio Jour. Sci., v. 24, p. 299-310.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 180, pl. 9, figs. 15-26.
--- --- Dennis 1928, Aquatic gastr. Bass Is. region, p. 3.
--- --- Brooks 1931, Nautilus, v. 45, p. 64.
--- --- Goodrich 1932, Moll. Mich., p. 82.
--- --- H. B. Baker 1942, Nautilus, v. 56, p. 33-34.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 304.
--- --- Goodrich 1945, *Goniobasis livescens* of Mich., 36 p.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 91, pl. 9, figs. 6, 13.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 273.

Type locality.—Lake Erie.

Diagnosis.—"Thick, much longer than wide, light shining yellow to black. Whorls about 12, the first six or seven having fine growth lines that are regularly spaced, carinae and sometimes a spiral line or two. Later whorls are usually unornamented, tending to become rough. Body whorl rounded, suture bordered by a narrow line of color that is lighter than the general shell hue. Columella white, narrow. Outer lip slightly incurved near the suture. Aperture a little larger than one-third the size of the shell. Height 20.5, diameter 9 mm. Operculum larger than in *Pleurocera,* the spiral lines crowded into small space near the left lower margin" (Goodrich, 1932, p. 82).

Ecology.—Goodrich (1945, p. 26) has summarized the literature on the subject and added further data from his own experience. It appears from his account that this species can live, even thrive, in a variety of habitats, in lakes and rivers, on a variety of bottoms (mud, sand, boulder and gravel) and even on solid rock walls, in swift or quiet water of various depths, even though water level fluctuates as much as four feet within a few hours. A moderate amount of sewage in the water does not harm the species; in fact, Goodrich (1945, p. 28) records it as abundant in the west end of Lake Erie, where the phytoplankton count is the highest known in the Great Lakes.

Associations.—Living: NEW YORK-3a, 5b, 6, 7, 15a, 15b, 16, 21, 22, 23, 26, 27, 29, 30, 32, 35; OHIO-8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 21, 43; ONTARIO-4, 6, 7. Fossil: W-28.

General distribution (fig. 273).—Great Lakes region south to Ohio River drainage; St. Lawrence and Ottawa Rivers and their tributaries. More precisely (Goodrich, 1940b, p. 18): "Tributaries of Ohio River, east of Scioto River in Ohio; Wabash River and branches, west to Illinois River.... St. Lawrence basin.... Des Moines

River, Iowa."

Distribution in Ohio (inset, fig. 273).—Widespread, from Williams, Ottawa, Erie, and Portage Counties in the north to Brown, Morgan, and Washington Counties in the south, but not recorded for the central part of the State.

Geologic range.—F. C. Baker (1920a, p. 385) lists this species only for "Wabash" (late Wisconsin) beds. In Ohio, Clark (1961, p. 22) cited it for the Castalia deposit. He lists the form *niagarensis*, here considered a synonym of *G. livescens*, from "Wabash" beds only.

[*Goniobasis livescens depygis* (Say) 1829]

Melania depygis Say 1829, New Harmony Disseminator, v. 2, p. 291.

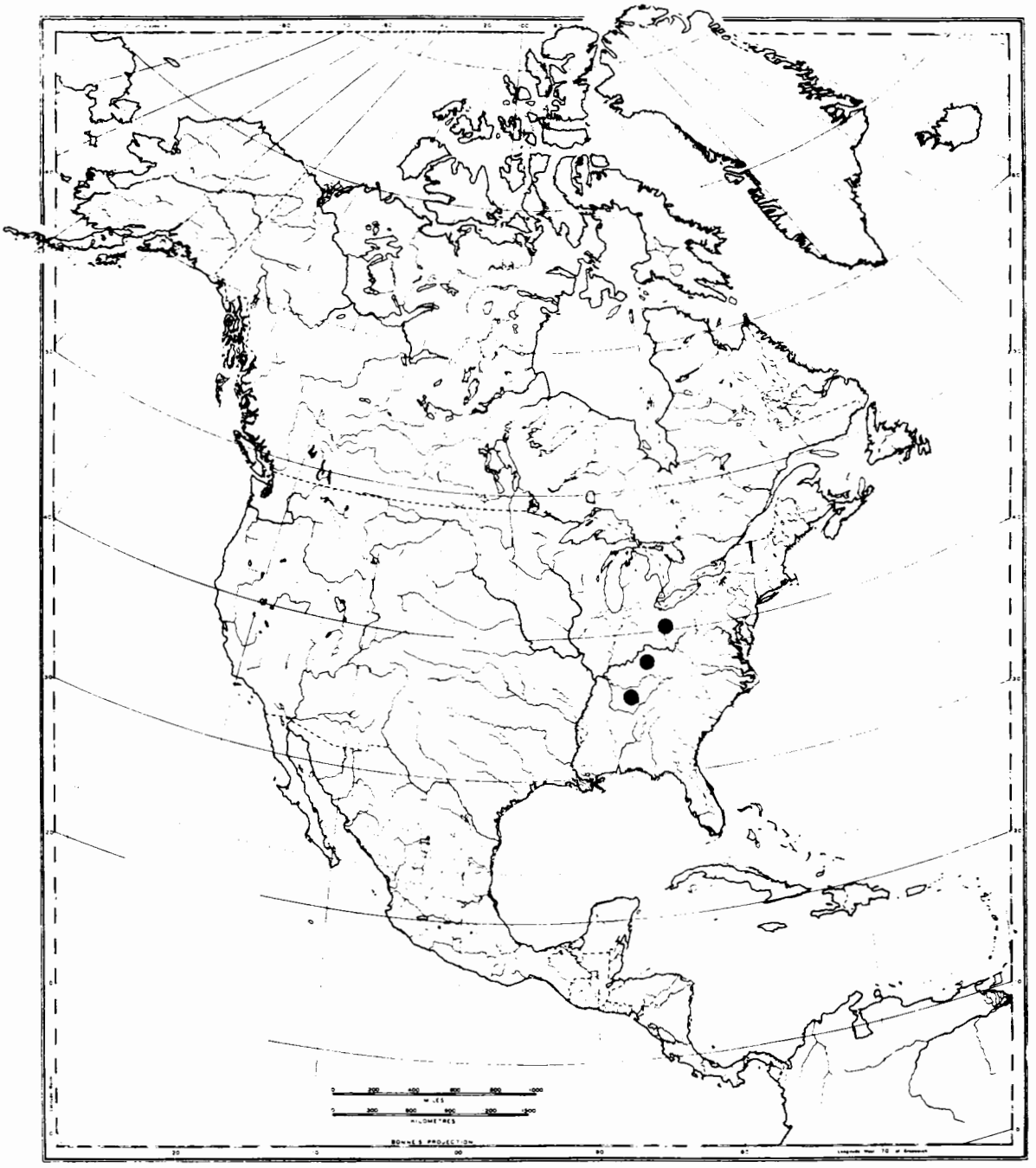


FIGURE 271.—Distribution of *Goniobasis laqueata* in North America.

FIGURE 272.–*Goniobasis livescens*, X1; after Call (1900, pl. 12, fig. 11).

Goniobasis depygis Call 1900, Moll. Ind., p. 432, pl. 12, figs. 3, 6, 8.

Goniobasis livescens depygis Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.

Goniobasis depygis Johnson 1915, Fauna New England, p. 125.

--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 36, 157; a distinct species.

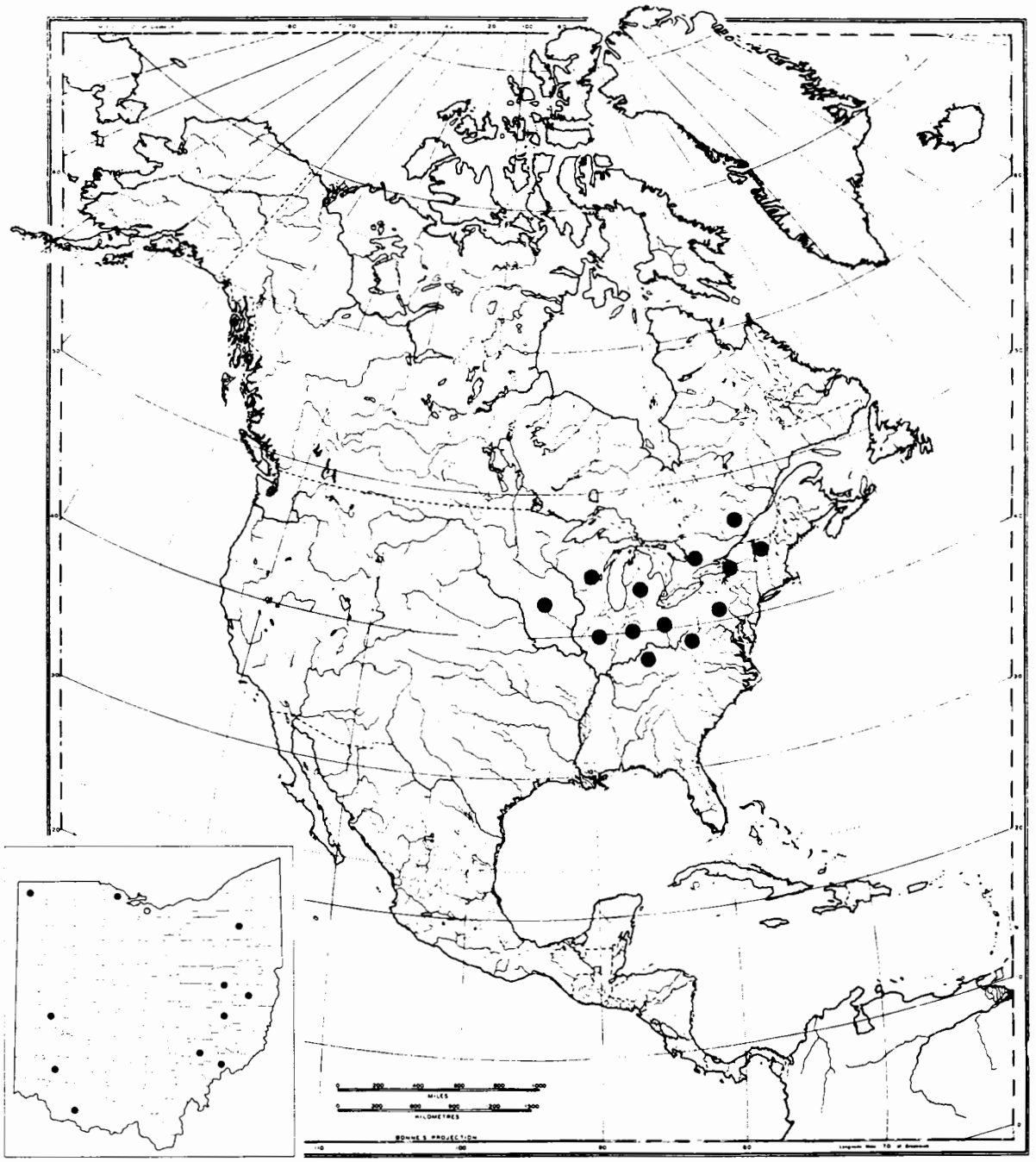


FIGURE 273.–Distribution of *Goniobasis livescens* in North America; *inset*, distribution in Ohio.

Goniobasis depygis F. C. Baker 1920, Life of Pleistocene, p. 385.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 273.

Remarks.—Say's original description refers to what is now called *Lithasia obovata* (Say) according to Goodrich and van der Schalie (1944, p. 304). The name *Melania depygis* Say (1830) is included in the synonymy of *L. obovata* (Say) by Goodrich (1940b, p. 6) but he recognizes it as a variety of *Lithasia obovata*. The Michigan records of *Melania depygis* are certainly referable to *Goniobasis livescens* according to Goodrich (1945, p. 5) and the same is probably true of specimens identified as *G. depygis* outside of the Ohio River drainage. As far as Ohio is concerned, the name *Goniobasis depygis* must be removed from the list of species of *Goniobasis* and the Ohio River drainage records must be referred to *Lithasia obovata depygis* (Say). Just what F. C. Baker had before him when he recorded this form from the Sangamon and "Wabash" (late Wisconsin) is unknown to me.

Goniobasis livescens gracilior (Anthony) 1854

Melania gracilis Anthony 1841 (preoccupied).
Melania gracilior Anthony 1854, N.Y. Lyceum Nat. History Annals, v. 6, p. 129, pl. 1, fig. 5.
Goniobasis gracilior Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
Goniobasis livescens gracilior Goodrich 1939, Pleuroceridae St. Lawrence, p. 4.

Type locality.—Stark County, Ohio.

Diagnosis.—"The body whorl of this subspecies is very much more rounded than it is in *livescens*, the base is somewhat flattened. All the specimens that have been seen are dark in color" (Goodrich, 1939a, p. 4).

Ecology.—Found in lakes of Summit and Stark Counties, Ohio, but not everywhere there as a "pure" race (Goodrich, 1939a, p. 4).

Associations.—Living: OHIO-43.

General distribution.—Known only for lakes in Summit and Stark Counties, Ohio.

Distribution in Ohio.—Same as general distribution.

Geologic range.—This form has not been recorded as a fossil.

Goniobasis semicarinata (Say) 1829
Fig. 274

Melania semicarinata Say 1829, New Harmony Disseminator, v. 2, no. 17, p. 261.
Melania exilis Haldeman 1841 (*fide* Goodrich, original description not located).
Melania brevispira Anthony 1850, Boston Soc. Nat. History Proc., v. 3, p. 361; Ohio.
Melania pulchella Anthony 1850, *ibid.*, v. 3, p. 361.
Goniobasis ohioensis Lea 1862 (*fide* Goodrich, original description not located).
Goniobasis semicarinata Call 1900, Moll. Ind., p. 435, pl. 12, fig. 10.
Goniobasis pulchella Call 1900, *ibid.*, p. 434, pl. 12, fig. 5.
Goniobasis semicarinata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
Goniobasis brevispira Sterki 1907, *ibid.*, p. 386.
Goniobasis exilis Sterki 1907, *ibid.*, p. 385.
Goniobasis ohioensis Sterki 1907, *ibid.*, p. 386.
Goniobasis pulchella Sterki 1907, *ibid.*, p. 385.
Goniobasis semicarinata Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 18.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 305.

FIGURE 274.—*Goniobasis semicarinata*, X1; after Call (1900, pl. 12, fig. 10).

Type locality.—Kentucky (Say).

Diagnosis.—Shell small, conic, turreted; spire acute at the apex, the four apical volutions carinate below; volutions about eight, somewhat convex; suture moderately impressed; surface, especially of the body whorl, slightly wrinkled; labrum a little prominent near the base; within slightly tinged with reddish brown (Say, quoted by Call, 1900, p. 435).

Ecology.—A common shell in many small streams and creeks of southern Indiana. In Ohio, it is recorded for the Scioto River, a river of moderate size.

General distribution (fig. 275).—"Tributaries of Ohio River, Scioto River, Ohio, to Big Blue River, Indiana; Licking River to Salt River in Kentucky; two creeks of Green River of Kentucky" (Goodrich, 1940b, p. 18).

Distribution in Ohio (inset, fig. 275).—Sterki (1907a, p. 385) records the species for Cincinnati and Rocky River, the latter presumably the Rocky River in Cuyahoga County. The latter record is out of range but not impossible as an introduction due to canal building. Eggleston (ms. records) gives Shelby, Miami, Clark, Montgomery, Hamilton, and Clermont Counties in the Miami drainages; Brown, Highland, Union, and Morgan Counties, drainage not stated; Marion, Delaware, Ross, and Pike Counties in the Scioto River drainage; and, finally, I have one Highland County record from specimens in the University of Michigan collections.

Geologic range.—There is no fossil record of this species.

Genus *Anculosa* Say 1821

Anculosa Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 178 (*fide* Neave).
Anculosa Walker 1918, Synopsis and cat. fresh-water Moll., p. 37, 163.
Anculosa Goodrich 1922, Mich. Univ. Mus. Zoology Misc. Pub. 7, 57 p., 3 pls.
Anculosa F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 171.

Type.—*Melania praerosa* Say.

Diagnosis.—Shell of moderate size, dextral, imperforate (except in one species), smooth, tuberculate,

FIGURE 275.—Distribution of *Goniobasis semicarinata* in North America; *inset,* distribution in Ohio.

spirally striate, sulcate or carinate, thick, solid, subglobose with a very short spire or thinner and conical; aperture oval or subcircular, entire, rounded below; columella callusly thickened; lip simple, acute.

Remarks.—This genus is represented in Ohio by only one species, which is the northernmost member of a variable and ancient genus. Goodrich (1922, p. 13) gives a list of the species found in Alabama alone and points out (1922, p. 3) that all these species are restricted to the Alabama River drainage and do not occur outside of it, although the genus is represented by other species in the Atlantic, Ohio, Cumberland, and Tennessee drainages. The migration pattern of the species represented in the State therefore appears to be clear. These snails penetrated into the Ohio drainage from either the Cumberland, Tennessee, or Mississippi after the Ohio River came into existence. Their occurrence in Pleistocene deposits in Ohio, where they have so far not been recorded, would be of extreme importance and interest. The species of the living fauna is therefore discussed here in the hope that it will be sought for in Pleistocene deposits.

Anculosa praerosa (Say) 1821
Fig. 276

Melania praerosa Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 177.
Anculosa praerosa Call 1900, Moll. Ind., p. 436, pl. 12, fig. 15.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386.
--- --- Goodrich 1929, Nautilus v. 43, p. 10 ff.
--- --- Goodrich 1940, Mich. Univ. Mus. Zoology Occas. Papers, no. 417, p. 20.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 304; Ohio River from Scioto County, Ohio, to Pope County, Illinois.

FIGURE 276.—*Anculosa praerosa*, X1; after Call (1900, pl. 12, fig. 15).

Type locality.—Ohio River.

Diagnosis.—"Shell subglobular, oval, horn color; volutions three or four, wrinkled across; spire very short, much eroded in the old shell, so much so as to be sometimes not prominent above the body whirl; body whirl large, ventricose, with a very obtuse, slightly impressed revolving band; aperture suboval, above acute and effuse; within on the side of the exterior lip about four revolving purplish lines, sometimes dotted, sometimes obsolete or wanting; labium thickened, particularly at the superior termination near the angle, and tinged with purplish; base of the columella somewhat elongated and incurved, meeting the exterior lip at an angle" (Say, 1821, original description, in part).

Ecology.—Abundant in deep and swiftly flowing waters, clinging to rocks in the Ohio River and some tributaries.

General distribution (fig. 277).—Ohio River, from Scioto County, Ohio, to Pope County, Illinois; Wabash and Blue Rivers in Indiana; Cumberland, Clinch, lower Holston, French Broad, Tennessee, Little Tennessee, Little, and other rivers in Tennessee and Alabama. Goodrich (1929, p. 13) gives a full list of localities.

Distribution in Ohio (inset, fig. 277).—Recorded only for the Ohio River, but probably present in its larger Ohio tributaries.

Geologic range.—Not recorded in the fossil state.

Remarks.—Goodrich (1929, p. 14) gives a synonymy which includes three names by Menke, 1828, one each by Deshayes, Conrad, and Lea. This is a measure of the variability of the species and of the complex literature, never completely summarized to my knowledge, to which it has given rise.

[*Anculosa subglobosa* (Say) 1825]

Paludina subglobosa Say 1825, Acad. Nat. Sci. Philadelphia Jour., v. 5, p. 125.
Anculosa gibbosa Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 34.
?Goniobasis gibbosa Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
Anculosa subglobosa Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 20.

Type locality.—"Northwest Territory."

Remarks.—This species is noted but not described here, as it may be based on a misidentification by Sterki. If he meant to identify his *Goniobasis gibbosa* with the *Anculosa gibbosa* of Lea, 1841, he was very probably in error, as Goodrich (1940b) cites the species only for the Tennessee River basin, headstreams and tributaries. Sterki's record is not well established. He merely listed *Goniobasis gibbosa* Lea under "Other species(?) listed from Ohio," without specific locality. I suspect that he had before him specimens of *Anculosa praerosa* (Say), which is known for the Ohio River, or that he was merely quoting the name from older lists and did not have specimens so identified before him. The record has never been confirmed and judging from Goodrich's treatment of the species of *Anculosa* in the Ohio River drainage the record is a misidentification in any case.

Genus *Lithasia* Haldeman 1840

Lithasia Haldeman 1840, Mon. Limniades N. America, pt. 1, supp., p. 1 (*fide* Neave).

Lithasia Walker 1918, Synopsis and cat. fresh-water Moll., p. 35.

Lithasia Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 3 ff.

Type.—*L. geniculata* Haldeman.

Diagnosis.—Shell of medium size, spire dextral, imperforate, globose conic, smooth or tuberculate; thick and solid, spire elevated, obtusely conic; aperture large, rhomboidal; columella smooth, callusly thickened above and below; base of the aperture shortly channelled below.

Remarks.—Goodrich (1940b) divides the genus into four groups which are simply numbered and not given subgeneric or sectional rank. All four groups are represented in the Ohio River or its tributaries but only two

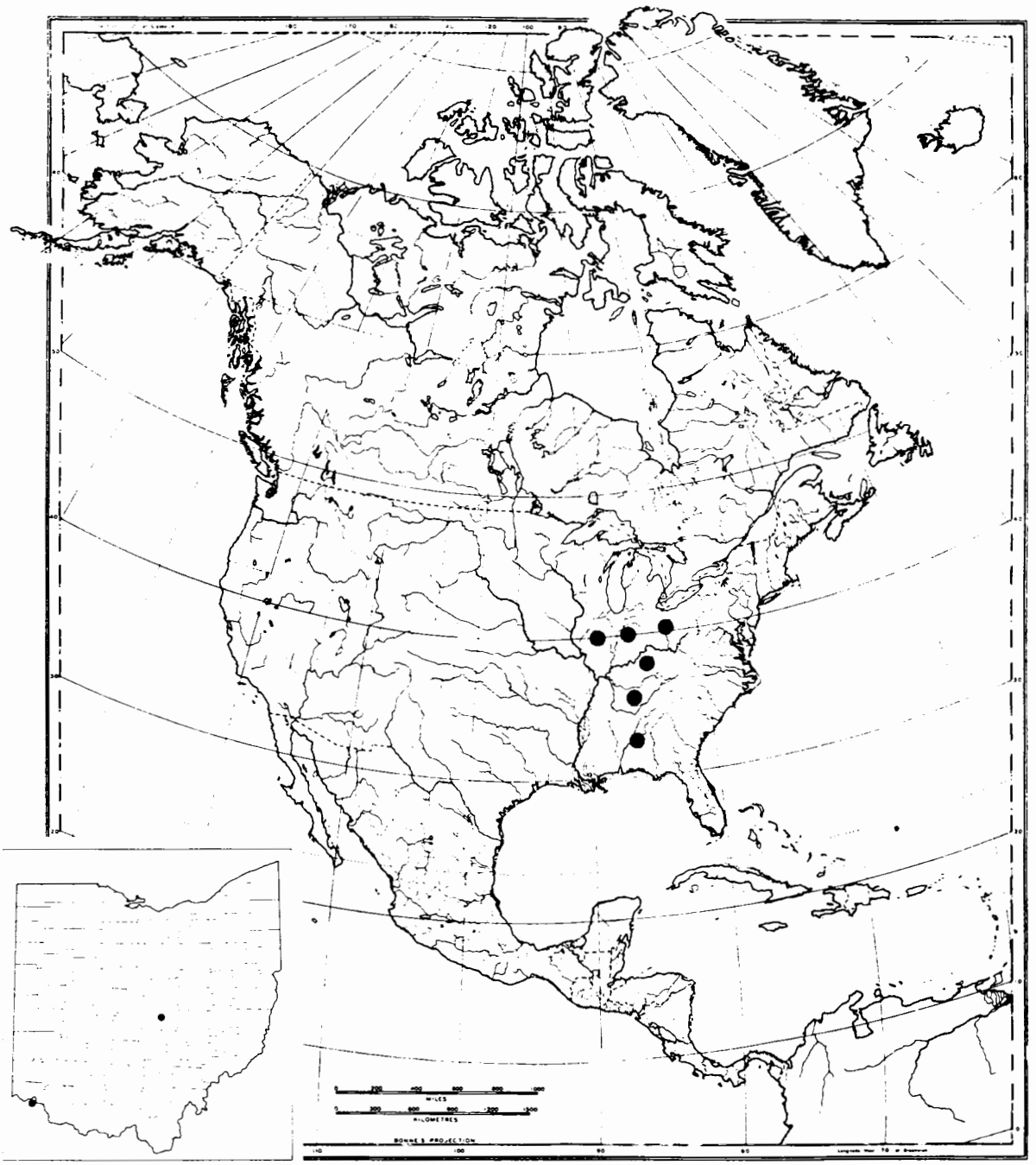


FIGURE 277.—Distribution of *Anculosa praerosa* in North America; *inset,* distribution in Ohio.

(nos. 3 and 4) have penetrated within the limits of the State. Goodrich's careful statement of ranges, together with his elimination of synonyms, would permit plotting of the species of this genus on drainage maps. Even without such maps, it is almost inevitable to suspect that geologic events, especially stream capture, have had something to do with the distribution of the species. Likewise, it is evident that the genus originated to the south of the Ohio River, from the Gulf Coastal Plain to Tennessee, and that it has spread outward from this focus northward and westward in the Mississippi drainage as far west as Arkansas, as far east as Pennsylvania, and as far north as Illinois.

Lithasia obovata (Say) 1829
Fig. 278

Melania obovata Say 1829, New Harmony Disseminator, v. 2, no. 9, p. 276.
Goniobasis infantula Lea 1863, Acad. Nat. Sci. Philadelphia Proc., May 1863; Observer, v. XI, p. 91, pl. 23, fig. 39.
Lithasia obovata Call 1900, Moll. Ind., p. 431, pl. 12, fig. 16.
Goniobasis infantula Call 1900, *ibid.*, p. 434, pl. 12, fig. 2.
Lithasia obovata Walker 1900, Nautilus, v. 13, p. 97.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386.
Goniobasis infantula Sterki 1907, *ibid.*
Lithasia obovata Walker 1918, Synopsis and cat. freshwater Moll., p. 150.
--- --- Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 6.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 303.

FIGURE 278.—*Lithasia obovata*, X1; after Call (1900, pl. 12, fig. 16).

Type locality.—Kentucky River.

Diagnosis.—"Shell subovate, dark brown or blackish, volutions nearly five; spire remarkably rounded, short; body-whorl with a very obtuse, slightly indented band or undulation, a little above the middle; aperture more than twice the length of the spire, narrow; labium polished, with a callus above; labrum not projecting near the base, subrectilinear from the shoulder to the basal curve, very convex at the shoulder; base rounded and without indentation." L. 0.75; W. nearly 0.5 in. (Call, 1900, p. 431).

Associations.—Living: OHIO-43.

General distribution (fig. 279).—Illinois east to Pennsylvania, south to Kentucky and West Virginia.

Distribution in Ohio (inset, fig. 279).—Recorded for the Ohio River at Cincinnati, Hamilton County, and for the Scioto River, Ross County.

Lithasia obovata depygis (Say) 1829

Melania depygis Say 1829, New Harmony Disseminator, v. 2, p. 291.
Melania vicina Anthony 1854, N.Y. Lyceum Nat. History Annals, v. 6, p. 114, pl. 3, fig. 14.
?*Goniobasis livescens depygis* Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 385.
Goniobasis vicina Sterki 1907, *ibid.*
Lithasia obovata depygis Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 6.

Type locality.—Falls of the Ohio.

General distribution.—"Ohio River and some of its tributaries" (Goodrich, 1940b, p. 6).

Remarks.—See remarks in this report under *Goniobasis livescens depygis*. Interpretation of the record is somewhat difficult, especially for the Sterki mention of this species under *Goniobasis livescens*. The subspecies or form is undoubtedly present in Ohio but its distribution is not clear.

[*Lithasia obovata consanguinea* (Anthony) 1854]

Melania consanguinea Anthony 1854, N.Y. Lyceum Nat. History Annals, v. 6, p. 125, pl. 3, fig. 26.
Lithasia obovata consanguinea Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 7.

Type locality.—Indiana.

General distribution.—"Ohio River, Indiana; Green River, Kentucky" (Goodrich, 1940, p. 7).

Remarks.—This form of *Lithasia obovata* might occur in Ohio, but so far there are no records nearer than those indicated for the general distribution above.

Lithasia verrucosa (Rafinesque) 1820
Fig. 280

Pleurocera verrucosa Rafinesque 1820, Annals of Nature, no. 1, p. 11.
Angitrema verrucosa Call 1900, Moll. Ind., p. 430, pl. 12, fig. 18.
Angitrema verrucosum Sterki 1907, Ohio Acad. Sci., v. 4, p. 386.
Lithasia verrucosa Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 5.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 303.

Type locality.—"Habitat, the lower parts of the Ohio" (Rafinesque).

Diagnosis.—"Shell oblong suboval; volutions five,

slightly rounded; body-whorl with about three revolving series of subequal, equidistant granules or tubercles, not higher than wide, occupying the superior portion of the surface; second volution with but two series; remaining volutions with slightly elevated, longitudinal lines instead of tubercles, often obsolete; spire decorticated towards the tip; suture not deeply impressed; aperture longer or as long as the spire; sinus of the superior angle profound; labium concave, with a callus near the superior angle; columella with a slight, obtuse, hardly prominent angle above the incipient sinus, which is obvious; labrum not abbreviated above, nor much produced near the base" (Say's description of *Melania nupera*, a synonym, quoted by Call, 1900, p. 431).

Ecology.—No precise data located.

FIGURE 279.—Distribution of *Lithasia obovata* in North America; *inset*, distribution in Ohio.

FIGURE 280.–*Lithasia verrucosa*, X1; after Call (1900, pl. 12, fig. 18).

General distribution (fig. 281).–"Branch of Ohio River near Cincinnati to lower part of river; lower Wabash River; lower parts of East Tennessee head streams of Tennessee River to Marshall County, Kentucky; Black and Spring Rivers, Arkansas" (Goodrich, 1940b, p. 5).

Distribution in Ohio (inset, fig. 281).–Sterki (1907a, p. 386) gives "Ohio River at Cincinnati" and there is

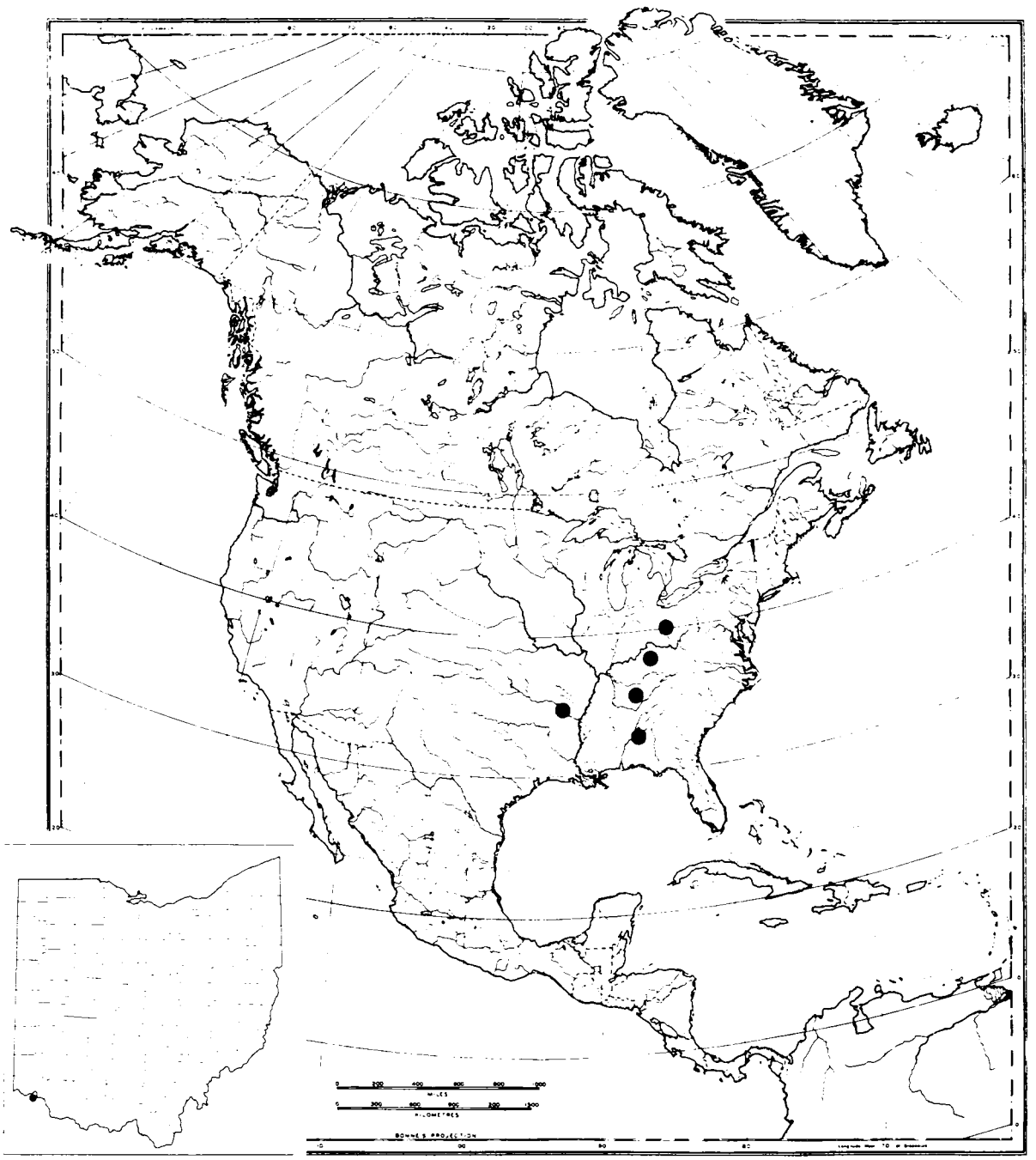


FIGURE 281.–Distribution of *Lithasia verrucosa* in North America; *inset*, distribution in Ohio.

no other record except Goodrich's, which is ambiguous in that the "branch" could be in Indiana or Kentucky and still near Cincinnati. It comes so close to the area of the State that it is listed here on the strength of Sterki's record.

Geologic range.—No fossil record to my knowledge.

Remarks.—Goodrich (1940b, p. 5) gives the full synonymy which is much more extensive than that given by Tryon (1873, p. 24). The names given by Goodrich as synonyms of this species are scattered all through the text in Tryon and are considered valid by him.

Genus *Nitocris* H. and A. Adams 1858

Nitocris Adams 1854, Genera Moll., v. I, p. 308 (*fide* Neave) *non* Rafinesque 1815, Analyse, p. 123 (Hym[enoptera]).

"*Nitocris* H. and A. Adams 1858" Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 304.

Nitocris Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 19.

Type.—Not given by Goodrich.

Diagnosis.—"Shells varying from depressed to pyramidal; smooth or sculptured with raised revolving lines. The operculum is small, neomelanian; in instances lacking any sign of spiral nucleus and developed into the shape of a ribbon. Species of the genus are placed under *Anculosa* in the older faunal lists, but their radulae resemble those of *Pleurocera*" (Goodrich, 1940, p. 19).

Remarks.—In the area of this report, only one species belongs to this genus. Farther south, several species of the genus occur in the Ohio River drainage. These are listed by Goodrich (1940b, p. 19 ff.).

Nitocris trilineata (Say) 1829
Fig. 282

Melania trilineata Say 1829, New Harmony Disseminator, v. 2, no. 18, p. 227.

Anculotus costatus Anthony 1840, Boston Jour. Nat. History, v. 3, p. 278, pl. 3, fig. 1.

Anculosa trilineata Tryon 1873, Land and fresh-water shells N. America, pt. 4, p. 400, figs. 797, 798.

Anculosa costata Tryon 1873, *ibid.*, p. 385, figs. 725, 726.

Anculosa trilineata Call 1900, Moll. Ind., p. 436, pl. 12, fig. 12.

Anculosa costata Call 1900, *ibid.*, p. 435, pl. 12, fig. 14.

Anculosa trilineata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 386 (=*viridis* Lea, syn. or var.?).

Anculosa costata Sterki 1907, *ibid.*, p. 386 (=*carinata* Bruguière?).

--- --- F. C. Baker 1920, Life of Pleistocene, p. 385.

Nitocris trilineata Goodrich 1940, Pleuroceridae Ohio R. drainage, p. 20.

--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 304.

FIGURE 282.—*Nitocris trilineata*, X1; after Call (1900, pl. 12, fig. 12).

Type locality.—Falls of the Ohio.

Diagnosis.—"Shell subglobose oval, yellowish, more or less tinged with brown; volutions about four, rounded, somewhat wrinkled; spire short, rather more than half the length of the aperture; suture not very deeply impressed; body-whorl with three brownish-black revolving lines, of which the two inferior ones are nearest together, the middle one widest, and the superior one placed nearest the suture and revolving on the spire; the middle one is concealed on the spire by the suture; aperture much dilated, ovate, acute above; labium a little flattened; labrum widely and regularly rounded, without any protrusion near the base; base slightly angulated, without any sinus or undulations; umbilicus none" (Say, quoted by Tryon, 1873, p. 400-401).

Ecology.—No precise data located.

General distribution (fig. 283).—"Ohio River, Cincinnati, Ohio, to Louisville, Kentucky; Little Miami River, Ohio, near mouth; Five-mile Creek, Campbell County, Kentucky" (Goodrich, 1940b, p. 20). Goodrich and van der Schalie (1944, p. 304) add no further distribution data.

Distribution in Ohio (inset, fig. 283).—Sterki (1907a) gives only "Ohio River," and I have no further records except those given by Goodrich (see above).

Geologic range.—F. C. Baker (1920a, p. 385) records this species for beds of Sangamon age.

Subclass EUTHYNEURA Spengel

This subclass is composed of gastropods in which the visceral commissures are not crossed, but form a simple loop; sexes united in the same individual (hermaphroditic); heart commonly in front of the gill; shell spiral or saucer-shaped, commonly vestigial or absent; operculum generally wanting (none in Ohio genera); radula generally multiserial.

Order PULMONATA Cuvier

Euthyneura of this order have the gill cavity transformed into a lung for breathing free air; includes two suborders, both of which are represented by terrestrial genera.

Suborder BASOMMATOPHORA A. Schmidt

This suborder is represented by animals with two tentacles which are flattened, triangular or subcylindrical, contractile but not evertible, the eyes sessile at their base; a shell is invariably present and is covered with a corneous epidermis; no operculum present; mostly aquatic in habitat.

Superfamily LIMNOPHILA

Limnophila are found living in fresh or, more rarely, in slightly brackish water; teguments smooth; genital orifices separated, the male orifice near the tentacle, the female at the base of the neck, near the respiratory orifice; respiration by a lung, to which is added, in several families, a more or less complicated pseudo-

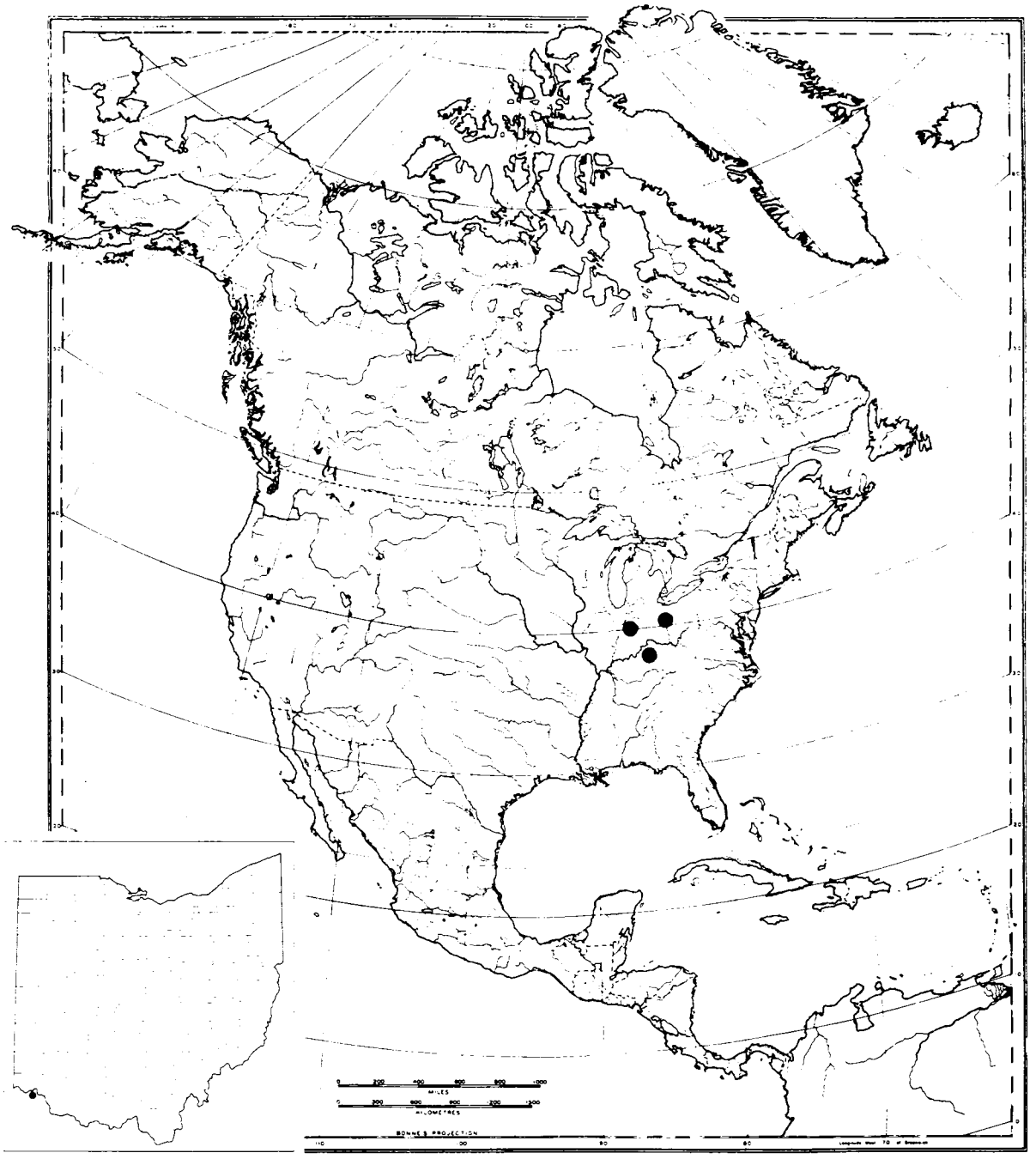


FIGURE 283.—Distribution of *Nitocris trilineata* in North America; *inset,* distribution in Ohio.

branch, or accessory branchia; jaw simple or composed of three pieces; radula with distinct lateral and marginal teeth in numerous rows; eggs enclosed in a gelatinous, transparent capsule; habits usually phytophagous, but some forms are carnivorous and others are scavengers.

The Limnophila include the majority of North American freshwater pulmonates, or pond snails, and the freshwater limpets. They are widely distributed in the western hemisphere, from the Canadian Arctic to South America, and as widely distributed in the eastern hemisphere.

The presence of a distinct pseudobranch or accessory gill in the Planorbidae and Ancylidae, in addition to a modified lung cavity, provides the individuals of these families with means for remaining submerged for much longer periods than are possible for individuals of other families. In the Lymnaeidae it has been shown that respiration takes place through the skin, thus achieving the same purpose.

The Ohio fauna includes representatives of the Lymnaeidae, Planorbidae, Ancylidae, and Physidae, discussed in order in this report, each of them represented by two or more genera and many species.

Family LYMNAEIDAE Broderip 1839, emend. F. C. Baker 1928

Shells of the Lymnaeidae are normally dextral, rarely sinistral, ovately oblong or elongate; spire more or less attenuated; columellar axis thickened by a shelly deposit and typically gyrate or twisted; peristome thin, sharp; shell covered with a corneous periostracum or epidermis.

The animal has a short, wide, rounded foot; head supporting a velum which is retained from the larval state; tentacles flattened, triangular, the eyes sessile upon their inner base; a large superior and two smaller narrow lateral jaws present; central tooth of radula unicuspid, lateral teeth bicuspid or tricuspid, marginals serrated; teeth overlapping, in numerous (80-100) rows; teeth in one row numerous (over 60), small, with a basal part which is commonly quadrate and a reflected part which bears the cusps.

The eggs are laid in sausage-shaped masses which are gelatinous and transparent except when covered with algae or debris, and are attached to sticks, stones, leaves of water plants, or any convenient object. The eggs in one mass are numerous (over 100 in some cases), small, light gray or hyaline, at least before the animal develops, yellowish when the shell has been formed. The young emerge from the egg with a shell of less than two whorls which is nearly globular in shape. As the animal develops the shell increases in size and takes on the typically elongate form characteristic of the majority of genera in the family.

The classification of the North American Lymnaeidae is still a vexing problem which awaits final solution. Dall (1905, p. 63) proposed a classification dividing the old all-inclusive genus *Lymnaea* into two subgenera, each with several sections. F. C. Baker (1911a), in his monograph of the Lymnaeidae, proposed a classification which essentially raised Dall's sections to generic rank. This action was severely criticized by Colton (1915a) and many malacologists still refuse to accept Baker's genera. Baker (1928a, pt. I, p. 194) revised his classification of the Lymnaeidae, noting that "whether the groups should be classed as genera or subgenera will probably be a matter of personal opinion. They are herein considered as of generic importance." Baker's revised classification did not fare better than the original one, most workers preferring to treat his genera as subgenera of *Lymnaea sensu lato*. The writer (La Rocque, 1953) accepted them as genera in his "Catalogue of the Recent Mollusca of Canada" and has so treated them in most of his publications. Two reasons are advanced for this action: (1) Baker's genera no more represent "ultra-splitting" than do those in general use for land snails; (2) use of the finer genera emphasizes the distinction between recognizable groups within the family, whether these groups are "natural" or not. The reader is advised to keep an open mind on this question; if his preference should be for a large genus *Lymnaea* subdivided into many subgenera, he need only remember that the generic names used in this report correspond to the subgenera of other writers.

Genus *Lymnaea* Lamarck 1799

Lymnoea Lamarck 1799, Mém. Soc. Hist. Nat. Paris, v. 75 (*fide* Neave).
Lymnaea Dall 1905, Harriman-Alaska Exped., v. 13, p. 59.
Lymnaea F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 134.
Lymnaea F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 196.
Lymnaea La Rocque 1953, Cat. Recent Moll. Canada, p. 274.

Type.—*Lymnaea stagnalis* (Linnaeus).

Diagnosis.—Shell large, thin, with an acute, slender spire and expanded body whorl; axis gyrate, forming a (generally) pervious spiral coil without a true umbilicus; the callus on the body whorl closely appressed; the outer lip flaring more or less, simple, sharp, normally without any thickening (Walker, 1918).

Remarks.—The genus as understood here is restricted to the typical species and excludes the species distinguished as subgenera or sections by Dall (1905) and others. Thus understood, it is represented in the Ohio fauna by a single species, *L. stagnalis*

(Linnaeus).

Species as old as Jurassic have been assigned to this genus but the assignment is in doubt in many cases. Henderson (1935, p. 234 ff.) has given full references to these fossil lymnaeids.

Lymnaea stagnalis (Linnaeus) 1758

Helix stagnalis Linnaeus 1758, Syst. Nat., 10th ed., p. 774.

Lymnaea stagnalis F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 136; synonymy.

Type locality.—Europe.

Diagnosis.—Elongate or oval, ventricose at the anterior end, thin; periostracum yellowish horn to brownish black; surface shining, growth lines numerous, crowded, more or less elevated, crossed by numerous fine, impressed spiral lines; apex smooth, brownish horn in color; whorls 6 to 7, rapidly increasing, all but the last two rather flat sided; last whorl very large, considerably dilated and inflated, inclining to form a shoulder; spire long, pointed, acute, occupying about half the length of the entire shell; sutures distinct, in some cases impressed; aperture large, broadly ovate, dilated, particularly at the upper part; peristome thin, acute, anterior part rounded; parietal wall with a rather wide spreading callus which is closely appressed to the body and either completely closes the umbilicus or leaves a very small chink; pillar of the columella gyrate, commonly forming a more or less heavy, oblique ascending plait.

Ecology.—Found in quiet bodies of water of a more or less stagnant but permanent character, such as backwaters of rivers, shallow, weedy parts of rivers and brooks, oxbow lakes, and ponds.

General distribution.—The species and its varieties may be described as circumboreal; in North America, south to about 40th parallel of latitude. According to F. C. Baker (1911a, p. 137) the typical form does not occur in North America except possibly in the northernmost parts of Canada. If the varieties recognized by Baker are discarded, then the range given in first sentence of this paragraph describes its occurrence in North America. Baker (1911a, p. 137 ff.; 1928a, pt. I, p. 198 ff.) has placed the North American specimens in five varieties, *L. stagnalis jugularis, lillianae, sanctaemariae, perampla,* and *wasatchensis,* of which the first four are eastern, the last western in distribution. Only the first of these has been recorded for Ohio.

Distribution in Ohio.—The typical form is not recorded for Ohio, unless Baker's varieties are rejected. If they are accepted, the name *L. stagnalis jugularis* should be applied to them.

Geologic range.—The species has been recorded from several Pleistocene deposits but does not seem to range farther back in time.

Remarks.—According to Baker's classification, *Lymnaea stagnalis s.s.* does not occur in North America. In this report, his system is followed and therefore detailed records will be found under the varieties (better, forms) of the species.

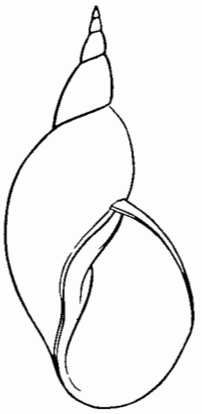


FIGURE 284.—*Lymnaea stagnalis jugularis,* X1; after Walker (1918, p. 6, fig. 1).

Lymnaea stagnalis jugularis Say 1817
Fig. 284

Lymnea jugularis Say 1817, Nicholson's Encycl., 1st ed., art. Conchology (no pagination).

Lymneus appressus Say 1818, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 168.

Lymnaea stagnalis Dall 1905 (part), Harriman-Alaska Exped., v. 13, p. 65, fig. 42.

--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.

Lymnaea stagnalis appressa F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 137, pl. 19, figs. 4-10; pl. 20, figs. 1-6; pl. 22, figs. 1-3.

--- --- --- Sterki 1914, Ohio Naturalist, v. 14, p. 271.

--- --- --- Johnson 1915, Fauna New England, p. 180.

--- --- --- F. C. Baker 1920, Life of Pleistocene, p. 387.

Lymnaea stagnalis jugularis F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 198, pl. 11, figs. 9-13; pl. 12, figs. 1-4, 11, 12.

Lymnaea stagnalis appressa Goodrich 1932, Moll. Mich., p. 42.

--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 283.

Lymnaea stagnalis jugularis Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 51, pl. 4, figs. 20, 29.

--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 274.

--- --- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 85.

Type locality.—Not stated by Say. Lake Superior, for *Lymneus appressus.*

Diagnosis.—As for the type form, but spire as long as or longer than the aperture; body whorl regularly rounded, not shouldered, aperture acutely angled above.

Ecology.—Inhabits quiet, shallow parts of ponds, lakes, and rivers, in or near vegetation, where wave action and current are at a minimum. Its food consists mainly of microscopic plants and animals but it will also eat rotting vegetables and fruit. F. C. Baker (1911a, p. 147) has also noted that it will attack living animals, such as small fish.

Associations.—Living: MANITOBA-8, 10, 16, 32, 33, 34, 35; MINNESOTA-10, 11c, 14d, 15; ONTARIO-1, 5, 9; QUEBEC-3, 5, 8; WISCONSIN-4, 16, 27, 80, 93, 94, 96, 105. Fossil: S-6; W-27, 33, 34, 45.

General distribution (fig. 285).—North America from about the 37th (Colorado) and 41st (Illinois) parallels

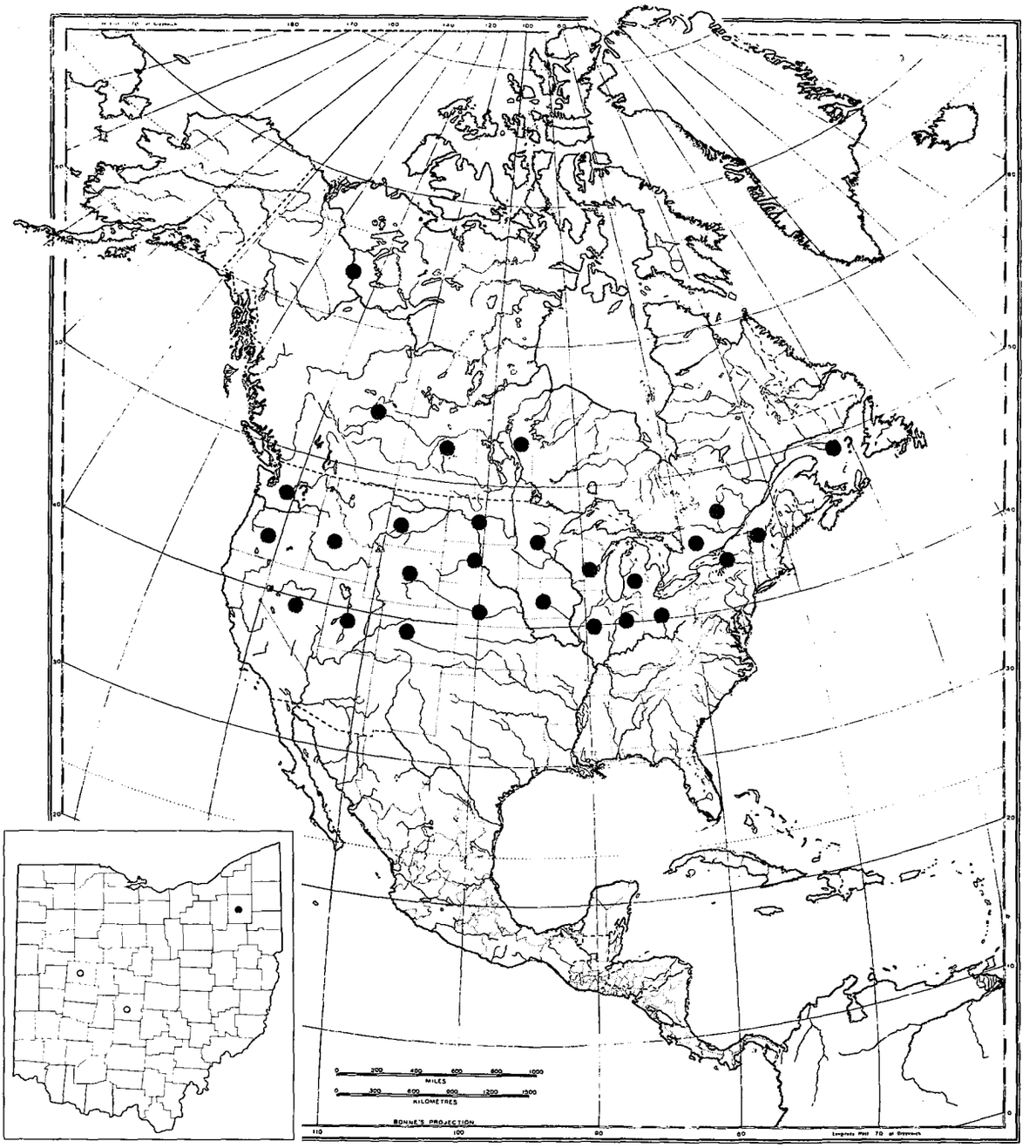


FIGURE 285.—Distribution of *Lymnaea stagnalis jugularis* in North America; *inset,* distribution in Ohio.

of north latitude to the Arctic Ocean.

Distribution in Ohio (inset, fig. 285).—Sterki (1907a, p. 381) gave only Kent, Portage County (Dean). I have records for Sandusky Bay (beach drift). Sterki (1920, p. 174) recorded it for the Tinkers Creek marl. Since then it has turned up in the Newell and Jewell deposits in Logan County.

Geologic range.—Most of the Pleistocene specimens of this species that I have seen belong to form *jugularis,* whether from Ohio or elsewhere. Baker (1920a, p. 387) gives Sangamon and "Wabash" as its range. Hibbard and Taylor (1960, p. 85) record it definitely from the Illinoian of Kansas and, doubtfully, from the late Kansan of the same State. It has been collected in the following late Wisconsin deposits in Ohio: Newell Lake (Zimmerman, 1960, p. 20), Oakhurst (Aukeman, 1960, p. 68), Aultman (Sheatsley, 1960, p. 69), and Jewell Hill (Mowery, 1961, p. 9).

Genus *Stagnicola* (Leach) Jeffreys 1830

Stagnicola (Leach ms.) Gray 1840, *in* Turton, Man. land and fresh-water shells, 2d ed., p. 239 (*fide* Neave).

"*Stagnicola* Leach, Proof-sheets, pp. 141, 145, 1819; Jeffreys, Linn. Trans., XVI, ii, p. 376, May 29, 1830" (F. C. Baker, 1928a, pt. I, p. 209).

Galba Schranck 1803, F. Boica, v. 3, no. 2, p. 262 (*fide* Neave) (part).

Stagnicola F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 209.

Stagnicola La Rocque 1953, Cat. Recent Moll. Canada, p. 275.

Type.—*L. palustris* Müller.

Diagnosis.—Shell elongate to short-ovate; outer lip generally somewhat thickened within; columella distinctly plicate; inner lip appressed; axis slightly or not at all perforate; surface with strong spirally impressed lines.

Remarks.—As revised by F. C. Baker (1911a, 1928a, pt. I) this genus is one containing a multitude of species and varieties characteristic of the northern part of the North American continent. Nevertheless, it is holarctic in distribution and has many representatives in Asia and Europe. The North American species are notable for intergrading and variation (see, for example, the list of Canadian species, La Rocque, 1953, p. 275 ff.) and it is likely that thorough revision will eliminate a number of them which are not constant or distinct enough to be accepted.

Stagnicola caperata (Say) 1829
Pl. 9, figs. 5-7

Lymneus caperatus Say 1829, New Harmony Disseminator, v. 2, p. 230.

Lymnaea smithsoniana Lea 1864, Acad. Nat. Sci. Philadelphia Proc. 1864, p. 113.

Limnophysa caperata Call 1900, Moll. Ind., p. 407, pl. 8, fig. 7.

Limnaea ferrissi F. C. Baker 1902, Moll. Chicago area, p. 277, pl. 31, fig. 26.

Lymnaea umbilicata auctt., non Adams.

Lymnaea (Stagnicola) caperata Dall 1905, Harriman-Alaska Exped., v. 13, p. 79, fig. 63.

Lymnaea caperta [sic] Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.

Galba caperata F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 225, pl. 28, figs. 20-33; pl. 29, figs. 1-3.

--- --- Johnson 1915, Fauna New England, p. 182.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.

Stagnicola caperata F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 260, pl. 18, figs. 43-47.

Lymnaea caperata Goodrich 1932, Moll. Mich., p. 51.

--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 284.

Stagnicola caperata Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 56, pl. 6, figs. 20, 21; pl. 7, fig. 10.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 276.

--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 92.

Stagnicola (Hinkleyia) caperata Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 53.

Type locality.—Indiana.

Diagnosis.—"Rather thick, elongate; light yellow, brown, reddish brown, or black. Whorls 6, convex, encircled by numerous raised lines that are elevated parts of the epidermis and often of a striking and beautiful appearance when examined under the magnifying glass. Aperture ovate to nearly round. Columella so raised as to leave a deep chink between it and the wall of the body whorl. Outer lip a little thickened within. Altitude 15.75, diameter 6.5 mm." (Goodrich, 1932, p. 51).

Ecology.—Found in intermittent streams or small pools, ponds, and ditches that dry up in the summer, associated with *Aplexa hypnorum* and *Sphaerium occidentale.* It can survive in temporary ponds that dry up completely in late spring and summer.

Associations.—Living: MANITOBA-3, 4, 11; ONTARIO-7, 10; WISCONSIN-138. Fossil: P-4; N-1, 2; A-1; K-1, 4, 5; K-14, 21, 26, 27; I-3; S-1, 2, 3, 4, 5, 6; W-28.

General distribution (fig. 286).—Quebec and Massachusetts west to California; Yukon Territory and James Bay south to Maryland, Indiana, Colorado, and California.

Distribution in Ohio (inset, fig. 286).—Sterki (1907a, p. 382) gives records for Lorain, Cuyahoga, Summit,

Portage, Stark, and Tuscarawas Counties; Sterki (1920, p. 182) adds a fossil record for the Castalia marl (Erie County) and this is confirmed by records in the Eggleston collection. Specimens from Auglaize County (Clark collection) are in the University of Michigan collection.

Geologic range.—F. C. Baker (1920a, p. 387) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash" (late Wisconsin). Hibbard and Taylor (1960, p. 92) extended this to Middle Pliocene to Recent.

Stagnicola catascopium (Say) 1817
Fig. 287

Lymnea catascopium Say 1817, Nicholson's Encycl., Am. ed., v. 2, pl. 2, fig. 3.

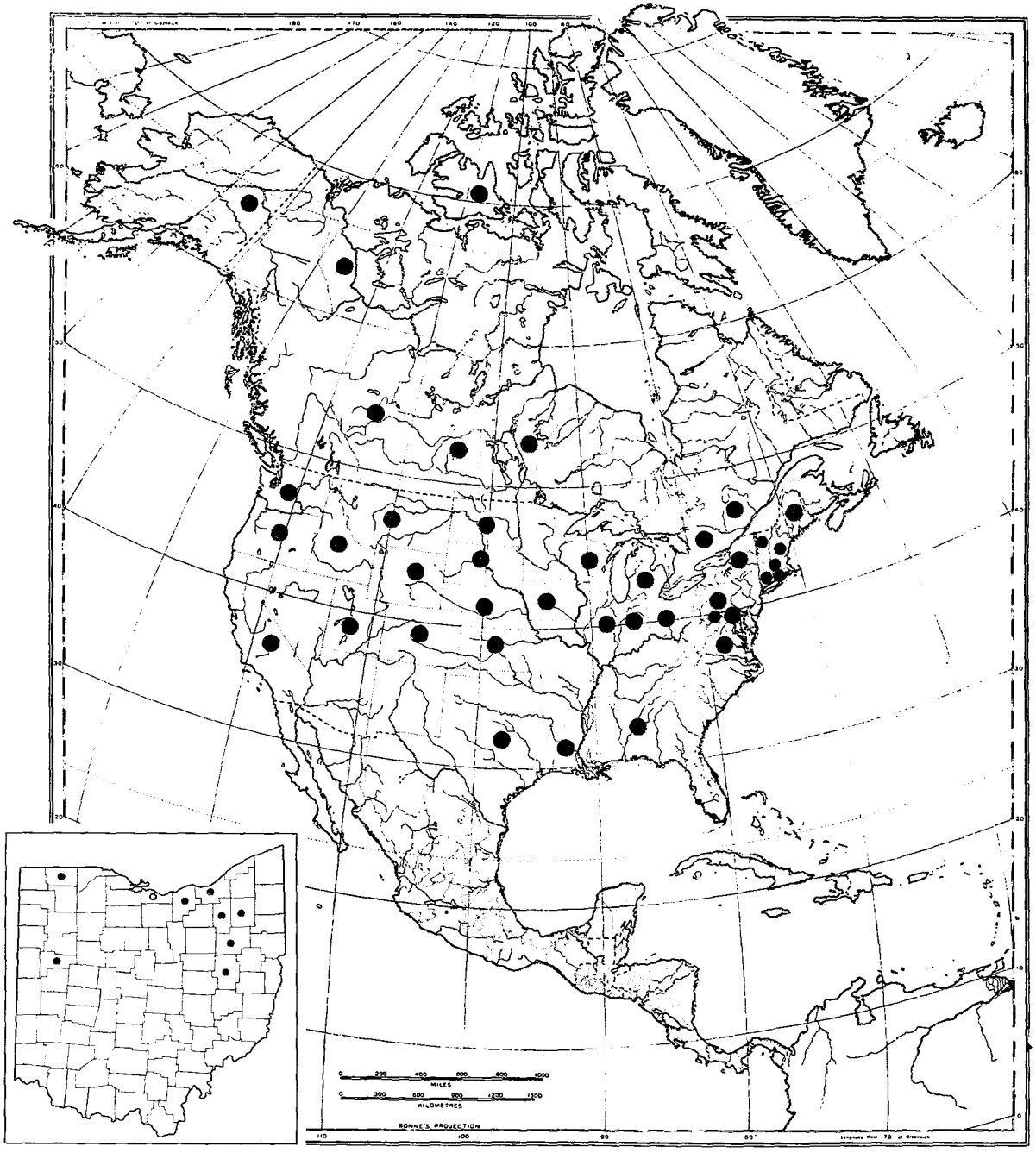


FIGURE 286.—Distribution of *Stagnicola caperata* in North America; *inset,* distribution in Ohio.

Lymnea pinguis Say 1825, Acad. Nat. Sci. Philadelphia Jour., v. 5, p. 123.
Lymnaea linsleyi De Kay 1843, Moll. N. Y., p. 72, pl. 4, figs. 74a, b.
Limnaea brownii Tryon 1865, Am. Jour. Conchology, v. 1, p. 229, pl. 23, fig. 15.
Limnaea intertexta Currier 1868, Kent Sci. Inst. Misc. Publ. 1.
Lymnaea (Stagnicola) catascopium Dall 1905, Harriman-Alaska Exped., v. 13, p. 77, fig. 60.
Lymnaea catascopium Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.
Galba catascopium F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 380, pl. 30, figs. 25-26; pl. 40, figs. 6-35; pl. 41, figs. 1-4; pl. 47, fig. 10.
--- --- Johnson 1915, Fauna New England, p. 186.
Stagnicola catascopium F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 250, pl. 10, figs. 13-19; pl. 17, figs. 21-30.
Lymnaea catascopium Goodrich 1932, Moll. Mich., p. 44.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 287.
Stagnicola catascopium Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 55, pl. 4, fig. 23.
Stagnicola catascopium catascopium La Rocque 1953, Cat. Recent Moll. Canada, p. 276.

FIGURE 287.–*Stagnicola catascopium*, X1; after W. G. Binney (1865, pt. II, p. 53, fig. 80).

Type locality.–Delaware River, Philadelphia, Pennsylvania.

Diagnosis.–"Thin in protected situations, often thick where exposed to wave action; spire usually varying in height under like conditions; white, bluish, or reddish brown. Whorls 5, covered with fine growth lines, sometimes irregularly spaced, that are crossed by revolving lines; body whorl large. Aperture wide, but seldom flaring. Outer lip sharp-edged, thickened within by a deposit of callus. Columella rather wide, a little twisted in the center, and nearly completely covering the umbilicus. Specimens in the Museum of Zoology vary from 10 to 21 mm. in height by 6 to 10 mm. in diameter" (Goodrich, 1932, p. 45).

Ecology.–This species is typically a river mollusk living on gravel, stones, and floating logs in shallow water 1 to 2 feet deep, current rather rapid. In the type locality, Delaware River, near Philadelphia, it lives in water that rises and falls with the tide but is not saline. This habitat gives an idea of the hardiness of this species which can live exposed to the sun between tides, possibly because of its heavy shell. The thickness of the shell varies from one habitat to another. In the Great Lakes region, it is very thick in individuals exposed to wave action, thinner in specimens living in protected situations.

Associations.–Living: MANITOBA - 22; NEW YORK - 3a, 4c, 5a, 5b, 6, 7, 10, 14, 15a, 15b, 21, 22, 23, 25, 26, 27, 29, 30, 32, 34, 35, 36, 37, 40a, 41, 42; ONTARIO - 10; WISCONSIN - 79.

General distribution (fig. 288).–Nova Scotia west to North Dakota; Great Slave Lake south to northern Iowa, northern Ohio, and Maryland.

Geologic range (inset, fig. 288).–Yarmouth and "Wabash," according to F. C. Baker (1920a, p. 388).

Stagnicola desidiosa (Say) 1821
Fig. 289

Lymneus desidiosus Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 169.
Limnophysa desidiosa Call 1900, Moll. Ind., p. 407, pl. 8, fig. 6.
Lymnaea (Galba) desidiosa Dall 1905, Harriman-Alaska Exped., v. 13, p. 73, fig. 73.
"*Lymnaea desidiosa* Say, *obrussa* Say t. Baker" Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.
Galba palustris desidiosa F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 316, pl. 34, figs. 1-12.
Lymnaea palustris desidiosa Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 286.
Stagnicola palustris desidiosa Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 54, pl. 7, fig. 14.
Stagnicola desidiosa La Rocque 1953, Cat. Recent Moll. Canada, p. 277.

Type locality.–Cayuga Lake, New York.

Diagnosis.–Shell of medium size, solid, ovate to elongate; epidermis pale horn color, darker in some specimens; surface dull, lines of growth crowded, conspicuous, crossed by fine impressed spiral lines; body whorl commonly malleated; whorls 5 to 6, spire acutely conic or elongated, as long as or a little longer than the aperture; aperture ovate or roundly ovate, rounded below, slightly angled above; outer lip thickened; inner lip narrow, triangular, reflected over the umbilicus which it almost closes; axis twisted; L. 17, W. 8, Ap. L. 7.5, Ap. W. 4 mm. (type locality).

Ecology.–Found in quarry pools and medium-sized lakes (Seneca Lake, New York) if the type locality given by Say is correct. F. C. Baker did not find it in Seneca Lake (Baker, 1911a, p. 319) and it is quite possible that Say received it from the general region of Seneca Lake but from ponds or quarry pools, where Miss Mary Walker found specimens sent to Baker.

Associations.–Living: OHIO - 43; ONTARIO - 9;

QUEBEC - 2.

General distribution (fig. 290).—Northern United States (New York to Indiana) and northward. Recorded, perhaps erroneously, from Alberta, Manitoba, and British Columbia. Baker (1911a, p. 320) discusses the history of the species and emphasizes the characteristics which distinguish it from others. Specimens labeled with this name in collections should be re-examined.

Distribution in Ohio.—Specimens identified by Sterki (1907a, p. 382) as this species were referred by him, on Baker's advice, to *Fossaria obrussa.* I have no authentic records as yet for the State of Ohio.

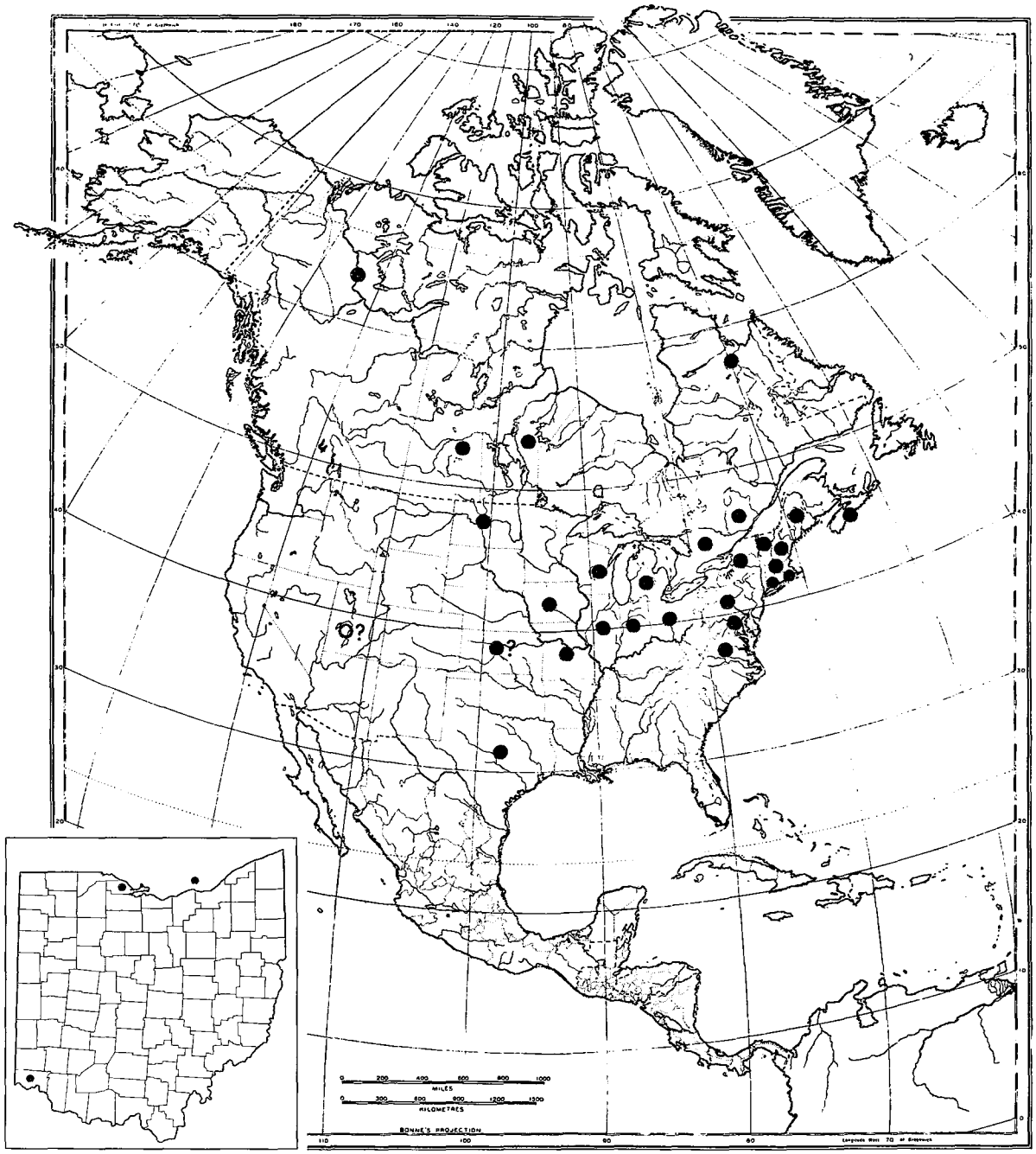


FIGURE 288.—Distribution of *Stagnicola catascopium* in North America; *inset,* distribution in Ohio.

Geologic range.—Unknown.

FIGURE 289.—*Stagnicola desidiosa*, X1; after W. G. Binney (1865, pt. II, p. 48, fig. 68).

Stagnicola exilis (Lea) 1837
Pl. 9, fig. 13

Lymnaea exilis Lea 1837, Am. Philos. Soc. Trans., v. 5, p. 114, pl. 19, fig. 82.

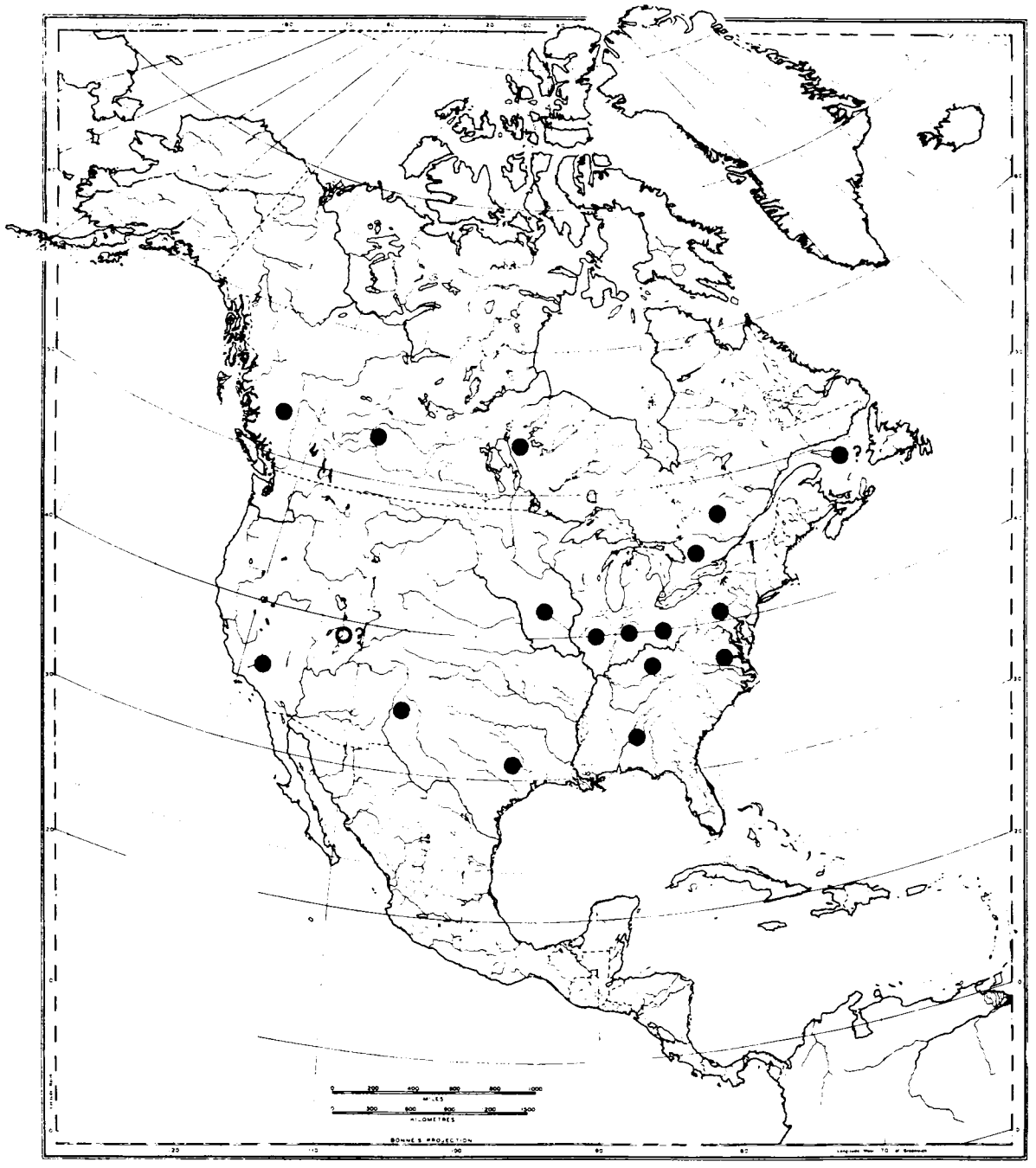


FIGURE 290.—Distribution of *Stagnicola desidiosa* in North America.

Limnaea zebra Tryon 1865, Am. Jour. Conchology, v. 1, p. 228, pl. 23, fig. 4.

Galba exilis F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 343, pl. 36, figs. 21, 22; pl. 37, figs. 1-11.

Lymnaea exilis Sterki 1914, Ohio Naturalist, v. 14, p. 271.

Stagnicola exilis F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 226, pl. 14, figs. 7-11; pl. 17, fig. 16.

Lymnaea exilis Goodrich 1932, Moll. Mich., p. 56.

--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 286.

Stagnicola exilis La Rocque 1953, Cat. Recent Moll. Canada, p. 278.

--- --- Hibbard and Taylor 1960, Mich. Univ. Mus.

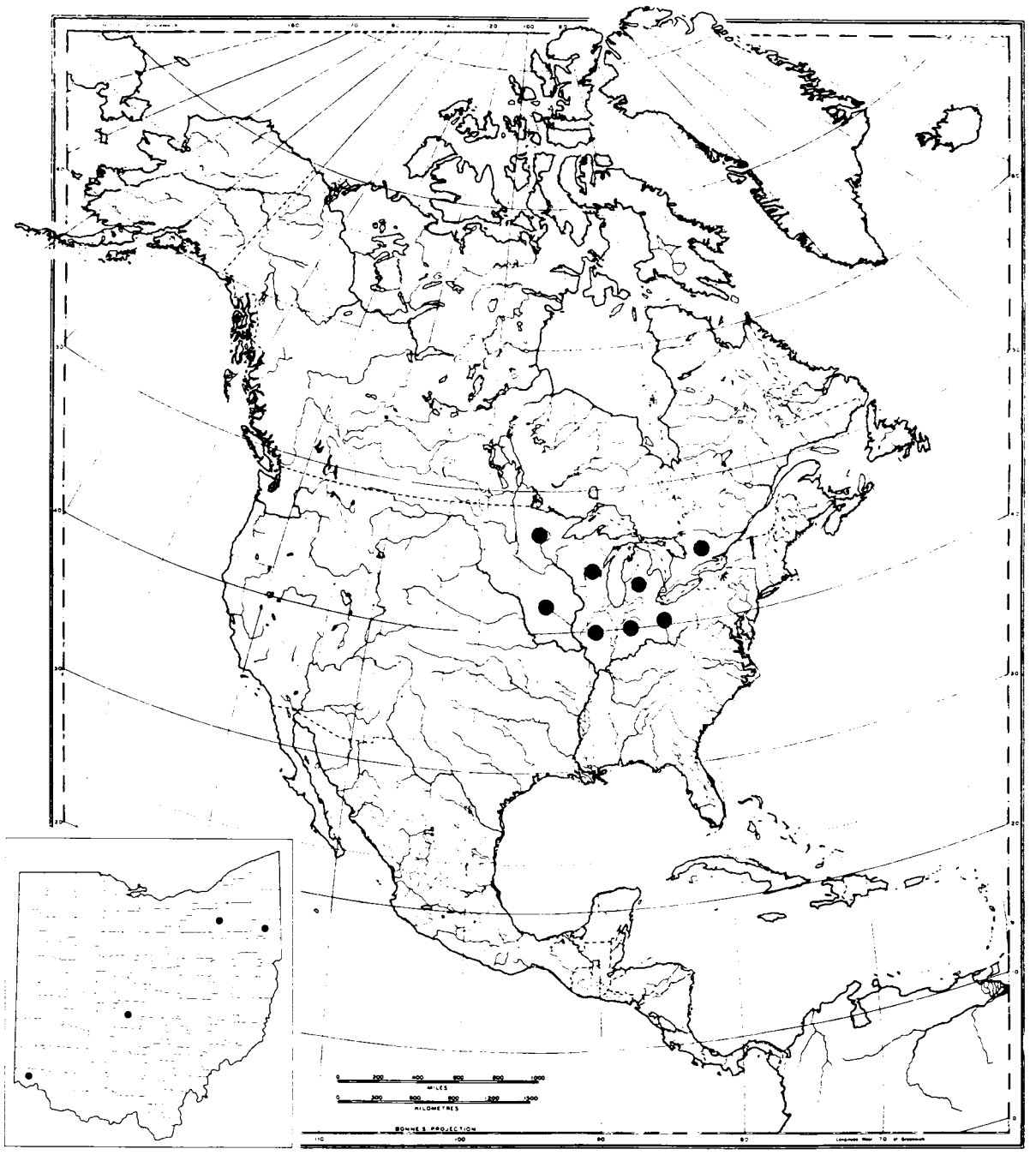


FIGURE 291.–Distribution of *Stagnicola exilis* in North America; *inset*, distribution in Ohio.

Paleontology Contr., v. 16, no. 1, p. 86.
--- --- Taylor, 1960, U.S. Geol. Survey Prof. Paper 337, p. 52.

Type locality.—Near Cincinnati, Ohio.

Diagnosis.—Shell very elongate, narrow, pointed; growing to nearly 40 mm. long; commonly with prominent rest scars showing through the substance of the shell.

Ecology.—Found in sloughs, ponds, and streams that dry up more or less during a portion of the year. Also in stagnant pools behind beaches.

Associations.—Living: MINNESOTA - 15; WISCONSIN - 42, 47, 83, 100, 138. Fossil: P - 3, S - 2.

General distribution (fig. 291).—Ohio to Kansas, northward to northern Minnesota and northern Michigan.

Distribution in Ohio (inset, fig. 291).—Sterki (1914, p. 271) gives Mahoning, Summit, Franklin, and Hamilton Counties. I have no other records.

Geologic range.—Late Pliocene to Recent (Hibbard and Taylor, 1960, p. 86).

Stagnicola lanceata (Gould) 1848
Fig. 292

Limnaea lanceata Gould 1848, Boston Soc. Nat. History Proc., v. 3, p. 64.
Galba lanceata F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 350, pl. 37, figs. 17-22.
Lymnaea lanceata Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Stagnicola lanceata F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 228, pl. 14, figs. 12-15; pl. 17, fig. 17.
Lymnaea lanceata Goodrich 1932, Moll. Mich., p. 56.
Stagnicola lanceata La Rocque 1953, Cat. Recent Moll. Canada, p. 279.

FIGURE 292.—*Stagnicola lanceata*, X1; after W. G. Binney (1865, pt. II, p. 68, fig. 112).

Type locality.—Pic Lake, north shore of Lake Superior, Ontario, Canada.

Diagnosis.—"Elongate-cyclindrical, rather thin, compressed; periostracum light to very dark horn colored; surface dull to shining; growth lines and spiral lines very heavy producing a conspicuously marked reticulated appearance; whorls 6 to 6½, flatly rounded, slightly oblique, not rapidly increasing in diameter, the body whorl very long and much compressed; sutures well marked; spire acutely pyramidal, generally a trifle longer than the aperture; nuclear whorls like *palustris* in outline and number, very dark chestnut colored; aperture elongated, slightly oblique, rounded below and somewhat acutely angled above, where the outer lip is slightly arched, as it joins the body whorl; outer lip with a conspicuous varix, bordered by a dark chestnut band; inner lip very narrow, forming a sharp keel on the columella and a thick deposit of callus on the parietal wall" (F. C. Baker, 1928a, pt. I, p. 228).

Ecology.—Found in swampy or quiet bays or pond-like bodies of water connecting with a lake, rare on sandy shores, in shallow water, more common in swampy areas with a quantity of vegetation and floating logs.

Associations.—Living: MANITOBA - 5, 21, 35; WISCONSIN - 2, 4, 9, 47, 99, 106, 123. Fossil: W - 35.

General distribution (fig. 293).—Ontario south to northern Ohio, west to Wisconsin.

Distribution in Ohio (inset, fig. 293).—Sterki (1914, p. 271) records the species for Lucas and Summit Counties. I have no other records.

Geologic range.—Late Wisconsin, Ohio: Orleton mastodon site (La Rocque, 1952, p. 14).

Stagnicola palustris (Müller) 1774
Fig. 294

Buccinum palustre Müller 1774, Verm. Terr. et Fluv. Hist., p. 131.
Limnophysa palustris Call 1900, Moll. Ind., p. 406, pl. 8, fig. 5.
Lymnaea (Stagnicola) palustris Dall 1905, Harriman-Alaska Exped., v. 13, p. 76, fig. 56.
Galba palustris F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 298, pl. 26, figs. 17-37; pl. 33, figs. 1-25; pl. 34, fig. 20.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Stagnicola palustris F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 212.
Lymnaea palustris Goodrich 1932, Moll. Mich., p. 54.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 285.
Stagnicola palustris palustris La Rocque 1953, Cat. Recent Moll. Canada, p. 280.
?*Stagnicola palustris* cf. *palustris blatchleyi* Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 87.
Stagnicola palustris Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 52.

Type locality.—Europe.

Diagnosis.—Shell elongate to elongate-ovate, rather thin; color pale brown to jet black; surface dull to shining, growth lines numerous, crossed by numerous very fine impressed spiral lines; commonly malleated on last whorl; whorls 7, rounded, the last commonly quite obese; spire sharp and pointed, from over half to three-fifths the length; aperture roundly-ovate to long-ovate; peristome thin, acute, rarely expanded, thick-

ened at the aperture or rest stages by callus deposit; peristome white edged with dark brown; axis twisted, umbilical chink very narrowly open, rarely closed.

Ecology.—This species is remarkable for its hardiness, which enables it to live in very small bodies of water with mud bottom and little aeration. It will live in both clear and stagnant water, but prefers a quiet habitat, with mud bottom or vegetation. It is almost omnivorous and has been reported feeding on dead animals and decaying fruit and vegetables, and eating a living leech.

Associations.—Living: MANITOBA-2, 4, 7, 8, 9, 10, 24, 25, 29, 30, 31, 32, 34, 37; MICHIGAN-12, 13, 14, 27; OHIO-29, 31, 32, 34, 37, 41, 42, 43; ONTARIO-3, 7. Fossil: K-2, 4, 5, 8, 9, 10, 11, 14, 16, 17, 18, 21, 23, 24; S-1; W-29.

FIGURE 293.—Distribution of *Stagnicola lanceata* in North America; *inset,* distribution in Ohio.

FIGURE 294.—*Stagnicola palustris,* X1; after Call (1900, pl. 8, fig. 5).

General distribution (fig. 295).—Circumboreal; northern Asia and Europe. North America from the Atlantic to the Pacific, all Canada south to New Mexico, the north-central and northeastern states.

Distribution in Ohio (inset, fig. 295).—Sterki (1907a, p. 381) gave "over the state" which is an indication of its ubiquity.

Geologic range.—This species is one of the most

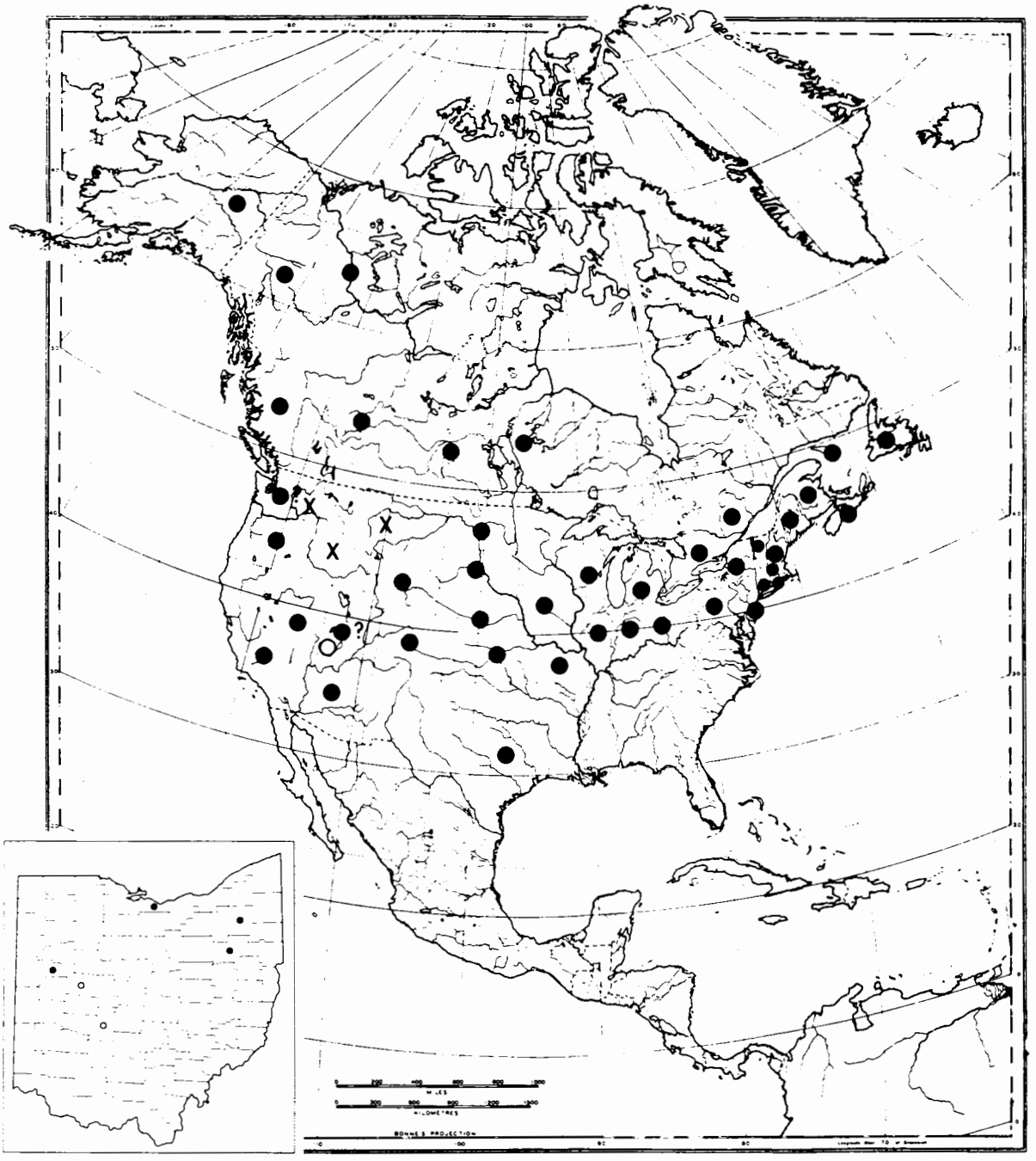


FIGURE 295.—Distribution of *Stagnicola palustris* in North America; *inset,* distribution in Ohio.

common in Pleistocene deposits, in Ohio and elsewhere. F. C. Baker (1920a, p. 387) recorded it for Aftonian, Yarmouth, Sangamon, and "Wabash" deposits. Hibbard and Taylor have noted form *blatchleyi* (Baker) from the late Sangamon of Kansas. D. W. Taylor (1960, p. 52) found it only in Recent deposits in Nebraska.

Stagnicola palustris elodes (Say) 1821
Fig. 296

Limneus elodes Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 169.
Lymnaea palustris elodes Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
Galba palustris F. C. Baker 1911 (part), Lymnaeidae N. and mid. America, p. 298, pls. 26, 33.
Lymnaea elodes Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Galba elodes F. C. Baker 1920, Life of Pleistocene, p. 387.
Stagnicola palustris elodes F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 212, pl. 13, figs. 3-7, 9-13.
Lymnaea elodes Goodrich 1932, Moll. Mich., p. 56.
Lymnaea palustris elodes Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 286.
Stagnicola palustris elodes Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 51, pl. 4, figs. 16-19.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 280.

FIGURE 296.—*Stagnicola palustris elodes*, X1; after W. G. Binney (1865, pt. II, p. 44, fig. 60).

Type locality.—Canandaigua Lake, New York (probably in a swampy shore pool).

Diagnosis.—Similar to the type form but more slender and having a flattened body whorl. Seldom higher than 30 mm.

Ecology.—See F. C. Baker (1928a, pt. I, p. 213).

Associations.—Living: NEW YORK - 1; WISCONSIN - 18. Fossil: W - 35.

General distribution (fig. 297).—Canada and the United States east of the Rockies.

Distribution in Ohio (inset, fig. 297).—Sterki (1914, p. 271) has recorded it for "various parts of the state." Eggleston (ms. records) adds the following specific county records: Clark, Greene, Brown, Franklin, Licking, Fairfield, Meigs, and Washington. I have no further records.

Geologic range.—Baker (1920a, p. 387) has recorded this form from the Sangamon only.

Stagnicola palustris jolietensis (F. C. Baker) 1901

Limnaea reflexa jolietensis F. C. Baker 1901, Nautilus, v. 15, p. 17.
Limnaea reflexa attenuata F. C. Baker 1901, Acad. Sci. St. Louis Trans., v. 11, p. 20, pl. 1, fig. 4.
Galba elodes jolietensis F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 327, pl. 34, figs. 25-30; pl. 35, figs. 1, 2.
Lymnaea elodes jolietensis Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Stagnicola umbrosa jolietensis F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 220, pl. 13, figs. 23-26.
Lymnaea elodes jolietensis Goodrich 1932, Moll. Mich., p. 56.
Lymnaea palustris jolietensis Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 285.
Stagnicola umbrosa jolietensis La Rocque 1953, Cat. Recent Moll. Canada, p. 282.

Type locality.—Rock Run, Joliet, Illinois.

Diagnosis.—Short, slender, with very convex whorls as compared with the type form.

Ecology.—In small creeks, ditches, and along the shores of rivers; habits similar to those of *S. palustris elodes*.

General distribution (fig. 298).—Wisconsin to eastern New York; central Michigan south to northern Illinois and northern Ohio.

Distribution in Ohio (inset, fig. 298).—Sterki (1914, p. 271) records this variety for Lorain, Summit, and Mahoning Counties. All of these localities are within the glacial boundary, whereas those for *S. palustris elodes* given by Eggleston (ms. records) are all to the south and west of the above counties, but partly within the glacial boundary (Clark, Greene, Brown, Franklin, Licking, and Fairfield Counties) and partly south of it (Meigs and Washington Counties). Sterki is not precise concerning the distribution of *S. palustris elodes*, merely stating "various parts of the state." At first glance, there seems to be some pattern connected with the distribution of these two varieties, a pattern which is related to the glacial boundary in some way. The point is well worth investigating.

Geologic range.—Unknown.

Stagnicola kirtlandiana (Lea) 1841
Fig. 299

?*Limnaea exilis* Lea 1837, Am. Philos. Soc. Trans., v. 5, p. 114, pl. 19, fig. 82.
Lymnaea Kirtlandiana Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 33.
Lymnaea (Acella?) kirtlandiana Dall 1905, Harriman-

Alaska Exped., v. 13, p. 72, fig. 48.
Lymnaea reflexa kirtlandiana Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.
Galba kirtlandiana F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 348, pl. 37, figs. 12-16.
Lymnaea kirtlandiana Sterki 1914, Ohio Naturalist, v. 14, p. 271.
--- --- Goodrich 1932, Moll. Mich., p. 57.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 286.
Stagnicola kirtlandiana La Rocque 1953, Cat. Recent Moll. Canada, p. 279.

Type locality.—Poland, Ohio.

Diagnosis.—Shell very elongate, turreted, rather thin; epidermis pale horn color to dark brown; sculp-

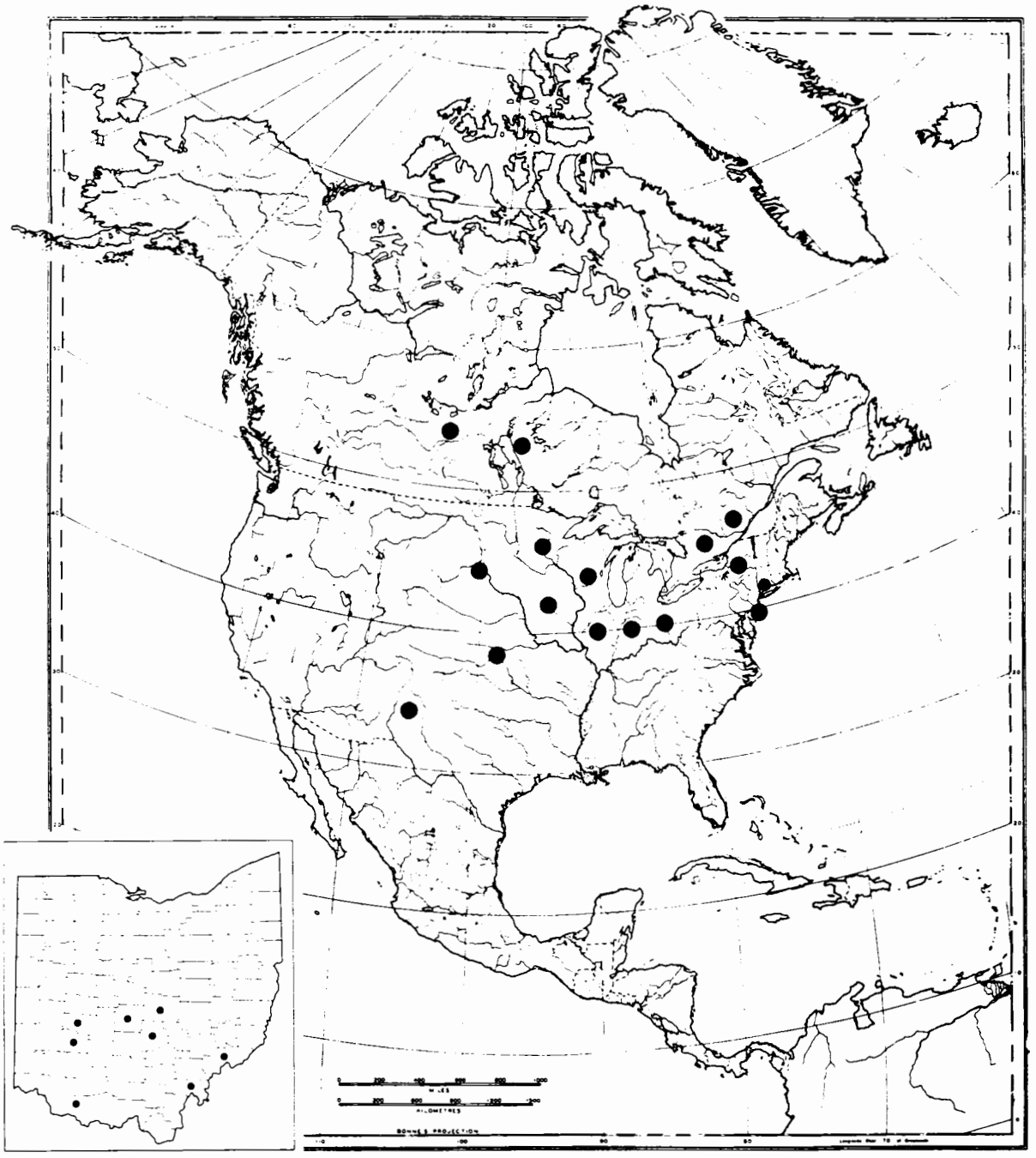


FIGURE 297.—Distribution of *Stagnicola palustris elodes* in North America; *inset,* distribution in Ohio.

ture as in *exilis*; whorls 6 to 7, slowly increasing in size, slightly convex, only a trifle oblique, the body whorl very flatly rounded; spire very long, acute, turreted; sutures impressed; aperture elongate-ovate or long elliptical, a trifle effusive and reflexed below; outer lip with a varical thickening; inner lip narrow, erect, tightly appressed to the body whorl, either entirely closing the umbilical opening or leaving a very narrow chink; parietal callus wide, thin; the columella is provided with a distinct ascending plait; the axis is slightly twisted; L. 18, W. 6.5, Ap. L. 7.0, Ap. W. 2.25 mm. (type).

Ecology.—Characteristic of small bodies of water, especially those that may become dry in the summer (F. C. Baker, 1911a, p. 349). Note that this habitat is close to that of *S. reflexa;* this may indicate that the

FIGURE 298.—Distribution of *Stagnicola palustris jolietensis* in North America; *inset,* distribution in Ohio.

FIGURE 299.–*Stagnicola kirtlandiana*, X1; after W. G. Binney (1865, pt. II, p. 67, fig. 111).

two species are related and, in fact, that *S. kirtlandiana* may be only a variety of *S. reflexa*.

General distribution (fig. 300).–Ohio west to South Dakota; northern Michigan south to northern Illinois.

Distribution in Ohio (inset, fig. 300).–Sterki (1907a, p. 382) records this form from Cuyahoga, Mahoning, Tuscarawas, and Hamilton Counties. Baker (1911a, p. 349) omitted the Hamilton County record. Sterki (1914,

FIGURE 300.–Distribution of *Stagnicola kirtlandiana* in North America; *inset*, distribution in Ohio.

p. 271) added Portage County to the list, possibly repeating the records given by Baker (1911a, p. 349).

Geologic range.—Baker (1920a, p. 100) records this species living, but not as a fossil. It is unknown in the fossil state as yet.

Stagnicola reflexa (Say) 1821
Pl. 9, figs. 3, 9

Lymneus reflexus Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 167.
Limnophysa reflexa Call 1900, Moll. Ind., p. 406, pl. 8, fig. 8.
Lymnaea (Stagnicola) reflexa Dall 1905, Harriman-Alaska Exped., v. 13, p. 77, fig. 58.
Lymnaea reflexa Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.
Galba reflexa F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 332, pl. 30, figs. 30, 31; pl. 35, figs. 3, 5-22; pl. 36, figs. 1-11; pl. 18, fig. 10.
--- --- Johnson 1915, Fauna New England, p. 186.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Stagnicola reflexa F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 221, pl. 16, figs. 1-6; pl. 17, fig. 15.
Lymnaea reflexa Goodrich 1932, Moll. Mich., p. 56.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 286.
Stagnicola reflexa reflexa La Rocque 1953, Cat. Recent Moll. Canada, p. 281.
Stagnicola reflexa Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 88.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 53.

Type locality.—Lake Superior.

Diagnosis.—Extremely elongate, narrow, thin; honey yellow to black, some specimens longitudinally banded; surface shining, with numerous crowded axial striae, crossed by fine impressed spiral striae; growth lines wavy and elevated, in some specimens forming ridges; nuclear whorls smooth, brownish or blackish; whorls 7, flatly rounded, last whorl much compressed; the sixth and seventh whorls are much longer in comparison with their width than any of the preceding whorls; spire very long and pointed, almost two-thirds of the length of the shell; aperture lunate or elongate ovate, narrowed at the upper part, very oblique and effuse in some specimens; peristome thin, sharp, thickened by a heavy callus on the inside, which is reddish brown or purplish in color; lower part of peristome dilated; inner lip narrow, reflected over the umbilical region; umbilicus closed or with a very small chink; columella oblique, with a heavy plait across its center, running up into the whorl; parietal callus thin or thick; axis twisted; L. 34, W. 11, Ap. L. 14.5, Ap. W. 5.5 mm. (Say's type).

Ecology.—Found in small pools or ponds, even those that dry out in summer, in woods or fields, not in large streams or lakes.

Associations.—Fossil: N-2; K-16, 19, 21; S-6; W-28. *S. cf. S. reflexa,* fossil: N-1.

General distribution (fig. 301).—Eastern Quebec west to Nebraska, Manitoba south to southern Illinois and southern Kansas.

Distribution in Ohio (inset, fig. 301).—Sterki (1907a, p. 382) records the species for the following counties: Sandusky, Lorain, Cuyahoga, Portage, and Hamilton. The University of Michigan has specimens from Ottawa County. It is probable that the species is widely distributed over the State, wherever the environment is suitable. See also under the varieties which add somewhat to the distribution of the species.

Geologic range.—F. C. Baker (1911a, p. 338) records the species from the loess in Illinois and Iowa, from marl deposits in Illinois, Michigan, and Wisconsin, from clay deposits in Illinois and Ontario, and from lacustrine deposits in Illinois, Nebraska, and Ontario. Baker (1920a, p. 387) gave Aftonian, Sangamon, and "Wabash." Hibbard and Taylor (1960, p. 88) extended this to Illinoian in Kansas. D. W. Taylor (1960, p. 53) records the species from the Nebraskan.

Stagnicola reflexa walkeri (F. C. Baker) 1902

Limnaea reflexa scalaris Walker 1892, Nautilus, v. 6, p. 33, pl. 1, fig. 7; *non* A. Braun 1853, *nec* Sowerby 1872, Van den Broeck 1872.
Limnaea reflexa var. *distortus* Walker 1879, Jour. Conchology, v. 2, p. 330.
Limnaea reflexa distortus Walker 1894, Rev. Moll. Mich., p. 17.
Limnaea reflexa walkeri F. C. Baker 1902, Moll. Chicago area, pt. 2, p. 281, pl. 31, fig. 2.
Galba reflexa walkeri F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 341.
Lymnaea reflexa walkeri Sterki 1914, Ohio Naturalist, v. 14, p. 271.
--- --- --- Goodrich 1932, Moll. Mich., p. 56.
Stagnicola reflexa walkeri La Rocque 1953, Cat. Recent Moll. Canada, p. 281.

Type locality.—Rouge River, Wayne County, Michigan; colony later destroyed by pollution (Goodrich, 1932, p. 56).

Diagnosis.—Shell very elongate, narrow, scalariform; whorls 7 to 7½, rounded, very long; spire twice as long as aperture; sutures much indented; aperture narrower and longer than in *S. reflexa,* the inner lip commonly erect and the aperture continuous; L. 37, W. 11, Ap. L. 12, Ap. W. 6 mm.

General distribution (fig. 302).—Illinois, Indiana, Michigan, Ohio. F. C. Baker (1911a, p. 342) adds that it probably occurs throughout the range of the typical form.

Distribution in Ohio.—Sterki (1914, p. 271) gives Cincinnati, Hamilton County, Ohio, as the only record. Since it occurs also in the neighboring states of Indiana and Michigan, it should probably occur at least throughout the western half of the State.

Geologic range.—Not recorded as a fossil.

Stagnicola umbrosa (Say) 1832
Fig. 303

Limneus elongatus Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 167 (*non* Draparnaud 1805).

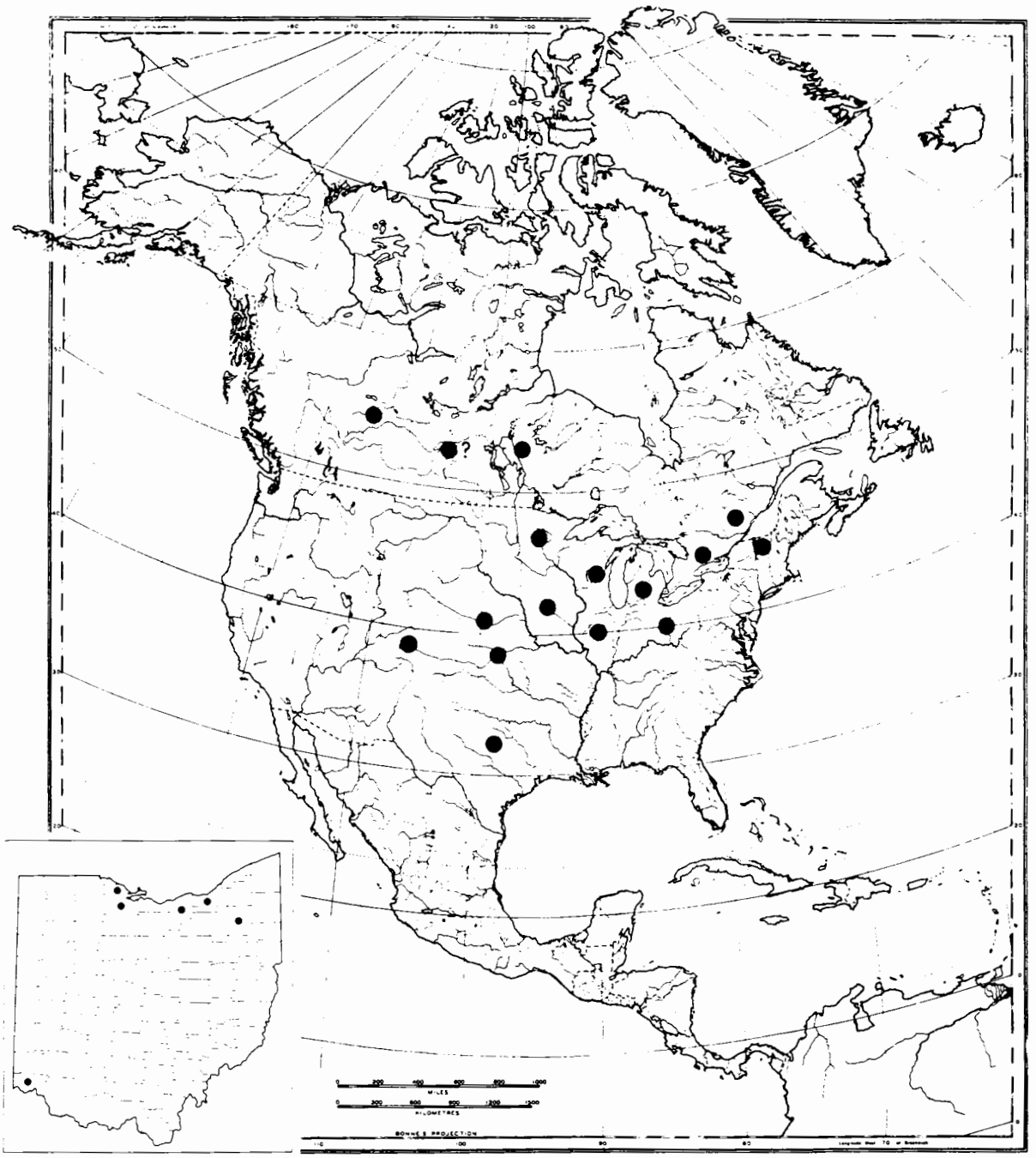


FIGURE 301.—Distribution of *Stagnicola reflexa* in North America; *inset,* distribution in Ohio.

Limneus umbrosus Say 1832, Am. Conchology, v. 4, pl. 31, fig. 2.

Limnaea palustris michiganensis Walker 1892, Nautilus, v. 6, p. 33, pl. 1, figs. 9, 10.

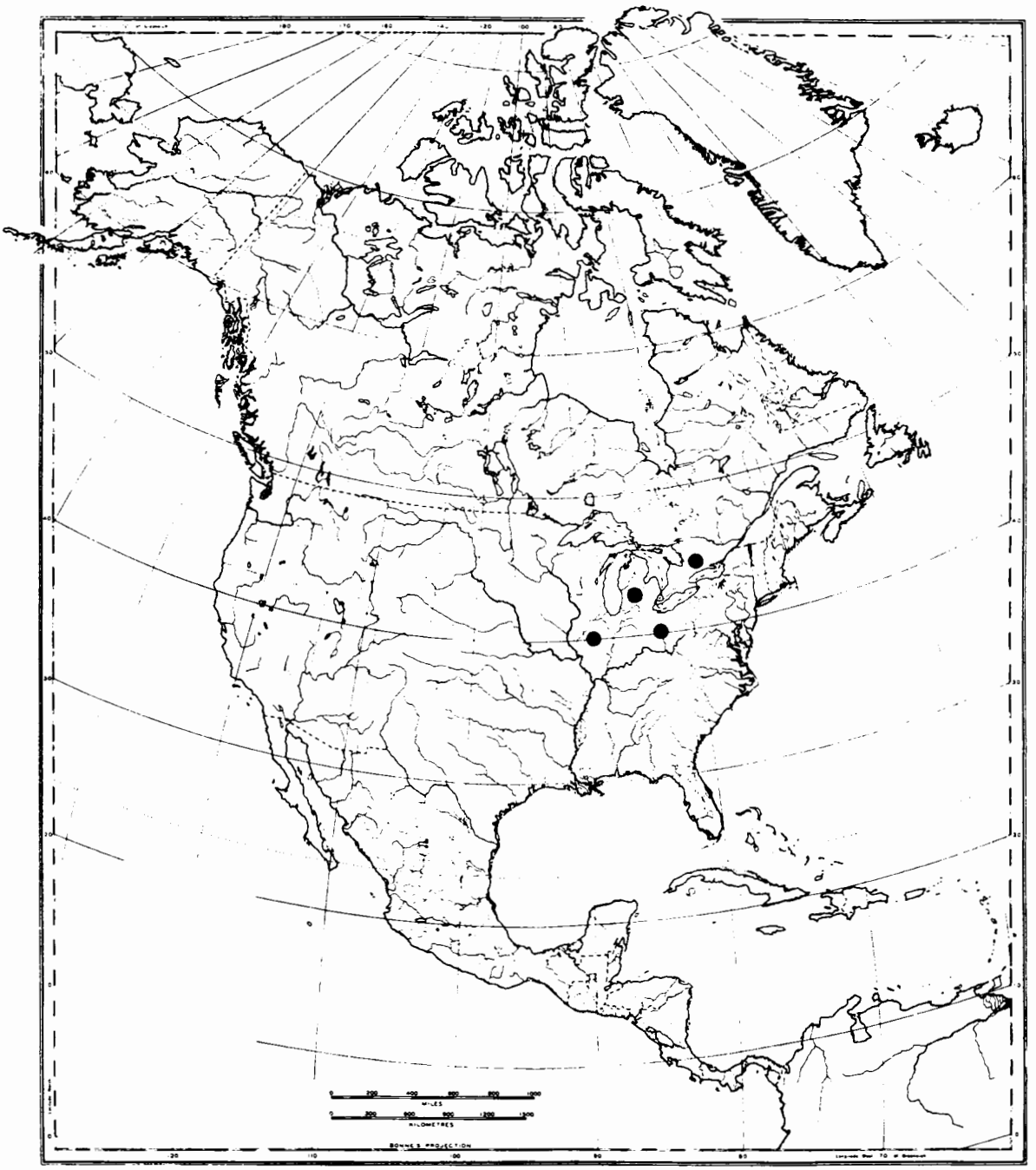
Galba elodes F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 322, pl. 30, figs. 32-34; pl. 34, figs. 14-19, 21-24.

Stagnicola umbrosa F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 218, pl. 13, figs. 13, 14-22; pl. 17, figs. 12-14.

Stagnicola umbrosa umbrosa La Rocque 1953, Cat. Recent Moll. Canada, p. 282.

Type locality.—Waters of the Missouri near Council Bluffs, Iowa.

Diagnosis.—Shell elongate, narrow, attenuated,



. FIGURE 302.—Distribution of *Stagnicola reflexa walkeri* in North America.

rather thin; epidermis light yellowish horn, frequently jet black; occasionally longitudinally striped; surface dull to shining; sculpture as in *S. palustris;* whorls 6 to 7, typically flatly rounded, especially the body whorl; spire long and very attenuated; sutures commonly less impressed than in *S. palustris;* aperture elongate-ovate, generally much shorter than the spire; peristome with heavy varical thickening; inner lip narrow, reflected and appressed to the columellar region, forming a distinct plait and commonly completely closing the umbilicus; parietal callus rather wide, heavy; L. 30, W. 12, Ap. L. 13, Ap. W. 5 mm. (Say's type of *S. umbrosa*).

FIGURE 303.–*Stagnicola umbrosa,* X1; after W. G. Binney (1865, pt. II, p. 40, fig. 49).

Ecology.–Found in pondlike areas with thick vegetation; in ponds and sloughs that become more or less dry in summer.

Associations.–Fossil: W-50, 51.

General distribution (fig. 304).–Western New York west to South Dakota; Rainy Lake, Ontario, south to northern Kansas and Ohio.

Distribution in Ohio (inset, fig. 304).–F. C. Baker (1911a, p. 326) gave the following records: Erie, Cuyahoga, Hamilton, Lucas, Franklin Counties, but under *"Galba elodes"* which he later (1928a, pt. I, p. 219) indicated should be referred to *S. umbrosa.* Some or perhaps all of the records for *S. elodes* from Ohio should be transferred here.

Geologic range.–Probably extensive, but the species is confused with *S. palustris* and its varieties. In Ohio, it has been identified from the following deposits: Newell Lake (Zimmerman, 1960, p. 20), Oakhurst (Aukeman, 1960, p. 71), Jewell Hill (Mowery, 1961, p. 9), and Castalia (Clark, 1961, p. 23).

Stagnicola woodruffi (F. C. Baker) 1901

Limnaea catascopium pinguis F. C. Baker (*non* Say) 1901, Acad. Sci. St. Louis Trans., v. 11, p. 5, pl. 1, fig. 12.

Limnaea woodruffi F. C. Baker 1901, Chicago Acad. Sci. Bull., v. 2, p. 229, fig.; 1902, Moll. Chicago area, pt. 2, p. 264, pl. 31, fig. 8.

Limnaea Woodruffi Cockerell 1902, Nautilus, v. 16, p. 96, probably the European *L. peregra.*

Limnaea woodruffi Blatchley and Daniels 1903, Ind. Dept. Geology and Nat. Resources, 27th Ann. Rept., p. 598, pl. 1, fig. 16.

Galba woodruffi F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 398, pl. 42, figs. 18-22.

Limnaea woodruffi Dennis 1928, Aquatic gastr. Bass Is. region, p. 3.

Stagnicola woodruffi F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 256, pl. 10, figs. 1-5.

--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 56, pl. 7, figs. 12, 13.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 283.

Type locality.–Lake Michigan, Oak Street, Chicago, Illinois.

Diagnosis.–Shell small, ventricose, inflated, rather solid; epidermis greenish horn or olivaceous green; surface shining, growth lines crowded, very distinct, crossed by fine impressed spiral lines; nuclear whorls roundly inflated, light or dark horn colored; whorls 4 to 4½, convex, tumid, the body whorl very large, occupying more than two-thirds the length of the shell; spire generally much depressed, globose; sutures well impressed; aperture very large, long-ovate to roundly ovate, occupying about two-thirds the total length of the shell; inner lip spreading over the umbilicus, forming a wide flattened expansion; a columella plait is not developed, but the axis, especially in the upper whorls, is distinctly twisted; L. 11.8, W. 8.5, Ap. L. 8.5, Ap. W. 5.5 mm., type (modified from F. C. Baker, 1928a, pt. I, p. 256-257).

Ecology.–Probably found living on sand bars in the Great Lakes at some distance from shore, perhaps in deep water.

Associations.–Living: OHIO-20.

General distribution (fig. 305).–In 1928, F. C. Baker gave its distribution as: "At present known only from the states bordering Lake Michigan–Michigan, Indiana, Illinois, and Wisconsin." In the same year Dennis recorded it for Lake Erie and in 1948 Robertson and Blakeslee for Lake Ontario. It would appear, therefore, that this name has been applied to the Great Lakes form of *S. catascopium,* which may be related to *Lymnaea peregra* of Europe.

Distribution in Ohio (inset, fig. 305).–The species is known only for Lake Erie, in the Bass Islands region (Dennis, 1928), and in beach drift, Sandusky Bay (Ohio State University collections).

Geologic range.–Unknown.

Remarks.–The status of this species is by no means clear. Cockerell (1902, Naut. 16) suggested that it was identical with *L. peregra* of Europe, introduced in the Great Lakes area, a possibility which is highly likely in view of the introduction of *Bulimus tentaculatus* in the same waters. Baker (1928a, pt. I) did not cite Cockerell's paper and emphasizes the relationship of *S. woodruffi* with *S. catascopium,* pointing out the similarity in the radula of both species.

Genus *Acella* Haldeman 1841

Acella Haldeman 1841, Mon. Limniades N. America, pt. 3, p. 6 (*fide* Neave).

Acella Walker 1918, Synopsis and cat. fresh-water Moll., p. 8.

Acella F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 265.

Acella La Rocque 1953, Cat. Recent Moll. Canada, p. 283.

Type.—*Lymnaea haldemani* "Deshayes" Binney.

Diagnosis.—Shell thin, smooth, acute, extremely slender; aperture expanded at the margin; the inner lip not appressed, a moderate chink behind it; axis gyrate, pervious, not plicate; outer lip simple, sharp.

FIGURE 304.—Distribution of *Stagnicola umbrosa* in North America; *inset,* distribution in Ohio.

Acella haldemani ("Deshayes" Binney) 1867
Fig. 306

Lymnaea gracilis Jay 1839, Cat. shells, 3d ed., p. 112, pl. 1, figs. 10, 11 (*non* Ziethen 1830).
Limnaea gracilis Haldeman 1842, Mon. Limniades N. America, p. 50, pl. 13, fig. 21.
Limnaea haldemani Deshayes, Binney 1867, Jour. Conchyl., v. 15, p. 428.
Lymnaea haldemani Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.
Acella haldemani F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 192, pl. 18, fig. 1; pl. 26, figs. 1-4.
--- --- Johnson 1915, Fauna New England, p. 182.
--- --- F. C. Baker 1920, Life of Pleistocene,

FIGURE 305.—Distribution of *Stagnicola woodruffi* in North America; *inset,* distribution in Ohio.

p. 387.

Acella haldemani F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 266, pl. 10, figs. 6-8.

--- --- Morrison 1932, Wis. Acad. Arts, Sci., Letters, Trans., v. 29, p. 397-414.

Lymnaea haldemani Goodrich 1932, Moll. Mich., p. 49.

--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 284.

Acella haldemani Herrington 1947, Nautilus, v. 61, p. 20-25.

--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 56, pl. 4, fig. 21.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 283.

FIGURE 306.–*Acella haldemani,* X1; after Walker (1918, p. 8, fig. 10).

Type locality.–Lake Champlain.

Diagnosis.–Shell very slender, thin and fragile; surface generally dull, growth lines closely set, fine; no spiral sculpture; nucleus consisting of about one whorl which is long-oval in outline and resembles the end of a bullet; whorls 5½, very oblique and flat-sided; spire very slender and acute, much longer than the aperture; sutures heavily impressed, bordered by a narrow band indicating the position of the previous connected lips; aperture long-ovate, elongate and narrowed, made continuous by the raised inner lip; peristome thin, acute, inner lip elevated in some specimens and causing the aperture to be continuous; in other individuals it is attached but not appressed to the parietal wall; the aperture is also twisted to the left and narrowed at its junction with the body whorl; axis gyrate; there is a small umbilical chink; there is no plait on the columella, which is almost straight.

Ecology.–This species is an inhabitant of the larger lakes, found in more or less sheltered bays, always a protected habitat, in water from 0.3 to over 1 m. deep. Adult specimens have been found only in the fall; apparently they come toward shore in the colder part of fall, in October and November. Young specimens have been found in July on the narrow leaves of the pondweed, *Potamogeton interruptus,* the flat leaves forming admirable habitats for the long shells of the *Acella* (F. C. Baker, 1918b, p. 178). Adults are usually found on the stem of the bullrush *(Scirpus).* For a resume of the known facts on the ecology of this species, see Baker, 1911a, p. 197; Morrison, 1932b; Herrington, 1947.

Associations.–Living: MINNESOTA-9, 15; NEW YORK-2b, 4a, 12, 36; WISCONSIN-11, 31, 42, 47. Fossil: W-27, 33, 34, 37, 38, 39, 45, 47, 54.

General distribution (fig. 307).–Lakes Huron and Ontario; Lake Simcoe; Lake Champlain, Quebec, Vermont, and New York; west to Illinois, Michigan, Minnesota, and Wisconsin, south to Ohio and Indiana.

Distribution in Ohio (inset, fig. 307).–Sterki (1907a, p. 382) notes the species only for Erie County. Baker (1911a, p. 195) adds Congress Lake, between Portage and Stark Counties. As a late Pleistocene fossil, it has been found in Logan County (Zimmerman, 1960) and in Franklin County (Cornejo, 1961; Aukeman, 1960, p. 72).

Geologic range.–Late Pleistocene (late Wisconsin) of Ohio; Stark (Sheatsley, 1960, p. 72), Logan (Zimmerman, 1960, p. 20), and Franklin (Aukeman, 1960, p. 72; Cornejo, 1961, fig. 11) Counties. Baker (1920a, p. 387) cites it for late Wisconsin ("Wabash") deposits.

Remarks.–This is the slenderest of the lymnaeids, its height about five times its width. It may be confused at first sight with the young of *Lymnaea stagnalis* and some of the more elongate *Stagnicolas,* but examination of the nuclear whorls and the extreme slenderness of even the immature shells will suffice to identify it.

Genus *Pseudosuccinea* F. C. Baker 1908

Pseudosuccinea F. C. Baker 1908, Science (n. s.), v. 27, p. 943 (*fide* Neave).

Pseudosuccinea Walker 1918, Synopsis and cat. freshwater Moll., p. 7.

Pseudosuccinea F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 271.

Pseudosuccinea La Rocque 1953, Cat. Recent Moll. Canada, p. 283.

Type.–*Limnaea columella* Say.

Diagnosis.–Shell of medium size, succineiform; spire generally short and somewhat dome-shaped; last whorl very large, expanded; axis gyrate and imperforate; columellar plait not well marked; outer lip sharp.

Pseudosuccinea columella (Say) 1817
Fig. 308

Lymnaea columella Say 1817, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 14.

Lymnaeus macrostomus Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 170.

Limnaea navicula Valenciennes 1833, Rec. Obs., v. 2, p. 251.

Lymnaea columellaris C. B. Adams 1839, Am. Jour. Sci., v. 36, p. 392.

Limnea succiniformis Adams, *teste* Haldeman 1842, Mon. Limniades N. America, p. 40.

Succinea pellucida Lea 1864, Acad. Nat. Sci. Philadelphia Proc., p. 109.

Succinea wilsoni Lea 1864, *ibid.*

Limnaea acuminata C. B. Adams 1870, Am. Jour. Sci., v. 39, p. 374.

Lymnaea (Radix?) columella Dall 1905, Harriman-Alaska Exped., v. 13, p. 70, fig. 47.

Lymnaea columella Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.

Pseudosuccinea columella F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 163, pl. 23, figs. 8-20; pl. 24, figs. 1-4.

--- --- Johnson 1915, Fauna New England, p. 181.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.

--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 272, pl. 10, figs. 9-12, 20.

Lymnaea columella Goodrich 1932, Moll. Mich., p. 46.

--- --- Goodrich and van der Schalie 1944, Revis.

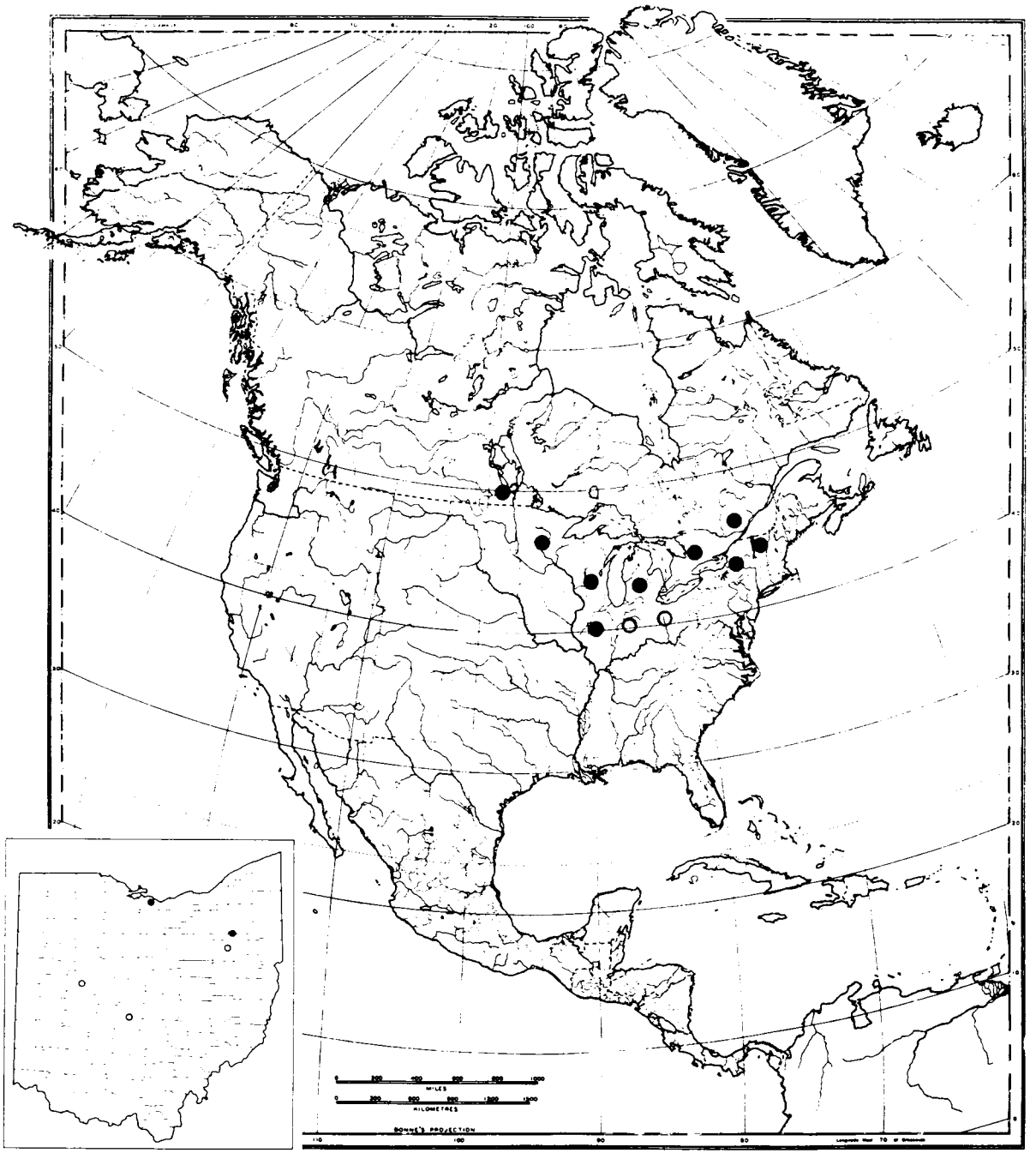


FIGURE 307.—Distribution of *Acella haldemani* in North America; *inset*, distribution in Ohio.

Moll. Ind., p. 284.

Pseudosuccinea columella Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 57, pl. 6, figs. 1, 2.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 283.

FIGURE 308.–*Pseudosuccinea columella*, X1; after Walker (1918, p. 7, fig. 3).

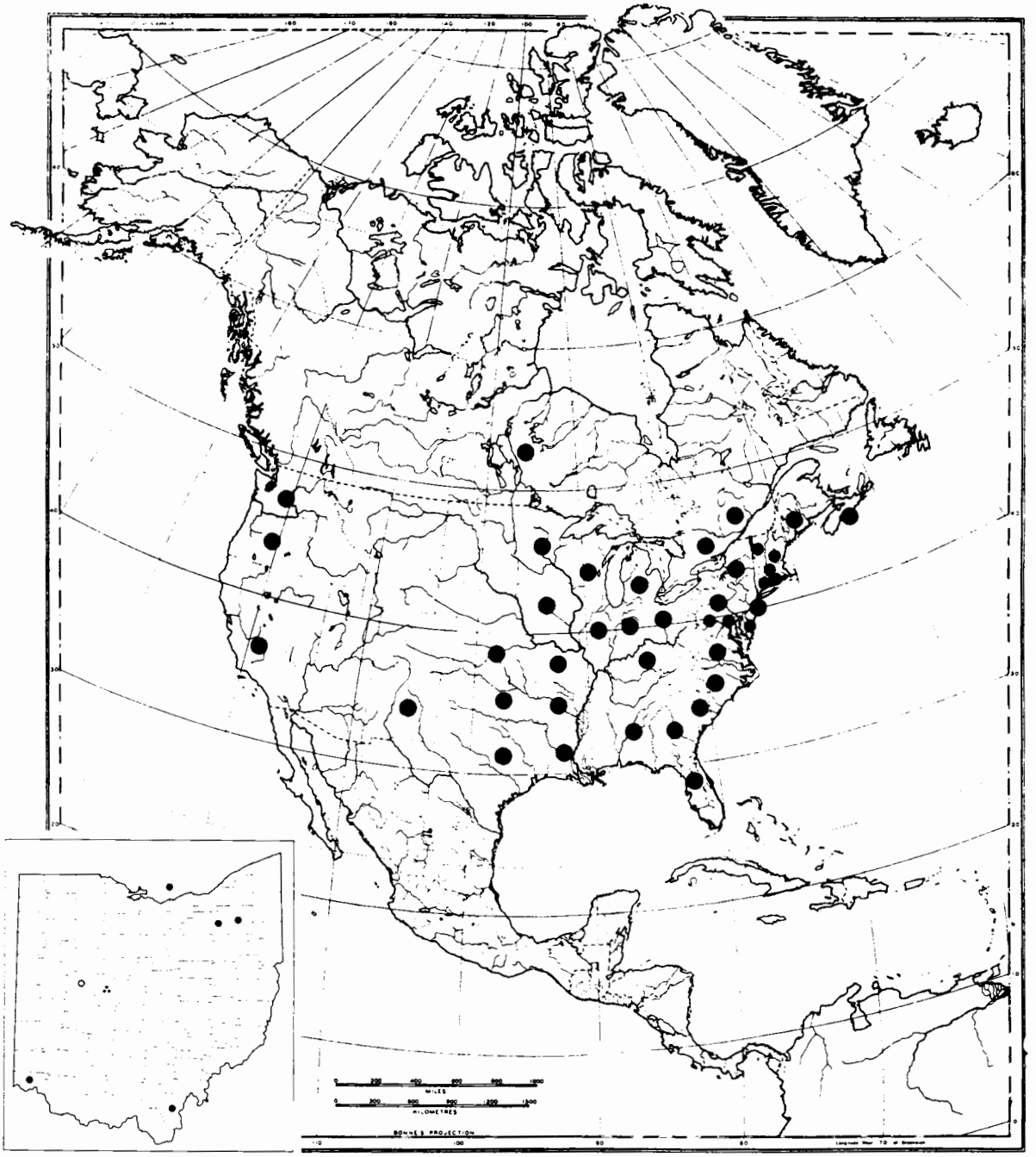


FIGURE 309.–Distribution of *Pseudosuccinea columella* in North America; *inset*, distribution in Ohio.

Type locality.—Probably near Philadelphia.

Diagnosis.—Shell thin, yellow to brown, commonly black with confervid deposits; in shape, very much like the larger species of *Succinea;* the longitudinal growth lines appear rather coarse under magnification; they are crossed by spiral lines which are commonly discontinuous; whorls 4 to 5, the last one very broad at the base; aperture large, flaring; columella reflected over the umbilicus; L. 12, D. 7.5 mm.

Ecology.—This species lives in stagnant and often muddy waters, in quiet parts of streams and in lakes. It is very hardy, living in streams with a high proportion of farmyard sewage. It thrives in quiet, shallow waters with abundant cattails and water lilies. In South Carolina, Rehder (1949, Naut. 62, p. 125-126) lists it from in and near a creek flowing into Midway Swash, at Myrtle Beach State Park, and at Myrtle Beach, at the outlet of a small pond, near the hotel.

Associations.—Living: NEW YORK - 2b, 4a, 9; OHIO - 33, 35, 36, 38, 40, 43; QUEBEC - 1, 3; WISCONSIN - 3, 4, 8, 31, 95, 106. Fossil: W - 27, 45, 46.

General distribution (fig. 309).—Manitoba to New England and Nova Scotia, New Mexico, and Georgia.

Distribution in Ohio (inset, fig. 309).—Sterki (1907a, p. 382) gives "over the state, common." In addition, Eggleston (ms. records) has specimens from Gallia County.

Geologic range.—Pleistocene, Goat Island gravel pits, Niagara River, New York (F. C. Baker, 1911a, p. 170). Yarmouth, Peorian, and "Wabash" (Baker, 1920a, p. 387). Zimmerman (1960, p. 20) has identified the species from the Newell Lake deposit in Ohio.

Remarks.—The varieties (better, forms) listed for Ohio are treated here separately although they probably have little taxonomic value.

Pseudosuccinea columella casta (Lea) 1841
Fig. 310

Lymnea casta Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 33.

Pseudosuccinea columella casta F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 174, pl. 24, figs. 14-19.

Lymnaea columella casta Sterki 1914, Ohio Naturalist, v. 14, p. 271.

FIGURE 310.—*Pseudosuccinea columella casta,* X1; after W. G. Binney (1865, pt. II, p. 36, fig. 43).

Type locality.—Poland, Ohio.

Diagnosis.—Shell very elongate, somewhat fusiform, much compressed, inclined to obliquity; whorls 4 to 4½, flat sided and compressed; body whorl occupying from three-quarters to four-fifths the length of the shell; spire short, very acute, narrow; aperture strongly elongate-ovate, compressed in the center, the margins parallel in many specimens, rounded anteriorly and roundly angled posteriorly; it is somewhat effuse anteriorly and occasionally a little expanded; inner lip straight in most examples, the lip somewhat erect, the columellar callus closely appressed to the parietal wall, but leaving, in most specimens, a small chink; axis gyrate; L. 18.5, W. 9.0, Ap. L. 12.5, Ap. W. 5.1 mm. (modified from F. C. Baker, 1911a, p. 174).

Ecology.—"Similar to *columella*" (Baker, 1911a, p. 175).

Associations.—Living: MANITOBA - 18.

General distribution (fig. 311).—Ohio to Illinois.

Distribution in Ohio.—Baker (1911a) gives Poland, Mahoning County, and Kent, Portage County. Sterki (1914) adds no new localities.

Geologic range.—Unknown.

Remarks.—This variety is included here because of Baker's insistence on its distinctness and the fact that its type locality is in Ohio. Later workers apparently have not used the name, preferring to lump all specimens under the specific name, and this may be the best course to follow.

Pseudosuccinea columella chalybea (Gould) 1840
Fig. 312

Limnaea chalybea A. A. Gould 1840, Am. Jour. Sci., v. 38, p. 196.

Lymnea strigosa Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 33.

Lymnea coarctata Lea 1841, *ibid.*

Lymnaea columella chalybea Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.

Pseudosuccinea columella chalybea F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 171, pl. 24, figs. 5-13.

--- --- --- Johnson 1915, Fauna New England, p. 181.

Lymnaea columella chalybea Goodrich 1932, Moll. Mich., p. 47.

Type locality.—Cambridge, Massachusetts *(L. chalybea);* near Cincinnati, Ohio *(L. strigosa);* Newport, Rhode Island *(L. coarctata).*

Diagnosis.—Distinguished from the type form by its narrow shell, compressed acuminate spire, flattened body whorl, and narrow and very effuse aperture; the excavated and arched columella is peculiar and will easily distinguish this variety from any form of typical *P. columella* (F. C. Baker, 1911a, p. 174).

Ecology.—"Probably the same as for typical *columella;* mud pool in old lime quarry (Lermond, Maine)" (Baker, 1911a, p. 174).

General distribution (fig. 313).—Principally eastern United States but about the same as that of the typical form, according to Baker (1911a, p. 173).

Distribution in Ohio.—Sterki (1907a, p. 382) gives only Kent, Portage County (Walker), but Baker's (1911a, p. 173) map shows three dots to the south of Lake Erie which are about in the positions of Sandusky, Columbus, and Portsmouth. Their exact meaning is unimportant as the form may be expected over most of the State.

Geologic range.—The form is recorded for Pleistocene loess, Otis Mill, Union County, South Dakota.

Remarks.—This variety is included here because of the Ohio record and Baker's insistence on its distinctness. Later workers have not used the name extensively and seem more inclined to include it with the type

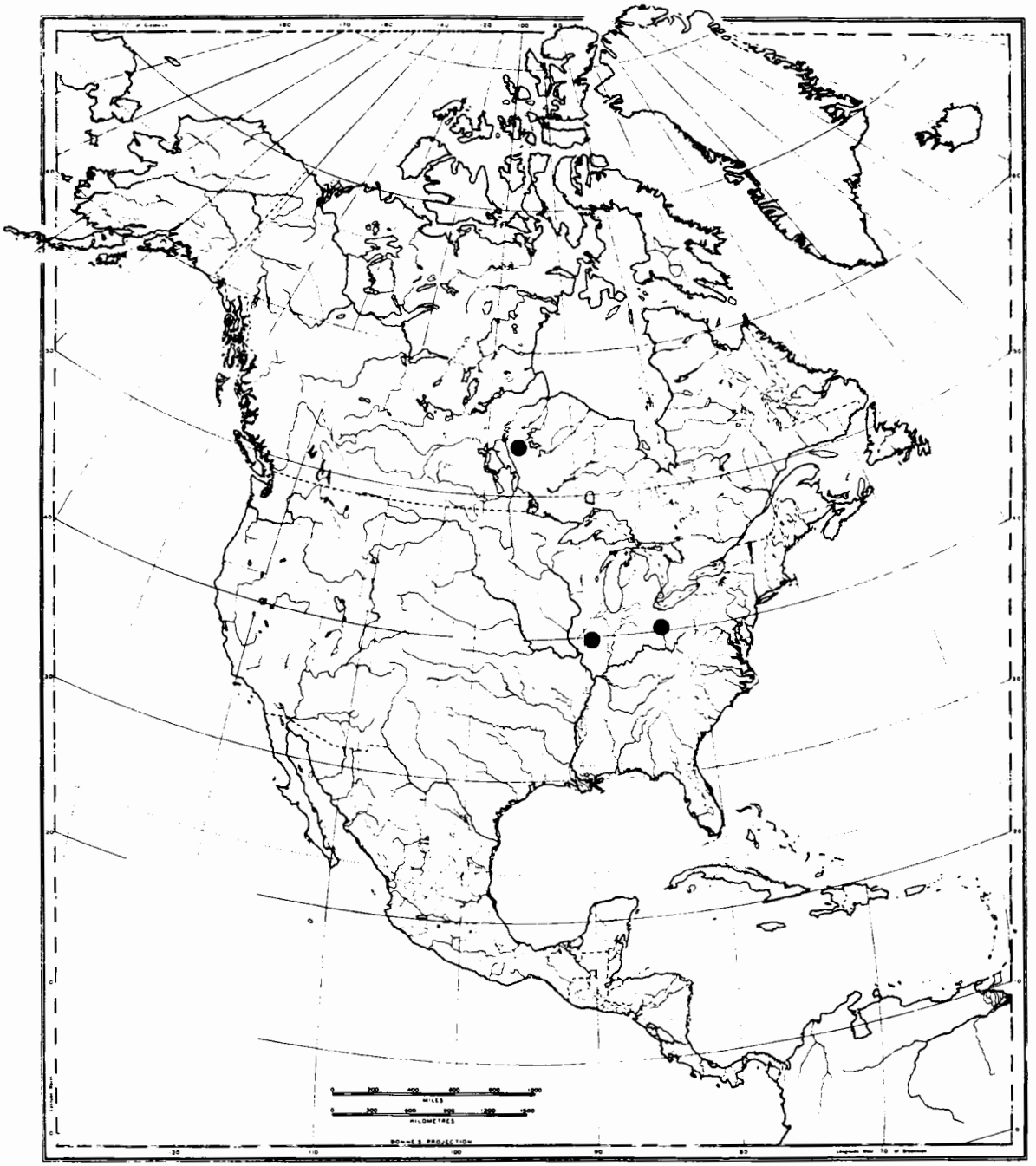


FIGURE 311.—Distribution of *Pseudosuccinea columella casta* in North America.

FIGURE 312.–*Pseudosuccinea columella chalybea,* X1; after W. G. Binney (1865, pt. II, p. 36, fig. 44).

form. As for the other form of *P. columella,* this may be the best course to follow.

Genus *Radix* Montfort 1810

Radix Montfort 1810, Conch. Syst., v. 2, p. 266 (*fide* Neave).
Radix Walker 1918, Synopsis and cat. fresh-water Moll.,

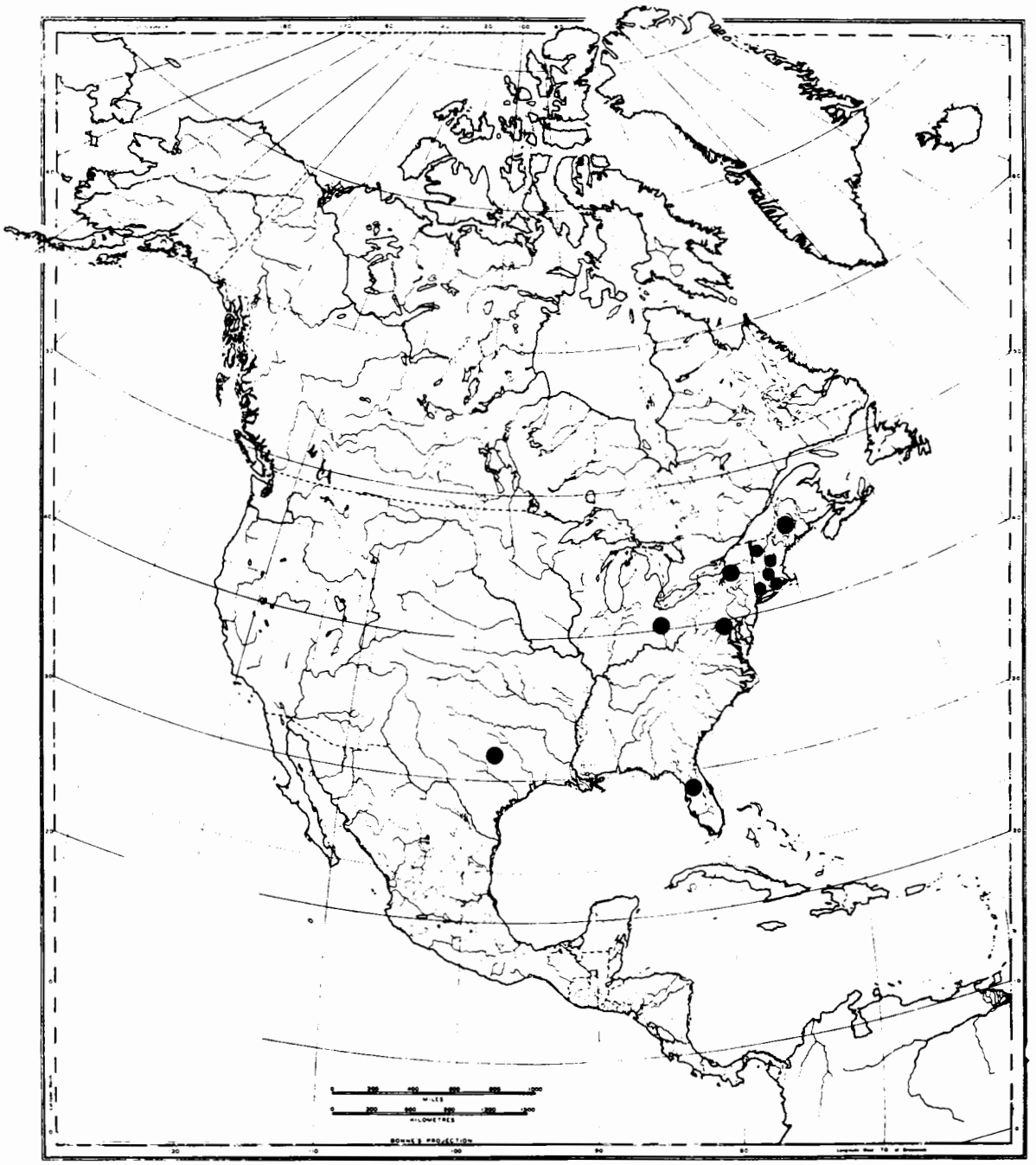


FIGURE 313.–Distribution of *Pseudosuccinea columella chalybea* in North America.

p. 7.
Radix F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 195.
Radix La Rocque 1953, Cat. Recent Moll. Canada, p. 274.

Type.—*Limnaea auricularia* Linnaeus.

Diagnosis.—Shell thin, globose-oval; spire short, acute; body whorl large, inflated; aperture very large; lip expanded.

Remarks.—This genus is mainly European and American records are mostly, if not entirely, for introduced species. The type species resembles some of the members of the genus *Stagnicola* in general form but F. C. Baker (1911a, p. 178, and 1928a, pt. I, p. 195) gives anatomical differences which may be sufficient to distinguish at least the type species from *Stagnicola.* The status of the short-spired, effuse, and patulous North American lymnaeids, especially those of Alaska and the Yukon, remains in some doubt as their anatomy is not well known. They certainly resemble *Radix* in shell characters but they likewise resemble forms of *Stagnicola catascopium* with large body whorl and patulous aperture.

In the Ohio fauna, the genus is represented by a single species, almost certainly introduced.

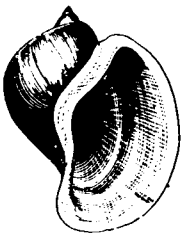


FIGURE 314.—*Radix auricularia,* X1; after Walker (1918, p. 7, fig. 6).

Radix auricularia (Linnaeus) 1758
Fig. 314

Helix auricularia Linnaeus 1758, Syst. Nat., 10th ed., p. 774.
Radix auricularia F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 179, pl. 22, figs. 12-15.
Lymnaea auricularia Allen 1911, Nautilus, v. 25, p. 60.
Lymnaea (Radix) auricularia Sterki 1914, Ohio Naturalist, v. 14, p. 272.
Radix auricularia Johnson 1915, Fauna New England, p. 181.
Lymnaea auricularia Walker 1918, Synopsis and cat. fresh-water Moll., p. 93.
Radix auricularia F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 195.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 45.
Lymnaea auricularia Goodrich 1932, Moll. Mich., p. 47.
--- --- Eyerdam 1941, Nautilus, v. 55, p. 18-19.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 284.
Radix auricularia Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 57, pl. 6, figs. 16, 17.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 274.

Type locality.—Europe.

Diagnosis.—Shell thin, with a small compact apex, a very large flaring body whorl; surface, when cleaned of foreign matter, a bright golden color; whorls 4, the last one much shouldered; aperture wide, outer lip sharp edged, the columella twisted; dimensions of an average specimen, H. 24, W. 17.5 mm.; of a large specimen, H. 27, W. 22 mm. (modified from Goodrich, 1932, p. 47).

Ecology.—Found in slow-moving bodies of water, such as lakes, ponds, and the quieter parts of rivers. It can withstand high temperatures (90° F. in an artificially heated lily pond). It has been slow to establish itself in Canada, possibly because of severe winter temperatures.

General distribution (fig. 315).—Europe and northern Asia. Introduced: Illinois, New York, Washington, Michigan, Ohio, and other parts of the United States. Shores of Lake Huron and Lake Erie; Detroit River.

Distribution in Ohio (inset, fig. 315).—Sterki (1914, p. 272) recorded it for Toledo, Lucas County; Ahlstrom (1930, p. 45) collected it in Squaw Harbor at Put-in-Bay.

Geologic range.—Unknown as a fossil in North America.

Genus *Bulimnea* Haldeman 1841

Bulimnea Haldeman 1841, Mon. Limniades N. America, pt. 3, p. 6 (*fide* Neave).
Bulimnea F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 183.
Bulimnea Walker 1918, Synopsis and cat. fresh-water Moll., p. 8.
Bulimnea F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 276.
Bulimnea La Rocque 1953, Cat. Recent Moll. Canada, p. 284.

Type.—*Limnaea megasoma* Say.

Diagnosis.—Shell large and solid, bulimiform, with an impervious axis, a twisted or subplicate pillar, the callus on the body whorl and pillar closely appressed and the outer lip not thickened or expanded.

Remarks.—If any genus of the family Lymnaeidae appears distinct enough, from the shell characters alone, to merit generic rank, it is this one, yet the anatomical features show that it is intimately related to the other genera of the Lymnaeidae (in Baker's classification). The genus is monotypic.

Bulimnea megasoma (Say) 1824
Fig. 316

Lymnaeus megasomus Say 1824, Rept. Long's Exped., v. 2, p. 263, pl. 15, fig. 10.
Lymnaea (Bulimnea) megasoma Dall 1905, Harriman-Alaska Exped., v. 13, p. 67, fig. 44.
Lymnaea megasoma Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
Bulimnea megasoma F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 184, pl. 25, figs. 1-6.
--- --- Johnson 1915, Fauna New England, p. 182.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 277, pl. 8, figs. 19-23; pl. 17, figs. 31, 35.
Lymnaea megasoma Goodrich 1932, Moll. Mich., p. 48.

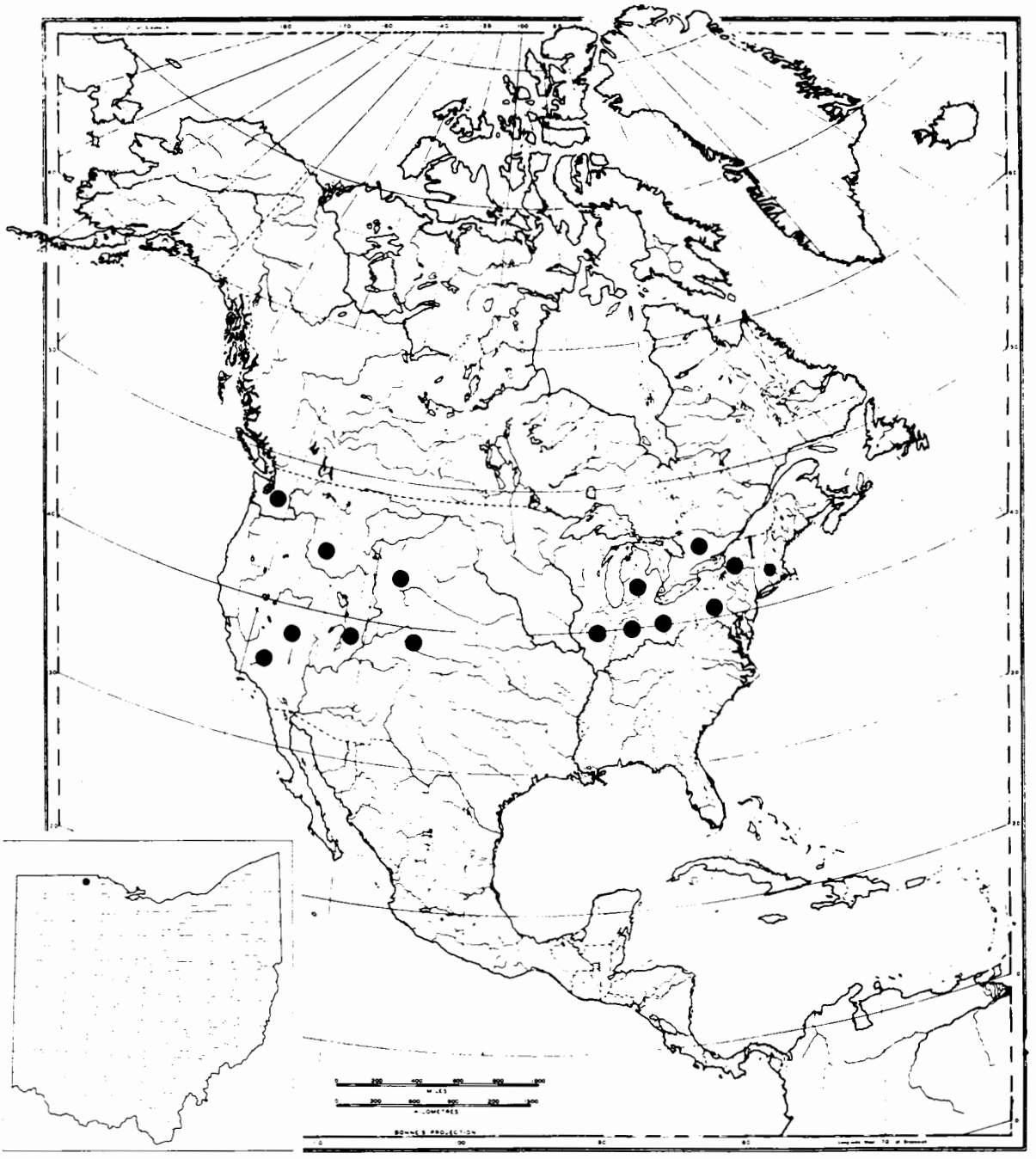


FIGURE 315.–Distribution of *Radix auricularia* in North America; *inset*, distribution in Ohio.

Lymnaea megasoma Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 284.
Bulimnea megasoma La Rocque 1953, Cat. Recent Moll. Canada, p. 284.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 56.

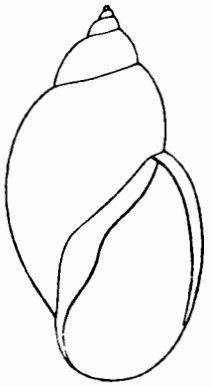


FIGURE 316.—*Bulimnea megasoma*, X1; after Walker (1918, p. 8, fig. 8).

Type locality.—Bois Blanc Lake, Manitoba.

Diagnosis.—Shell large, ovate, inflated, bulimiform; epidermis brownish, greenish, or olive, with, in many specimens, longitudinal streaks of green, orange, purple, or ocher; surface strongly marked with growth lines, which are raised to form wide flat ridges in some specimens; the spiral wavy lines of the lymnaeids are present but are rather faint; some specimens are strongly malleated; nuclear whorls 1¼ in number, dark chestnut colored in some specimens, light yellowish horn in others; outline of second whorl shouldered near the suture of the first whorl; whorls 5 to 5½, rounded, somewhat flattened at the previous sutures; spire varying from rather pointed to depressed dome shaped; sutures well impressed; aperture large, subovate, inflated, chestnut brown or dark purple within, occupying from half to two-thirds the length of the entire shell; peristome thin; parietal wall with a thin wash of callus which is tightly appressed to the body whorl, completely closing the axis; pillar twisted, forming a raised, prominent ascending plait; large specimen, L. 47, W. 27, Ap. L. 21, Ap. W. 14 mm.; a type measures, L. 43.25, W. 22.50, Ap. L. 26.25, Ap. W. 12.10 mm. (modified from F. C. Baker, 1911a, p. 185).

Ecology.—Found in quiet, protected parts of rivers, lakes, sloughs, and ponds. The animal is sluggish in its movements as compared with some species of *Stagnicola* and drops to the bottom almost instantly when alarmed. Its food consists mostly of microscopic animals and plants on the surface of aquatic vegetation but it has been observed to feed on dead animals also. The most remarkable occurrence of this species is reported by Latchford (quoted by Baker, 1911a, p. 190) in Cobalt Lake, Ontario, Canada, where the waters are heavily impregnated with arsenic, yet the specimens of *B. megasoma* thrive and attain large size and normal shape. It has been collected clinging to logs, sticks, and vegetation, in boggy or swampy parts of lakes and bays. In one instance, I have collected it from the clay bottom of a small stream connecting two lakes where vegetation was sparse and the majority of the snails were on the clay bottom, probably feeding on algae. In Ontario, it has lost ground in many lakes where it used to be abundant in the 1890's, possibly because of pollution from cottages along the lakes, possibly because of artificial maintenance of the lakes at high levels by means of dams. At any rate, it seems to be one of the first species to disappear in populated areas. In a detailed study of Meach Lake (La Rocque, 1935) I found it absent from places in the lake where it had been recorded as abundant 40 years before. In contrast, in other lakes of the same drainage where cottages were fewer, it seemed to have managed to survive in comparatively large numbers.

Associations.—Living: MANITOBA - 20, 21, 35; MINNESOTA - 9, 14d, 15; QUEBEC - 1, 7, 8; WISCONSIN - 4, 18, 31, 40, 42, 47, 54, 60, 72, 79, 83, 86, 106, 123, 137. Fossil: N - 1, 2.

General distribution (fig. 317).—New England, Quebec, Ontario, and Manitoba to lat. 41° N. (Ohio) and 57° N. (western Canada).

Distribution in Ohio (inset, fig. 317).—Sterki (1907a, p. 381) records it only for the Mahoning River at Alliance, Stark County, collected by himself. I have no other record, save as fossils, for the State.

Geologic range.—Pleistocene "Leda clay," ten miles below Ottawa, Ontario, Canada. This deposit is marine and, if the identification was correct, the shell is one that was most probably rolled into the sea from a stream. D. W. Taylor (1960, p. 56) records the species for the Sand Draw (Nebraskan) and Dixon (Nebraskan or earliest Aftonian) local faunas in Nebraska. In Ohio, it has been recorded for the Aultman deposit (Sheatsley, 1960, p. 76) and the Oakhurst deposit (Aukeman, 1960, p. 77). The latter, at lat. 39°53'04" N., is the southernmost record for the species in the east.

Genus *Fossaria* Westerlund 1885

Fossaria Westerlund 1885, Fauna Paläarct. Reg. Binnenconch., v. V, p. 24, 49 (*fide* Neave).
Simpsonia F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 236 (*fide* Neave).
Pseudogalba F. C. Baker 1913 (*nom. nov. pro Simpsonia* F. C. Baker, *non* Rochebrune, 1905), Nautilus, v. 26, p. 120 (*fide* Neave).
Fossaria F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 283.
Fossaria La Rocque 1953, Cat. Recent Moll. Canada, p. 284.

Type.—*Buccinum truncatulum* O. F. Müller.

Diagnosis.—Shell small, turreted; spiral sculpture wanting or subobsolete; columella smooth; inner lip flatly reflected over the umbilicus. Inner lip less expanded than in *Stagnicola* (Walker, 1918, p. 8).

"Small, turreted, spire usually pointed and as long as or longer than the aperture; without distinct spiral striation; axis not twisted, smooth, without a plait; inner lip reflected, forming a narrow, somewhat triangular expansion either rolled in toward the umbilical chink or standing erect and emargining the umbilical chink, which may be narrowly open or quite deep and round" (F. C. Baker, 1928a, pt. I, p. 283).

FIGURE 317.—Distribution of *Bulimnea megasoma* in North America; *inset,* distribution in Ohio.

Fossaria dalli (F. C. Baker) 1906
Pl. 9, figs. 10-12

Lymnaea parva F. C. Baker 1905, Nautilus, v. 19, p. 52 (not of Lea).

Lymnaea dalli F. C. Baker 1906, Ill. Lab. Nat. History Bull., v. 7, p. 104; 1907, Nautilus, v. 20, p. 125.

Galba dalli F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 251, pl. 30, figs. 13-18.

Lymnaea dalli Sterki 1914, Ohio Naturalist, v. 14, p. 271.

Galba dalli F. C. Baker 1920, Life of Pleistocene, p. 387.

Fossaria dalli F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 288, pl. 16, fig. 11.

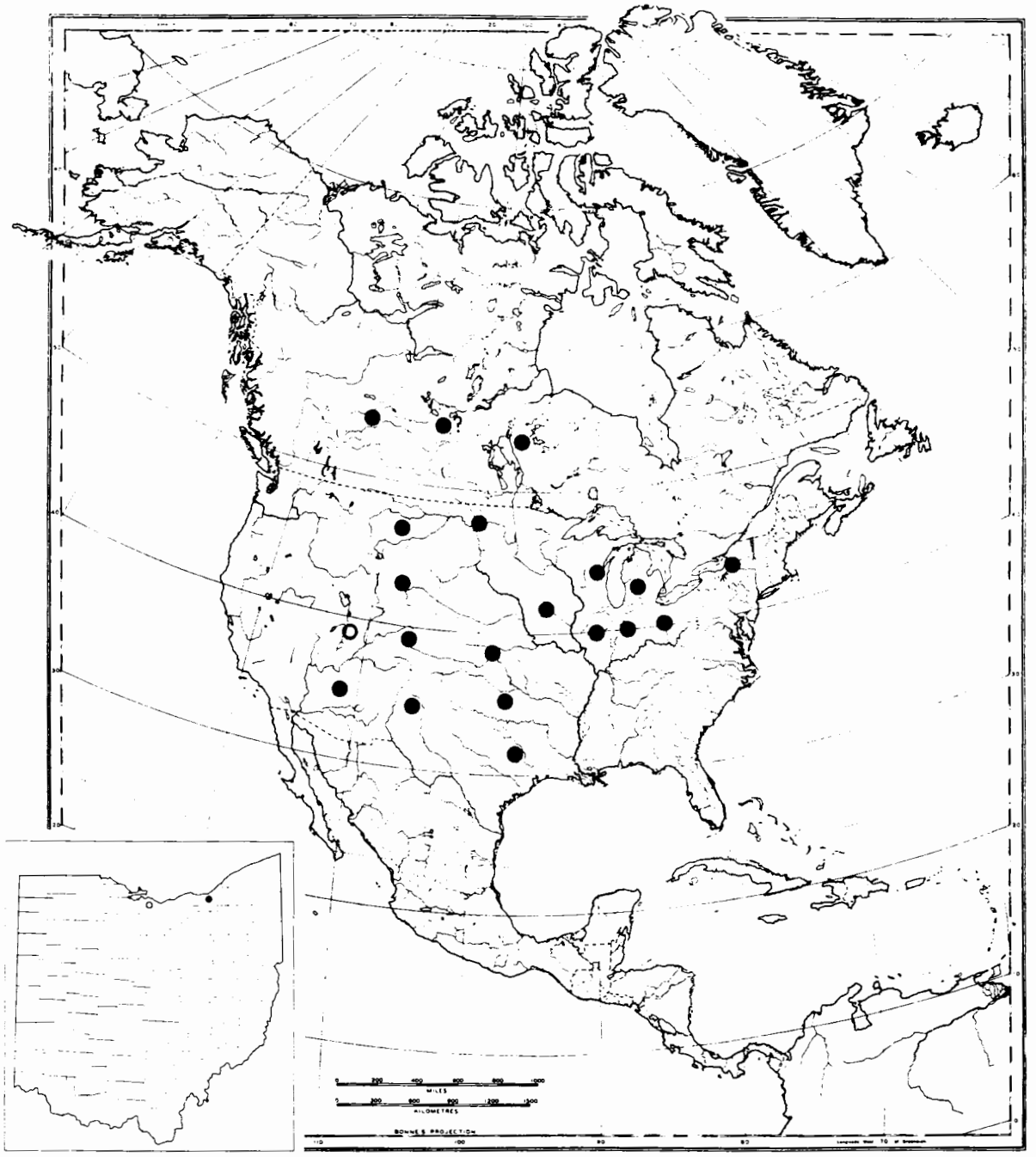


FIGURE 318.–Distribution of *Fossaria dalli* in North America; *inset*, distribution in Ohio.

Lymnaea dalli Goodrich 1932, Moll. Mich., p. 54.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 285.
Fossaria dalli Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 59.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 93.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 54.

Type locality.—Marsh, west side of Lake James, Steuben County, Indiana.

Diagnosis.—Shell very small, thin, ovate-conic, turreted; color greenish or whitish horn; surface dull to shining, marked by heavy crowded growth lines which are elevated into indistinct ridges in some specimens; nucleus very small, flatly rounded, light horn color, similar in form to that of *Fossaria parva;* whorls 4½ to 5, rounded and distinctly shouldered; spire generally obtusely conic, turreted, a trifle longer than the aperture; sutures very deeply impressed; aperture elongate-ovate or elliptical, continuous in many specimens; outer lip acute; inner lip forming a rather flat erect extension over the umbilical region, leaving a pronounced chink; the lower part of the aperture is somewhat effusive; the columellar extension of the inner lip is so appressed in some specimens at its junction with the parietal wall as to form a pseudoplait; the inner edge of the outer lip may form a riblike varix in very old specimens; dimensions of the largest of four types, L. 4.25, W. 2.00, Ap. L. 1.75, Ap. W. 1.00 mm. (modified from F. C. Baker, 1911a, p. 251).

Ecology.—Found in situations similar to those occupied by *Fossaria parva.*

Associations.—Living: MANITOBA - 25; MICHIGAN - 11, 13. Fossil: P - 1, 3, 4; N - 1, 2; A - 1; S - 2, 3, 6; W - 28. *F. dalli grandis,* fossil: W - 60.

General distribution (fig. 318).—Ohio to northern Michigan and Montana, south to Kansas and Arizona.

Distribution in Ohio (inset, fig. 318).—Baker (1911a, p. 253) gives localities in Cuyahoga, Erie, and Ottawa Counties. Sterki (1914, p. 271) repeats the Cuyahoga County record. Eggleston (ms. records) has it as a fossil from marl in Erie County.

Geologic range.—Pleistocene, marl beds in Michigan and in Erie County, Ohio. Baker (1920a, p. 387) gave only late Wisconsin ("Wabash"). Hibbard and Taylor (1960, p. 93) gave early Pliocene to Recent, Oklahoma and Kansas.

Fossaria exigua (Lea) 1841
Fig. 319

Lymnea exigua Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 33.
Lymnea plica Lea 1841, *ibid.*
Lymnea planulata Lea 1841, *ibid.*
Limnaea plicatula D'Urban 1859, Canada Geol. Survey Rept. Prog. 1858, p. 242.
Galba obrussa exigua F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 285, pl. 32, figs. 7-14.
--- --- --- Johnson 1915, Fauna New England, p. 185.
Galba obrussa exiqua [sic] F. C. Baker 1920, Life of Pleistocene, p. 387.
Fossaria exigua F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 301, pl. 16, fig. 9; pl. 18, figs. 34-37.
Lymnaea obrussa exigua Goodrich 1932, Moll. Mich., p. 53.
--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 285.
Fossaria exigua Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 59.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 284.

FIGURE 319.—*Fossaria exigua,* X1; after W. G. Binney (1865, pt. II, p. 65, fig. 105).

Type locality.—Tennessee.

Diagnosis.—Shell small, turreted, subfusiform, generally narrow; surface dull to shining, growth lines coarse, elevated, crowded; spiral lines occasionally present; whorls 5, generally well rounded, slowly increasing in diameter; spire wide, elevated, turreted, generally longer than the aperture; nuclear whorls as in *F. obrussa;* sutures deeply impressed; body whorl generally compressed, subcylindrical; aperture ovate to elliptical, slightly effuse; outer lip thin; inner lip narrow, tightly appressed at its junction with the parietal wall, the lower part erect or turned upward; umbilical chink very small, commonly entirely closed; L. 9.10, W. 4.25, Ap. L. 4.10, Ap. W. 1.75 mm. (modified from F. C. Baker, 1911a, p. 285).

Ecology.—Found in small shallow bodies of water and along the protected shores of rivers, on mud flats or in ditches, or in the swampy places and along the protected shores of lakes and bays. Baker (1911a, p. 289) reports a case of protective coloring in this species; specimens in the same pond are whitish or horn colored on a sandy bottom, black or nearly black on a muddy bottom and in moss.

Associations.—Living: MANITOBA - 6, 15, 30, 31, 33; WISCONSIN - 14, 59.

General distribution (fig. 320).—Maine west to Iowa and Minnesota, northern Michigan south to Tennessee.

Distribution in Ohio (inset, fig. 320).—Sterki (1907a, 1914) did not record this species for the State. Eggleston (ms. records) has specimens from Montgomery and Greene Counties.

Geologic range.—Pleistocene marl, Washtenaw County, Michigan. "Wabash" (Baker, 1920a, p. 387).

Fossaria galbana (Say) 1825
Fig. 321

Lymnaeus galbanus Say 1825, Acad. Nat. Sci. Philadelphia Jour., v. 5, p. 123.
Lymnaea (Galba) galbana Dall 1905, Harriman-Alaska Exped., v. 13, p. 73, fig. 52.
Galba galbana F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 291, pl. 32, figs. 25, 27.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Fossaria galbana F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 304, pl. 16, fig. 13; pl. 18, figs. 40-42.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 284,

Type locality.—Marl pit near Franklin, New Jersey.

Diagnosis.—Shell small, subovate, rather inflated, thick; surface shining, growth lines coarse, prominent,

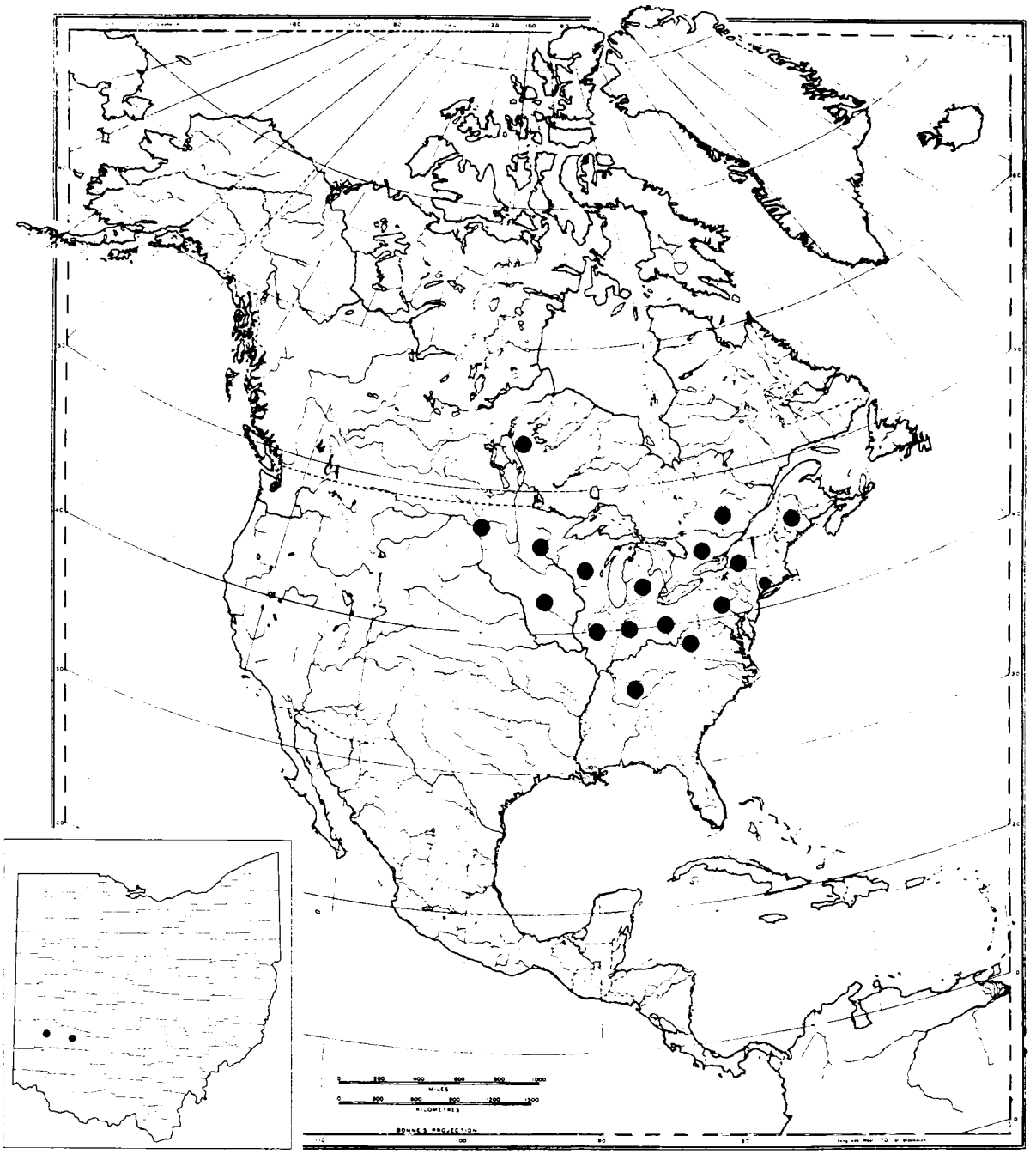


FIGURE 320.—Distribution of *Fossaria exigua* in North America; *inset*, distribution in Ohio.

without spiral lines; whorls 5, convex, roundly shouldered, rapidly increasing in diameter, the body whorl very large and somewhat flattened on the periphery; nucleus small, flatly rounded, similar in form to that of *F. obrussa;* spire generally short, broadly acutely conical, generally occupying about half the length of the shell; sutures deeply impressed; aperture ovate, generally rounded above and below; outer lip simple, acute; inner lip erect, forming a rather broad, flat reflection over the umbilical region which obstructs the umbilical chink and which is without plaitlike thickening; there is a rather thick callus on the parietal wall; umbilical chink narrowly open; L. 8.0; W. 4.5; Ap. L. 4.2; Ap. W. 2.0 mm. (Say's type) (modified from F. C. Baker, 1928a, pt. I, p. 304).

FIGURE 321.—*Fossaria galbana,* X1; after W. G. Binney (1865, pt. II, p. 72, fig. 117).

Ecology.—Probably a lake or pond species.

Associations.—Fossil: Y-1; I-5; S-1; W-35.

General distribution (fig. 322).—Imperfectly known. Baker (1911a, p. 294) gave records for California, Michigan, New York, Washington, Keewatin, Ontario, and Saskatchewan (living) and for Indiana, Michigan, Minnesota, New Jersey, New York, Alaska, New Brunswick, Ontario, Quebec (fossil). Later (1928a, pt. I, p. 304) he gave only "New Jersey west to Wisconsin. The distribution of the fossil form is insufficiently known." He stated further: "There is good reason to believe that the species is now extinct, recent forms referred to it being characteristic of another species."

Distribution in Ohio (inset, fig. 322).—Not at present recorded for the State, but probably to be found in marl deposits of small-lake or pond environments.

Geologic range.—Pleistocene, especially characteristic of marl deposits. Baker (1920a, p. 387) gave Aftonian, Peorian, and late Wisconsin ("Wabash").

Fossaria humilis (Say) 1822
Fig. 323

Lymneus humilis Say 1822, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 378.

Limnophysa humilis Call 1900, Moll. Ind., p. 408, pl. 8, fig. 9.

Lymnaea (Galba) humilis Dall 1905, Harriman-Alaska Exped., v. 13, p. 73, fig. 50.

Lymnaea humilis Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.

Galba humilis F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 257, pl. 29, figs. 26-30; pl. 30, figs. 19, 20.

Lymnaea humilis Sterki 1914, Ohio Naturalist, v. 14, p. 271, typical form not in Ohio.

Limnea humilis Dennis 1928, Aquatic gastr. Bass Is. region, p. 3.

Fossaria humilis La Rocque 1953, Cat. Recent Moll. Canada, p. 284.

Type locality.—South Carolina.

Diagnosis.—Shell small, ovate-conic; periostracum light yellowish horn; surface shining, rarely polished; lines of growth crowded, prominent; spiral sculpture absent or but slightly indicated; whorls 5 to 5½, convex, rather rapidly increasing in diameter, the body whorl quite obese; spire conic, turreted, about as long as the aperture; sutures well impressed; aperture ovate or roundly ovate; peristome thin; inner lip reflected to form a narrow, somewhat triangular expansion which may be rolled in toward the umbilical chink or stand more or less erect; umbilical chink small; parietal callus well marked; axis smooth, forming a column; L. 8.50, W. 4.50, Ap. L. 4.50, Ap. W. 2.50 mm. (Say's type) (modified from F. C. Baker, 1911a, p. 257).

Ecology.—Found in tide meadow ditch and at mouth of creek; in vacant lots and in ditches (Baker, 1911a, p. 258).

Associations.—Living: OHIO-8, 9, 10, 11, 13, 15, 19, 20, 43.

General distribution (fig. 324).—Southeastern United States. "So far as at present known, *humilis* is confined to the Upper and Lower Austral life zones, east of the Appalachian Mountains. It is characteristic of the Carolinian region" (Baker, 1911a, p. 258). In 1953 I gave the following range: "Georgia to Kansas and northward. Lake Superior; Lake Winnipeg; Manitoba." Baker restricted the name to the southern form and gave varietal names for the northern forms. The general distribution according to any given author will depend on the recognition of these northern forms and the restriction of the name to the typical form.

Distribution in Ohio (inset, fig. 324).—Sterki (1907a, p. 382) gave "over the state" for the species and recognized one unnamed variety from New Philadelphia, Tuscarawas County. Later (1914, p. 271) he followed Baker (1911a) in his restricted concept of the species. Later records (University of Michigan, Museum of Zoology; Eggleston ms. records) are for the varieties and are given under them.

Geologic range.—For the typical form, unknown (Baker, 1911a, p. 258).

Fossaria modicella (Say) 1825
Fig. 325

Lymneus modicellus Say 1825, Acad. Nat. Sci. Philadelphia Jour., v. 5, p. 122.

Lymnaea jamesii Lea 1864, Acad. Nat. Sci. Philadelphia Proc., p. 113.

Lymnaea desidiosa modicella Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.

Galba humilis modicella F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 259, pl. 19, figs. 31-37;

pl. 31, figs. 1-9.

Lymnaea humilis modicella Sterki 1914, Ohio Naturalist, v. 14, p. 271.

Galba humilis modicella Johnson 1915, Fauna New England, p. 183.

--- --- --- F. C. Baker 1920, Life of Pleistocene, p. 387.

Fossaria modicella F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 289, pl. 16, fig. 8; pl. 18, figs. 6-10.

Lymnaea humilis modicella Goodrich 1932, Moll. Mich., p. 54.

--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 285.

Fossaria modicella Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 58, pl. 7, fig. 9.

Fossaria modicella modicella La Rocque 1953, Cat. Recent Moll. Canada, p. 284.

Type locality.—Owego, Tioga County, New York,

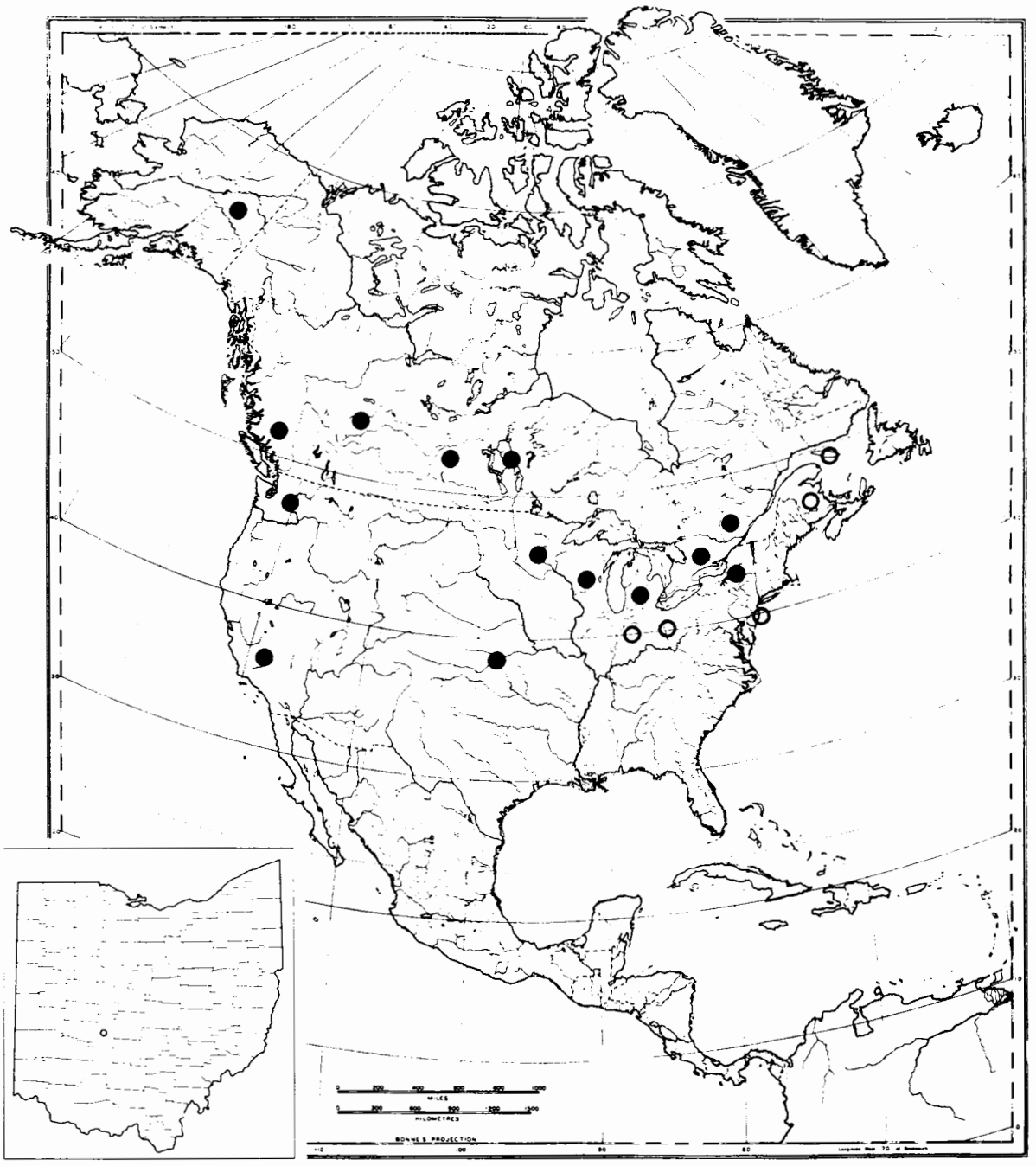


FIGURE 322.—Distribution of *Fossaria galbana* in North America; *inset,* distribution in Ohio.

on the Susquehanna River.

Diagnosis.—Shell of medium size, elongate-ovate or fusiform; epidermis light yellowish horn; surface

FIGURE 323.—*Fossaria humilis,* X1; after Call (1900, pl. 8, fig. 9).

shining, with distinct rather coarse lines of growth and commonly very fine spiral lines; whorls 4½ to 5, convex, the body whorl very large, flatly rounded; spire generally short, broadly or acutely conic, rarely dome shaped; sutures well impressed; nuclear whorls 1¼, the first whorl very small, the second very large, the sculpture of the postnuclear whorls beginning gradually; aperture ovate or elongate-ovate, somewhat narrowed above; peristome thin; inner lip narrow, reflected over the umbilical region, rolled over and appressed at the point of contact with the parietal wall, but standing more erect at the lower part; umbilical chink small,

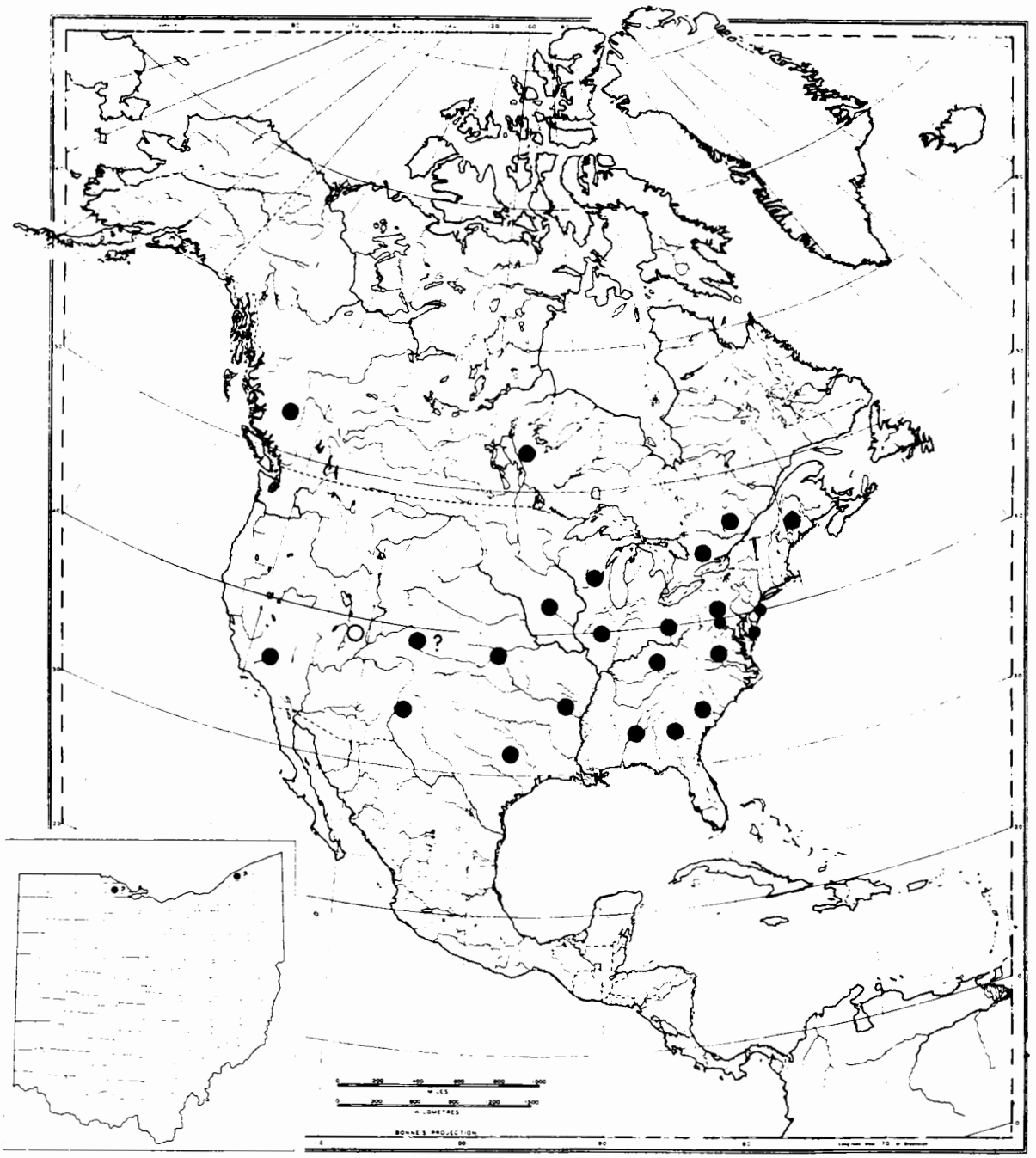


FIGURE 324.—Distribution of *Fossaria humilis* in North America; *inset,* distribution in Ohio.

narrow but distinct; axis smooth, forming an hourglass-shaped column; L. 8.5, W. 4.2, Ap. L. 4.7, Ap. W. 2.7 mm. (type) (modified from F. C. Baker, 1928a, pt. I, p. 290).

FIGURE 325.–*Fossaria humilis modicella,* X1; after W. G. Binney (1865, pt. II, p. 64, fig. 100).

Ecology.–Found on mud flats and strips of muddy beach that remain constantly moist or nearly so. It is also found in small pools, especially those with moss or much debris along the shore. It does not normally live in large bodies of water.

Associations.–Living: MANITOBA-6; WISCONSIN-134. Fossil: S-1; W-27, 28, 56, 57, 58, 59.

General distribution (fig. 326).–Nova Scotia, Quebec, and New Jersey west to Vancouver Island, British Columbia. Manitoba south to southern California, Arizona, Texas, and Alabama.

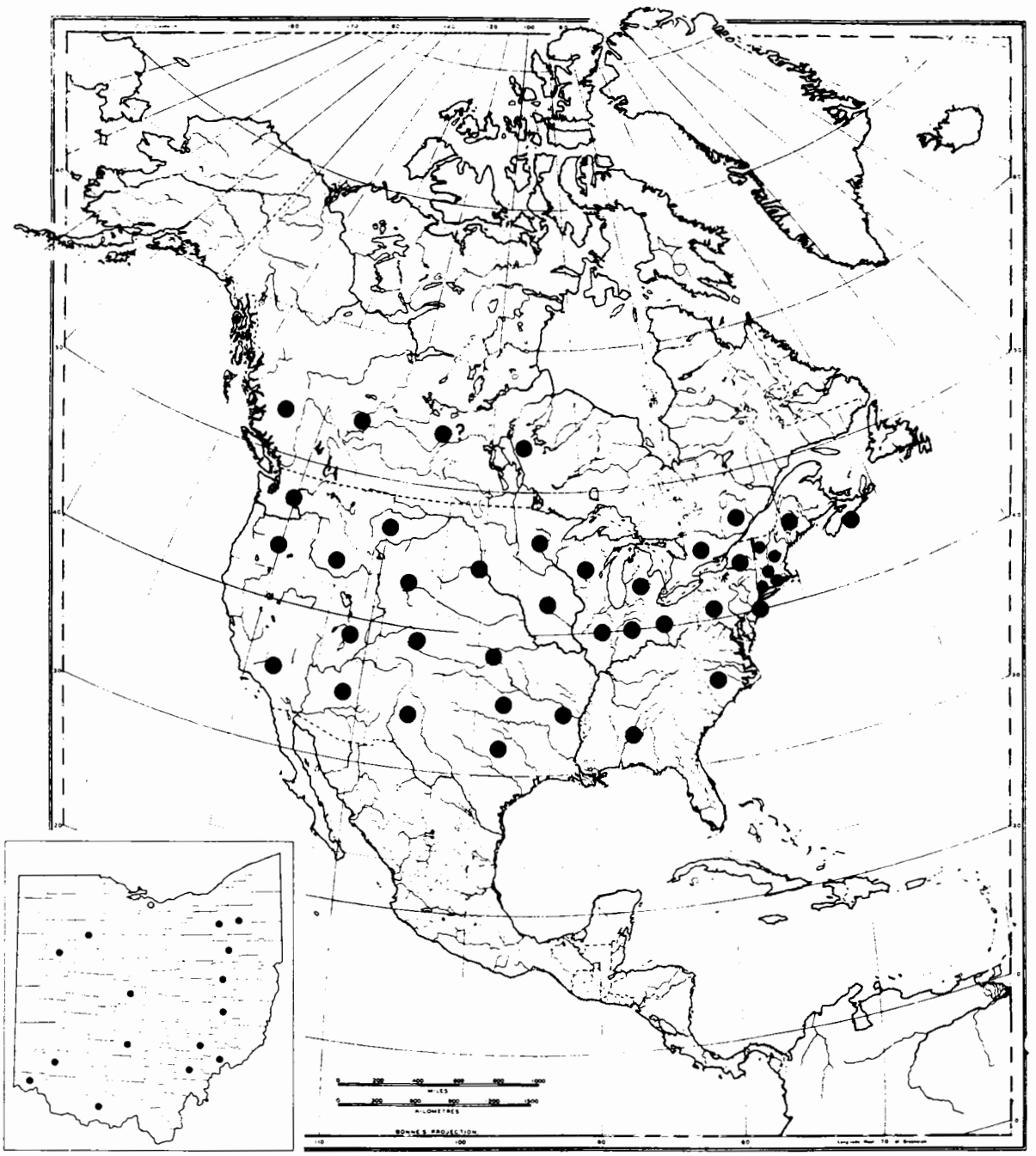


FIGURE 326.–Distribution of *Fossaria humilis modicella* in North America; *inset,* distribution in Ohio.

Distribution in Ohio (inset, fig. 326).—The variety is recorded by Sterki (1907a, p. 382; 1914, p. 271); Eggleston (ms. records) and the University of Michigan, Museum of Zoology, have numerous specimens which indicate that the variety is found over most, if not all of the State.

Geologic range.—Baker (1911a, p. 264 ff.) has Pleistocene records for Illinois, Iowa, Nebraska, Wisconsin, Indiana, Michigan, New Jersey, South Dakota, California, Nevada, New Mexico, Texas, and Ontario. Eggleston records it for the Castalia marl, Erie County, Ohio. Clark (1961, p. 23) confirms the record. Baker (1920a, p. 387) gives its range as Aftonian, Yarmouth, Sangamon, Peorian, "Wabash."

Fossaria modicella rustica (Lea) 1841
Fig. 327

Lymnea rustica Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 33.
Galba humilis rustica F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 268, pl. 31, figs. 10-14.
Lymnaea humilis rustica Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Galba humilis rustica Johnson 1915, Fauna New England, p. 184.
--- --- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Fossaria modicella rustica F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 291, pl. 16, fig. 10; pl. 18, figs. 11-13.
Lymnaea humilis rustica Goodrich 1932, Moll. Mich., p. 54.
--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 285.
Fossaria modicella rustica Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 58, pl. 7, fig. 6.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 285.

FIGURE 327.—*Fossaria humilis rustica.* X1; after W. G. Binney (1865, pt. II, p. 65, fig. 106).

Type locality.—Poland, Mahoning County, Ohio.

Diagnosis.—Shell small, elongated, subfusiform; epidermis light yellowish horn, darker in some specimens; surface shining, growth lines coarse, spiral lines absent or very faint; whorls 5 to 5½, convex, rather slowly increasing in diameter, the body whorl suddenly enlarging; spire long, very acute, generally a trifle longer than the aperture; nuclear whorls resembling those of *F. modicella;* sutures impressed; aperture generally narrowly elliptical; outer lip thin, in some specimens with a varix; inner lip narrow, reflected, the lower part turned up, the upper part at its junction with the parietal wall impressed and flattened, forming a slight plait; umbilical chink generally very narrow, in some specimens nearly closed; L. 7.5, W. 4.0, Ap. L. 3.7, Ap. W. 1.5 mm. (autotype) (modified from F. C. Baker, 1928a, pt. I, p. 291, 292).

Ecology.—Similar to that of the type form; form found usually on mud flats and the margins of rivers and streams.

Associations.—Fossil: W-27, 28.

General distribution (fig. 328).—New York west to Utah, Nebraska south to New Mexico.

Distribution in Ohio (inset, fig. 328).—Sterki (1914, p. 271) gave only Mahoning County (type locality); Eggleston (ms. records) added Tuscarawas and Clark Counties.

Geologic range.—Baker (1911a, p. 270 and 1920a, p. 387) recorded the variety for a marl bed in Emmet County, Michigan; later (1928a, pt. I, p. 292) he recorded it for a marl bed in Green Lake County, Wisconsin.

Fossaria obrussa (Say) 1825
Pl. 9, figs. 8, 16

Lymneus obrussus Say 1825, Acad. Nat. Sci. Philadelphia Jour., v. 5, p. 123.
Lymnea philadelphica Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 23.
Lymnaea desidiosa auctt., non Say.
Lymnaea desidiosa Say, *obrussa* Say, *t.* Baker, Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.
Galba obrussa F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 270, pl. 26, figs. 8-13; pl. 31, figs. 20-37.
Lymnaea obrussa Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Galba obrussa Johnson 1915, Fauna New England, p. 184.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Fossaria obrussa F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 293, pl. 16, figs. 14; pl. 18, figs. 14-24.
Lymnaea obrussa Goodrich 1932, Moll. Mich., p. 52.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 285.
Fossaria obrussa Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 59, pl. 7, fig. 7.
Fossaria obrussa obrussa La Rocque 1953, Cat. Recent Moll. Canada, p. 285.
Fossaria obrussa Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 94.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 54.

Type locality.—Harrowgate, Philadelphia County, Pennsylvania.

Diagnosis.—Shell subconic, pointed, oblong, rather thin, commonly somewhat inflated; epidermis generally

light yellowish horn color; surface shining, covered with numerous coarse lines of growth; under a strong lens very fine spiral lines may be seen; whorls 5½, rounded, somewhat shouldered, the shoulder being near the suture; the last whorl is very large, half the length of the entire shell, generally compressed but quite obese in some specimens; spire acute, sharply conical; nuclear whorls 1¼, resembling those of *F. parva* in outline and sculpture; sutures deeply indented; aperture very elongate-ovate, somewhat produced anteriorly; peristome thin, acute; inner lip reflected over the umbilical chink to form a thin, narrow expansion, which is commonly appressed to the umbilical region, giving the axis a slight twist; parietal callus very thin; umbilical chink varying from distinctly open to scarcely observable; the surface of the shell is commonly mal-

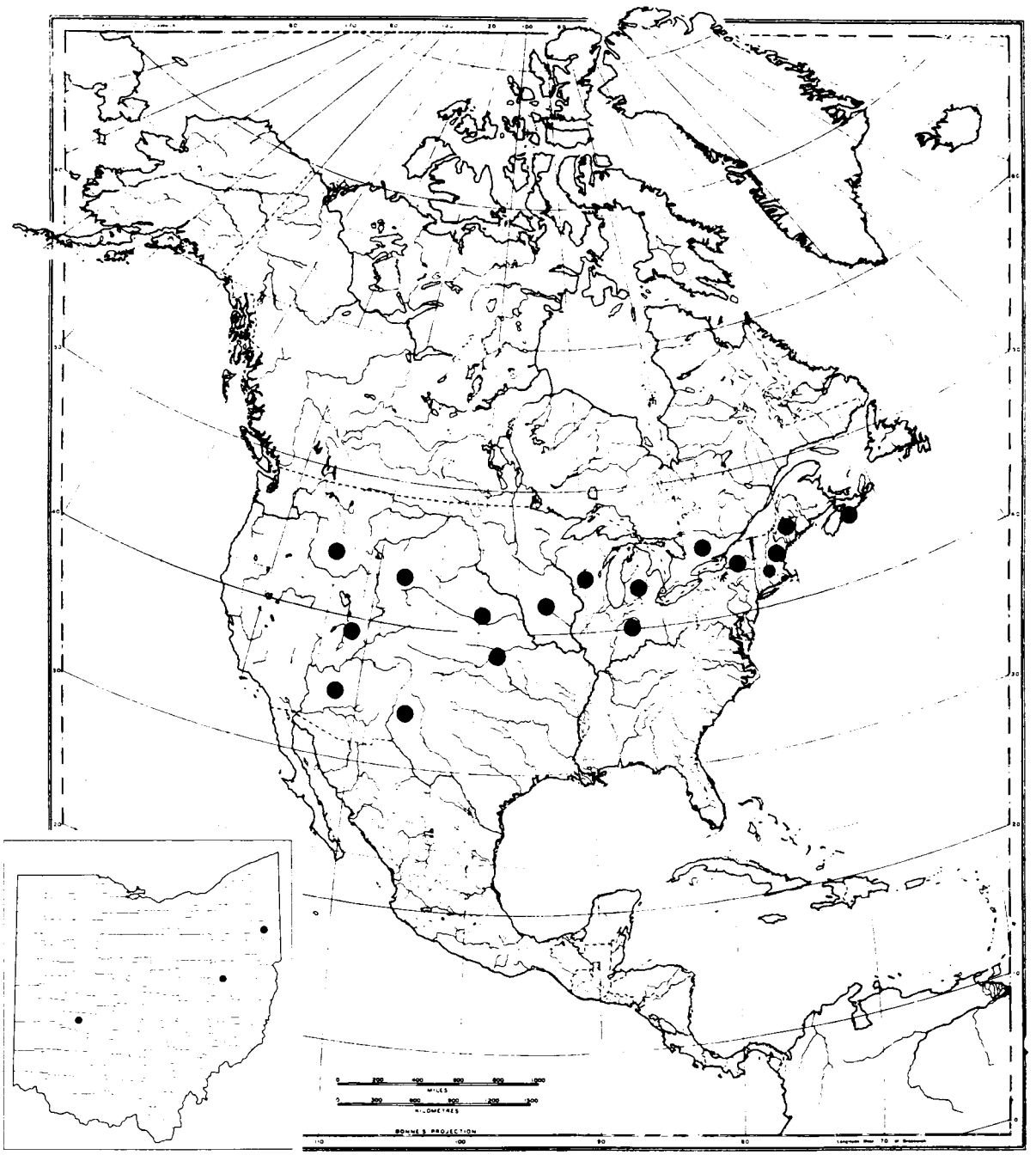


FIGURE 328.–Distribution of *Fossaria humilis rustica* in North America; *inset,* distribution in Ohio.

leated; L. 9.5, W. 4.5, Ap. L. 5.0, Ap. W. 2.5 mm. (type) (modified from F. C. Baker, 1928a, pt. I, p. 293, 294).

Ecology.—Found in small bodies of water, such as creeks, ponds, sloughs, bays, and marshy spots along river banks. It lives on sticks, stones, and any other debris that may be in the water or along its edge (Baker, 1928a, pt. I, p. 296).

Associations.—Living: OHIO-29, 31, 32, 33, 34, 35, 37, 38, 40, 41, 42; WISCONSIN-4, 48, 54, 59, 61, 79, 106, 117, 128. Fossil: N-1; S-6; W-38, 39, 45, 46, 47, 48, 49, 50, 51.

General distribution (fig. 329).—From the Atlantic to the Pacific Oceans, and from the Mackenzie District, Canada, south to Arizona and northern Mexico.

Distribution in Ohio (inset, fig. 329).—Sterki (1907a,

FIGURE 329.—Distribution of *Fossaria obrussa* in North America; *inset,* distribution in Ohio.

p. 382) recorded the species "over the state." Eggleston (ms. records) has specimens from Hancock, Portage, Stark, Miami, Franklin, Licking, Greene, Hamilton, Highland, Ross, Brown, and Adams Counties. The absence of records from the unglaciated parts of the State, in which Eggleston collected intensively, is remarkable.

Geologic range.—Baker (1911a, p. 280, 281) recorded the species from the Pliocene of California (Tassajora Lake bed, Alameda County) and from the Pleistocene of Illinois, Iowa, Nebraska, Maine, Michigan, Utah, Wisconsin, Ontario, and New York. Baker (1920a, p. 387) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash." Hibbard and Taylor (1960, p. 94) gave early Pliocene to Recent. In Ohio, Zimmerman (1960, p. 20) has recorded it for the Newell Lake deposit, Mowery (1961, p. 9) for the Jewell Hill deposit, and Cornejo (1961, fig. 11) for the Souder Lake deposit.

Variation.—The fossil forms of the species have long been called *Fossaria obrussa decampi* (Streng), described later in this report, and Baker (1911a, p. 283; 1928a, pt. I, p. 298) recognized the variety *peninsulae* (Walker) 1908; the species *F. exigua* was considered a variety of *F. obrussa* by Baker (1911a, p. 285) but he later (1928a, pt. I, p. 301) elevated it to specific rank.

Fossaria obrussa decampi (Streng) 1906
Fig. 330

Limnaea desidiosa var. *decampi* Streng 1906, Nautilus, v. 9, p. 123, fig.
Galba obrussa decampi F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 289, pl. 32, figs. 15-22.
--- --- --- Johnson 1915, Fauna New England, p. 185.
--- --- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Lymnaea (Galba) obrussa decampi Sterki 1920, Ohio Jour. Sci., v. 20, p. 174.
Fossaria obrussa decampi F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 299, pl. 18, figs. 30-33; pl. 16, fig. 12.
Lymnaea obrussa decampi Goodrich 1932, Moll. Mich., p. 53.
--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 285.
Fossaria obrussa decampi Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 59, pl. 7, fig. 8.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 285.

Type locality.—Brooks Lake, Newaygo County, Michigan.

Diagnosis.—Shell small, oblong or subfusiform, somewhat inflated, subconic, rather solid; epidermis pale horn; growth lines distinct but not coarse, spiral striation generally absent; whorls 5, spire whorls convex, distinctly shouldered near the suture, the body whorl very much flattened in the middle; spire short, broadly conic, turreted, about as long as the aperture; sutures deeply impressed; aperture very long and narrow, somewhat elliptical, rounded below and forming a prominent shoulder above; inner lip narrowly reflected, forming an expansion which is not much compressed at its junction with the parietal wall; the lower part of the inner lip stands quite erect; umbilical chink large and conspicuous, obstructed by the inner lip; L. 12.0, W. 6.0, Ap. L. 7.0, Ap. W. 3.5 mm. (modified from F. C. Baker, 1928a, pt. I, p. 300).

FIGURE 330.—*Fossaria obrussa decampi*, magnified; after Streng (1896, Naut. 9, p. 123, 2 figs.).

Ecology.—On the basis of associated species in Ohio assemblages, this variety is thought to have lived in much the same situations as other members of the genus *Fossaria*, namely on the margins of small bodies of water, on mud flats and debris.

Associations.—Living: MANITOBA-12; MINNESOTA-13a, 13b, 16, 17; WISCONSIN-55, 79, 84, 85, 123. Fossil: W-27, 29, 30, 31, 32, 33, 34, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 72.

General distribution (fig. 331).—Maine west to Wisconsin; northern Michigan south to northern Illinois.

Distribution in Ohio (inset, fig. 331).—It has been recorded in recent years from several marl deposits, listed below, which supplement Sterki's previous records of this variety as a fossil. Sterki (1920, p. 174) also states that it has been collected living in Summit County.

Geologic range.—Baker (1911a, p. 291) has records from marls in Illinois, Maine, and Michigan; other postglacial deposits in Michigan and New York. In Ohio, Sterki (1920, p. 174) records the variety from the Tinkers Creek marl, and Eggleston (ms. records) has specimens from a marl in Summit County. It is also known from the following late Pleistocene deposits: Humboldt (Reynolds, 1959, p. 155), Newell Lake (Zimmerman, 1960, p. 20), Oakhurst (Aukeman, 1960, p. 78), Aultman (Sheatsley, 1960, p. 79), Souder Lake (Cornejo, 1961, fig. 11), Castalia (Clark, 1961, p. 23), and Jewell Hill (Mowery, 1961, p. 9).

Fossaria parva (Lea) 1841
Fig. 332

Lymnaea parva Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 33.
Lymnaea curta Lea 1841, *ibid.*
Lymnaea parva Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.
Galba parva F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 243, pl. 29, figs. 5-14; pl. 30, figs. 9-12.
--- --- Johnson 1915, Fauna New England, p. 183.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Fossaria parva F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 285, pl. 16, fig. 7; pl. 18, figs. 1-5.

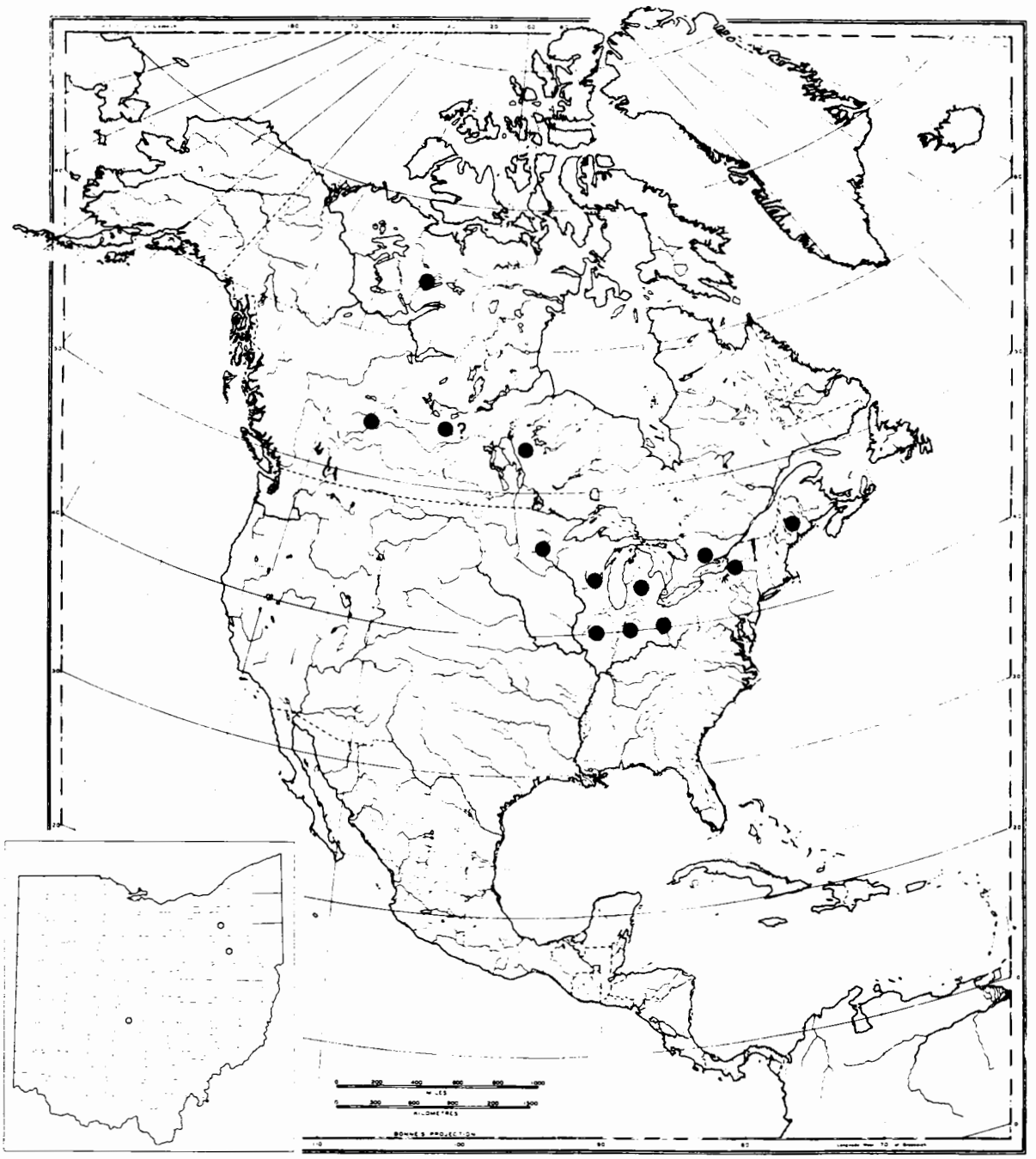


FIGURE 331.—Distribution of *Fossaria obrussa decampi* in North America; *inset,* distribution in Ohio.

Lymnaea parva Goodrich 1932, Moll. Mich., p. 54.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 285.
Fossaria parva Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 57, pl. 7, fig. 11.
Fossaria parva parva La Rocque 1953, Cat. Recent Moll. Canada, p. 285.

FIGURE 332.–*Fossaria parva,* magnified; after F. C. Baker (1931c, p. 279, pl. 32, fig. 10A).

Type locality.–Cincinnati, Ohio.

Diagnosis.–Shell small, rather solid, turreted, translucent; epidermis light horn or yellowish white, pellucid; surface shining, growth lines close set and well marked, rarely elevated and rough; spiral lines very fine or absent; whorls 5 to 5½, very convex, regularly increasing in size; nucleus of 1¼ whorls, smooth, with satin-finish sculpture; in outline the nucleus is rounded, the first whorl very large; the sculpture of the shell begins very abruptly; spire elevated, forming an acute pyramid, generally longer than the aperture; sutures deeply impressed; aperture roundly and regularly elliptical, continuous in many specimens, a trifle effusive at the lower end; outer lip thin, in some specimens developing a white deposit or varix a short distance from the edge; inner lip markedly and broadly reflected over the umbilicus, forming a broad, even expansion; parietal callus well marked, thick; umbilical chink well marked, open, axis straight, not twisted, thickened by shelly deposit; L. 4.5, W. 2.5, Ap. L. 1.5, Ap. W. 0.5 mm. (type) (modified from F. C. Baker, 1928a, pt. I, p. 285).

Ecology.–The species lives in wet, marshy places, generally out of the water, on sticks, stones, or muddy flats. It is more prone to leave the water than any other species of the family.

Associations.–Living: MANITOBA-11 (var.); MICHIGAN-37; OHIO-31; WISCONSIN-138. Fossil: K-5, 6, 13, 14, 15, 18, 20, 21, 22; W-6, 9, 10, 28, 43, 64, 67, 69, 71.

General distribution (fig. 333).–Connecticut west to Idaho, James Bay, and Montana, south to Maryland, Kentucky, Oklahoma, New Mexico, and Arizona.

Distribution in Ohio (inset, fig. 333).–Widely distributed over the State. Sterki (1907a, p. 382) has specimens from Defiance, Summit, Auglaize, Tuscarawas, Franklin, and Butler Counties. Eggleston (ms. records) adds Seneca, Stark, Madison, Licking, Clinton, and Washington Counties. The University of Michigan, Museum of Zoology, has fossil specimens from Butler County, probably marl specimens.

Geologic range.–Pleistocene of Iowa (loess), Colorado, and Illinois (Baker, 1911a, p. 246), and Ohio (above). Baker (1920a, p. 387) gives Peorian and "Wabash."

Fossaria parva sterkii (F. C. Baker) 1905
Fig. 334

Lymnaea sterkii F. C. Baker 1905, Nautilus, v. 19, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382, 399.
Lymnaea parva sterkii F. C. Baker 1910, Ill. State Lab. Nat. History Bull., v. 8, p. 492, pl. 25, fig. 21.
Galba parva sterkii F. C. Baker 1911, Lymnaeidae N. and mid. America, p. 248, pl. 29, figs. 15-22.
Lymnaea parva sterkii Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Fossaria parva sterkii Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 58, pl. 7, fig. 2.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 286.

Type locality.–Twelve miles west of Cleveland, Ohio.

Diagnosis.–Shell small, elongate, turreted, rather thin; color light yellowish horn, darker in some specimens; surface marked by distinct, crowded, raised growth lines generally without spiral lines; nucleus small, rounded, about the same size and shape as that of *F. parva;* whorls 5½ to 6, very convex, somewhat shouldered, especially the last; spire narrow, rather acute, turreted, generally longer than the aperture, sutures very deeply impressed; aperture ovate, much expanded anteriorly; outer lip sharp, thin; inner lip forming a very broad, flatly concave expansion reflected over the umbilicus, which it obstructs; there is a thin wash of callus on the parietal wall; umbilical chink narrow but deep; axis thickened, straight; L. 7.75, W. 3.50, Ap. L. 3.50, Ap. W. 1.75 mm. (type); L. 10, W. 4.75, Ap. L. 4.75, Ap. W. 2.50 mm. (large specimen, Canton, Illinois) (modified from F. C. Baker, 1911a, p. 248).

Ecology.–"In more or less swampy brooks and streams, in situations similar to those in which *Galba parva* is found" (Baker, 1911a, p. 250).

Associations.–Living: MANITOBA-37.

General distribution (fig. 335).–Central New York west to Minnesota and Illinois, south to Tennessee.

Distribution in Ohio (inset, fig. 335).–Sterki (1907a, gave "Near Dover, Cuyahoga Co. (St.)," which is probably the type locality; Baker (1911a, p. 249) added Blicktown, near New Philadelphia and Goshen, three miles southeast of New Philadelphia, Tuscarawas

County; near Doner [sic], Cuyahoga County (Sterki).
Geologic range.–Unknown (Baker, 1911a, p. 250).

Fossaria sayi F. C. Baker 1928
Fig. 336

Galba galbana F. C. Baker 1911 (part), Lymnaeidae N. and mid. America, p. 291, pl. 32, figs. 23, 24, 28-36.
Lymnaea galbana auctt., in part, *fide* Baker, 1928, p. 305.
Fossaria sayi F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 305, pl. 18, figs. 38, 39.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 62, pl. 7, fig. 1.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 286.

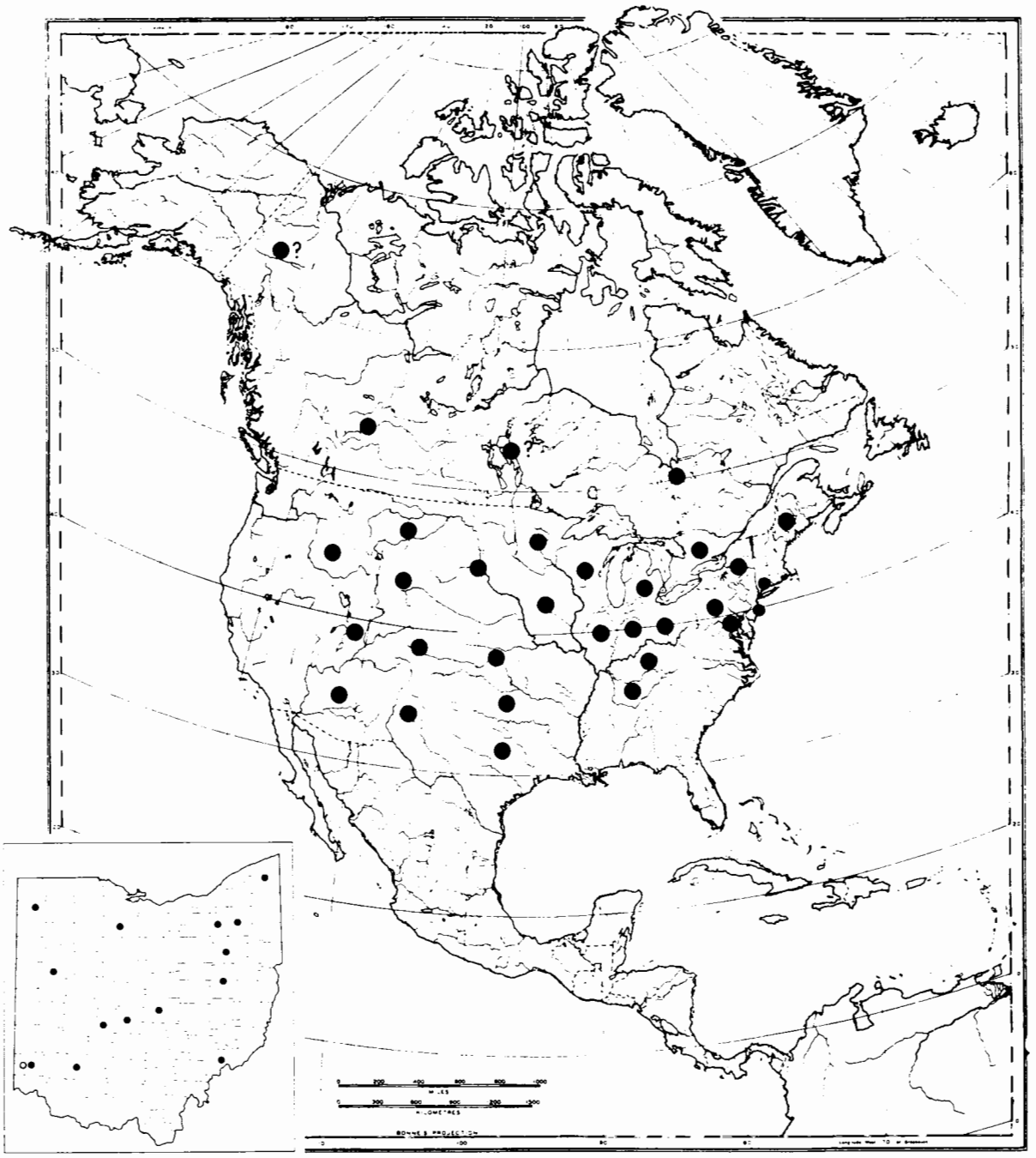


FIGURE 333.–Distribution of *Fossaria parva* in North America; *inset*, distribution in Ohio.

FIGURE 334.–*Fossaria parva sterkii,* magnified; after F. C. Baker (1911a, pl. 29, figs. 17, 22).

Type locality.–Squaw Island, near Buffalo, New York.

Diagnosis.–Shell elongate-ovate, very thick; epidermis whitish or yellowish; surface shining, commonly malleated, lines of growth very coarse, without spiral lines; whorls about 5, flatly convex, body whorl very large, somewhat shouldered at the upper part, much flattened at the periphery; nucleus dark colored,

FIGURE 335.–Distribution of *Fossaria parva sterkii* in North America; *inset,* distribution in Ohio.

FIGURE 336.–*Fossaria sayi,* magnified; after F. C. Baker (1928a, pt. I, pl. 18, figs. 38, 39).

similar to that of *F. obrussa;* spire as long as or shorter than aperture, rather acute; sutures impressed; aperture elongate-ovate, broadly rounded and effuse below, narrowly rounded above; outer lip simple but thickened within, especially at the upper part; inner lip rather thick, broadly reflected over the umbilical region, either closing the umbilicus or leaving a very small chink; a more or less heavy callus on the parietal wall produces an entire aperture in some specimens; the columella is nearly straight and is appressed in the middle to form a pseudoplait in many specimens; L. 8.0, 7.8; W. 4.9, 4.0; Ap. L. 4.1, 5.0; Ap. W. 2.2, 2.0

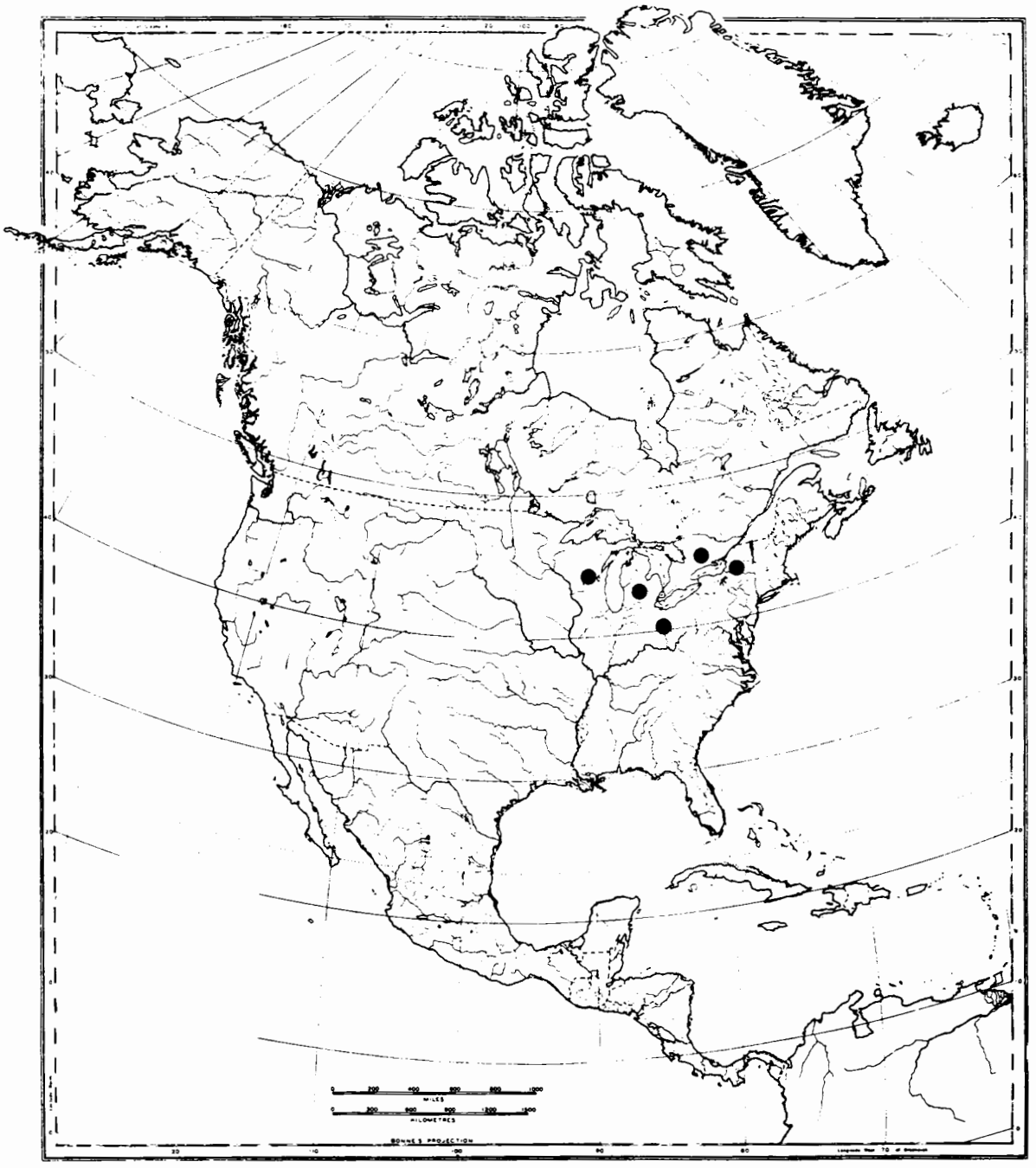


FIGURE 337.–Distribution of *Fossaria sayi* in North America.

mm. (type and paratype) (modified from F. C. Baker, 1928a, pt. I, p. 305).

Ecology.—Found in protected situations in the bays and connecting waters of the Great Lakes.

General distribution (fig. 337).—Great Lakes region; New York to Michigan; Ontario.

Distribution in Ohio.—No actual records as yet but the species is to be expected from Lake Erie and its drainage.

Geologic range.—Unknown.

Remarks.—Baker (1928a) erected this species for living forms referred formerly to *F. galbana* or mistakenly identified with other species such as *F. humilis, F. modicella,* and *F. obrussa decampi.*

Family PLANORBIDAE H. and A. Adams 1855

Shells of the Planorbidae are discoidal, ultradextral or ultrasinistral, or physoid in a few genera; animal sinistral, with the pulmonary, genital, and excretory openings on the left side; tentacles long and slender, cylindrical, the eyes placed at their inner base; head with large velar area; genitalia variable; jaw in three segments, the superior large, the lateral narrow, very long; radula with a comparatively small number of teeth in a straight, horizontal row; center tooth bicuspid, lateral teeth large, bi- or tricuspid, marginals long and narrow, multicuspid. There is a large secondary brachia (pseudobranch) on the left side which is highly vascular.

The family is subdivided by Baker (1945) into four subfamilies, Planorbinae, Segmentininae, Helisomatinae, and Planorbulinae, and one subfamily, Choanomphalinae, which is assigned to the Planorbidae with some doubt. Three of these subfamilies (Planorbinae, Helisomatinae, and Planorbulinae) are represented in the Ohio fauna; the Segmentininae are mainly European and the Choanomphalinae are a Eurasiatic group.

Subfamily PLANORBINAE H. A. Pilsbry 1934

The fundamental characteristics differentiating this subfamily from others in the family Planorbidae are anatomical (see F. C. Baker, 1945, p. 50). From the standpoint of shell morphology, this subfamily includes such diverse genera as *Planorbis,* with fairly high shell, and *Gyraulus,* in which some of the species have a very flat spire. The following genera of the subfamily occur in the Ohio fauna; *Gyraulus, Armiger* (considered as a subgenus of *Gyraulus* in this report), and, erroneously, *Australorbis* (see below).

Genus *Anisus* Studer 1820 (Gray 1847)

Anisus Studer 1820, Naturwiss. Anzeiger Allg. Schweiz. Gesell. Gesammt. Naturwiss. 3te Jahrg., Nr. 12, p. 91.

Spirorbis Swainson 1840, Treat. Malacology, p. 337 (*non* Daudin 1800).

Anisus F. C. Baker 1945, Moll. family Planorbidae, p. 57.

Type.—*Helix spirorbis* Linnaeus, selected by Gray, 1847.

Diagnosis.—"Shell ... discoidal with many tightly coiled whorls very slowly increasing in diameter, all of the whorls visible on both sides of the shell; whorls rounded or with a sharp carina at the periphery; aperture small, rounded or ovate, modified in carinate species by the peripheral carina" (F. C. Baker, 1945, p. 57).

Geologic range.—According to Baker (1945, p. 60), "the genus begins about the middle of the Miocene period." This statement applied to the species then known, which were all Eurasian and North African. Since then, the genus has been recorded in North America from the Pliocene to the Pleistocene but is not known in the living molluscan fauna of the continent.

Remarks.—Baker (1945, p. 55-57) gives an extensive synonymy which is not reproduced here but which should be consulted for a full history of the genus. He recognized fifteen species from Europe, Asia, and North Africa. The discovery of an American representative dates from 1958; see below, under *Anisus pattersoni.*

Anisus (Anisus) pattersoni (F. C. Baker) 1938
Pl. 9, fig. 4

Gyraulus pattersoni F. C. Baker 1938, Nautilus, v. 51, p. 129.

--- --- Frye, Swineford, and Leonard 1948, Jour. Geology, v. 51, fig. 2.

--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 20, pl. 3, fig. I.

--- --- Frye and Leonard 1952, Kans. Geol. Survey Bull. 99, p. 158, pl. 15, fig. g.

--- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 370, 373.

--- --- Leonard 1957, Ill. Geol. Survey Rept. Inv. 201, p. 12, pl. 2, figs. 4-6.

Anisus pattersoni Taylor 1958, Jour. Paleontology, v. 32, p. 1149.

--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. I, p. 95, pl. 5, fig. 4.

--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 56.

Type locality.—Sand Draw locality 5 (D. W. Taylor, 1960, p. 34), center of north side sec. 34 and southeast corner SW¼ sec. 27, T. 31 N., R. 22 W., Brown County, Nebraska; exposures on small draw near earth

dam; marly silt, 18-20 feet below unconformity.

Diagnosis.—"Shell small, discoidal, presumably ultradextral, nearly plane on both sides; whorls 5-6, flattened on the left side, subangulate at junction of left side with periphery, rounded on periphery and right side, very slowly and regularly increasing; suture well impressed; aperture subquadrate, left side flattened to arcuate, periphery gently rounded, right side strongly rounded; lip sometimes thickened within; sculpture of numerous fine, irregular growth lines and weak spiral striation; embryonic shell of about one-half whorl, spirally striate only" (Taylor, 1960, p. 56).

Ecology.—"Known only from inference, since the species is extinct. Its association with fossils which represent living species suggests it lived in shallow, quiet waters, in the backwaters along streams or in semipermanent ponds and sloughs" (Taylor, 1960, p. 56).

Associations.—Fossil: N-1, 2; K-1, 2, 9, 10, 16, 18, 19, 20, 21, 26, 27; S-6, 7; W-60.

General distribution (fig. 338).—Known only as a fossil.

Distribution in Ohio (inset, fig. 338).—Recorded only for Cuyahoga County, as a fossil.

Geologic range.—"Pliocene in southwestern Idaho, northern Utah, western Wyoming; early Pleistocene in southwestern Idaho, Nebraska, and Kansas; middle Pleistocene in the central Great Plains; late Pleistocene, Ohio" (Taylor, 1960, p. 56).

Genus *Gyraulus* Agassiz *in* J. de Charpentier 1837

Gyraulus Agassiz 1837, *in* Charpentier, N. D. Allg. Schweiz. Gesellsch., v. 1, p. 21 (*fide* Neave).
Gyraulus Walker 1918, Synopsis and cat. fresh-water Moll., p. 12 (credited to Agassiz, 1837).
Gyraulus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 364 (credited to Charpentier).
Gyraulus F. C. Baker 1945, Moll. family Planorbidae, p. 66 (credited to (Agassiz MS) Charpentier, 1837).
Gyraulus La Rocque 1953, Cat. Recent Moll. Canada, p. 293 (credited to Charpentier).

Type.—*Planorbis albus* Müller.

Diagnosis.—Shell dextral, small, with few rapidly increasing whorls, fully exposed above and below, with a nearly median periphery, rounded or obtusely angulated, but not acutely carinated.

Remarks.—In Pleistocene molluscan assemblages, members of this genus can be easily confused at first with species of *Promenetus* and *Menetus* among the Planorbidae and with certain planospiral land snails, especially those of the genus *Helicodiscus*. Examination of the figures in this report and attention to the generic or specific characteristics given will help separate these similar shells. *Gyraulus* may be distinguished from *Promenetus* and *Menetus* mainly by the character of the umbilicus, which is wide and entirely open in *Gyraulus*, narrow, although open to the nuclear whorl in the other two. The presence of strong spiral ornamentation on *Helicodiscus* will separate it instantly from *Gyraulus*.

The genus has been divided into two subgenera, *Gyraulus s.s.* and *Torquis* Dall 1905, by F. C. Baker (1945, p. 66 ff.). A third subgenus, *Armiger*, is given generic rank here, following Baker (1945, p. 75). The use of *Armiger* as a genus seems to be increasing but the reader may consider it as a subgenus of *Gyraulus* if he so prefers.

Speciation.—Baker (1945, p. 70, 71) recognizes a long list of species in *Gyraulus s.s.*, in subgenus *Torquis* (*ibid.*, p. 75), and in *Armiger* (*ibid.*, p. 78), which are discussed under the respective subgenera.

Subgenus *Gyraulus s.s.*

Shells of this subgenus are small, ultradextral, of comparatively few flattened whorls, equally visible above and below, rapidly enlarging in diameter; body whorl at aperture commonly somewhat deflected, the aperture oblique; the periphery commonly median and in some species carinate; the shell in several species is covered with short, hairlike projections of the epidermis and may be described as hirsute.

Type.—*Planorbis albus* Müller.

Remarks.—In fossil shells, one of the most diagnostic features of this subgenus is completely absent, namely the hirsute character of the epidermis. Placing of specimens in this subgenus must be done on the basis of the relationship with living forms and is therefore unsatisfactory in many extinct species.

Speciation.—F. C. Baker (1945, p. 70, 71) has given a list of species recognized by him. The list is a long one, with species from every continent, but it is remarkable that the North American list is much shorter than that for Europe and western Asia or that for Africa, or for India and Asia.

Gyraulus arcticus ('Beck' Möller) 1842
Fig. 339

Planorbis arcticus (Beck, ms.) Möller 1842, Index Moll. Groenl., p. 5.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 96.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 96.
Planorbis hirsutus F. C. Baker 1920, Jour. Geology, v. 28, p. 449 (*non* Gould).
Gyraulus arcticus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 380, pl. 23, figs. 34-38.
--- --- F. C. Baker 1945, Moll. family Planorbidae, p. 71.

Gyraulus arcticus La Rocque 1953, Cat. Recent Moll. Canada, p. 293.

Type locality.—Kuksuk, Greenland.

Diagnosis.—Shell rather large for the genus, ultradextral, depressed, the periphery rounded; color light corneous, surface shining; sculpture of fine oblique lines of growth with very fine spiral lines on some specimens, rarely entirely without these lines; nucleus small, rounded, spirally striate in sculpture; whorls about 4, rapidly enlarging, the last somewhat expanded near the aperture, roundly angled at the periphery of the last whorl, the upper part of the body whorl slightly flattened; spire flat, the whorls coiled in the same plane; the body whorl is more or less deflected about a third of the distance from the aperture; sutures deep-

FIGURE 338.—Distribution of *Anisus pattersoni* in North America; *inset,* distribution in Ohio.

ly channelled; base concave, exhibiting all of the whorls, the umbilical region wide, but the body whorl well rounded, not flattened as in *G. parvus;* aperture obliquely, ovately rounded; lip thin, sharp, simple or slightly thickened with a callus deposit; parietal wall with a white callus (modified from F. C. Baker, 1928a, pt. I, p. 380).

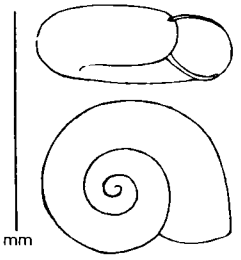


FIGURE 339.—*Gyraulus arcticus,* two views, greatly enlarged; after F. C. Baker (1928a, pt. I, p. 375).

Ecology.—At the type locality, found in a little lake on stones, covered with confervae, chiefly on the underside, and in a tank at Kuksuk, on bullrush, *Potamogeton,* and the stems of *Equisetum.* Baker (1928a, pt. I, p. 381) says that no ecological notes on the American form are available, but that it is found in lakes in the Mackenzie District of Canada. This is evidently a species of lakes and ponds, found in cold shallow water, which is just the environment suggested by its occurrence as a Pleistocene fossil in the Rush Lake deposit, Logan County, Ohio (Baker, 1920b, p. 449).

Associations.—Living: MANITOBA - 7, 10, 16, 21, 25, 31, 32, 33, 34; NEW YORK - 1; WISCONSIN - 59.

General distribution (fig. 340).—Living in West Greenland and at Fort Chimo, Ungava, Labrador, Canada. As a Pleistocene fossil, as far south as Illinois and Ohio.

Distribution in Ohio.—At present known certainly only from the Rush Lake deposit, late Wisconsin, Logan County, Ohio, identified by Baker. It should be found also in other late Wisconsin deposits in the State.

Geologic range.—Pleistocene, Illinois and Ohio, probably also elsewhere in the northern United States and Canada.

Remarks.—As Baker noted (1928a, pt. I, p. 382) this appears to be a northern form that lived farther south during Pleistocene time; its migration northward since late Wisconsin time may be connected with an ecological requirement such as cold water.

Gyraulus deflectus (Say) 1824
Fig. 341

Planorbis deflectus Say 1824, Long's Exped., v. 2, p. 261, pl. 15, fig. 8.
Gyraulus deflectus Call 1900, Moll. Ind., p. 412, pl. 8, fig. 13.
Planorbis (Gyraulus) deflectus Dall 1905, Harriman-Alaska Exped., v. 13, p. 94, fig. 74.
Planorbis deflectus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
--- --- Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Planorbis (Gyraulus) deflectus Johnson 1915, Fauna New England, p. 191.
Planorbis deflectus Walker 1918, Synopsis and cat. fresh-water Moll., p. 98.
Gyraulus deflectus F. C. Baker 1920, Life of Pleistocene, p. 387.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 370, pl. 23, figs. 15-21.
--- --- Goodrich 1932, Moll. Mich., p. 66.
--- --- Goodrich and van der Schalie 1944, Rev. Moll. Ind., p. 288.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 63, pl. 8, figs. 9, 10.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 294.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 57.

Type locality.—Northwest Territories (Say).

Diagnosis.—Shell dextral, depressed, orbicular, with a more or less distinct keel at the periphery; color light to dark yellowish horn, rarely dark brown; surface shining; sculpture of fine lines of growth crossed by more or less distinct impressed spiral lines rather widely spaced; surface covered with a heavy epidermis which is set with rigid hairlike projections at the spiral lines, with an especially well developed line of projecting hairs at the periphery; these hairlike projections are not as large as in *G. hirsutus;* whorls about 4½, rapidly enlarging; spire flat, all of the whorls, excepting the apical, in the same plane; sutures impressed; base slightly concave, flattened, showing all of the volutions; aperture suboval, more or less deflected, much wider than high; outer lip acute, thin, the superior portion produced much beyond the inferior portion, slightly thickened on the inside, parietal wall with thin white callus; interior of aperture commonly brownish; L. 2.0, 2.0, 2.6; W. 7.2, 6.6, 6.6; Ap. L. 1.5, 1.7, 1.5; Ap. W. 2.5, 2.5, 2.4 mm. (modified from F. C. Baker, 1928a, pt. I, p. 370).

Ecology.—Generally, found in quiet bodies of water: shores of protected bays, in 1 to 5 feet of water on sand and mud, but as deep as 9 to 16 feet on mud bottom.

Associations.—Living: MANITOBA - 12; MICHIGAN - 10; OHIO - 43; ONTARIO - 3, 9; QUEBEC - 2; WISCONSIN - 9, 23, 37, 42, 47, 60, 61, 79, 80, 85, 89, 95, 99, 112, 113. Fossil: W - 29, 33, 34, 53, 54, 55.

General distribution (fig. 342).—New England to Alaska, southward to Maryland. The exact boundaries of its distribution remain to be worked out as the identifications in the literature are not all reliable. The

Alaska record is accepted by Baker and he likewise accepts the records for Great Slave Lake, Wisconsin, and a number of Canadian records personally confirmed by him.

Distribution in Ohio (inset, fig. 342).—Sterki (1907a, p. 383) gives only Garretsville, Portage County, and Tuscarawas County, later (1914, p. 271) remarking that the species is in need of revision. In addition, there are specimens from Allen County in the University of Michigan collections.

Geologic range.—Baker (1928a, pt. I, p. 371) records the species from a marl bed (probably late Wisconsin) in Door County, Wisconsin. He had previously (1920b) recorded it for the Rush Lake marl (Logan County, Ohio), and (1920a, p. 387) for Yarmouth, Sangamon, and "Wabash" deposits. D. W. Taylor (1960, p.

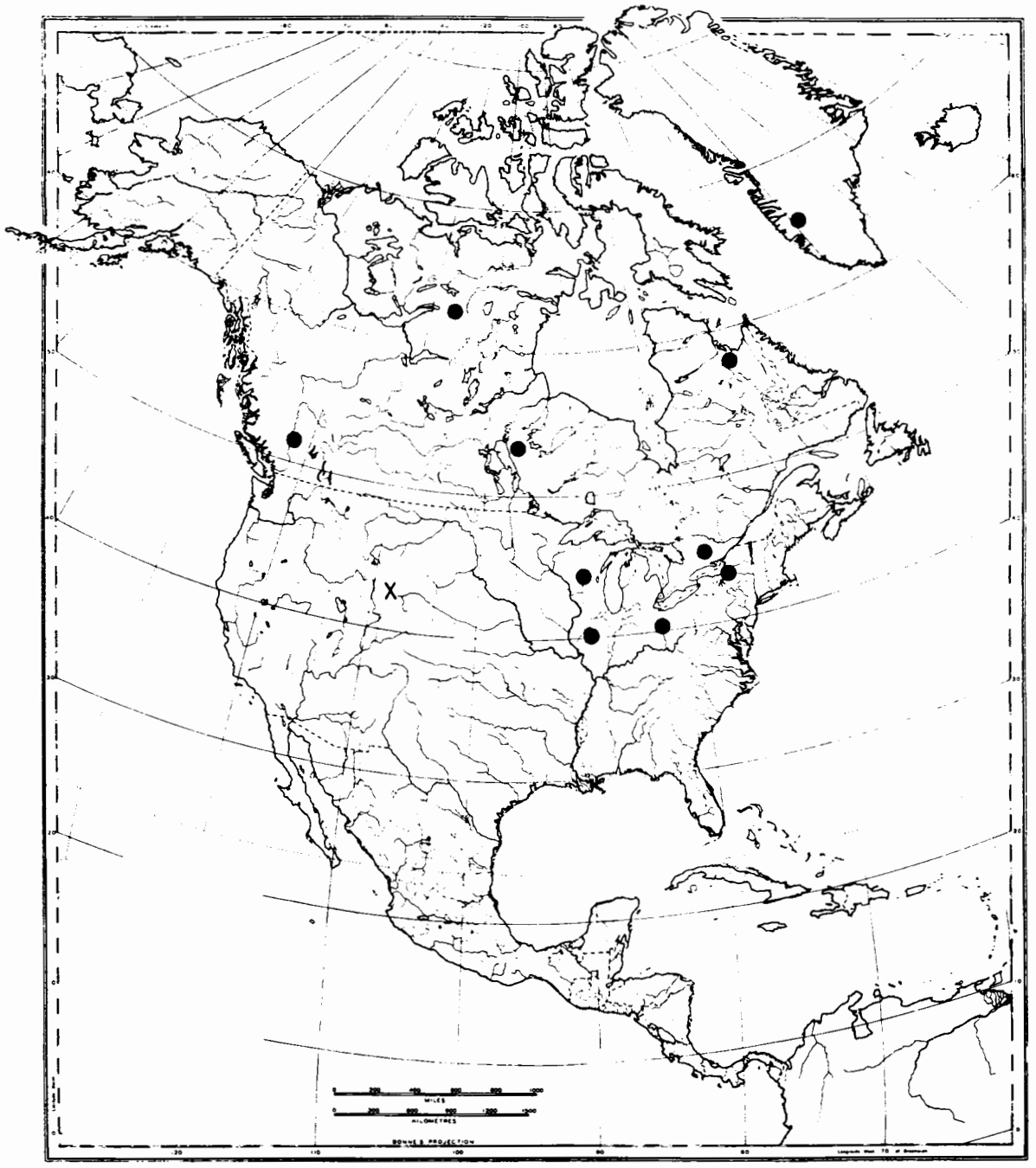


FIGURE 340.—Distribution of *Gyraulus arcticus* in North America.

FIGURE 341.–*Gyraulus deflectus*, magnified; after Call (1900, pl. 8, fig. 13).

57) records it only as "Recent" in Nebraska. In Ohio, the Rush Lake marl record has been added to in recent years as follows: Oakhurst deposit (Aukeman, 1960, p. 96) and Aultman deposit (Sheatsley, 1960, p. 95).

Gyraulus deflectus obliquus (De Kay) 1843
Fig. 343

Planorbis obliquus De Kay 1843, Zoology N.Y., Moll., p. 62, pl. 4, figs. 57a, b.
Gyraulus deflectus obliquus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 372, pl. 23, figs. 22-26.

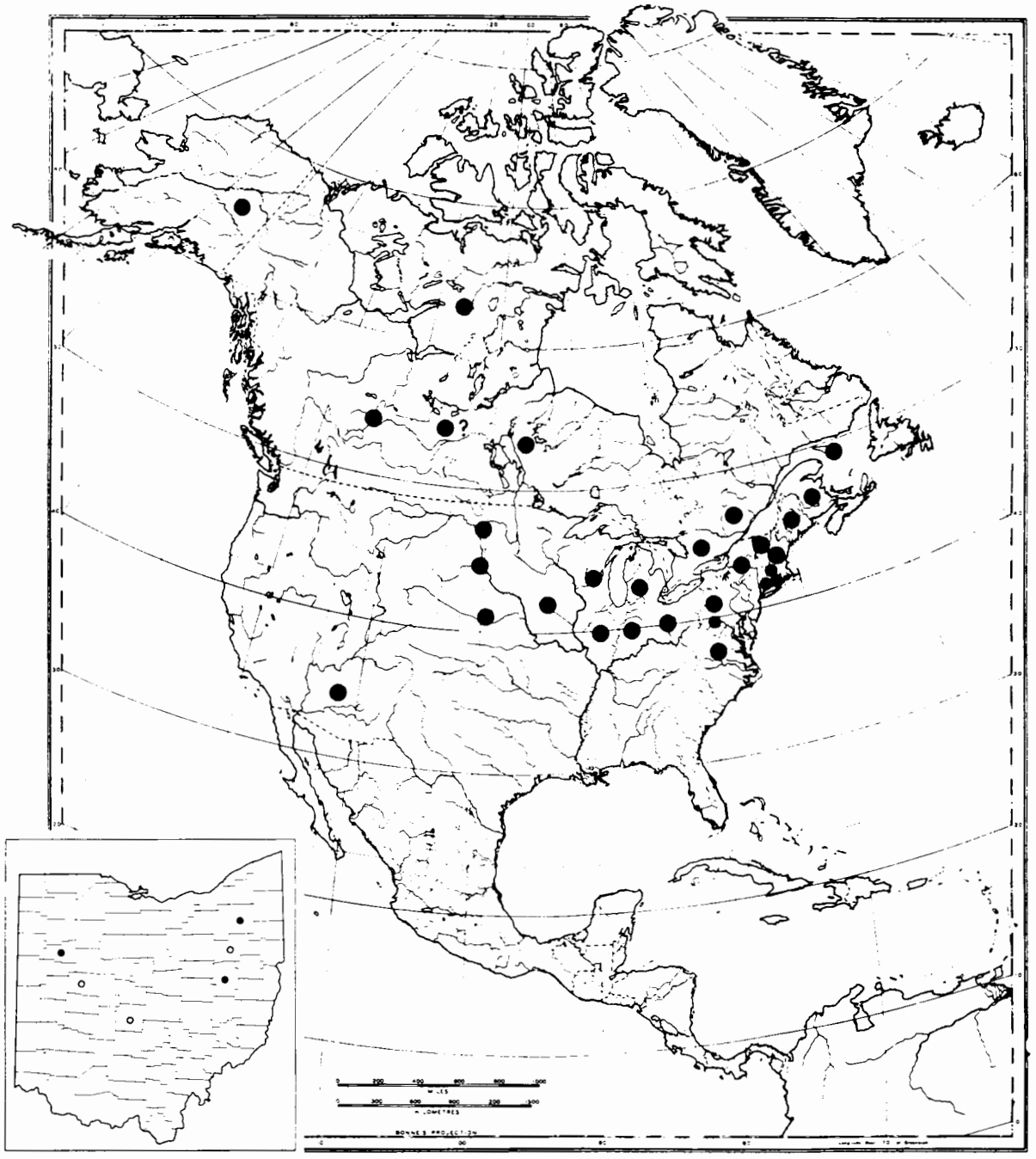


FIGURE 342.–Distribution of *Gyraulus deflectus* in North America; *inset*, distribution in Ohio.

--- --- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 63.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 294.

FIGURE 343.–*Gyraulus deflectus obliquus,* magnified; after W. G. Binney (1865, pt. II, p. 130, fig. 217).

Type locality.–Mohawk and Newcomb's Pond, in Pittstown, New York.

Diagnosis.–"Differing from typical *deflectus* in having the body whorl subangulate on the lower part, not angular at the periphery, the body whorl usually flatly sloping above the subangulated area and rounded below this area; the lower side of the body whorl is rounder than in *deflectus* and the umbilical region is deeper; the whorls are also higher than in typical *deflectus;* the sutures are also deeper" (F. C. Baker, 1928a, pt. I, p. 372).

Ecology.–Generally similar to that of the type form. Baker (1928a, pt. I, p. 372) gives the following specific habitats: "Swampy tracts on shore of Wisconsin River. Slough in Lake Chetek, water .6 m. deep, bottom boggy mud few cm. to .3 m. deep, snails on logs, none on coniferous logs; vegetation *Elodea* and *Castalia,* algae."

Associations.–Living: MINNESOTA - 13b, 16, 17; NEW YORK - 1; QUEBEC - 4; WISCONSIN - 14, 15, 16, 42, 59, 69, 80, 85, 86, 90, 93, 94, 96, 98, 102, 116, 123, 124, 135.

General distribution (fig. 344).–Probably the same as that of the typical form according to Baker (1928a, pt. I, p. 372).

Distribution in Ohio.–No definite records as yet, but the variety is to be expected in the State.

Geologic range.–Unknown.

Remarks.–Baker (1928a, pt. I, p. 373) discusses the history of this variety and maintains that it "seems to have good claims for varietal distinction." Whether individual workers agree with this or not, it is necessary to point out the existence of specimens matching the original description and Baker's careful differentiation of the form wherever it occurs. When the distribution of the form has been worked out, it may be possible to say more definitely whether it is entitled to recognition or not.

Gyraulus hirsutus (Gould) 1840

Planorbis hirsutus Gould 1840, Am. Jour. Sci., 1st ser., v. 38, p. 196.
Planorbis albus Haldeman 1844 (*non* Müller), Mon. Limniades N. America, p. 29, pl. 4, figs. 8-10.
Planorbis (Gyraulus) hirsutus Dall 1905, Harriman-Alaska Exped., v. 13, p. 93, fig. 73.
"*Planorbis albus* Müller, *hirsutus* Gould" Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
Planorbis (Gyraulus) hirsutus Johnson 1915, Fauna New England, p. 190.
Gyraulus hirsutus F. C. Baker 1920, Life of Pleistocene, p. 387.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 367, pl. 23, fig. 8.
--- --- Goodrich 1932, Moll. Mich., p. 66.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 288.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 63.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 294.

Type locality.–Mansfield, Dedham, and Cambridge, Massachusetts.

Diagnosis.–Shell ultradextral, discoidal, rounded; color light yellowish to brownish; surface dull; sculpture of fine lines of growth and widely spaced impressed spiral lines, about 7 to 11 from suture to periphery, in which the epidermis is puckered to form hairlike projections; this is lost when the shell is denuded of the epidermis and only the spiral lines are left; nucleus small, rounded, of about one whorl, partly embraced by the second whorl, sculpture at first roughly punctate, later punctostriate; whorls 3½, discoidal, well rounded on the periphery (rarely faintly subangulate on the body whorl), rather flattened above and below; spire flattened, exhibiting all the whorls, the nuclear and second whorls only depressed below the general plane of the spire; sutures well impressed; base of shell concave, forming a wide umbilicus, showing all the volutions to the nucleus; aperture subovate, more or less oblique, rounded above and below and bluntly subangular at the periphery in some specimens; outer lip thin, acute, rarely somewhat expanded; a thin callus on parietal wall; the body whorl near the aperture is slightly deflected and enlarged (modified from F. C. Baker, 1928a, pt. I, p. 368).

Ecology.–Found in small ditch bordering railroad track, Dedham Road, Neponset, Massachusetts (Baker, 1920, Johnson, 1915). Gould (1840) says it was "found adhering to sticks in stagnant water." In Tomahawk Lake, Wisconsin, in a swamp near shore of small bay, water a few cm. to 0.3 m. deep, bottom soft, sticky mud of clayey character, water filled with algae (Baker, 1928a, pt. I).

Associations.–Living: MANITOBA - 12, 16, 21, 25, 34, 35; MICHIGAN - 10; NEW YORK - 2b, 4b, 5b, 16, 18b, 21, 23, 29, 37, 40a; OHIO - 43; ONTARIO - 9; WISCONSIN - 3, 4, 29, 55, 66, 70, 79, 89, 98, 106, 119, 123, 128. Fossil: W - 27, 29.

General distribution (fig. 345).–New England west to Minnesota, northward to Great Slave Lake and Alaska, southward to District of Columbia and Ohio.

Distribution in Ohio (inset, fig. 345).–Sterki (1907a,

p. 383) gives only Stark and Tuscarawas Counties, but adds "probably over the state," which is probably correct as the species is recorded for Indiana and Michigan and it is known for New York and eastward.

Geologic range.—Recorded by Baker (1920a, p. 387) for Aftonian, Sangamon, and "Wabash" deposits.

Subgenus *Torquis* Dall 1905

Torquis Dall 1905, Harriman-Alaska Exped., v. 13, p. 83, 86, as section of subgenus *Gyraulus*.
Torquis F. C. Baker 1945, Moll. family Planorbidae, p. 72, extensive synonymy.

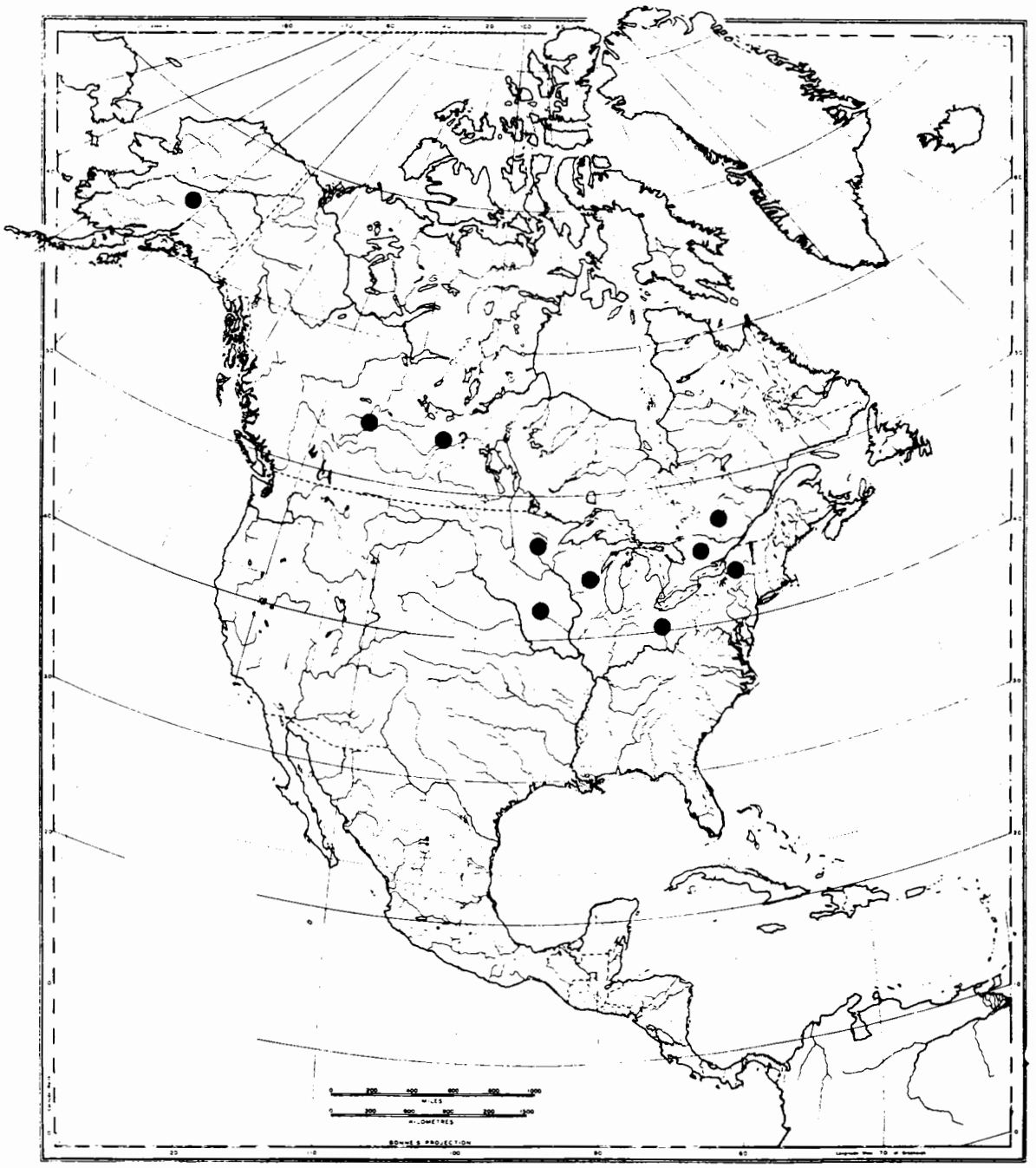


FIGURE 344.—Distribution of *Gyraulus deflectus obliquus* in North America.

Type.—*Planorbis parvus* Say, by original designation.

Diagnosis.—Shell ultradextral, smaller than *Gyraulus s.s.*, with the whorls less distinctly spirally striated, not hirsute, the base (left side) more or less concave or excavated (appearing as though reamed out), the lip in some specimens slightly thickened within (modified from F. C. Baker, 1945, p. 72).

Speciation.—Baker (1945, p. 75) gives a list of eleven species and varieties which he considers valid. He also mentions an Oligocene species.

Remarks.—Baker (1945, p. 75) admits that the subgenus is based on rather slight anatomical characters but considers it "a convenient name for the smaller

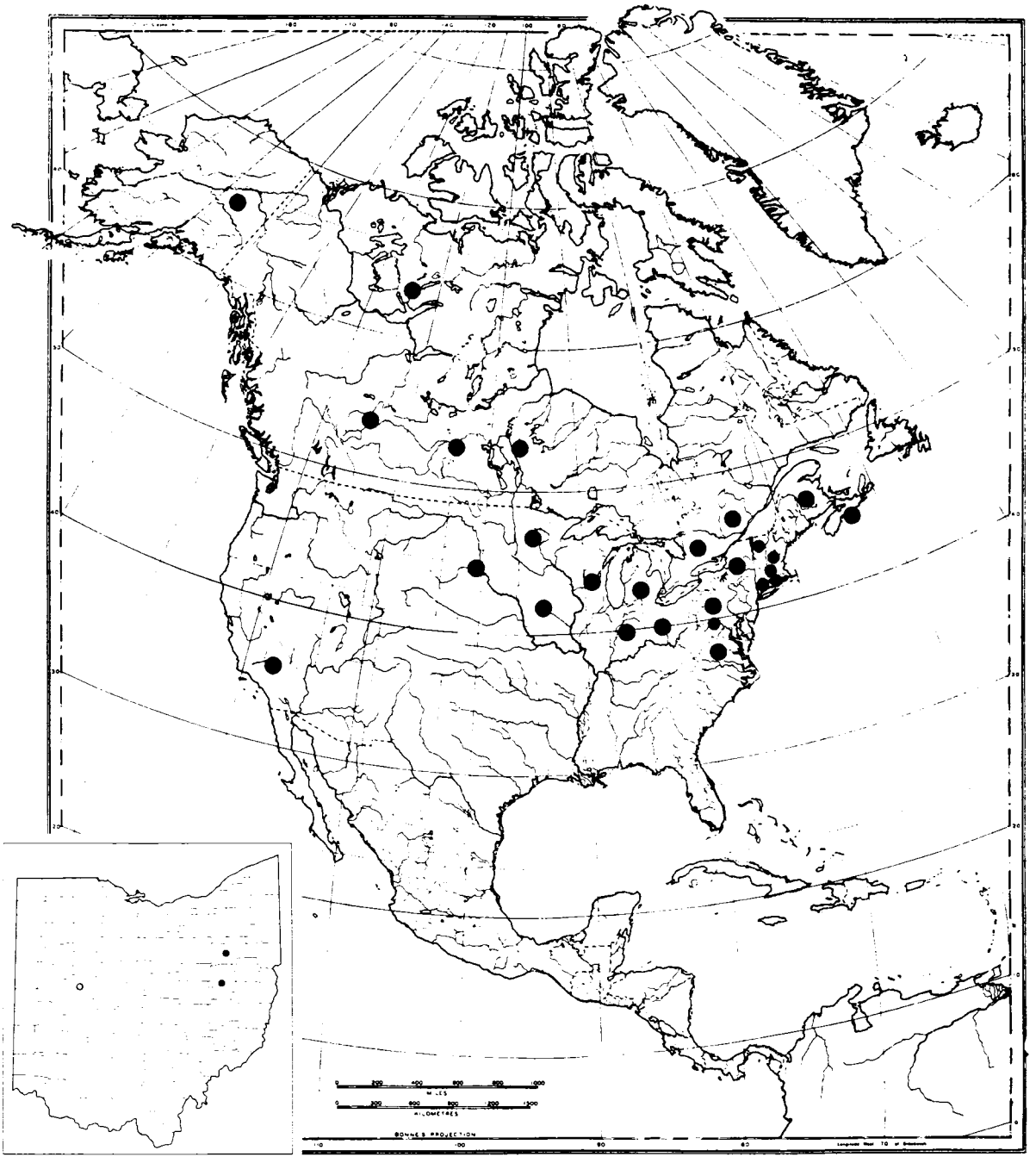


FIGURE 345.—Distribution of *Gyraulus hirsutus* in North America; *inset,* distribution in Ohio.

species with 'reamed out' left side, like *parvus* and *vermicularis,* which have narrower and smoother whorls than the species of typical *Gyraulus,* like *albus* and *deflectus.*" The subgenus is of special interest from the standpoint of Pleistocene faunas as it includes *G. altissimus,* one of the commonest and most widespread members of the genus.

Gyraulus parvus (Say) 1817
Pl. 12, figs. 2, 3, 5, 6, 8, 9, 11, 12, 15

Planorbis parvus Say 1817, Nicholson's Encycl., 1st ed., v. 2, pl. 1, fig. 5 (no pagination).
Planorbis elevatus Adams 1840, Boston Jour. Nat. History, v. 3, p. 327, pl. 3, fig. 16.
Planorbis billingsi Lea 1864, Acad. Nat. Sci. Philadelphia Proc., v. 3, p. 109.
Planorbis concavus Anthony 187?, Cat. shells Cincinnati (no pagination).
Gyraulus parvus Call 1900, Moll. Ind., p. 413, pl. 8, fig. 14.
Planorbis (Torquis) parvus Dall 1905, Harriman-Alaska Exped., v. 13, p. 96.
Planorbis parvus Sterki 1907, Ohio Acad. Sci. Proc., v. 8, p. 383.
Planorbis (Gyraulus) parvus Johnson 1915, Fauna New England, p. 191.
Planorbis parvus Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, Tinkers Creek marl; p. 182, Castalia marl.
Gyraulus parvus F. C. Baker 1920, Life of Pleistocene, p. 387.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 374, pl. 23, figs. 27-31, 39.
Planorbis parvus Dennis 1928, Aquatic gastr. Bass Is. region, p. 3.
Gyraulus parvus Goodrich 1932, Moll. Mich., p. 65.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 288.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 63, pl. 8, figs. 1, 2.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 294.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 100.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 58.

Type locality.—Delaware River, near Philadelphia, Pennsylvania.

Diagnosis.—Shell small, ultradextral, depressed, with a rounded periphery; shell color bright horn to jet black, commonly pearly; surface shining in the light colored specimens, dull in the dark examples; lines of growth oblique, crowded, fine, commonly crossed on the base by several fine spiral lines; nucleus small, rounded, sculpture of distinct spiral striae; whorls about 3½, rapidly enlarging, rounded below the periphery and somewhat flattened above on the body whorl and flattened above in all the spire whorls; spire flat, the first two whorls sunken below the body whorl; sutures very deeply impressed; base slightly concave, the body whorl flattened, umbilical region wide, shallow, exhibiting all the volutions; aperture long-ovate, very nearly in the same plane as the body whorl in most specimens but somewhat oblique in some examples; outer lip acute, thin, simple, the superior margin produced very much over the inferior margin; parietal wall with a thin wash of callus; interior of aperture yellowish white or whitish; L. 1.3, W. 3.5, Ap. L. 1.0, Ap. W. 1.2 mm. (Delaware River form, Baker collection).

Ecology.—Generally found in quiet bodies of water, mainly those of small size, on mud, sandy mud, sand, gravel, or boulder bottom; also on logs and vegetation, in shallow water a foot or more, up to 4 feet deep. Its ideal habitat seems to be vegetation, in protected situations.

Associations.—Living: MICHIGAN-10, 11; MINNESOTA-9, 10, 13b, 14b, 15, 16; NEW YORK-1, 38, 43; OHIO-10, 19, 20, 29, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 43; ONTARIO-7, 9; WISCONSIN-3, 5, 14, 16, 18, 27, 28, 29, 51, 54, 55, 68, 74, 79, 84, 85, 86, 89, 94, 104, 106, 107, 123, 124, 138. Fossil: P-1, 2; N-1, 2; A-1; S-6, 7; W-28, 60.

General distribution (fig. 346).—Eastern North America east of the Rocky Mountains from Florida to Alaska and northern Canada.

Distribution in Ohio (inset, fig. 346).—Sterki, 1907a, p. 383) gives "over the state, common and variable," which is borne out by Dennis' record for the Lake Erie region, a number of Eggleston records scattered over most of the State, and University of Michigan records, as well as by specimens in the Ohio State University collections.

Geologic range.—Middle Pliocene to present (Hibbard and Taylor, 1960, p. 100). In Ohio, the species has been recorded from the Tinkers Creek and Castalia marls (Sterki, 1920, p. 174, 182). It is a common Pleistocene species, recorded by D. W. Taylor and Hibbard (1955, p. 7, 10) from probable Illinoian, Sangamon, and Wisconsin faunas in Kansas.

Remarks.—The temptation to identify all small unangulated forms of *Gyraulus,* whether living or fossil, as this species should be resisted until the specimens have been compared with other species of the genus described in this report and elsewhere. For example, *Gyraulus arcticus* and *G. circumstriatus* are distinct enough to merit recognition and fossil material of these species is easily separated from *G. parvus* in most collections. Because of a tendency to lump everything under *G. parvus,* the distribution records are not as reliable as might be desired and careful comparisons are in order even when dealing with identified material.

Gyraulus altissimus (F. C. Baker) 1919
Fig. 347

Planorbis altissimus F. C. Baker 1919, Nautilus, v. 32, p. 95, pl. 7, figs. 7-10.
--- --- F. C. Baker 1920, Jour. Geology, p. 449, Rush Lake marl.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
--- --- F. C. Baker 1922, Jour. Geology, v. 30, p. 54.
--- --- F. C. Baker 1923, Ill. Acad. Sci. Trans., v. 15, p. 413.
Gyraulus altissimus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 382, pl. 22, figs. 10-17.
--- --- Goodrich and van der Schalie 1944, Revis.

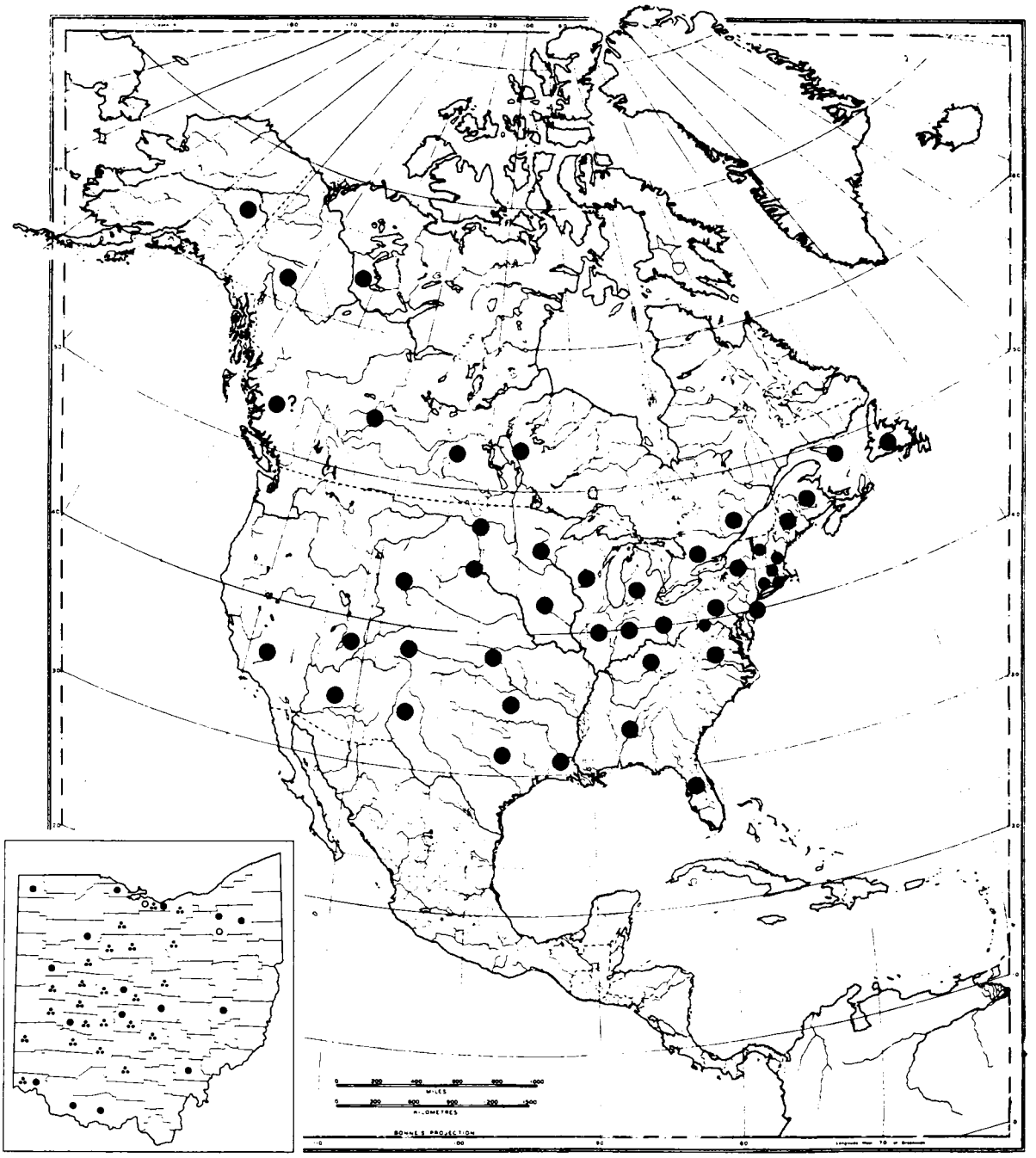


FIGURE 346.–Distribution of *Gyraulus parvus* in North America; *inset*, distribution in Ohio.

Moll. Ind., p. 288.
Gyraulus altissimus Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 64, pl. 8, figs. 4, 7.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 293.

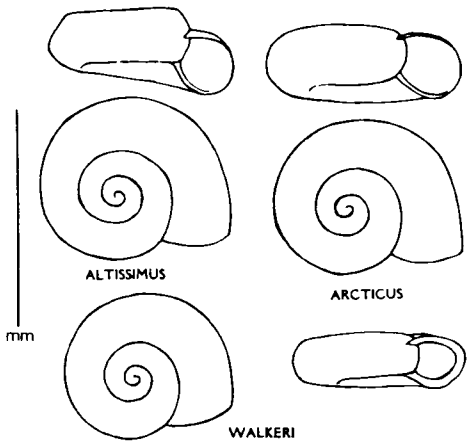


FIGURE 347.—*Gyraulus altissimus* and related species, shells greatly enlarged; after F. C. Baker (1928a, pt. I, p. 375, fig. 162).

Type locality.—Urbana, Illinois, in Pleistocene deposits.

Diagnosis.—Shell depressed, with flatly rounded periphery which is located below the center of the whorl; lines of growth fine, crowded, but surface without spiral ornamentation; whorls 4, regularly increasing in diameter, sloping flatly to the rounded periphery; spire whorls sunken below the general level of the surface, the whorls forming a rather sharp V-shaped suture, causing the shell to resemble a miniature *Helisoma anceps* and producing a subacute carina on the upper surface of the whorls; base of shell deeply concave, forming a wide saucer-shaped depression and umbilicus; the earlier whorls are carinate on the under side but the last whorl is flatly rounded; the last half of the body whorl is markedly deflected in typical examples, forming a contact with but half of the preceding whorl; aperture roundly ovate, shouldered or arched above, the upper margin much produced over the lower margin, the parietal callus joining the margins and causing the aperture to be continuous; the nuclear whorl is ornamented as in *G. deflectus* and *G. parvus;* L. 2.0, W. 4.5, Ap. L. 1.5, Ap. W. 1.5 mm., type (modified from F. C. Baker, 1928a, pt. I, p. 382).

Ecology.—This species, from its association with other mollusks in Pleistocene deposits, can be said to have preferred shallow bodies of water with abundant vegetation. The contrast between its relative numbers in the same body of water before and after the development of abundant vegetation has been brought out by the writer (La Rocque, 1952, p. 12), who showed an increase from about 10 percent of the fauna before development of abundant vegetation to about 82 percent after the change. In the same work (1952, p. 15) I compared this species with *G. arcticus* of the living fauna; Zimmerman (1961) has rightly pointed out that comparison with *G. parvus* is more to the point as both species belong to the same subgenus whereas *G. arcticus* belongs under *Gyraulus s.s.* The comparison does not change the conclusions arrived at above but it indicates a somewhat different pH and fixed carbon dioxide range for the species.

Associations.—Living: MINNESOTA-17. Fossil: W-29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 72.

General distribution (fig. 348).—Pleistocene of Ohio, Indiana, Illinois, Michigan, Ontario; interglacial, Toronto, Ontario. Russell (1934, p. 35) reports it also from interglacial deposits in southern Saskatchewan. In the same paper he records it from Wadena, Saskatchewan, north shore of Fishing Lake, living.

Distribution in Ohio (inset, fig. 348).—The species occurs only as a Pleistocene fossil, at least so far, in Ohio.

Geologic range.—"Wabash" (late Wisconsin) only, according to Baker (1920a, p. 387). It is one of the most abundant species in marl deposits and has been found in the following deposits in Ohio: Orleton (La Rocque, 1952), Humboldt (Reynolds, 1959, p. 55), Rush Lake marl (Baker, 1920b, p. 449), Newell Lake (Zimmerman, 1960, p. 20), Jewell Hill (Mowery, 1961, p. 10), Aultman (Sheatsley, 1960, p. 88), Oakhurst (Aukeman, 1960, p. 92), Souder Lake (Cornejo, 1961, fig. 11), Castalia (Clark, 1961, p. 24).

Gyraulus circumstriatus (Tryon) 1866
Pl. 12, figs. 10, 13, 14, 16-18

Planorbis (Gyraulus) circumstriatus Tryon 1866, Am. Jour. Conchology, v. 2, p. 113.
Planorbis circumlineatus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
Planorbis circumstriatus Walker 1918, Synopsis and cat. fresh-water Moll., p. 97.
Planorbis parvus urbanensis F. C. Baker 1919, Nautilus, v. 32, p. 94, pl. 7, figs. 4-6.
Gyraulus circumstriatus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 378, fig. 162.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 288.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 64.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 293.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 96.

Gyraulus circumstriatus Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 57.

Type locality.—Artificial pond at Weatogue, Connecticut.

Diagnosis.—Shell with rounded periphery, but body whorl slightly flattened above, obtusely subangulate below; sculpture of rather coarse growth lines with fine spiral lines frequently visible; on the base there are commonly several raised revolving lines; whorls about 4½, slowly and regularly increasing in diameter, all commonly in the same plane; sutures deeply impressed, the spire whorls rounded; base flattened, with all whorls visible to spire; body whorl slightly rounded, not flattened as in *G. parvus;* aperture roundly ovate, not as oblique as in *G. parvus;* lips often joined by

FIGURE 348.—Distribution of *Gyraulus altissimus* in North America; *inset,* distribution in Ohio.

parietal callus; L. 1.5, W. 6.0, Ap. L. --, Ap. W. -- (Tryon's type) (modified from F. C. Baker, 1928a, pt. I, p. 378).

Ecology.—The types came from an artificial pond, but specimens have been collected in spring-fed pools and small lakes, in clear water, on water cress, and even on clean sand bottom with no vegetation.

Associations.—Living: MINNESOTA - 12, 19; OHIO - 43; WISCONSIN - 43, 79, 85, 95, 123. Fossil: S - 2, 3, 4, 5, 6. *G. circumstriatus walkeri,* living: NEW YORK - 1.

General distribution (fig. 349).—Connecticut west to Wisconsin; the species ranges at least as far south as Ohio.

Distribution in Ohio (inset, fig. 349).—Sterki (1907a, p. 383) gave "Summit and Tuscarawas Counties." I have no other records.

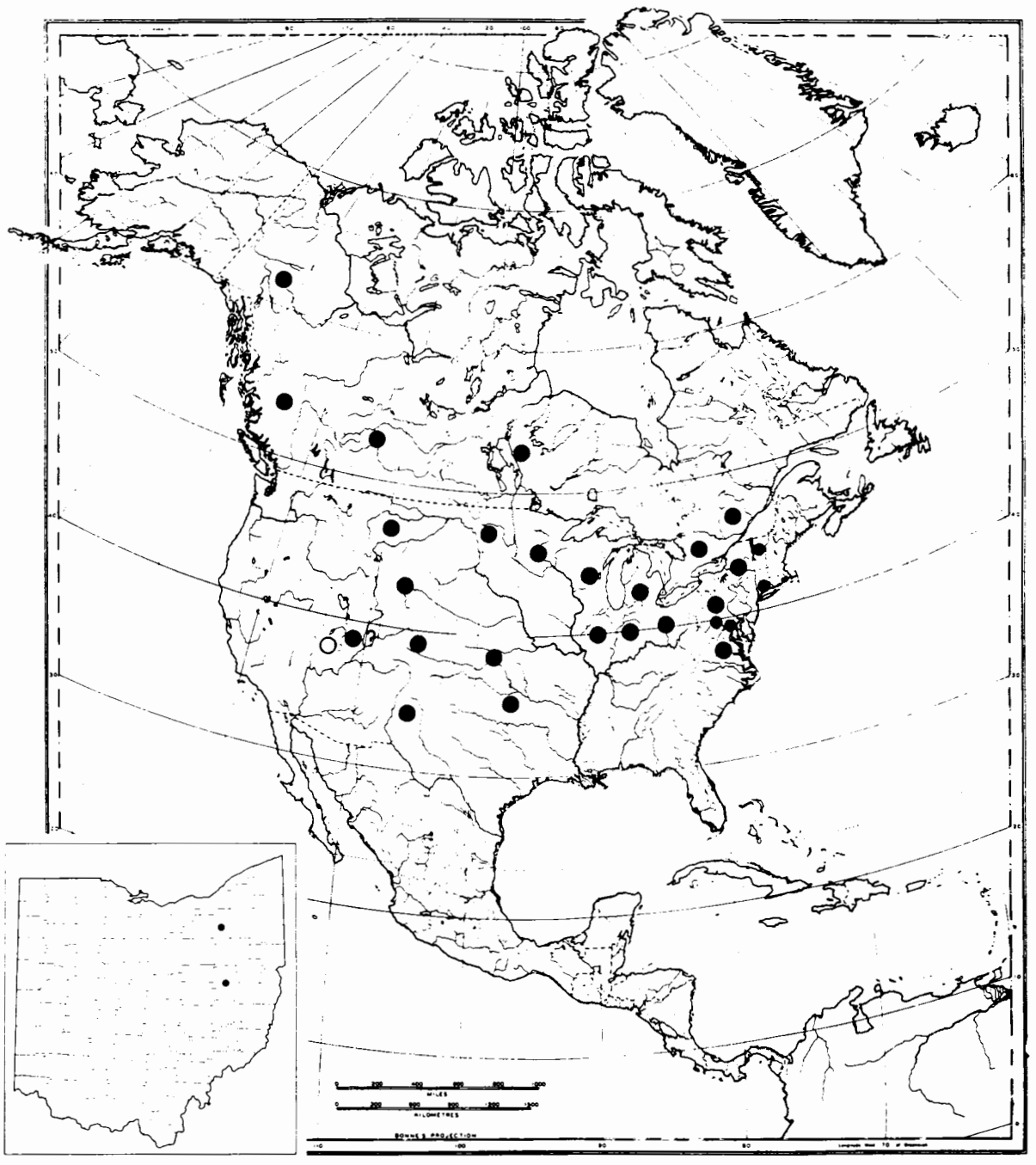


FIGURE 349.—Distribution of *Gyraulus circumstriatus* in North America; *inset,* distribution in Ohio.

Geologic range.—Middle Pleistocene (Kansan) to Recent (Hibbard and Taylor, 1960, p. 96).

Remarks.—The variety *walkeri* (Vanatta) should be found in Ohio as its range is "Ontario and Quebec, Vermont and New York, south to Illinois and Indiana" (La Rocque, 1953, p. 293) but so far there are no records. The variety is described by Baker (1928a, pt. I, p. 379).

Genus *Armiger* Hartmann 1840

Armiger Hartmann 1840, Syst. ubers. Europ. Gatt., table.
Armiger F. C. Baker 1945, Moll. family Planorbidae, p. 75.
Armiger Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 58.

Type.—*Nautilus crista* Linnaeus, by designation of Hartmann, 1842.

Diagnosis.—Shell ultradextral, small, with few rapidly increasing costate whorls, the costae usually projecting at the periphery; the general form is like that of *Gyraulus* (F. C. Baker, 1945, p. 76).

Remarks.—Baker (1945, p. 75) recognizes this as a genus but it should be noted that the soft parts, as described by Baker, are closely related to those of *Gyraulus*. The current custom of considering it a genus is followed here, though with some misgivings.

Speciation.—Baker (1945, p. 78) recognizes three species and one variety, including *A. crista* (Linnaeus), the type species. He also mentions that the genus is first known from the middle Miocene; probably this means that several fossil species should also be recognized. In north America the genus is represented only by the type species; others live in northern Europe and Asia.

Armiger crista (Linnaeus) 1758
Fig. 350; pl. 9, figs. 1, 2

Nautilus crista Linnaeus 1758, Syst. Nat., 10th ed., p. 709.
Turbo nautileus Linnaeus 1767, Syst. Nat., 12th ed., p. 1241.
Planorbis imbricatus Müller 1774, Verm. Terr. et Fluv. Hist., p. 165.
Planorbis cristatus Draparnaud 1774, Hist. nat. Moll. France, p. 44, pl. 2, figs. 1-3.
Planorbis costatus De Tar and Beecher 1878, leaflet of one page, Albany, N.Y. (see F. C. Baker, 1906, Nautilus, v. 19, p. 120).
Planorbis nautileus Walker 1897, Nautilus, v. 10, p. 117; Hanham, 1897, Nautilus, v. 10, p. 130; Taylor, 1897, Nautilus, v. 10, p. 139.
Planorbis (Armiger) crista Dall 1905, Harriman-Alaska Exped., v. 13, p. 96.
Planorbis crista v. *cristatus* Drap., Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 400, "possibly to be found in Ohio."
Planorbis (Armiger) crista Johnson 1915, Fauna New England, p. 191.
Planorbis crista Walker 1918, Synopsis and cat. freshwater Moll., p. 13, fig. 34; p. 98.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Planorbis crista cristata F. C. Baker 1920, *ibid.*
Gyraulus (Armiger) crista F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 385, fig. 164.
Gyraulus cristus Goodrich 1932, Moll. Mich., p. 65.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 289.
Armiger crista Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 65, pl. 8, fig. 8.
Gyraulus crista La Rocque 1953, Cat. Recent Moll. Canada, p. 293.
Armiger crista Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 58.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 101.
Gyraulus crista Aukeman 1960, Oakhurst deposit, p. 93.
--- --- Sheatsley 1960, Aultman deposit, p. 91.
--- --- Clark 1961, Sterkiana, no. 3, p. 24.
--- --- Cornejo 1961, Sterkiana, no. 4, fig. 11.
--- --- Mowery 1961, Sterkiana, no. 4, p. 10.

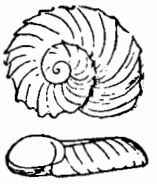


FIGURE 350.—*Armiger crista*, magnified; after Walker (1918, fig. 34, p. 13).

Type locality.—Europe.

Diagnosis.—Shell very small, ultradextral, depressed, fragile; color light corneous to brownish; surface shining; sculpture of rather coarse lines of growth crossed by very fine, crowded spiral striae; nucleus large, roundly ovate, sculptured with impressed spiral lines; whorls 2½, rapidly increasing in diameter, flatly rounded above, well rounded below, costate on the periphery where the costae project conspicuously; costae reduced to low ridges on the upper and lower surfaces; spire flat, the last part of the body whorl descending either below the ventral part of the second whorl or about to its periphery; umbilicus open to the apex; aperture ovate, flattened above, rounded below, appressed to the body whorl only a short distance; lip simple, thin; L. 5, W. 1.5, Ap. L. 4, Ap. W. 0.5 mm. (condensed from F. C. Baker, 1928a, pt. I, p. 385).

Ecology.—This species lives in small lakes with shallow, quiet water, muddy or silty bottoms, and abundant vegetation. It will survive even in seasonally dry

bog lakes and has been recorded from a brook in Maine, probably from weed-choked areas of shallow, quiet water. The fossil associations, in which it is generally a minor component, suggest that it is much more widespread than records for present-day lakes would indicate.

Associations.—Living: MICHIGAN-10; MINNESOTA-15, 17; ONTARIO-3. Fossil: W-27, 28, 35, 48, 49, 50, 51, 53, 54, 57, 58, 59.

General distribution (fig. 351).—Europe, Asia; North America, from Maine west to Alberta, south to California, central Utah, Illinois, Indiana, and Ohio. As a Pleistocene fossil, as far south as Texas.

Distribution in Ohio (inset, fig. 351).—Sterki (1907a, p. 400) listed this species as probably to be found in Ohio. Later (1920, p. 174) he found it in the Tinkers

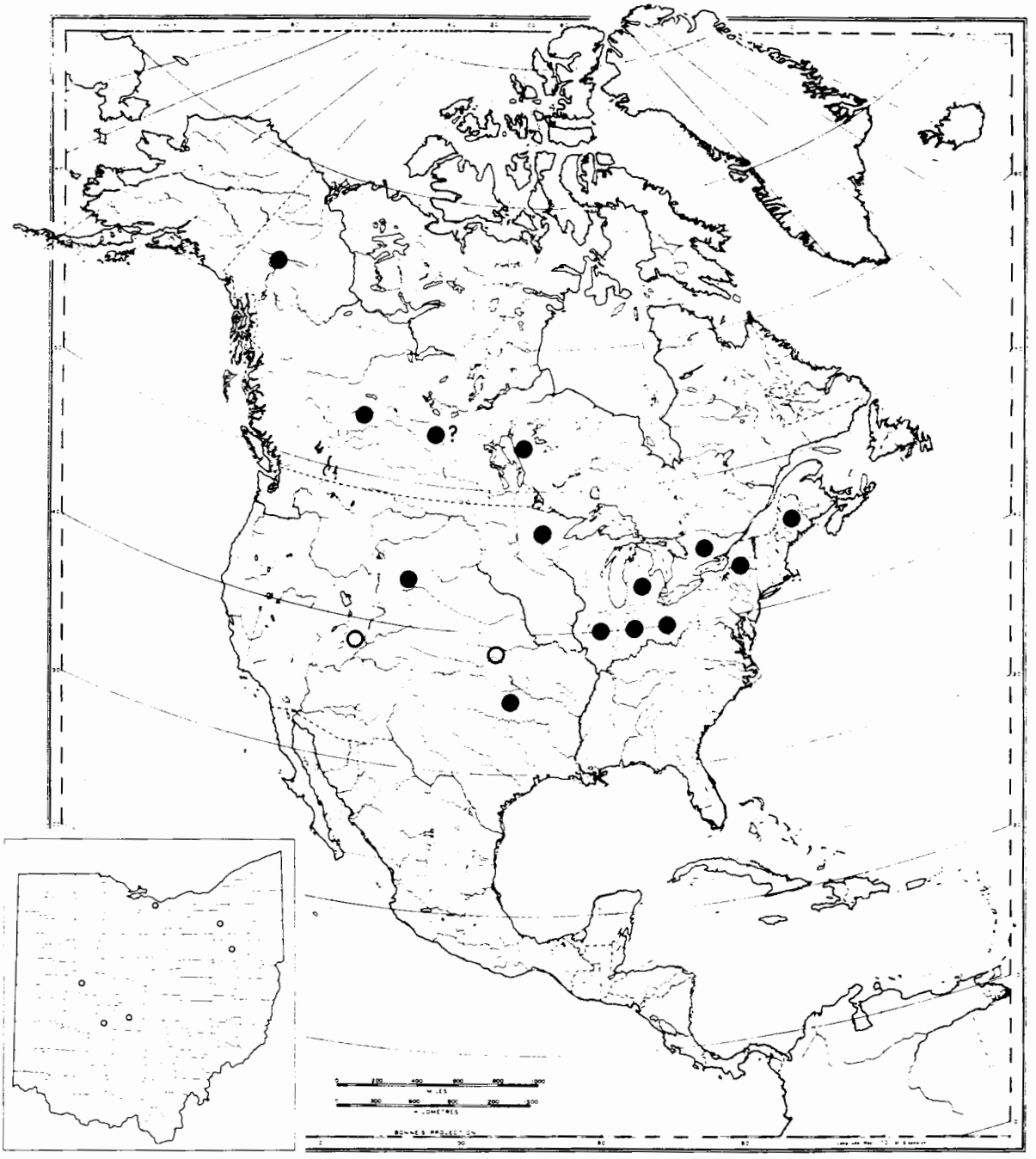


FIGURE 351.—Distribution of *Armiger crista* in North America; *inset,* distribution in Ohio.

Creek marl (on the line between Summit and Portage Counties) and in the Castalia marl (*ibid.*, p. 182), and mentioned that it was rare, "recent," in Ohio, Indiana, etc. It has been found in several Pleistocene deposits in Ohio: Orleton site (La Rocque, 1952, p. 12), Newell Lake deposit (Zimmerman, 1960, p. 20), etc.

Geologic range.—Late Pliocene to Recent. In North America, the oldest known occurrence is in the middle Pleistocene Tule Formation, Texas (Hibbard and Taylor, 1960, p. 101).

[Genus *Australorbis* Pilsbry 1934]

Australorbis Pilsbry 1934, Acad. Nat. Sci. Philadelphia Proc., v. 86, p. 55.
Australorbis F. C. Baker 1945, Moll. family Planorbidae, p. 90.

Type.—*Planorbis glabratus* Say.

Diagnosis.—Shell large, sinistral, biconcave, rather smooth, with numerous slowly increasing whorls; whorls rounded or angular laterally.

Remarks.—This is a South American group whose northernmost representatives live in the Caribbean islands and Florida. It is included here because of Sterki's record for the type species (see below).

[*Australorbis glabratus* (Say) 1818]

Planorbis glabratus Say 1818, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 280.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 99, does not range outside of Florida.
Australorbis glabratus F. C. Baker 1945, Moll. family Planorbidae, p. 93.
--- --- van der Schalie 1948, Land and fresh-water Moll. Puerto Rico, p. 101, pl. 9, fig. 5.

Remarks.—This species was recorded for Cincinnati by Sterki (1907a, p. 382), quoting Harper and Wetherby. If the identification is correct, this was an accidental introduction which did not survive.

Subfamily HELISOMATINAE F. C. Baker 1928

The anatomical characteristics are the only ones permitting of definite assignment of genera to this family, but F. C. Baker (1945, p. 123) includes here *Vorticifex, Perrinilla,* and *Pompholopsis* because of the similarities of their shells to those of *Carinifex* and *Parapholyx,* represented by living species. The subfamily is American, with the single rather doubtful exception of *Planorbarius,* and its genera form perhaps the most important planorbid element of the North American fauna.

The following genera of the subfamily are represented in the Ohio fauna: *Helisoma* and *Planorbarius,* a European genus of which one species appears sporadically in North America as a result of aquarium escapes. The genus *Helisoma* is discussed in detail but *Planorbarius* is only mentioned here, as Ohio records for *P. corneus* (Linnaeus) have not, to my knowledge, appeared in the literature.

Genus *Helisoma* Swainson 1840

Helisoma Swainson 1840, Treat. Malacology, p. 337 (*fide* Neave).
Helisoma Walker 1918, Synopsis and cat. fresh-water Moll., p. 11.
Helisoma F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 311.
Helisoma F. C. Baker 1945, Moll. family Planorbidae, p. 123.
Helisoma La Rocque 1953, Cat. Recent Moll. Canada, p. 286.

Type.—*Planorbis carinatus* Say, =*H. anceps* (Menke).

Diagnosis.—Shell large, ultrasinistral, of few whorls, the whorls carinate above and commonly below, rapidly enlarging; base funicular; aperture suddenly expanding and thickened; shell carried perpendicularly, not at a sharp angle.

Speciation.—The species considered valid by F. C. Baker (1945, p. 128) fall into four subgenera: *Helisoma s. s., Seminolina, Pierosoma,* and *Planorbella.* Three of these, the first and the last two, are represented in the Ohio fauna by one or more species. The subgenus *Seminolina* is confined to Florida.

Subgenus *Helisoma s. s.*

Helisoma s. s. F. C. Baker 1945, Moll. family Planorbidae, p. 124.

Diagnosis.—Shell large, sinistral, of comparatively few whorls which rapidly increase in size, carinated; spire and umbilicus funicular; aperture expanded, outer lip thickened.

Speciation.—F. C. Baker (1945, p. 128) recognizes only two species: *H. anceps* (Menke) and *H. eucosmium* (Bartsch).

Helisoma anceps (Menke) 1830
Pl. 13, figs. 1, 6, 7

Planorbis bicarinatus Say 1817, Nicholson's Encycl., 1st ed., v. 2, no. 2, pl. 1, fig. 4 (no pagination) (*non* Lamarck 1804).
Planorbis anceps Menke 1830, Syn. Meth., p. 36.
Planorbis antrosus Conrad 1834, Am. Jour. Sci., 1st

ser., v. 25, p. 343.

Planorbis engonatus Conrad 1834, New freshwater shells, Suppl., p. 8, pl. 9, fig. 8.

Helisoma bicarinata Call 1900, Moll. Ind., p. 411, pl. 8, fig. 10.

Planorbis (Helisoma) bicarinatus Dall 1905, Harriman-Alaska Exped., v. 13, p. 87, fig. 64.

Planorbis bicarinatus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.

Planorbis antrosus Johnson 1915, Fauna New England, p. 188.

--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 95.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.

Helisoma antrosa F. C. Baker 1928, Fresh water Moll.

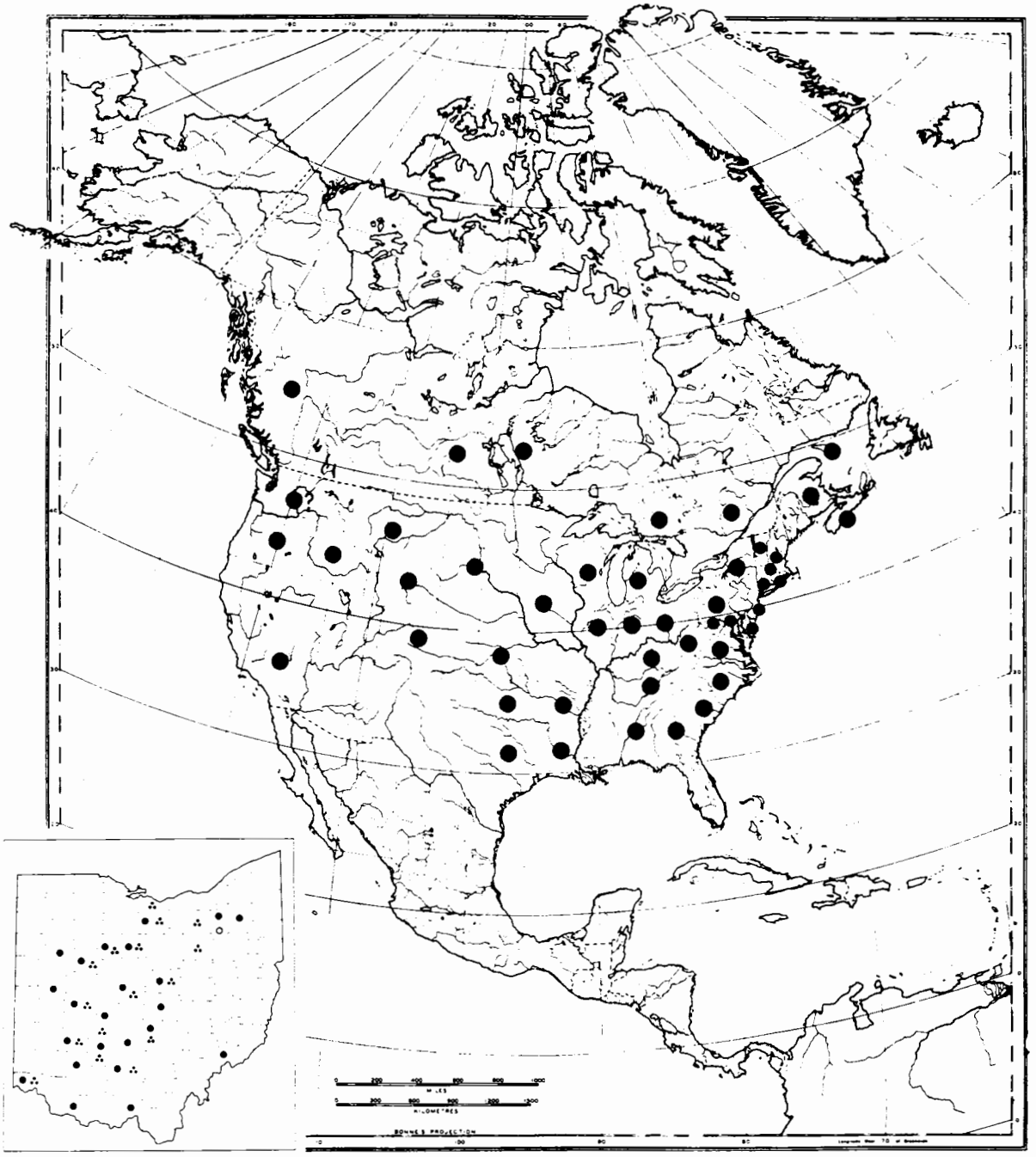


FIGURE 352.–Distribution of *Helisoma anceps* in North America; *inset,* distribution in Ohio.

Wis., pt. I, p. 317, pl. 19, figs. 8-15.
Helisoma antrosum Goodrich 1932, Moll. Mich., p. 62.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 287.
Helisoma anceps Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 65, pl. 6, figs. 31, 32.
Helisoma anceps anceps F. C. Baker 1945, Moll. family Planorbidae, p. 128 ff.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 286.
Helisoma anceps Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 103.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 58.

Type locality.—Virginia.

Diagnosis.—Shell discoidal, deeply concave above and below, yellow to dark brown; whorls about 4, sharply angled on the periphery of the early whorls and rounded on the body whorl; aperture ovate to lunate, commonly decidedly narrowed; outer lip thin at the edge and thickened within; L. 6.1, 8.0; W. 11.1, 15.0; Ap. L. 5.7, 8.0; Ap. W. 4.2, 5.5 mm. (modified from Goodrich, 1932, p. 62, and F. C. Baker, 1928a, pt. I, p. 318).

Ecology.—The typical form lives in rivers and creeks as do a number of more or less recognizable varieties; numerous varieties have been named which live in lakes of various sizes.

Associations.—Living: MANITOBA - 36; MICHIGAN - 10; NEW YORK - 2a, 6, 14, 15b, 21, 22, 30, 32, 37, 40a; OHIO - 43; ONTARIO - 7, 9; QUEBEC - 3, 8; WISCONSIN - 14, 15, 16, 19, 25, 27, 28, 29, 44, 46, 47, 56, 58, 73, 79, 81, 85, 89, 93, 100, 103, 104, 112, 116, 117, 123, 127, 128, 133. Fossil: P - 1; N - 1; K - 23, 27; I - 3; S - 1, 6; W - 29, 60.

General distribution (fig. 352).—The following data are for the species and all its varieties: Canada and United States, east of the Rockies, from about the latitude of Hudson Bay south to western Mexico. Pleistocene to present.

Distribution in Ohio (inset, fig. 352).—The species is found all over the State; Sterki, Eggleston, and others give specific localities so numerous that there is no point in enumerating them. The living varieties are scarcely worth differentiating and their distribu- in Ohio has not been worked out.

Geologic range.—Lower Pliocene to present (A. B. Leonard, 1950, p. 16; Hibbard and Taylor, 1960, p. 103).

Variation.—Baker (1945, p. 128, 219-221) recognized a number of varieties, several of them Pleistocene. Some of these, *e.g., H. anceps portagense* and *H. anceps latchfordi,* are difficult to separate as they are based mainly on trifling characteristics of the shell. To the writer, they seem to be unstable strains, persistent and numerous in restricted environments, such as a particular lake, but reverting to the typical form in outlets or rivers. As such, they seem less deserving of recognition than is implied by my treatment (La Rocque, 1953, p. 286 ff.) of them for the Canadian area and I am now inclined to consider them as local populations rather than true varieties. There may be exceptions to this rule; in fact, the Pleistocene form *H. anceps striatum* seems to be an outstanding one, but until the relationships of these groups are worked out, this is the only Pleistocene form given varietal rank in this report (see following variety or subspecies).

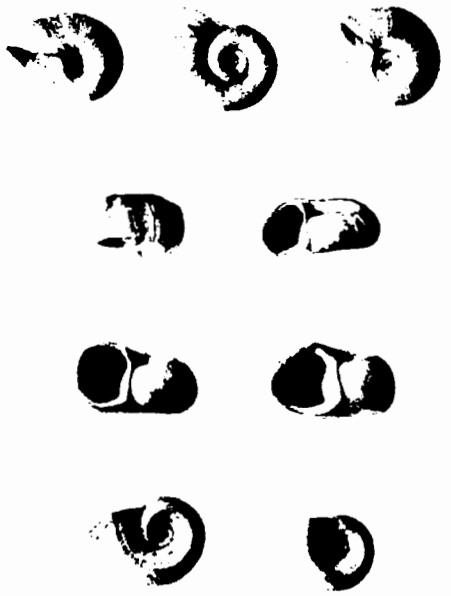


FIGURE 353.—*Helisoma anceps striatum,* X2; after Whittaker (1921, pl. 7, figs. 16a-i).

Helisoma anceps striatum (F. C. Baker) 1902
Fig. 353

Planorbis bicarinatus striatus F. C. Baker 1902, Nautilus, v. 15, p. 120.
Planorbis antrosus striatus Johnson 1915, Fauna New England, p. 189.
--- --- --- Walker 1918, Synopsis and cat. freshwater Moll., p. 96.
--- --- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 449, Rush Lake marl.
--- --- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Helisoma antrosa striata F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 328, pl. 19, figs. 28-31.
Helisoma antrosum striatum Goodrich 1932, Moll. Mich., p. 63.
Helisoma anceps striatum F. C. Baker 1945, Moll. family Planorbidae, p. 128.

Helisoma antrosa Leonard 1950 (part), Kans. Univ. Paleont. Contr., Moll., art. 3, p. 16, pl. 3, fig. B.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 21, pl. 2, figs. H, I.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 288.

Type locality.—Coldspring Park, Milwaukee, Wisconsin; Pleistocene.

Diagnosis.—Shell small, of 3½ whorls; dorsal and ventral carinae distinctly marked, cordlike, elevated; the dorsal carina is placed on the center of the upper side of the body whorl and not near the outer margin; body whorl commonly well rounded, not flattened; umbilicus small, deep; surface sculpture of heavy spiral lines which may become distinct ridges in many specimens; the aperture is higher than wide, more or less auriculate, commonly campanulate (modified from F. C. Baker, 1928a, pt. I, p. 328).

Ecology.—Found in lacustrine deposits, in marl, silt, and peaty marl. A number of these deposits have been studied in detail in Ohio (La Rocque, 1952, Reynolds, 1959, Zimmerman, 1960, etc.) and results indicate that this variety lived in shallow freshwater lakes with abundant vegetation, with pH as high as 8, and with fixed carbon dioxide of about 24 p.p.m. The water in these lakes was probably colder than that of present-day lakes in the same areas as there is evidence in several instances that the variety was living in the lake not long after the retreat of the ice, while mastodons were still roaming in the area. Baker's (1928a, pt. I, p. 328) assumptions concerning the ecology of this variety are valid; the studies mentioned above add considerable detail to his general statement.

Associations.—Living: MINNESOTA-10, 11b, 11c, 13b, 14b, 14c, 15, 16; WISCONSIN-1, 2. Fossil: W-29, 30, 31, 32, 33, 34, 36, 37, 38, 39, 41, 42, 45, 46, 47, 48, 49, 50, 51, 53, 54, 55.

General distribution (fig. 354).—Pleistocene deposits from Wisconsin and Illinois east to Quebec and south to Ohio and Indiana. The distribution needs revision and is probably more extensive than is indicated here.

Distribution in Ohio (inset, fig. 354).—Pleistocene marl deposits, early Wisconsin to late Wisconsin, in all parts of the State: Rush Lake marl (Baker, 1920b), Humboldt deposit (Reynolds, 1959, p. 155), Newell Lake deposit (Zimmerman, 1960, p. 20), Oakhurst deposit (Aukeman, 1960, p. 80), Aultman deposit (Sheatsley, 1960, p. 83), Souder Lake deposit (Cornejo, 1961, fig. 11), Jewell Hill deposit (Mowery, 1961, p. 10).

Geologic range.—The variety is recorded only for the Pleistocene but its exact range within it is not precisely known. Baker (1920a, p. 387) gives Yarmouth and "Wabash."

Remarks.—In all populations of this variety studied quantitatively, there was a small proportion of individuals that lacked one or more of the characteristics of the variety, either the well-defined carinae, the spiral striations, or the small size of the shell. Whenever a large number of individuals are studied, it can be seen that such atypical specimens are in a small minority and that the majority of individuals display the varietal characters. This pattern of variation seems to be sufficient reason to recognize the variety and to subordinate it to *H. anceps* (Menke) without giving it specific rank.

Subgenus *Pierosoma* Dall 1905

Pierosoma Dall 1905, Harriman-Alaska Exped., v. 13, p. 81, 85.
Pierosoma F. C. Baker 1945, Moll. family Planorbidae, p. 134.

Type.—*Planorbis trivolvis* Say, by original designation.

Diagnosis.—Shell large, sinistral, of few whorls, the last large and capacious, the early whorls commonly flattened and carinate above, widely umbilicate below; spire of the adult shell commonly flattened and sunk below the level of the body whorl; aperture notably expanded, even flared in some specimens, the outer lip thickened within; sculpture of coarse growth lines and conspicuous spiral lines; surface generally dull, never glossy as in *Seminolina* (modified from F. C. Baker, 1945, p. 135).

Speciation.—Baker (1945, p. 149) has recognized a long list of species as valid. The majority of these are not found in Ohio. The principal difficulty in this State is to recognize the variants named *pilsbryi, infracarinatum, trivolvis,* and their varieties or forms, especially for Pleistocene material for which only the shell is available. Baker had made extensive studies on the soft parts of this group before he died but had not yet related the shell characteristics to those of the soft parts to his complete satisfaction. Nevertheless, some of these forms are well known, so far as the shell is concerned, from specimens which would permit recognition if they are found in Pleistocene deposits. So far, however, all the Pleistocene material seen from Ohio, and a good deal of the living material as well, belongs under *H. trivolvis.*

Helisoma trivolvis (Say) 1817
Pl. 13, figs. 10, 14, 17

Planorbis trivolvis Say 1817, Nicholson's Encycl., Am. ed., v. 2, pl. 2, fig. 2 (no pagination).
Bulla fluviatilis Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 178 (juvenile).
Planorbis regularis Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 32 (immature).

Physa planorbula De Kay 1843, Zoology N. Y., p. 76, pl. 5, fig. 83 (juvenile).
Planorbis megastoma De Kay 1843, *ibid.*, p. 61, pl. 4, figs. 60, 61.
Planorbis macrostomus Whiteaves 1863, Canad. Naturalist, v. 8, p. 113, fig.
Helisoma trivolvis Call 1900, Moll. Ind., p. 411, pl. 8, fig. 11.
Planorbis (Pierosoma) trivolvis Dall 1905, Harriman-Alaska Exped., v. 13, p. 88, fig. 68.
Planorbis trivolvis Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 382.
Planorbis trivolvis lentus Sterki 1907, *ibid.*, p. 383.
Planorbis trivolvis binneyi Sterki 1914, Ohio Natural-

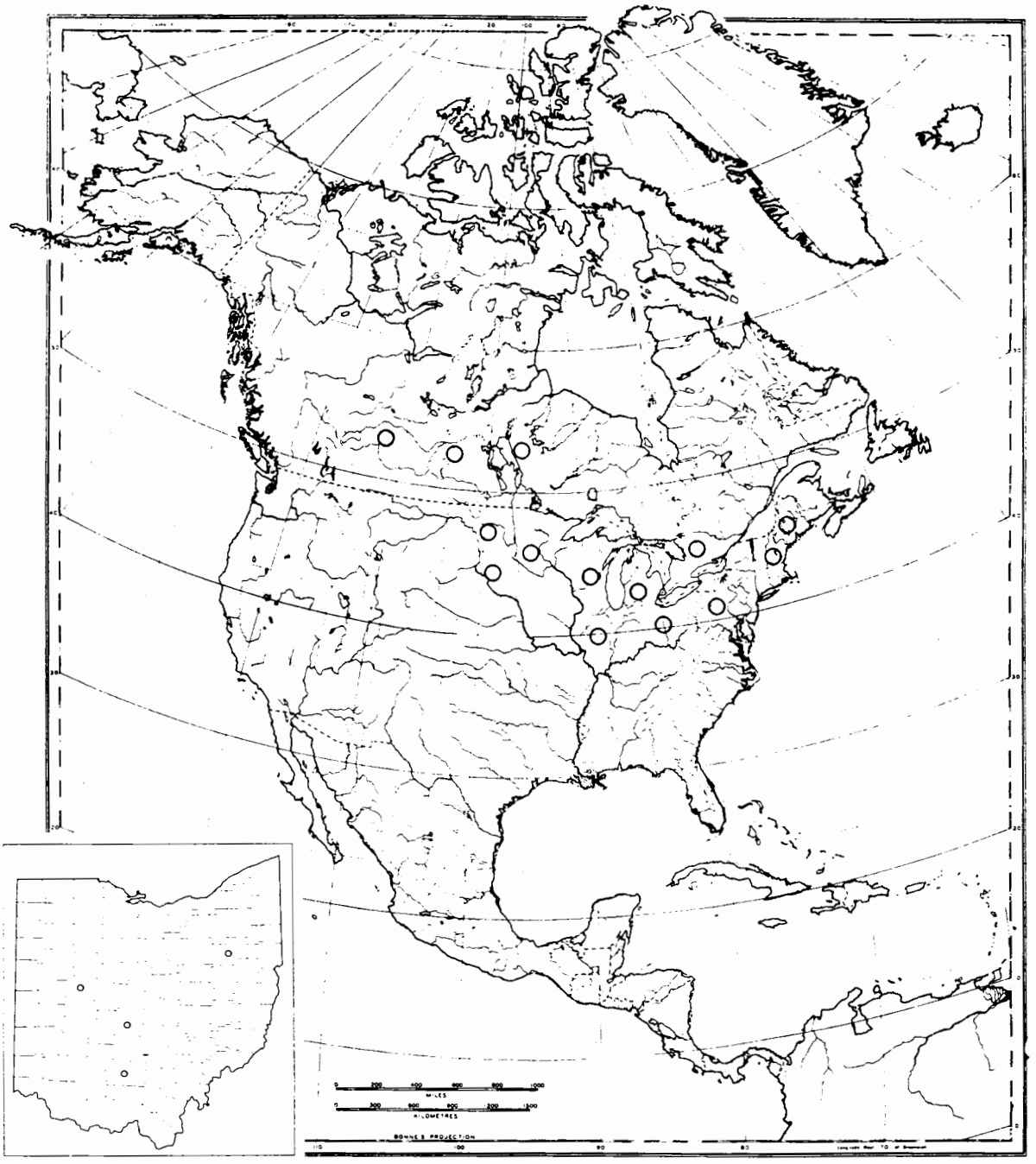


FIGURE 354.–Distribution of *Helisoma anceps striatum* in North America; *inset,* distribution in Ohio.

ist, v. 14, p. 271.
Planorbis trivolvis Johnson 1915, Fauna New England, p. 189.
Planorbis binneyi Johnson 1915, *ibid.*
Planorbis trivolvis Walker 1918, Synopsis and cat. fresh-water Moll., p. 104.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Helisoma trivolvis F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 330, pl. 20, figs. 1-13, 22, 23.
Planorbis trivolvis Dennis 1928, Aquatic gastr. Bass Is. region, p. 3.
Helisoma trivolvis Goodrich 1932, Moll. Mich., p. 59.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 287.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 68, pl. 6, figs. 26, 33, 34; pl. 8, fig. 17.
Helisoma trivolvis trivolvis La Rocque 1953, Cat. Recent Moll. Canada, p. 291.
Helisoma trivolvis Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 104.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 59.

Type locality.—French Creek, near Lake Erie. This is probably the French Creek that flows into a tributary of Lake Erie in Pennsylvania, but it is worth noting that there is another French Creek, a tributary of Lake Erie, in Ohio.

Diagnosis.—Shell disclike, showing all whorls both above and below, light yellow to dark brown; whorls 4, covered with fine ridged growth lines, the early ones more or less angled; spire sunken below the level of the plane of the shell; aperture large, white or bluish; outer lip unreflected, but somewhat expanded, a little thickened within; size and proportions vary greatly; adult specimens generally show traces of former apertures, conspicuous because they break the regularity of the growth lines; dimensions of an average specimen, L. 14, W. 27, Ap. L. 12, Ap. W. 9 mm. (modified from Goodrich, 1932, p. 59, and F. C. Baker, 1928a, pt. I, p. 331).

Ecology.—A hardy species that will thrive in lakes, the more sluggish parts of rivers, ponds, creeks, and even ditches; it has been collected in woods pools that dry up completely in midsummer. Baker (1928a, pt. I, p. 332) emphasizes that it is always an inhabitant of quiet, more or less stagnant water. It seems to prefer a habitat with an abundance of vegetation but can live also on bottoms with sparse vegetation.

Associations.—Living: MANITOBA-8, 25; NEW YORK-1, 2b, 7, 15b, 18b, 31, 34, 35, 36, 37, 38, 39, 42; OHIO-18, 19, 20, 30, 37, 42, 43; ONTARIO-1, 3, 7, 9, 10; QUEBEC-3, 8; WISCONSIN-4, 10, 15, 23, 40, 42, 47, 49, 54, 59, 60, 68, 72, 79, 80, 81, 83, 86, 87, 89, 106, 112, 116, 117, 123, 125, 138. Fossil: N-2; K-2, 4, 14, 15, 17, 18, 21, 22, 23; S-1, 2, 6; W-25, 27, 28, 32, 35, 50, 51, 56, 57, 58.

General distribution (fig. 355).—Atlantic and Mississippi drainages, north to the Arctic coast of Canada and Alaska, south to Tennessee and Missouri. There is some doubt about some parts of this distribution as *H. trivolvis* may have been mistaken for some of the very similar western species.

Distribution in Ohio (inset, fig. 355).—Sterki (1907a, p. 382) gave "over the state, common and variable" and "Cincinnati; Columbus" for *H. trivolvis lentum.* The specimens assigned to *H. trivolvis* and its relatives in Ohio should be re-examined, but there is no doubt that the typical form of this species is found in the State.

Geologic range.—Pleistocene: Nebraskan or Aftonian to present. Baker (1920a, p. 387) gave Yarmouth, Sangamon, and "Wabash." Hibbard and Taylor (1960, p. 104) extended this to Nebraskan or Aftonian. In Ohio, it has been recorded for the following deposits: Humboldt (Reynolds, 1959, p. 155), Newell Lake (Zimmerman, 1960, p. 20), Oakhurst (Aukeman, 1960, p. 86), Jewell Hill (Mowery, 1961, p. 9), Castalia (Clark, 1961, p. 23), and Souder Lake (Cornejo, 1961, fig. 11). A. B. Leonard (1952, p. 21) records *H. trivolvis lentum* from the "Sappa silts to Recent."

Subgenus *Planorbella* Haldeman 1842

Planorbella Haldeman 1842, Mon. Limniades N. America, Physidae, p. 14.
Planorbella F. C. Baker 1945, Moll. family Planorbidae, p. 150.

Type.—*Planorbis campanulatus* Say, by original designation.

Diagnosis.—Shell sinistral, of medium size, resembling *Pierosoma* in general form but the last whorl notably restricted behind the aperture, which is campanulate (F. C. Baker, 1945, p. 150).

Remarks.—The gap of more than one hundred years between the two entries in the abbreviated summary above may be filled by reference to the second entry. A number of synonyms of *Planorbella* described through the years are not mentioned here as Baker has covered that aspect of the history of the subgenus.

Only two species are recognized by Baker of which only one, the type species, has been recorded for Ohio. The other, *Helisoma multivolvis* (Case), may be only an extreme variant of *H. campanulatum* (Say), as indicated by its relationship to a variety of that species, *H. campanulatum collinsi* (Baker), which can almost certainly be called intermediate between the two.

Helisoma campanulatum (Say) 1821
Fig. 356

Planorbis campanulatus Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 166.
Planorbis minor Dunker 1850, Conch. Cab., Limniades, p. 52, pl. 9, fig. 10.
Planorbella campanulata Call 1900, Moll. Ind., p. 410, pl. 8, fig. 12.
Planorbis (Planorbella) campanulatus Dall 1905, Harriman-Alaska Exped., v. 13, p. 90, fig. 70.
Planorbis campanulatus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
--- --- Johnson 1915, Fauna New England, p. 190.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.

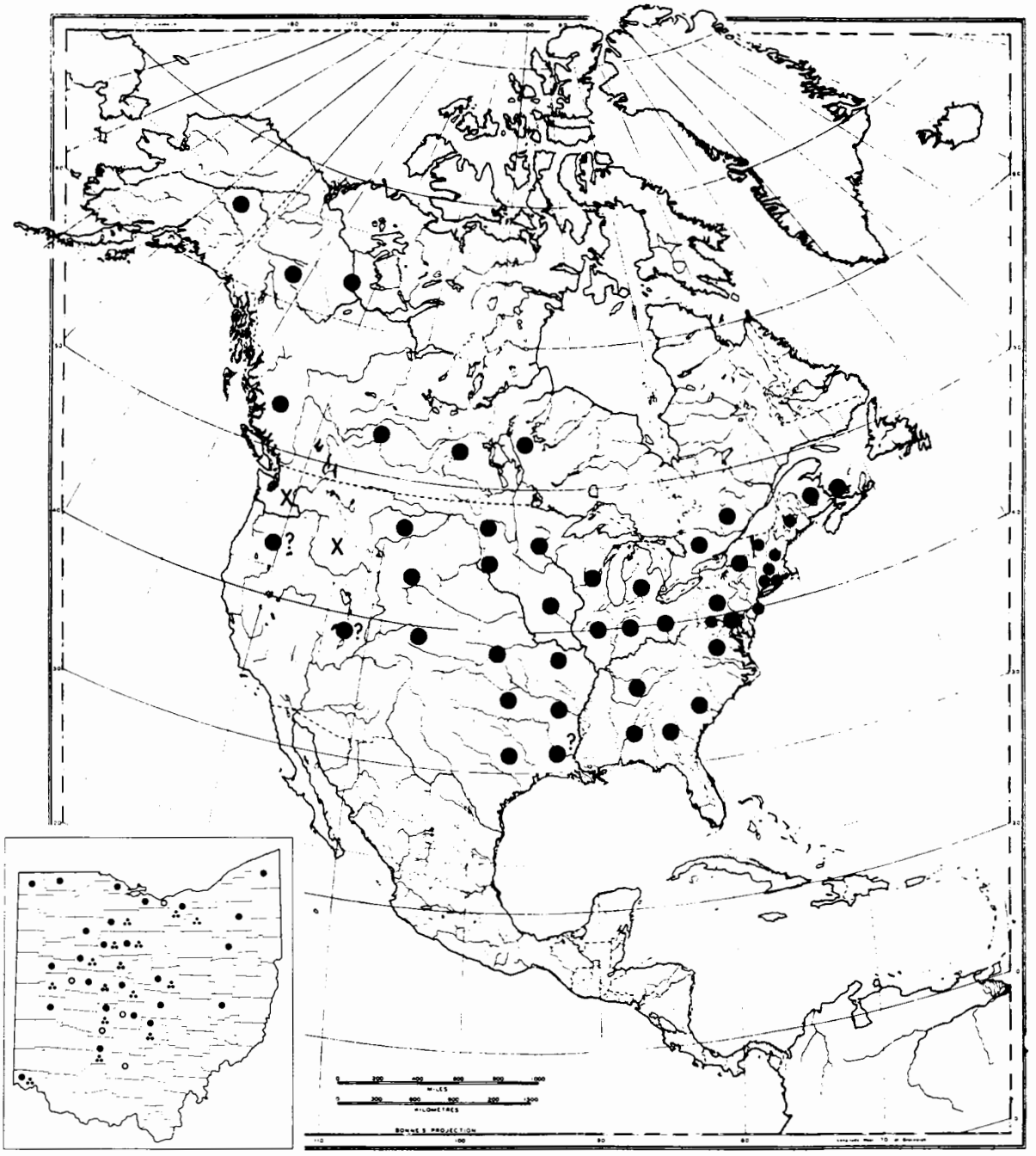


FIGURE 355.–Distribution of *Helisoma trivolvis* in North America; *inset*, distribution in Ohio.

Helisoma campanulata F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 345, pl. 21, figs. 1, 2, 4, 5, 8, 9, 13, 14.

Helisoma campanulatum Goodrich 1932, Moll. Mich., p. 63.

--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 288.

--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 69, pl. 6, figs. 35, 36.

Helisoma campanulatum campanulatum La Rocque 1953, Cat. Recent Moll. Canada, p. 288.

FIGURE 356.–*Helisoma campanulatum*, magnified, after Call (1900, pl. 8, fig. 12).

Type locality.–Cayuga Lake, New York.

Diagnosis.–Shell with the early whorls slightly raised above the later ones, rounded, more often smooth than noticeably striate; translucent white to brown; last whorl of adults pinched in before a flaring, bell-like outer lip; aperture narrowed at the throat; L. 5.5, W. 11 mm. (Goodrich, 1932, p. 63).

Ecology.–This species is characteristic of lakes, found in shallow water, with rock, sand, or mud bottom, with or without vegetation. It is also found in quiet parts of rivers and even small creeks.

Associations.–Living: MINNESOTA - 10, 11b, 11c, 13a, 13b, 14a, 14b, 14c, 15, 16, 17; NEW YORK - 2a, 2b, 3b, 4a, 4b, 5b, 6, 7, 9, 10, 11, 14, 15b, 16, 21, 22, 23, 25, 27, 29, 30, 32, 34, 36, 37, 40a, 41, 42, 43, 44; OHIO - 29, 43; ONTARIO - 9; WISCONSIN - 1, 2, 3, 15, 19, 20, 23, 28, 29, 30, 42, 47, 68, 69, 79, 85, 87, 89, 90, 93, 94, 96, 97, 100, 112, 116, 123, 124, 128. Fossil: W - 27, 29, 33, 34, 38, 45, 46, 47, 48, 49, 50, 53, 54, 55.

General distribution (fig. 357).–Vermont west to North Dakota, south to Ohio and Illinois, north to the Mackenzie drainage.

Distribution in Ohio (inset, fig. 357).–Sterki (1907a, p. 383) recorded the species only for Summit, Stark, and Tuscarawas Counties. Eggleston (ms. records) adds Portage and Licking Counties. It is also found in Lake Erie (Sandusky Bay, Ohio State University collection) and should be found in most counties of the State. Its apparent absence in the western part of Ohio may be due to lack of collecting, as it does occur in Indiana and Michigan. It is an abundant fossil in Pleistocene deposits of Ohio.

Geologic range.–Pleistocene: Late Wisconsin. Pleistocene of North America, at least as far south as Ohio, Indiana, and Illinois, but apparently not as far south as Kansas or Oklahoma. F. C. Baker (1920a, p. 387) gave only "Wabash." In Ohio it occurs in the following late Wisconsin deposits: Oakhurst (Aukeman, 1960, p. 84), Aultman (Sheatsley, 1960, p. 86), Souder Lake (Cornejo, 1961, fig. 11), and Jewell Hill (Mowery, 1961, p. 6).

Subfamily PLANORBULINAE Pilsbry 1934

Planorbulinae Pilsbry 1934, Rev. Planorbidae Fla., p. 54.

Planorbulinae F. C. Baker 1945, Moll. family Planorbidae, p. 172.

The genera of this subfamily have been grouped together on the basis of anatomical characters (F. C. Baker, 1945, p. 172). The subfamily is represented in the Ohio fauna by the following genera: *Planorbula*, *Promenetus*, and *Menetus*. These genera differ greatly in their shell characteristics; *Planorbula* has a number of teeth which obstruct the body whorl at some distance inside the aperture, whereas the other two genera have none. *Promenetus* and *Menetus* at first sight appear to be more closely related to *Gyraulus* but Baker (1945, p. 172) places them in this subfamily on the basis of the soft parts. This group is an example of the danger of grouping genera into subfamilies and families on the basis of shell characters alone; in this respect the three genera of this subfamily would certainly be placed in different groups.

Genus *Planorbula* Haldeman 1842

Planorbula Haldeman 1843, Mon. Limniades N. America, pt. I, suppl., p. 2 (*fide* F. C. Baker, 1945, p. 172); *ibid.* pt. 6, p. 14 (*fide* Neave).

Planorbula Walker 1918, Synopsis and cat. fresh-water Moll., p. 14.

Planorbula F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 353.

Planorbula F. C. Baker 1945, Moll. family Planorbidae, p. 172.

Planorbula La Rocque 1953, Cat. Recent Moll. Canada, p. 291.

Type.–*Planorbis armigerus* Say.

Diagnosis.–Shell rather small, whorls few, slowly and regularly increasing, rounded or carinated above and below; aperture somewhat expanded, lip more or less thickened within; a single persistent set of 6 dentiform lamellae at a short distance within the aperture (Walker, 1918).

Remarks.–The genus is subdivided by F. C. Baker (1945, p. 172 ff.) into two subgenera, of which only *Planorbula s. s.* occurs in Ohio. The other subgenus (*Haldemanina* Dall 1905) is restricted, so far as known, to the State of Alabama.

Speciation.–The species of the northern United States and Canada have quite often in the past been referred to the single species *P. armigera* (Say). Three

other species were accepted by Baker (1945, p. 176) of which one, *P. crassilabris* (Walker), occurs in Ohio; the other, *P. jenksii* (H. F. Carpenter), may eventually be found in Ohio also. The other species, *P. campestris* (Dawson), is more northern and western. See La Rocque (1953, p. 292) for details on these species. A. B. Leonard (1950, p. 17) notes two Yarmouth species, *Planorbula nebraskensis* Leonard, and *P. vulcanata* Leonard and its variety, *P. vulcanata occidentalis* Leonard, all apparently confined to deposits of Yarmouth age. These species should be looked for in Yarmouth deposits in Ohio and elsewhere. *P. vulcanata* is considered by Hibbard and Taylor (1960, p. 105) to be a synonym of *P. armigera* (Say) and they consider it possible that *P. nebraskensis* and *P. vulcanata occidentalis* may also be synonyms of Say's species.

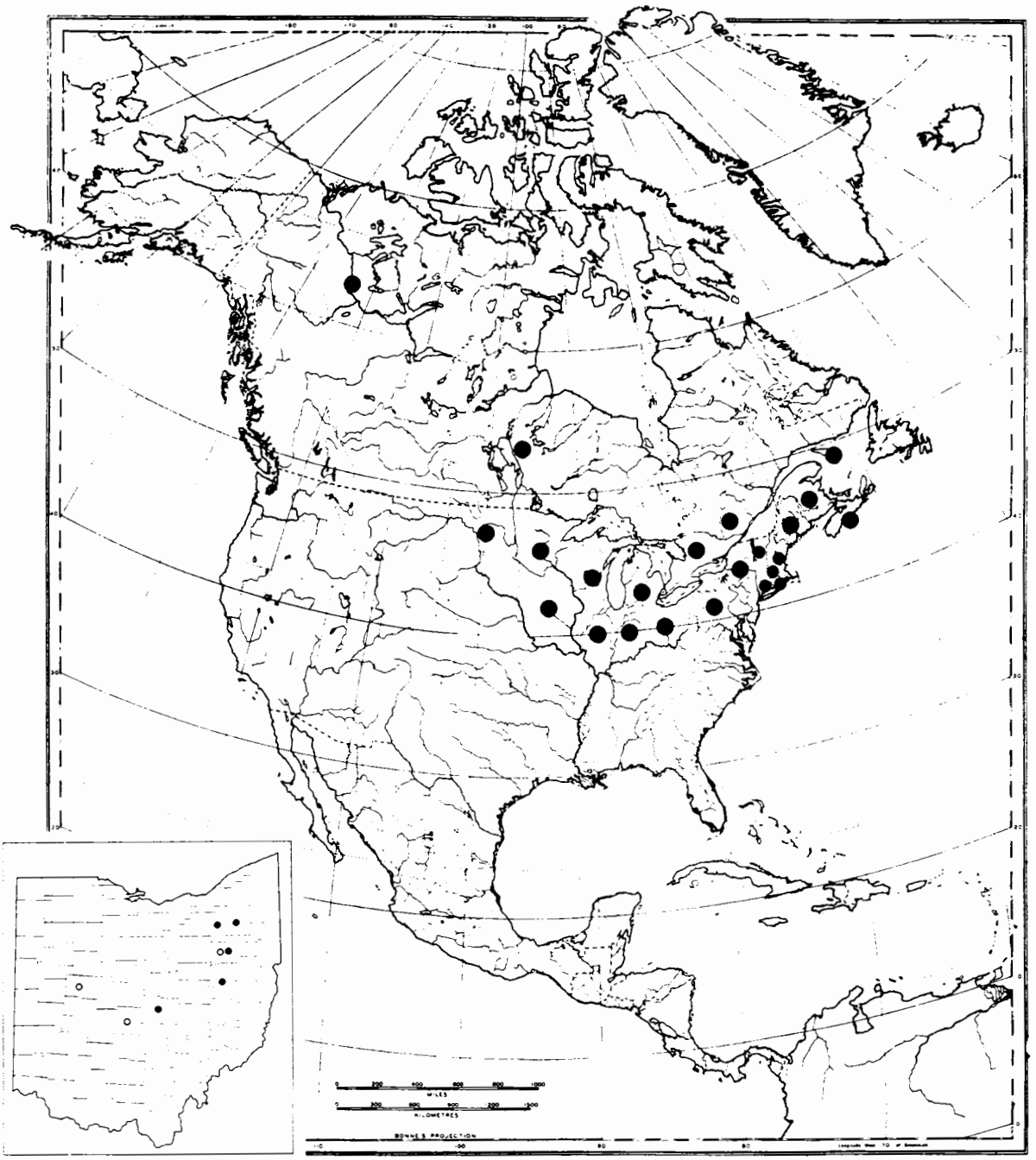


FIGURE 357.–Distribution of *Helisoma campanulatum* in North America; *inset,* distribution in Ohio.

Planorbula armigera (Say) 1818
Figs. 358, 360

Planorbis armigerus Say 1818, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 164.
Planorbis lautus H. Adams 1861, Zool. Soc. London Proc., p. 145.
Segmentina (Planorbula) armigera Dall 1905, Harriman-Alaska Exped., v. 13, p. 98, fig. 76.
Segmentina armigera Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
--- --- Johnson 1915, Fauna New England, p. 192.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 104.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Planorbula armigera F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 355, pl. 8, figs. 27-30.
--- --- Goodrich 1932, Moll. Mich., p. 67.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 289.
--- --- F. C. Baker 1945, Moll. family Planorbidae, p. 176.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 291.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 105.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 59.

FIGURE 358.—*Planorbula armigera,* magnified; after Walker (1918, p. 14).

Type locality.—Upper Missouri.

Diagnosis.—Shell flat, disclike, thicker than in species of *Gyraulus;* reddish to brown, and usually black when found; whorls 4, rounded on top and base, all of them showing in the umbilicus, aperture nearly round, narrowed by long teeth, a large and a small one on the parietal wall, four arranged around the curve of and inside the outer lip; these four show through the shell substance of the cleaned specimen; L. 3, W. 8 mm. (modified from Goodrich, 1932, p. 67).

Ecology.—This is a species of small stagnant bodies of water, found even in marshy areas in disconnected pools of water. It seems to prefer mud bottom but can accommodate itself to a bottom of meadow grass and can also live on logs. It seldom lives in water more than three feet deep.

Associations.—Living: MANITOBA - 10; MICHIGAN - 10, 12, 14; MINNESOTA - 15; OHIO - 43; WISCONSIN - 4, 106, 107, 112, 136, 138. Fossil: N - 1, 2; W - 28, 35, 51, 56, 57, 58, 59.

General distribution (fig. 359).—New England to Great Slave Lake; Manitoba, Saskatchewan, and Ontario, south to Georgia and Louisiana.

Distribution in Ohio (inset, fig. 359).—Sterki (1907a, p. 383) merely gave "over the state"; Eggleston (ms. records) has it from Ottawa, Erie (fossil), and Stark Counties; University of Michigan records are for Fulton, Hancock, Auglaize, and Mercer Counties. It is also found in Sandusky Bay (Ohio State University collection).

Geologic range.—Nebraskan to present. Aftonian, Sangamon, and "Wabash" (F. C. Baker, 1920a, p. 387). Illinoian of Kansas (Hibbard and Taylor, 1960, p. 105). Nebraskan, and Nebraskan or earliest Aftonian (D. W. Taylor, 1960, p. 59). In Ohio, it has been identified from the following deposits: Newell Lake (Zimmerman, 1960, p. 20), Jewell Hill (Mowery, 1961, p. 10), and Castalia (Clark, 1961, p. 23).

Planorbula crassilabris (Walker) 1907
Fig. 360

Segmentina crassilabris Walker 1907, Nautilus, v. 20, p. 122, pl. 7, figs. 4-6.
--- --- Sterki 1914, Ohio Naturalist, v. 14, p. 271.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 104.
Planorbula crassilabris F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 359, pl. 8, figs. 24-26.
--- --- Goodrich 1932, Moll. Mich., p. 67.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 289.
--- --- F. C. Baker 1945, Moll. family Planorbidae, p. 176.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 292.

Type locality.—Hamtramck, Wayne County, Michigan. This former suburb of Detroit is now completely absorbed by the city. It is likely that the species is extinct there.

Diagnosis.—Shell smaller and more compactly coiled than that of *P. armigera,* higher in proportion to its width, umbilicus smaller and deeper, angulation of the base of the whorl around the umbilicus more pronounced; internally, the principal parietal lamella of *P. armigera* is much shorter, less oblique, and its anterior end is less curved and truncated than that of *P. crassilabris,* the palatal folds are all less developed, and the spaces between them consequently greater; the upper extremity of the basal fold is less deflected and scarcely noticeable externally; L. 3.0, W. 7.5 mm., type (Walker, 1907).

Ecology.—Similar to that of *P. armigera.*

Associations.—Living: MANITOBA - 4, 16, 20, 25, 31.

General distribution (fig. 361).—Michigan, Ohio, Indiana, Iowa; probably occurs also in other states.

Distribution in Ohio (inset, fig. 361).—Sterki (1914, p. 271) saw specimens from Wood County, collected by Goodrich; no further record is known to me.

Geologic range.—The species appears to be unknown as a fossil.

Genus *Promenetus* F. C. Baker 1935

Promenetus F. C. Baker 1935, Nautilus, v. 49, p. 48 (*fide* Neave).

Promenetus F. C. Baker 1945, Moll. family Planorbidae, p. 178.

Promenetus La Rocque 1953, Cat. Recent Moll. Canada, p. 292.

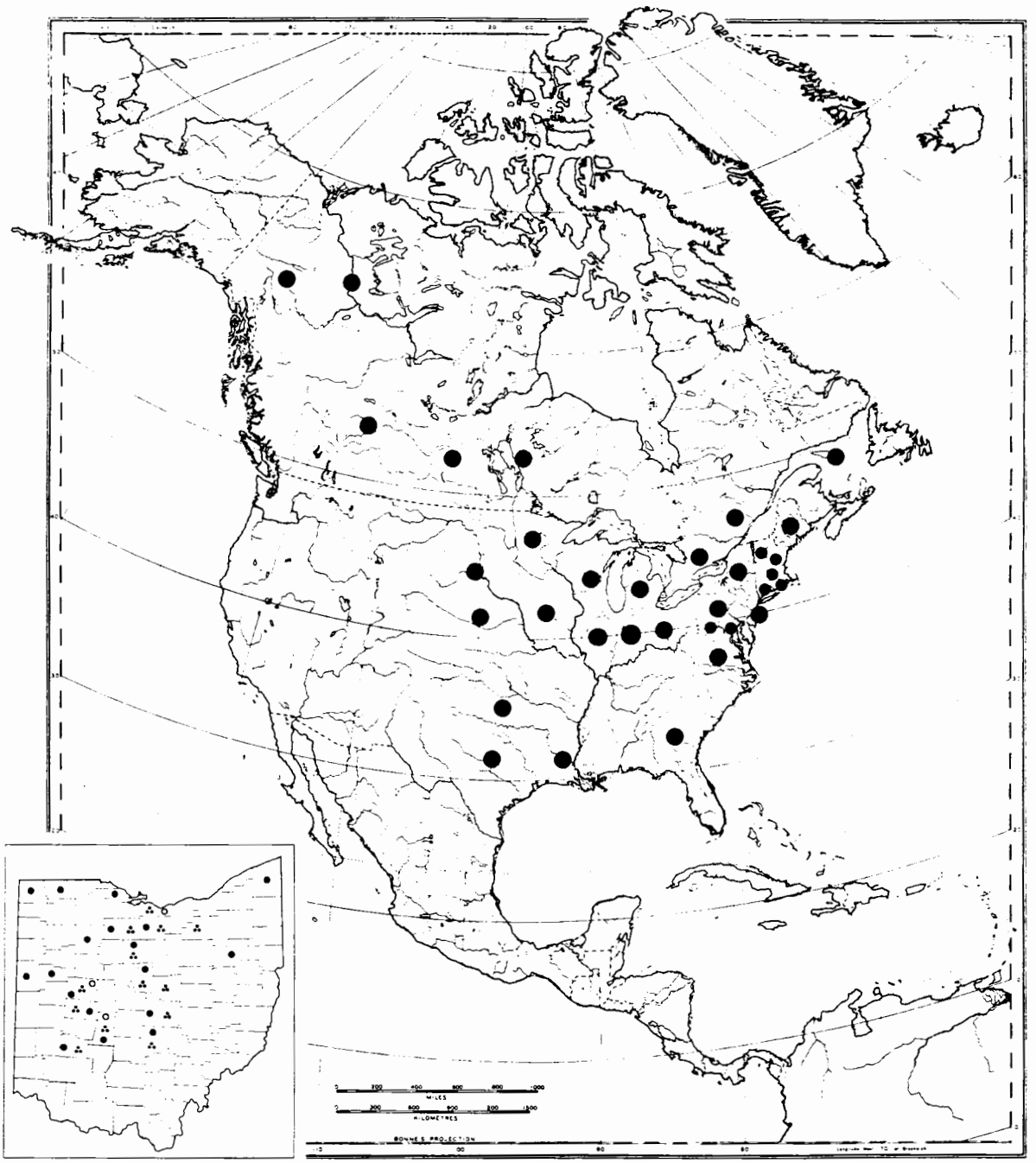


FIGURE 359.—Distribution of *Planorbula armigera* in North America; *inset,* distribution in Ohio.

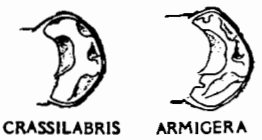


FIGURE 360.–*Planorbula crassilabris* and *Planorbula armigera;* apertural lamellae compared; magnified; after Winslow (1921).

Type.–*Planorbis exacuous* Say.

Diagnosis.–Ultradextral, lenticular, with a small number of rapidly increasing whorls, the last partly enveloping the preceding whorls; periphery carinated or rounded; apical whorls not much depressed; base with a narrow umbilicus; aperture oblique, wider than high; lip sharp.

Speciation.–F. C. Baker (1945, p. 182) recognizes five species, of which three (see following entries) occur in Ohio. He also recognizes one variety of *P. exacuous, megas* (Dall), which is northern in distribution.

FIGURE 361.–Distribution of *Planorbula crassilabris* in North America; *inset,* distribution in Ohio.

No subgenera are recognized.

Remarks.—Representatives of this genus are widely distributed, from Maine west to Washington and Oregon and from Hudson Bay and Alaska south to New Mexico and Alabama. One species *(P. imus)* is known from Bermuda.

Promenetus exacuous (Say) 1821
Fig. 362

Planorbis exacuous Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 168.
Planorbis exacutus Haldeman 1844, Mon. Limniades N. America, p. 21, pl. 4, figs. 1-3.
Menetus exacuous Call 1900, Moll. Ind., p. 412, pl. 8, fig. 24.
Planorbis (Menetus) exacuous Dall 1905, Harriman-Alaska Exped., v. 13, p. 91.
Planorbis exacuous Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
Planorbis (Menetus) exacuous Johnson 1915, Fauna New England, p. 190.
Planorbis exacuous Walker 1918, Synopsis and cat. fresh-water Moll., p. 99.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Menetus exacuous F. C. Baker 1928, Fresh water Moll. Wis., pt. 1, p. 361, pl. 23, figs. 1-5.
Planorbis exacutus Dennis 1928, Aquatic gastr. Bass Is. region, p. 3.
Menetus exacuous Goodrich 1932, Moll. Mich., p. 68.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 289.
Promenetus exacuous exacuous F. C. Baker 1945, Moll. family Planorbidae, p. 182, pl. 41, figs. 1-10; pl. 42, figs. 1-3, 7, 12; pl. 46, figs. 3, 4; pl. 48, figs. 4, 5; pl. 50, fig. 8; pl. 67, fig. 1; pl. 122, figs. 14-19, 26, 28.
Promenetus exacuous Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 70, pl. 8, figs. 5, 6.
Promenetus exacuous exacuous La Rocque 1953, Cat. Recent Moll. Canada, p. 292.
Promenetus exacuous Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 107.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 59.

FIGURE 362.—*Promenetus exacuous*, X2.5; after Goodrich (1932, p. 68).

Type locality.—Lake Champlain, New York, Vermont, and Quebec.

Diagnosis.—Shell very much depressed, with an acute periphery; light horn to brownish, shining; sculpture of fine lines of growth, commonly slightly elevated, crossed by very fine spiral lines under the corneous epidermis; nucleus small, rounded, sculptured with fine spiral lines; whorls 4, rapidly increasing in diameter, sloping in a flatly rounded curve to the acutely keeled periphery; spire very flat, all of the whorls in the same plane, or the apical whorls slightly sunken below the plane; sutures well impressed; base flatly convex; umbilicus rather narrow, deep, exhibiting all the volutions to the apex; aperture obliquely, obtusely triangular or ovate; outer lip thin, acute, the superior part very much produced beyond the inferior part and expanded near the periphery; outer lip a little thickened with callus on the inside; parietal wall with thin wash of callus.

Ecology.—Found in quiet, more or less marshy places, as a general rule, in shallow water with soft mud bottom; in streams, always on mud flats in quiet water, not in the more rapid parts of the streams.

Associations.—Living: MANITOBA - 4, 8, 10, 12, 16, 18, 21, 35; MICHIGAN - 10, 14; MINNESOTA - 13b, 15, 16, 17 (var. *megas*); NEW YORK - 1, 38; OHIO - 20, 29, 39, 41, 43; ONTARIO - 3, 9; QUEBEC - 1; WISCONSIN - 15, 42, 54, 58, 61, 79, 98, 116; 28, 59, 68, 79, 97 (var. *megas*). Fossil: S - 1; W - 27, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 45, 46, 47, 48, 49, 50, 51.

General distribution (fig. 363).—Northern United States east of the Rockies; Canada south to New Mexico. Some of the northern United States records include variety *megas* (Dall).

Distribution in Ohio (inset, fig. 363).—Sterki (1907a, p. 383) gives "over the state"; Dennis (1928, p. 3) collected it in the Bass Islands region; the Ohio State collections contain specimens from Sandusky Bay (beach drift), and it is also found in several Pleistocene deposits in the State.

Geologic range.—F. C. Baker (1920a, p. 387) gave Yarmouth and "Wabash." Hibbard and Taylor (1960, p. 107) gave only Sangamon to Recent. In Ohio, it occurs in the following deposits: Humboldt (Reynolds, 1959, p. 155), Oakhurst (Aukeman, 1960, p. 89), Souder Lake (Cornejo, 1961, fig. 11), Castalia (Clark, 1961, p. 24), Jewell Hill (Mowery, 1961, p. 11), and Newell Lake (Zimmerman, 1960, p. 20).

Promenetus rubellus (Sterki) 1894
Fig. 364

Planorbis harni Pilsbry 1891, Nautilus, v. 4, p. 137 (no description).
Planorbis exacutus rubellus Sterki 1894, Land and fresh water Moll. New Philadelphia, p. 7.
Planorbis rubellus Pilsbry 1899, Nautilus, v. 13, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383, 399.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 102.
--- --- F. C. Baker 1920, Life of Pleistocene,

p. 387.

Menetus rubellus Goodrich 1932, Moll. Mich., p. 68.

--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 289.

Promenetus rubellus F. C. Baker 1945, Moll. family Planorbidae, p. 182, pl. 123, figs. 37-39.

Type locality.—Stone Creek Valley, Odbert's Station, Ohio. This locality is just south of New Philadelphia, in Tuscarawas County.

Diagnosis.—Shell small, flattened, color reddish; whorls about 4, periphery acutely keeled; umbilicus wider and less deep than *P. exacuous;* aperture smaller than in that species; L. 1, W. 4½ mm.

Ecology.—No data at hand, but ecology probably similar to that of *P. exacuous,* judging by the locali-

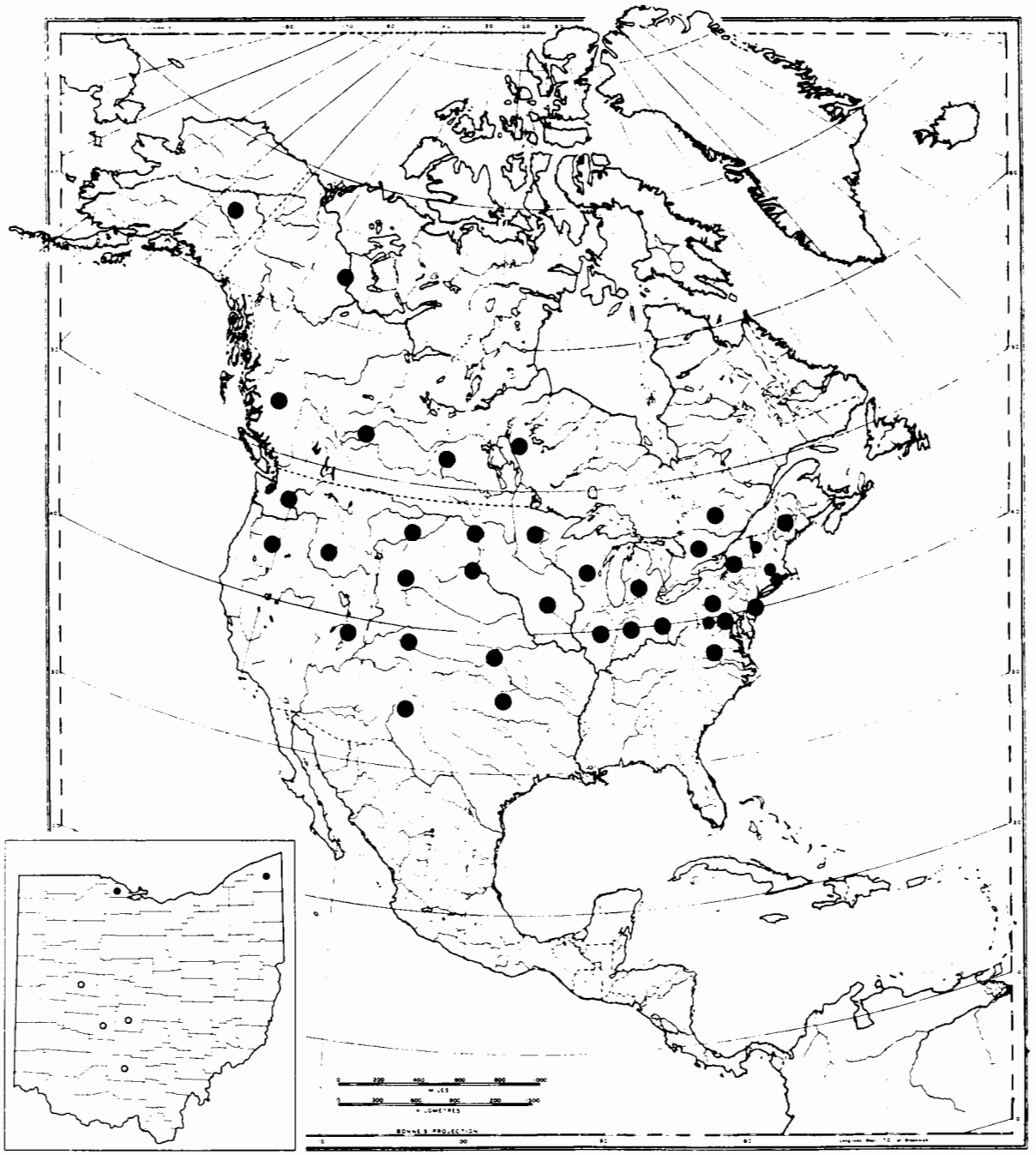


FIGURE 363.—Distribution of *Promenetus exacuous* in North America; *inset,* distribution in Ohio.

ties and associations.

Associations.—Living: NEW YORK - 1; OHIO - 43.

General distribution (fig. 365).—Pennsylvania, Ohio, Indiana.

Distribution in Ohio (inset, fig. 365).—Type locality in Tuscarawas County, and Stark, Summit, and Portage Counties (Sterki, 1907a, p. 383).

Geologic range.—F. C. Baker (1920a, p. 387) gives only "Wabash" (late Wisconsin).

Remarks.—This species can be distinguished from *P. exacuous* by its smaller size, its more delicate shell, which is more tightly coiled, and, in living specimens, by its reddish color. It has not as yet been recorded as a fossil but should be looked for in lots identified as *P. exacuous.* It may be differentiated from *P. umbilicatellus* by its shallower umbilicus and carinate periphery.

FIGURE 364.—*Promenetus rubellus,* magnified; after F. C. Baker (1945, pl. 123, figs. 37-39).

Promenetus (Phreatomenetus) umbilicatellus
(Cockerell) 1887
Pl. 14, figs. 5-9

Planorbis umbilicatus Taylor 1885, Jour. Conchology, v. 4, p. 351 (*non* Müller 1774).

Planorbis umbilicatellus Cockerell 1887, Conchol. Exch., v. 2, p. 68.

Planorbis (Torquis) umbilicatellus Dall 1905, Harriman-Alaska Exped., v. 13, p. 96.

Planorbis umbilicatellus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383, 399.

--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 104.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.

Gyraulus umbilicatellus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 383, pl. 22, figs. 18-21.

--- --- Goodrich 1932, Moll. Mich., p. 67.

Promenetus umbilicatellus Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 289.

--- --- F. C. Baker 1945, Moll. family Planorbidae, p. 182, pl. 42, fig. 6; pl. 43, figs. 1-12; pl. 50, fig. 15; pl. 67, fig. 2; pl. 123, figs. 34-36.

--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 71.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 293.

--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 110.

Promenetus (Phreatomenetus) umbilicatellus Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 60.

Type locality.—Brandon and Birtle, Manitoba.

Diagnosis.—Shell small, depressed, disclike, light yellow to brown, or stained black by extraneous deposits; whorls 4 to 5; sculpture of fine oblique lines of growth and very fine spiral lines; whorls only slightly subangulated at the periphery, which is at about the center of the whorl; umbilicus wide, deep, exhibiting all the whorls to the apex; aperture elongate-lunate or roundly triangular; L. 2.0, W. 6.0, Ap. L. 1.8, Ap. W. 2.4 mm.

Ecology.—Found in swamps with more or less persistent pools of water; not found in running water or in lakes of medium or large size.

Associations.—Living: MANITOBA - 1a, 4, 28; MINNESOTA - 20; OHIO - 43. Fossil: P - 1, 2, 3, 4; N - 1, 2; A - 1; K - 1, 4, 9, 10, 17, 19, 21, 24, 25, 26, 27; S - 2, 6; W - 28.

General distribution (fig. 366).—Alberta to Manitoba, south to New Mexico, eastward to Michigan and Ohio. It is recorded for the states of New Mexico, Colorado, Montana, Iowa, Minnesota, Illinois, Michigan, South Dakota, North Dakota, Wisconsin, Indiana, and Ohio.

Distribution in Ohio (inset, fig. 366).—Sterki (1907a, p. 383) collected specimens from Tuscarawas and Summit Counties; Eggleston (ms. records) obtained it from these same two counties and from Erie County (living and fossil).

Geologic range.—Middle Pliocene to present. F. C. Baker (1920a, p. 387) gave only "Wabash." Hibbard and Taylor (1960, p. 110) extend this to Middle Pliocene to present. In Ohio, one late Wisconsin record for Erie County.

Remarks.—Until a few years ago, this species was classified under the genus *Gyraulus,* mainly on the basis of shell characteristics. Baker (1945, p. 182) has shown that it is more closely allied to *Promenetus exacuous* and has transferred it to this genus.

Genus *Menetus* H. and A. Adams 1855

Menetus Adams 1855, Genera Moll., v. 2, p. 262 (*fide* Neave).

Menetus Walker 1918, Synopsis and cat. fresh-water Moll., p. 12.

Menetus F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 360.

Menetus F. C. Baker 1945, Moll. family Planorbidae, p. 182.

Menetus La Rocque 1953, Cat. Recent Moll. Canada, p. 292.

Type.—*Planorbis opercularis* Gould, by designation of Dall, 1870.

Diagnosis.—Shell ultradextral, lenticular, with a small number of rapidly increasing whorls, the last partly enveloping the preceding whorls; apical whorls not much depressed; base with a narrow umbilicus, aperture oblique, lip sharp.

Subgenera.—F. C. Baker (1945, p. 182) divides the genus into two subgenera, *Menetus s.s.* and *Micromenetus* Baker (1945, p. 187). Both subgenera are represented in Ohio, if the records are correct.

Remarks.—According to Baker (1945, p. 186) typical *Menetus* is a group of the west coast of North America and does not extend far inland to the east.

FIGURE 365.—Distribution of *Promenetus rubellus* in North America; *inset,* distribution in Ohio.

[Subgenus *Menetus s.s.*]

Diagnosis.—As for the genus; the main differences between this subgenus and the subgenus *Micromenetus* are anatomical.

Speciation.—F. C. Baker (1945, p. 186) recognizes three species, all of them from the Pacific Coast. Only one variety of these, *M. cooperi multilineatus*, has been recorded for Ohio; the specimens on which this identification was based should probably be referred to another species.

[*Menetus cooperi multilineatus* (Vanatta) 1899]

Planorbis opercularis oregonensis Vanatta 1895, Nautilus, v. 9, p. 54 (*non* Tryon 1865).

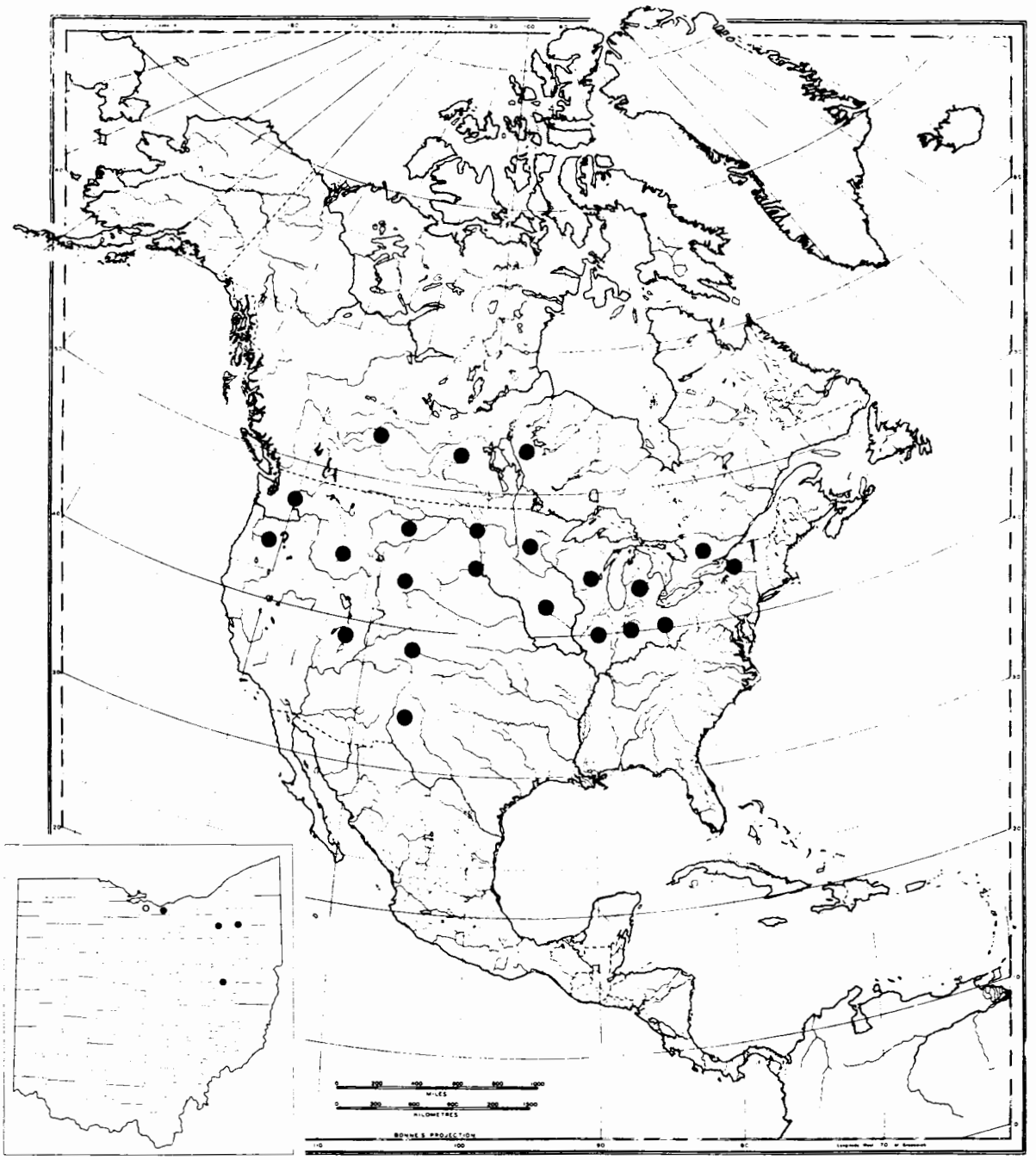


FIGURE 366.—Distribution of *Promenetus umbilicatellus* in North America; *inset*, distribution in Ohio.

Planorbis opercularis multilineatus Vanatta 1899, Nautilus, v. 13, p. 48.
--- --- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383, 399.
Planorbis multilineatus Sterki 1914, Ohio Naturalist, v. 14, p. 271, appears to be not distinct from *dilatatus* Gould.
Planorbis opercularis multilineatus Walker 1918, Synopsis and cat. fresh-water Moll., p. 101.
Menetus cooperi multilineatus F. C. Baker 1945, Moll. family Planorbidae, p. 186.

Type locality.—Salem and Portland, Oregon.

Remarks.—No diagnosis is given for this variety as it is almost certain that it does not occur in Ohio. Sterki (1914, p. 271) placed the name in the synonymy of *M. dilatatus* but this action should be taken to apply only to the Ohio specimens. F. C. Baker (1945, p. 186) transferred the variety to *Menetus cooperi*, new name for *M. planulatus* Cooper, which he considered distinct from *M. opercularis*. These data are given here to prevent future errors which might arise from Sterki's original record (1907a, p. 383). According to Baker (1945, p. 186) *M. cooperi multilineatus* (Vanatta) is a valid subspecies or variety but it is a western one, not found except in the Pacific Coast States. The Ohio record appears to be based on specimens of *M. dilatatus* or one of its varieties, discussed in the next section of this report.

Subgenus *Micromenetus* F. C. Baker 1945

Micromenetus F. C. Baker 1945, Moll. family Planorbidae, p. 187.

Type.—*Planorbis dilatatus* Gould, by original designation.

Diagnosis.—Shell very small, ultradextral, of few rapidly enlarging whorls; right side flat or convex, left side with inner whorls submerged by the body whorl; body whorl with a more or less well developed carina, usually placed just below the top of the right side; aperture large, somewhat dilated; lips thin (F. C. Baker, 1945, p. 187).

Speciation.—Baker (1945, p. 190) recognizes the following species and varieties: *Menetus dilatatus* (Gould) with varieties *pennsylvanicus* Pilsbry and *buchanensis* (Lea); *M. alabamensis* Pilsbry, with variety *avus* Pilsbry; *M. brogniartianus* (Lea); *M. sampsoni* (Ancey); and *M. uliginosus* Vanatta. All of these, except *M. alabamensis* and *M. uliginosus*, may be expected in Ohio although only three of them have been recorded for the State.

Menetus dilatatus (Gould) 1841
Fig. 367

Planorbis dilatatus Gould 1841, Invert. Mass., p. 210, fig. 140.
--- --- Binney 1865, Land and fresh water shells N. America, pt. II, p. 131, fig. 218.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
Planorbis multilineatus Sterki 1914, Ohio Naturalist, v. 14, p. 271.
Planorbis (Gyraulus) dilatatus Johnson 1915, Fauna New England, p. 191.
Planorbis dilatatus Walker 1918, Synopsis and cat. fresh-water Moll., p. 98.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Menetus (Micromenetus) dilatatus F. C. Baker 1945, Moll. family Planorbidae, p. 190.
--- *(---)* --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 71, pl. 6, figs. 24, 25.
?*Menetus opercularis multilineatus* Reynolds 1959, Ohio Jour. Sci., v. 59, p. 155.

FIGURE 367.—*Menetus dilatatus*, magnified; after W. G. Binney (1865, pt. II, p. 131, fig. 218).

Type locality.—"Nantucket . . . Hingham," Massachusetts.

Diagnosis.—Shell small, yellowish green, growth lines minute; spire flat, of about 3 whorls, sutures well defined; whorls well rounded, with a sharp angulation at the superior edge of the whorl; umbilicus small, deep; aperture oblique, lip expanded.

Ecology.—Specimens from Hingham came from a small pool "southeast of the Old Colony House" (W. G. Binney, 1865, pt. II, p. 131).

Associations.—Fossil: W-27.

General distribution (fig. 368).—Massachusetts west to western New York and Ohio.

Distribution in Ohio (inset, fig. 368).—Sterki (1907a, p. 383) gave "over the state"; Eggleston (ms. records) has it from the Maumee River; Fairfield and Tuscarawas Counties.

Geologic range.—F. C. Baker (1920a, p. 387) records the species for Aftonian only. The record for the Humboldt deposit (Reynolds, 1959, p. 155) is doubtful.

Menetus dilatatus buchanensis (Lea) 1841

Planorbis buchanensis Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 32.
Planorbis exacutus Binney 1865, Land and fresh water shells N. America, pt. II, p. 127 (part), reproduces Lea's original description.
Planorbis dilatatus buchanensis Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
Planorbis dilatatus Walker 1918 (part), Synopsis and cat. fresh-water Moll., p. 98.

Menetus dilatatus buchanensis Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 289.

--- --- --- F. C. Baker 1945, Moll. family Planorbidae, p. 190, pl. 121, figs. 23, 27, 28, Cincinnati, Ohio.

Type locality.—Near Cincinnati, Ohio.

Diagnosis.—"Shell sub-lenticular, above sub-convex, carinate at the periphery, beneath narrow umbilicate, horn-color or brownish, smooth; whirls three; lip sharp; aperture rounded" (Lea's original description, quoted by W. G. Binney, 1865, pt. II, p. 127).

Ecology.—No exact data located.

General distribution (fig. 369).—Ohio, Indiana, and probably some, if not all, of the neighboring states.

Distribution in Ohio (inset, fig. 369).—Sterki (1907a, p. 383) gave only New Philadelphia, in Tuscarawas County. Eggleston (ms. records) mentions no speci-

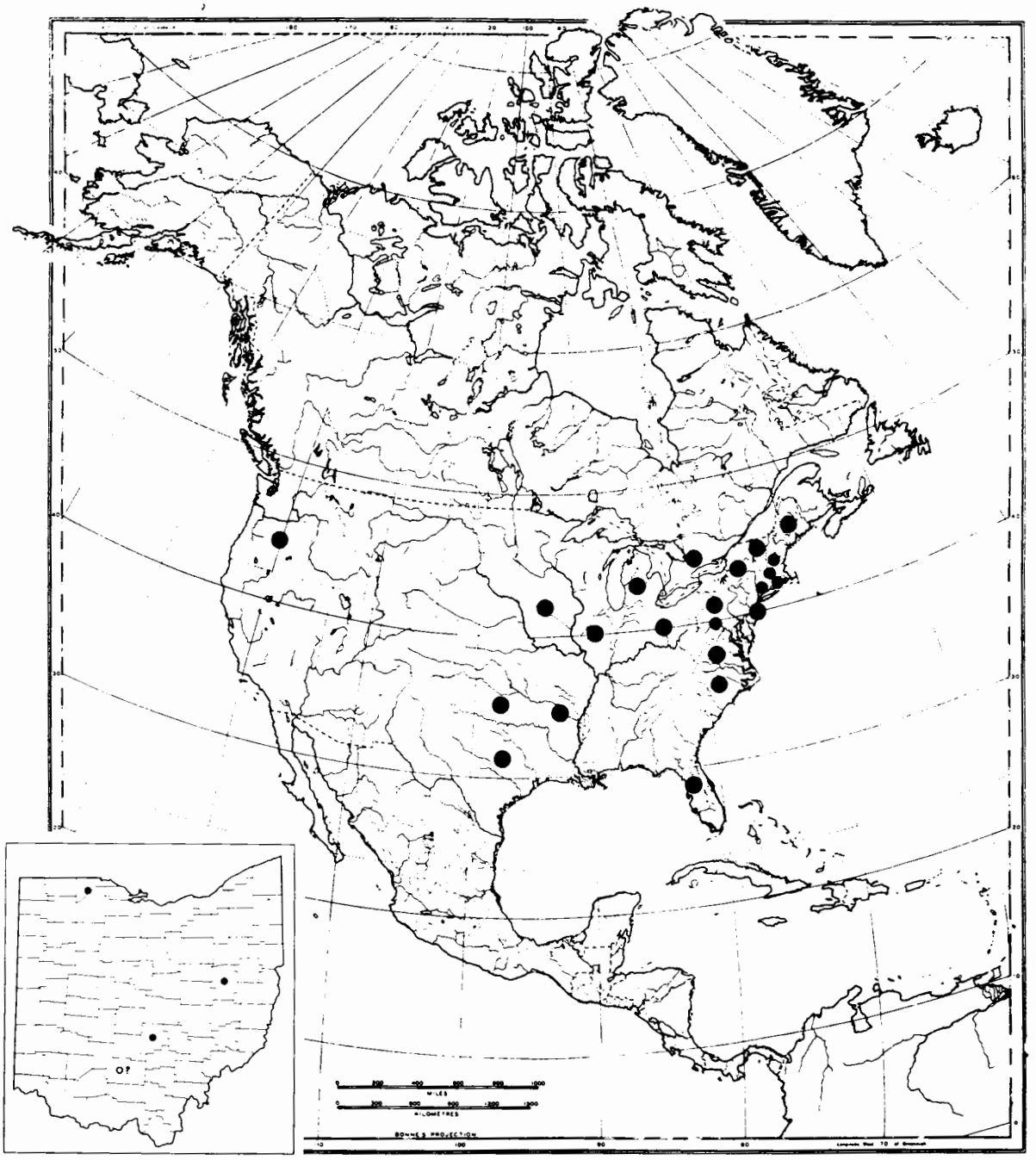


FIGURE 368.—Distribution of *Menetus dilatatus* in North America; *inset,* distribution in Ohio.

mens of this variety. The certain range in Ohio is vicinity of Cincinnati (type locality) and Tuscarawas County. It should be found at least in the southern counties of the State at least as far north as Warren, Greene, Madison, Franklin, Licking, Coshocton, and Carroll Counties, but even in Ohio its range is not well known.

Geologic range.—Unknown.

Menetus brogniartianus (Lea) 1842

Planorbis lens Lea 1839, Am. Philos. Soc. Trans., v. 6, p. 68, pl. 23, fig. 83; Observer, pt. 2, p. 68; (*non* Brongniart, 1810).

Planorbis brogniartiana Lea 1842, Am. Philos. Soc. Proc., v. 2, p. 242; 1844, Am. Philos. Soc. Trans., v. 9, p. 24; 1844, Observer, pt. 4, p. 6.

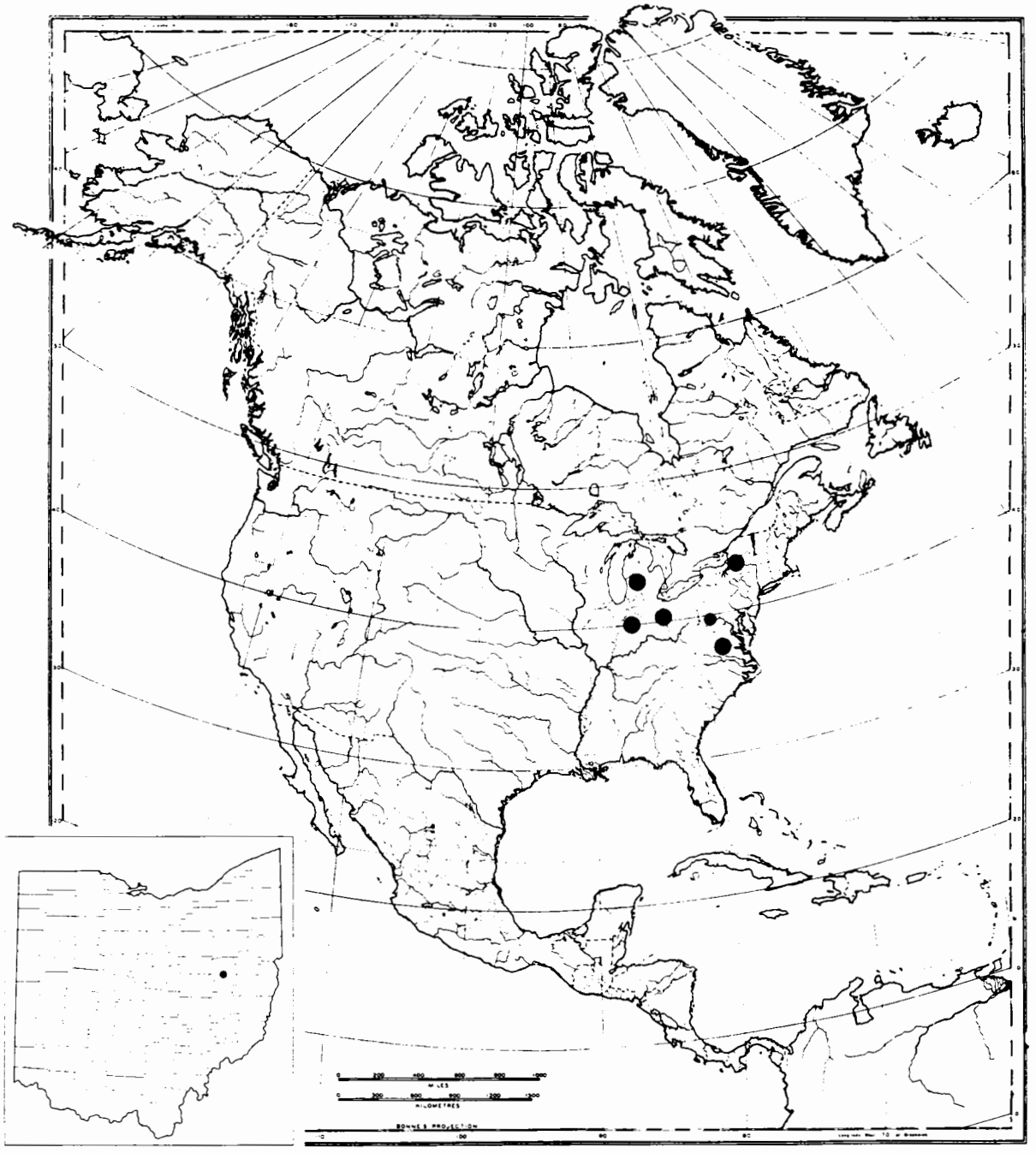


FIGURE 369.—Distribution of *Menetus dilatatus buchanensis* in North America; *inset,* distribution in Ohio.

Planorbis lenticularis Lea 1844, Am. Philos. Soc. Trans., v. 9, p. 6 (*non* Schlotheim, 1818).

Planorbis exacutus Binney 1865 (part), Land and fresh water shells N. America, pt. II, p. 127.

Menetus brogniartianus F. C. Baker 1945, Moll. family Planorbidae, p. 190, pl. 121, figs. 42-44.

Type locality.—Near Cincinnati, Ohio.

Diagnosis.—"Shell small, lenticular, widely umbilicate, carinate on the periphery, pellucid, horn-colored; whirls three; aperture large.... Diam. 3-20ths, length 1-20th of an inch" (Lea, original description of *Planorbis lens*, quoted by W. G. Binney, 1865, pt. II, p. 128).

General distribution (fig. 370).—Recorded only for Ohio.

Distribution in Ohio (inset, fig. 370).—Known only for the type locality.

Remarks.—Binney (1865, p. 128) considered this a

FIGURE 370.—Distribution of *Menetus brogniartianus* in North America; *inset*, distribution in Ohio.

synonym of *Promenetus exacuous;* Dall (1905, p. 91) referred it to *M. dilatatus* but F. C. Baker (1945, p. 190) considered it a valid species. The name was misspelled by Lea, corrected to *brongniartiana* by Dall, but Baker returned to the original spelling given by Lea. It is probable that this should be recognized at most as a variety or local form of *M. dilatatus.* Sterki did not note it and Eggleston gave no records. It is mentioned here in order that its status might be investigated.

Family ANCYLIDAE Menke 1828

Ancylidae Walker 1918, Synopsis and cat. fresh-water Moll., p. 16.
Ancylidae Walker 1923, Ancylidae S. Africa, p. 4 ff.
Ancylidae F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 387.

Diagnosis.—Shell patelliform or dextrally spiral, neritiform or planorbiform.

Remarks.—From the standpoint of the paleontologist, this is one of the most difficult freshwater gastropod families to deal with, as the characteristics distinguishing genera and subgenera are found almost entirely in the soft parts of the animal. As Walker (1923, p. 4) noted: "The simple form of the shell not only renders the determination of species exceedingly difficult, but affords very slight indications of generic relations, and none as to the evolutionary history and affinities of the various groups."

The North American genera fall into four subfamilies, Neoplanorbinae, Rhodacmeinae, Lancinae, and Ferrissiinae. For the genera classified in these subfamilies, see Walker (1918, p. 17 ff.; 1923, p. 11 ff.).

Subfamily FERRISSIINAE Walker 1917

Laevapecinae Hannibal 1912, Malac. Soc. London Proc., v. 10, p. 147.
Ferrissiinae Walker 1917, Nautilus, v. 31, p. 2.
Ferrissiinae Walker 1918, Synopsis and cat. fresh-water Moll., p. 18.
Ferrissiinae Walker 1923, Ancylidae S. Africa, p. 14 ff.
Ferrissiinae F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 387.

Diagnosis.—"Shell small, thin, broadly ovate to oblong; apex more or less posterior and eccentric, apex (in North American species) smooth or radially striate" (Walker, 1918, p. 18).

Remarks.—The truly diagnostic features of the subfamily are those of the soft parts, given by Walker and Baker in the references cited above. Of the two genera of this subfamily represented in North America, one is septate *(Gundlachia),* the other is not *(Ferrissia).* Both genera have been recorded from Ohio.

Genus *Ferrissia* Walker 1903

Ferrissia Walker 1903, Nautilus, v. 17, p. 15.
Ferrissia Walker 1917, Nautilus, v. 31, p. 3 ff.
Ferrissia Walker 1918, Synopsis and cat. fresh-water Moll., p. 18.
Ferrissia Walker 1923, Ancylidae S. Africa, p. 14 ff.
Ferrissia F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 394.
Ferrissia La Rocque 1953, Cat. Recent Moll. Canada, p. 295.

Type.—*Ancylus rivularis* Say, by original designation.

Diagnosis.—Shell ovate to oblong, conic, more or less elevated, apex eccentric and posterior, radially striate or smooth.

Remarks.—The genus is subdivided into two subgenera, one with elevated radially striate shell *(Ferrissia s.s.),* the other with depressed shell with smooth apex *(Laevapex).*

Subgenus *Ferrissia s.s.*

Type.—*Ancylus rivularis* Say.

Diagnosis.—Shell ovate to oblong, conic, elevated, apex radially striate.

Speciation.—In his Synopsis and Catalogue, Walker (1918, p. 18, 118) lists all the species of *Ferrissia* and specifies the subgenus to which they belong. Six Ohio species can be placed in this subgenus.

Ferrissia (?Ferrissia) bartschi Walker 1920
Fig. 371

Ferrissia bartschi Walker 1920, U.S. Natl. Mus. Proc., v. 57, p. 525, 1 fig.

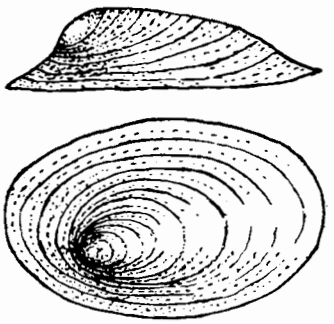


FIGURE 371.—*Ferrissia bartschi,* magnified; after Walker's original figure (1920, p. 525, fig. 1).

Type locality.—Lake Maxinkuckee, Indiana; at the south end of the lake.

Diagnosis.—"Shell small, very much depressed, regularly oval, the left margin being only slightly more curved than the right, regularly rounded at both ends;

apex prominent, blunt, rounded, situated on the posterior third of the shell, slightly turned to the right; apical striae conspicuous; lines of growth fine and regular; anterior slope nearly straight, but oblique, curving down more rapidly as it approaches the anterior margin. Irregularly radiately striate; posterior slope straight below the swell of the apex; left slope convex, slightly flattened towards the apex; right slope nearly straight. Length 2.5, width 1.5, alt. 5 mm." (Walker, 1920).

General distribution (fig. 372).—Known only from Indiana.

Remarks.—This species is closely allied to *F. novangliae* Walker, which has been recorded for Ohio. It is possible that some of the records for *F. novangliae* refer rather to this species.

FIGURE 372.—Distribution of *Ferrissia bartschi* in North America.

The subgeneric assignment is in doubt. The species has a depressed shell but the apex is distinctly striate. The latter characteristic would place the species in *Ferrissia s.s.* but Walker notes that it is allied to *F. novangliae,* subgenus *Laevapex,* with smooth apex.

Ferrissia rivularis (Say) 1819
Fig. 373

Ancylus rivularis Say 1819, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 125.
Ancylus (Ferrissia) rivularis Dall 1905, Harriman-Alaska Exped., v. 13, p. 110.
Ancylus rivularis Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.
--- --- Johnson 1915, Fauna New England, p. 192.
Ferrissia rivularis Walker 1918, Synopsis and cat. fresh-water Moll., p. 119.
Ancylus rivularis F. C. Baker 1920, Life of Pleistocene, p. 387.
Ferrissia rivularis F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 398, pl. 24, figs. 16-18.
--- --- Goodrich 1932, Moll. Mich., p. 73.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 292.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 72, pl. 9, fig. 1.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 296.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 61.

FIGURE 373.–*Ferrissia rivularis,* magnified; after W. G. Binney (1865, pt. II, p. 142, fig. 238).

Type locality.–Delaware and Susquehanna Rivers, Pennsylvania.

Diagnosis.–Shell ovate, the margins regularly curving, the ends rounded; anterior slope convex, posterior slope concave below the apex but more or less straight near the peritreme; right slope slightly convex or straight; left slope generally straight but occasionally slightly convex; shell rather well elevated, with a subacute apex, inclining somewhat toward the right side; the apex situated about a third the distance from the posterior end; apex radially striate; growth lines somewhat irregular, well marked, with more or less of radial sculpture on anterior slope; peritreme of shell commonly quite flat; greatest width of shell in front of apex, shell narrowing somewhat posteriorly; color pale corneous (modified from F. C. Baker, 1928a, pt. I, p. 398).

Ecology.–Found adhering to stones or dead naiad shells in small streams; apparently not recorded from lakes.

Associations.–Living: MANITOBA - 36; MINNESOTA - 22a; OHIO - 43. Fossil: P - 1, 2, 3; N - 1, 2; S - 1; W - 28.

General distribution (fig. 374).–Northern United States east of the Mississippi, New Mexico to Manitoba, east at least to western New York, Ohio, and Pennsylvania.

Distribution in Ohio (inset, fig. 374).–Sterki (1907a, p. 384) gives "Cincinnati; Cuyahoga River (Allen): Tuscarawas Co. (St.)." Eggleston has no records.

Geologic range.–Pliocene to present (D. W. Taylor, 1960, p. 61). Baker (1920a, p. 387) had previously recorded the species for the Aftonian, Sangamon, and late Wisconsin ("Wabash").

Ferrissia parallela (Haldeman) 1841
Fig. 375

Ancylus parallelus Haldeman 1841, Mon. Limniades N. America, pt. 2, p. 3 of cover; 1844, p. 11, pl. 1, fig. 6.
Ancylus (Ferrissia) parallelus Dall 1905, Harriman-Alaska Exped., v. 13, p. 110.
Ancylus parallelus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
--- --- Johnson 1915, Fauna New England, p. 193.
Ferrissia parallela Walker 1918, Synopsis and cat. fresh-water Moll., p. 119.
Ancylus parallelus F. C. Baker 1920, Life of Pleistocene, p. 386.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 395, pl. 29, figs. 1-5.
--- --- Dennis 1928, Aquatic gastr. Bass Is. region, p. 4.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 292.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 71, pl. 9, fig. 4.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 21, pl. 1, fig. C.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 296.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 61.

Type locality.–New England.

Diagnosis.–Shell narrow, elongate, the lateral margins nearly straight, widening more or less anteriorly, ends well rounded; anterior slope rather long, slightly convex; posterior slope shorter than anterior, straight or slightly concave; right lateral slope nearly straight, left lateral slope slightly convex; apex subacute, slightly turned toward the right and slightly anterior of the center of the shell; radially striate; lines of growth fine, irregular, but well marked; peritreme of the shell even or concave at both ends; color of shell pale corneous (modified from F. C. Baker, 1928, pt. I, p. 396).

Ecology.—Found in quiet water, one to six feet deep, on plants, usually in ponds or lakes. The species seems to have no particular preference as to kind of plants; it has been collected on all kinds of water weeds, including the under sides of water lilies and the stems and leaves of submerged kinds.

Associations.—Living: MANITOBA - 2; MINNESOTA - 9, 17, 18; NEW YORK - 12, 40a, 43; OHIO - 18, 19; ONTARIO - 5, 7; WISCONSIN - 3, 4, 5, 15, 29, 42, 47, 60, 63, 64, 83, 104, 106, 107, 117, 123, 124. Fossil: K - 9, 11, 14, 21, 25, 26, 27; S - 1; W - 27, 29, 34, 35, 36, 37, 38, 39, 41, 42, 45, 54, 56, 57, 58, 59.

General distribution (fig. 376).—Nova Scotia and New England west to Minnesota, Manitoba south to Rhode Island, central New York, northern Ohio, and Indiana.

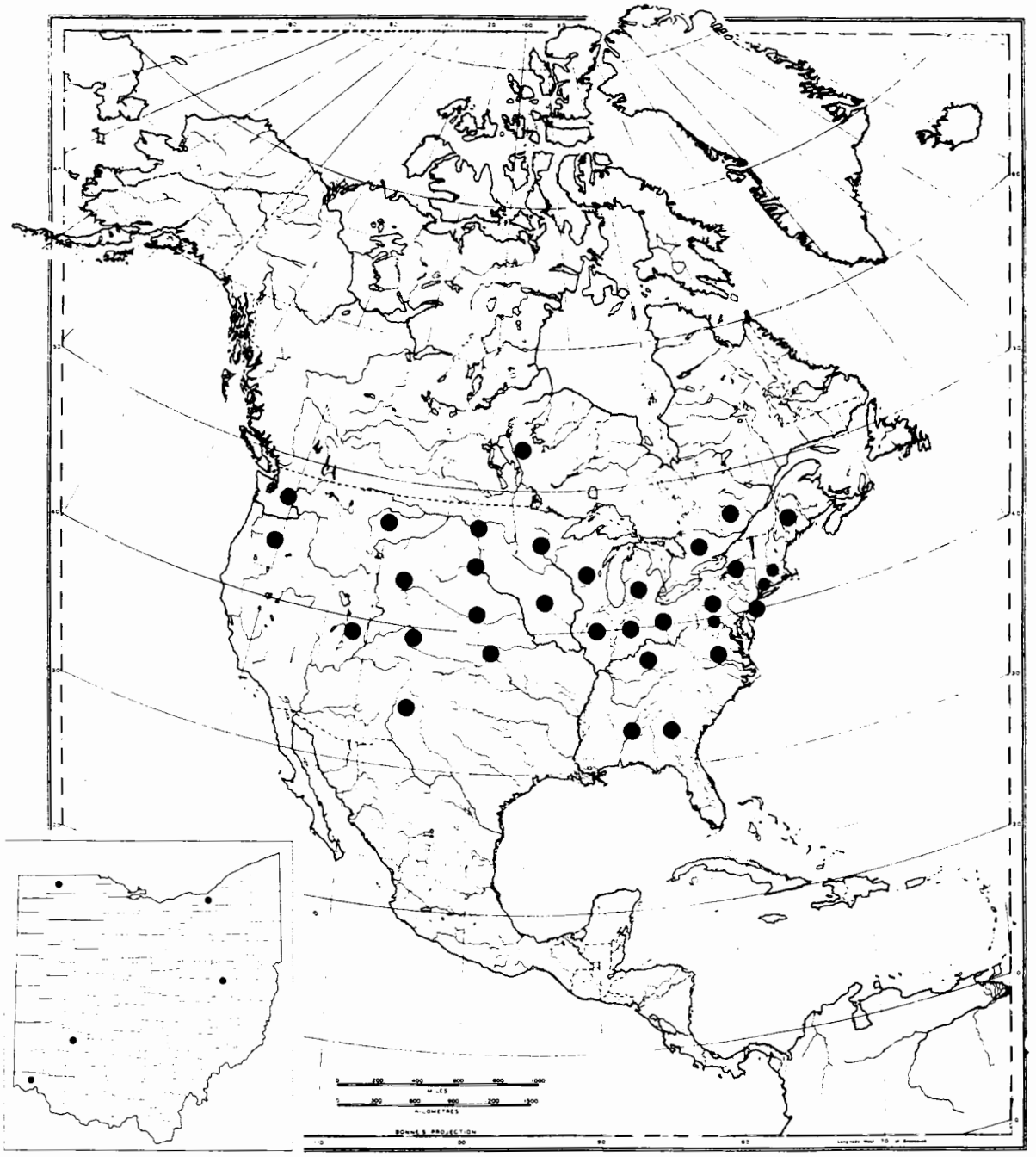


FIGURE 374.—Distribution of *Ferrissia rivularis* in North America; *inset,* distribution in Ohio.

FIGURE 375.–*Ferrissia parallela*, magnified; after W. G. Binney (1865, pt. II, p. 142, fig. 237).

Distribution in Ohio (inset, fig. 376).–Sterki (1907a, p. 383) mentions only "Ohio Canal at Navarre, Stark Co." I have no other records for living specimens.

Geologic range.–Pliocene to Recent, according to D. W. Taylor (1960, p. 61). A. B. Leonard (1950, p. 21) records it as a fossil from Iowa, Nebraska, Kansas, Oklahoma, and Texas. In Ohio it has been collected from the following deposits: Newell Lake (Zimmerman, 1960, p. 20), Oakhurst (Aukeman, 1960, p. 97), Aultman (Sheatsley, 1960, p. 96), Souder Lake (Cornejo, 1961, fig. 11), Castalia (Clark, 1961, p. 24), and Jewell Hill (Mowery, 1961, p. 11).

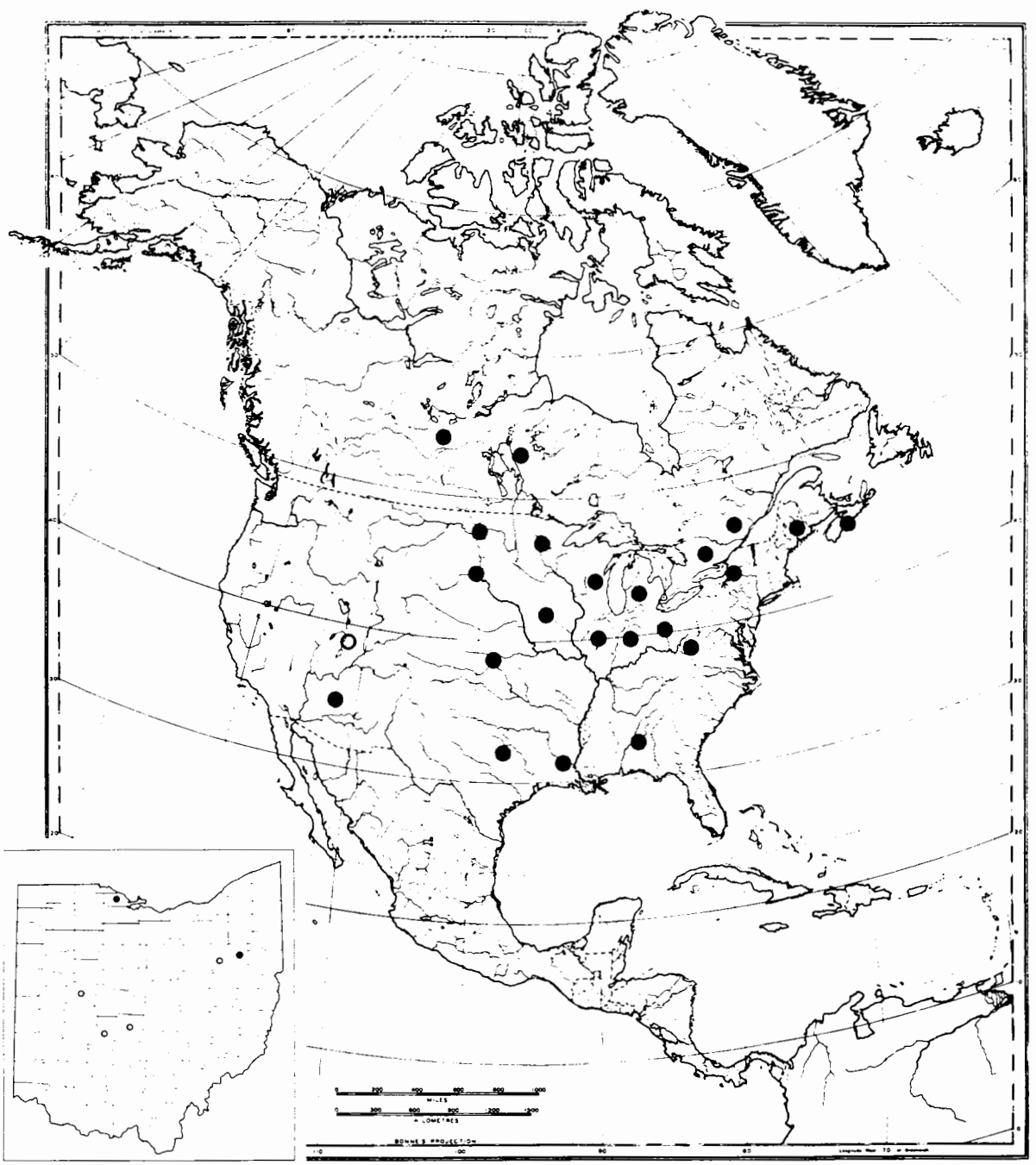


FIGURE 376.–Distribution of *Ferrissia parallela* in North America; *inset*, distribution in Ohio.

Ferrissia meekiana (Stimpson) 1863
Pl. 13, figs. 15, 16, 18, 19

Gundlachia meekiana Stimpson 1863, Boston Soc. Nat. History Proc., v. 9, p. 250.
--- --- Binney 1865, Land and fresh water shells N. America, pt. II, p. 150, fig. 252.
Ancylus pumilus Sterki 1899, Ohio Acad. Sci. Eighth Ann. Rept., p. 36.
--- --- Walker 1904, Nautilus, v. 18, p. 82, pl. 6, figs. 20-22.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.
Gundlachia? meekiana Sterki 1907, *ibid.*
Ancylus pumilus Johnson 1915, Fauna New England, p. 194.

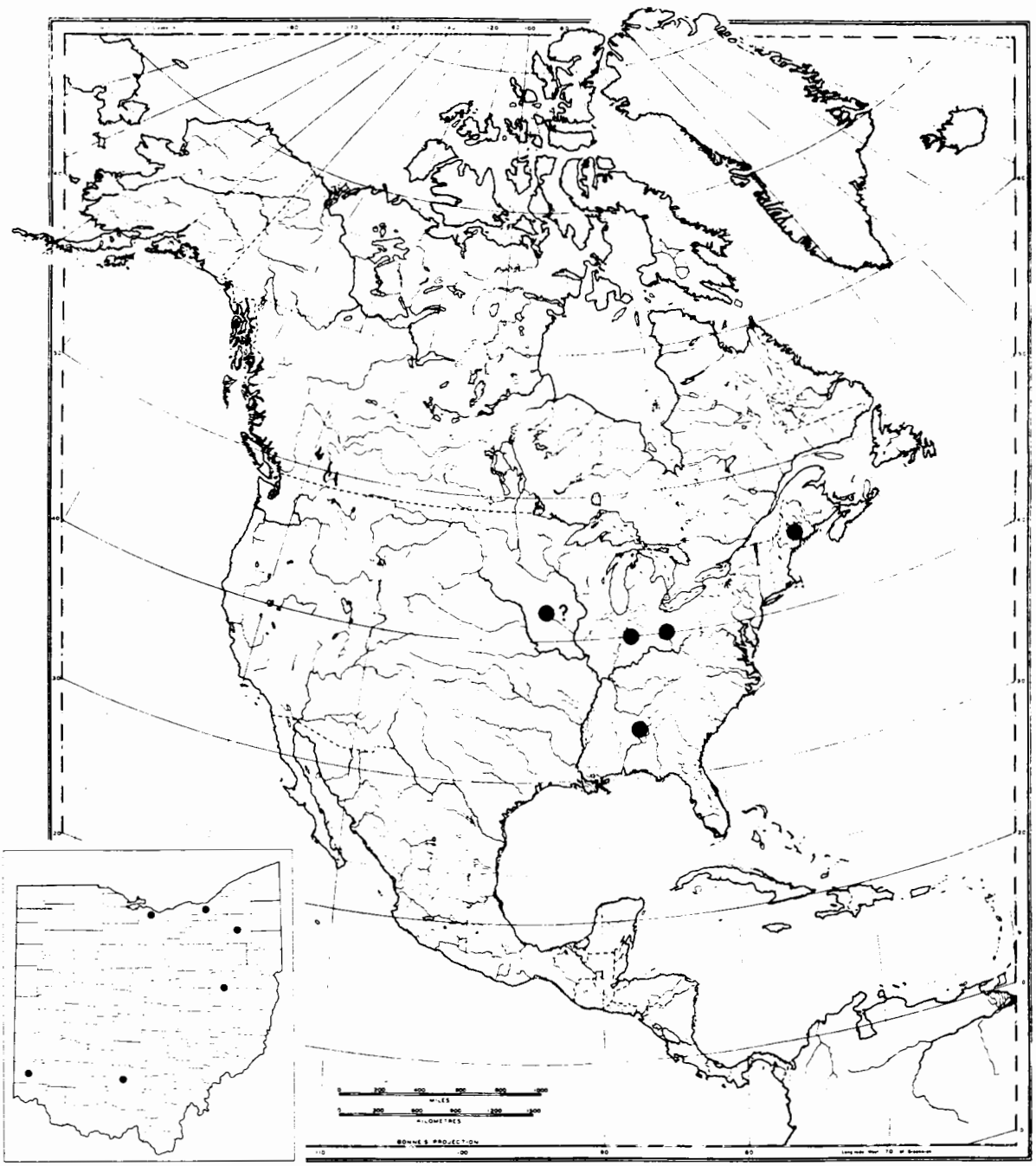


FIGURE 377.–Distribution of *Ferrissia meekiana* in North America; *inset,* distribution in Ohio.

Ferrissia pumila Walker 1918, Synopsis and cat. fresh-water Moll., p. 119.
Gundlachia meekiana Walker 1918, *ibid.*, p. 121.
?Gundlachia sp. Sterki 1920, Ohio Jour. Sci., v. 20, p. 175, 183.
Gundlachia meekiana Goodrich 1944, Nautilus, v. 58, p. 14.
Ferrissia pumila Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 292.
Gundlachia meekiana Goodrich and van der Schalie, 1944, *ibid.*, p. 293.
Ferrissia pumila La Rocque 1953, Cat. Recent Moll. Canada, p. 296.
Ferrissia meekiana Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 61.

Type locality.—*Gundlachia meekiana:* small pond of clear water, near north bank of Potomac River, near Georgetown, Maryland. *Ancylus pumilus:* Tuscarawas River, near New Philadelphia, Tuscarawas County, Ohio.

Diagnosis.—Shell small, thin translucent, shining, horn-colored; oval or slightly obovate; ends regularly rounded; sides nearly equally curved; apex radially striate, prominent, rather obtuse, not depressed at the tip, about halfway between the central and posterior margins and decidedly turned to the right; anterior and left slopes very convex; left slope nearly straight; posterior slope straight below the projecting apex; surface with the lines of growth fine and inconspicuous, more or less irregularly rippled with transverse wrinkles on the anterior slope; L. 2.75, W. 1.75, H. 1.0 mm. (modified from Walker, 1904, Naut. 18, p. 82).

Ecology.—Judging by the type locality, a species of ponds or pools near a stream, but in clear water, as emphasized by Stimpson; see also Sterki's collecting notes, below.

Associations.—As *F. meekiana,* fossil: N-1, 2; S-2, 6; W-27?, 28? As *F. pumila,* living: OHIO-43; fossil: W-27, 28.

General distribution (fig. 377).—Ohio east to New York, Maine, and Virginia; west to Illinois and Iowa *(F. pumila).* Indiana, Ohio, and Maryland, south to Alabama. The distribution may be more extensive than these localities indicate *(G. meekiana).*

Distribution in Ohio (inset, fig. 377).—Sterki (1907a, p. 384) gave the following for *"Gundlachia meekiana:"* "Pools near New Philadelphia (St.). Thornburg, Cuyahoga Co., on *Nuphar* leaves in a slough on the Cuyahoga River (Allen), may be of another species." Eggleston (ms. records) collected the species in Ross County. For *"Ferrissia pumila,"* Sterki (1907a, p. 384) gave "Tuscarawas River (types), Miami Canal at Hamilton (St.)." Walker (1904, Naut. 18, p. 82) gave the type locality and added Vermilion and Cuyahoga Rivers, and Garrettsville, Ohio. Eggleston (ms. records) has it as a fossil and living from Erie County, living from Cuyahoga County, living and fossil from Portage County.

Geologic range.—Early Pleistocene (Nebraskan) to Recent (Hibbard and Taylor, 1960, p. 113), and Sangamon in Kansas (*ibid.*, p. 11). In Ohio it is known from late Wisconsin deposits (Tinkers Creek marl, Castalia marl) according to Sterki (1920, p. 174, 182).

Ferrissia shimekii (Pilsbry) 1890
Fig. 378

Ancylus shimekii Pilsbry 1890, Nautilus, v. 4, p. 48.
Ancylus obliquus Shimek 1900, Iowa Univ. Lab. Nat. History Bull., v. 1, p. 214, pl. 3, figs. 5a-c (*non* Say 1832, C. B. Ads. 1850, Krauss 1853).
Ancylus shimekii Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.
Ferrissia shimekii Walker 1918, Synopsis and cat. fresh-water Moll., p. 119.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 402, pl. 24, figs. 14, 15.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 293.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 297.

FIGURE 378.—*Ferrissia shimekii,* magnified; after Walker (1904, Naut. 18, pl. 6, figs. 17-19).

Type locality.—Deadman's Run, Lincoln, Nebraska.

Diagnosis.—Shell elevated, thin, transparent, horn-colored, with yellowish-brown epidermis; aperture ovate, wider anteriorly; apex somewhat acute, elevated, strongly depressed posteriorly and to the right and curved downward, in most specimens quite overhanging the posterior right margin of the shell; the apical portion of the shell (one-half or more) is strongly laterally or, rather, obliquely compressed, a character which makes the young appear proportionally much narrower than the adults; the anterior slope of the shell is long and strongly convex, the posterior is short and concave; surface marked by fine lines of growth; apex radially striate (modified from F. C. Baker, 1928a, pt. I, p. 402).

Ecology.—Found adhering to any solid object available, naiad shells, sticks, stones; in streams (type locality) or lakes (Lake Winnebago; Baker, 1928a, pt. I).

Associations.—Living: OHIO-43.

General distribution (fig. 379).—Pennsylvania west to Nebraska; Wisconsin south to Indiana, Ohio; probably also southern Ontario.

Distribution in Ohio (inset, fig. 379).—Sterki (1907a,

p. 384) records the species only for Tuscarawas County. Eggleston (ms. records) has it from Ottawa County (Bass Is.), Cuyahoga, Portage, Tuscarawas, Licking, Franklin, and Hamilton Counties.

Geologic range.—Late Wisconsin, Erie County (Eggleston, ms. records).

Ferrissia tarda (Say) 1830
Fig. 380

Ancylus tardus Say 1830, New Harmony Disseminator, Jan. 15, 1830.
--- --- Call 1900, Moll. Ind., p. 413, pl. 8, fig. 15.

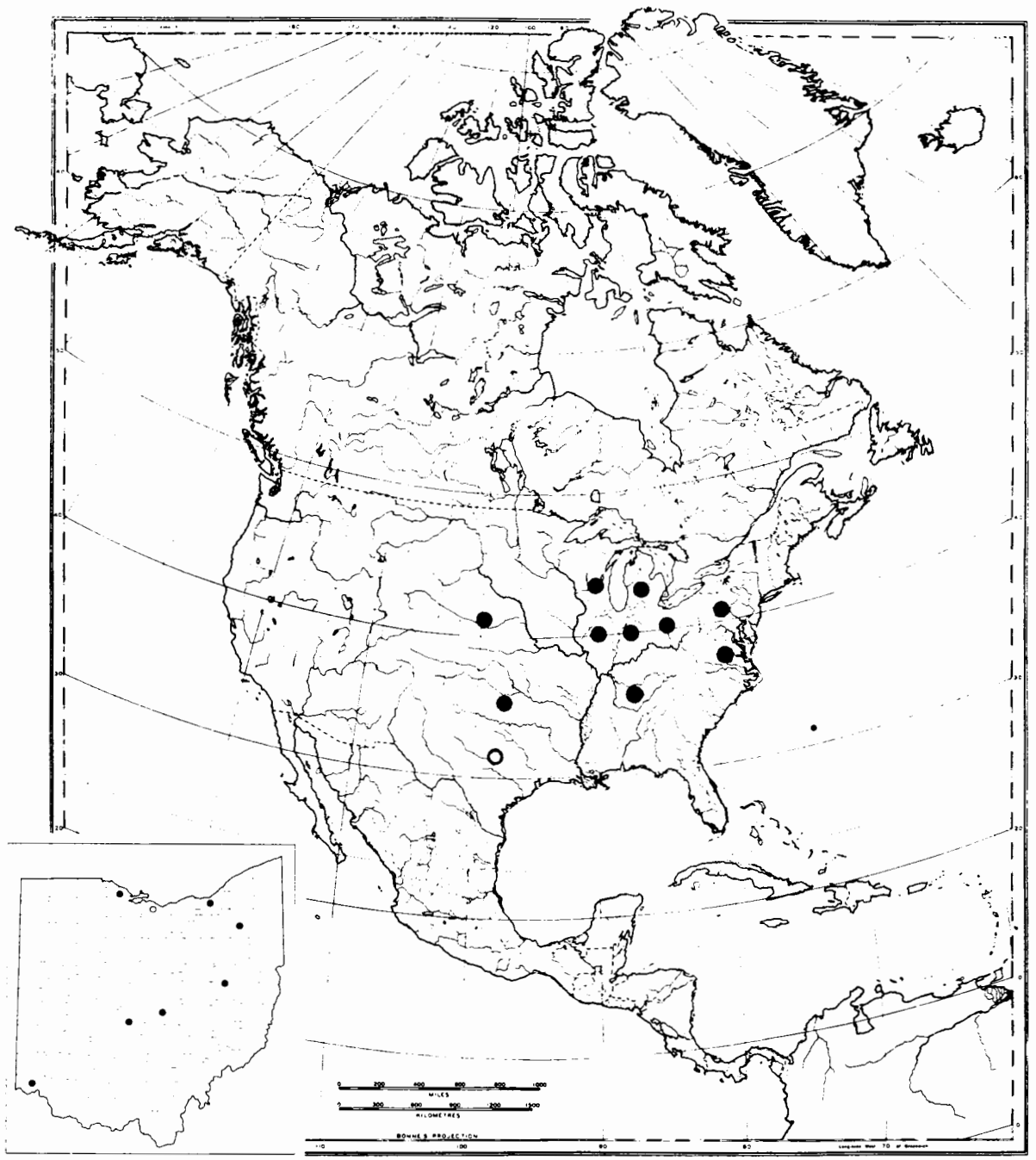


FIGURE 379.—Distribution of *Ferrissia shimekii* in North America; *inset*, distribution in Ohio.

Ancylus tardus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.
--- --- Johnson 1915, Fauna New England, p. 193.
Ferrissia tarda Walker 1918, Synopsis and cat. fresh-water Moll., p. 120.
Ancylus tardus F. C. Baker 1920, Life of Pleistocene, p. 387.
Ferrissia tarda F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 399, pl. 24, figs. 6-9.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 293.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 72.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 297.

FIGURE 380.—*Ferrissia tarda*, magnified; after Call (1900, pl. 8, fig. 15).

Type locality.—Wabash River, Indiana.

Diagnosis.—Shell regularly oval or elongate oval; anterior slope quite convex; posterior slope concave; right slope almost straight; left slope slightly convex; all slopes very steep; apex elevated, obtuse, almost in the median line and about a third of the length of the shell from the posterior end; apex radially striate; color rather brownish horn or even purplish, in some specimens light whitish horn (condensed from F. C. Baker, 1928a, pt. I, p. 400).

Ecology.—Found on rocks, dead naiad shells, or debris; in water that is generally shallow; seemingly preferring cold swiftly flowing streams or lakes.

Associations.—Living: MINNESOTA - 22a; NEW YORK - 18a; OHIO - 43; WISCONSIN - 108. Fossil: W - 31, 32.

General distribution (fig. 381).—Maine west to the Mississippi Valley, south to Illinois and Ohio, north to Michigan and Wisconsin. Southern Canada.

Distribution in Ohio (inset, fig. 381).—Sterki (1907a, p. 384) gave "Cincinnati; Tuscarawas Co. (St.). Probably over the state." Eggleston (ms. records) collected it in Franklin, Pike, and Hamilton Counties.

Geologic range.—Baker (1920a, p. 387) recorded this species from the Sangamon only, with question. Reynolds (1959, p. 155) has identified it from the Humboldt deposit in Ohio.

Ferrissia novangliae (Walker) 1908
Fig. 382

Ancylus (Ferrissia) novangliae Walker 1908, Nautilus, v. 21, p. 138, pl. 9, figs. 5-7.
Ancylus novangliae Johnson 1915, Fauna New England, p. 193.
Ferrissia novangliae Walker 1918, Synopsis and cat. fresh-water Moll., p. 119.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 292.

Type locality.—Cambridge, Massachusetts.

Diagnosis.—"Shell small, depressed, elongate oval, sides nearly parallel, the left being slightly more curved than the right; regularly rounded at the extremities; apex prominent, bluntly rounded, situated on the posterior third, very eccentric, turned decidedly to the right, apical striae prominent; lines of growth fine and regular; anterior slope long, convex, with numerous, fine, radiating ribs, which extend to the periphery; posterior slope oblique, nearly straight below the swell of the spex; left slope very convex, more or less compressed toward the apex; right slope nearly straight below the protrusion of the apex" (Walker, 1908, Naut. 21, p. 138).

Ecology.—No specific data located.

General distribution (fig. 383).—Massachusetts and Illinois; possible for the states in between.

Distribution in Ohio.—No records as yet; possible for the entire State.

Geologic range.—Unknown.

Genus *Laevapex* Walker 1903

Haldemania Clessin 1882, Conch. Cab., 2d. ed., pt. 299, Mon. *Ancylus*, p. 14 (*non Haldemania* Tryon 1862).
Laevapex Walker 1903, Nautilus, v. 17, p. 15.
Laevapex F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 403.
Laevapex Basch 1959, Mich. Univ. Mus. Zoology Misc. Pub. 108, p. 1-56.

Type.—*Ancylus fuscus* Adams.

Diagnosis.—Shell more or less depressed, apex smooth, obtuse or subacute.

Speciation.—Four species occurring in Ohio belong in this genus: *L. diaphanus* (Haldeman), *L. fuscus* (Adams), *L. kirklandi* (Walker), and *L. novangliae* (Walker).

Laevapex diaphanus (Haldeman) 1841
Fig. 384

Ancylus diaphanus Haldeman 1841, Mon. Limniades N. America, pt. 3, p. 3 of cover; 1844, p. 8, pl. 1, fig. 4.
--- --- Binney 1865, Land and fresh water shells N. America, pt. II, p. 141, fig. 235.
--- --- Walker 1903, Nautilus, v. 17, p. 17, pl. 2, figs. 13-18.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
Ferrissia (Laevapex) diaphana Walker 1917, Nautilus, v. 31, p. 3, pl. 2, fig. 4.
Ferrissia diaphana Walker 1918, Synopsis and cat. fresh-water Moll., p. 120.

Ferrissia diaphana Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 293.

Type locality.—Ohio.

Diagnosis.—Shell thin, diaphanous, very wide, nearly circular, depressed; apex obtuse, almost central; slope scarcely convex; color very pale olivaceous green, translucent, aperture white; L. 5.5, W. 4.5, H. 2 mm.; distinguished by its circular and flattened form and inconspicuous central apex (condensed and modified from W. G. Binney, 1865, pt. II, p. 141). Apex smooth, surface smooth or delicately shagreened with fine transverse ripples, which in none of the specimens examined become sufficiently raised or connected to be called ribs; left side more arcuate than the right, in some specimens decidedly so (condensed from Walker, 1903, Naut. 17,

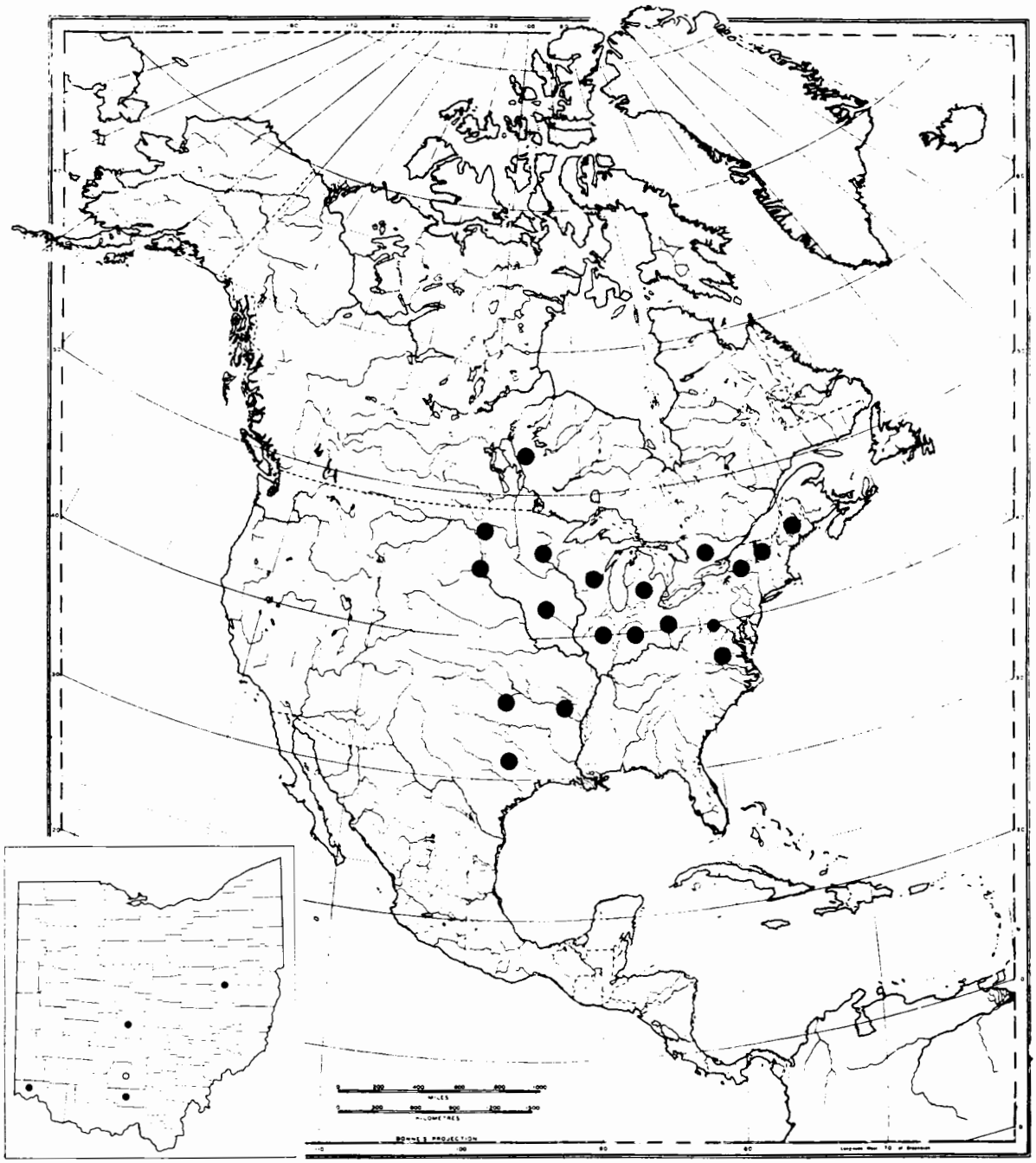


FIGURE 381.—Distribution of *Ferrissia tarda* in North America; *inset*, distribution in Ohio.

FIGURE 382.–*Ferrissia novangliae*, magnified; after Walker (1908, Naut. 21, pl. 9, figs. 5-7).

p. 18).

Ecology.–No data available.

Associations.–Living: OHIO-43.

General distribution (fig. 385).–New York west to Wisconsin, south to Illinois, Indiana, Tennessee, Ohio, and Pennsylvania. This is based on the following records: Ohio (type locality); Wisconsin (W. G. Binney,

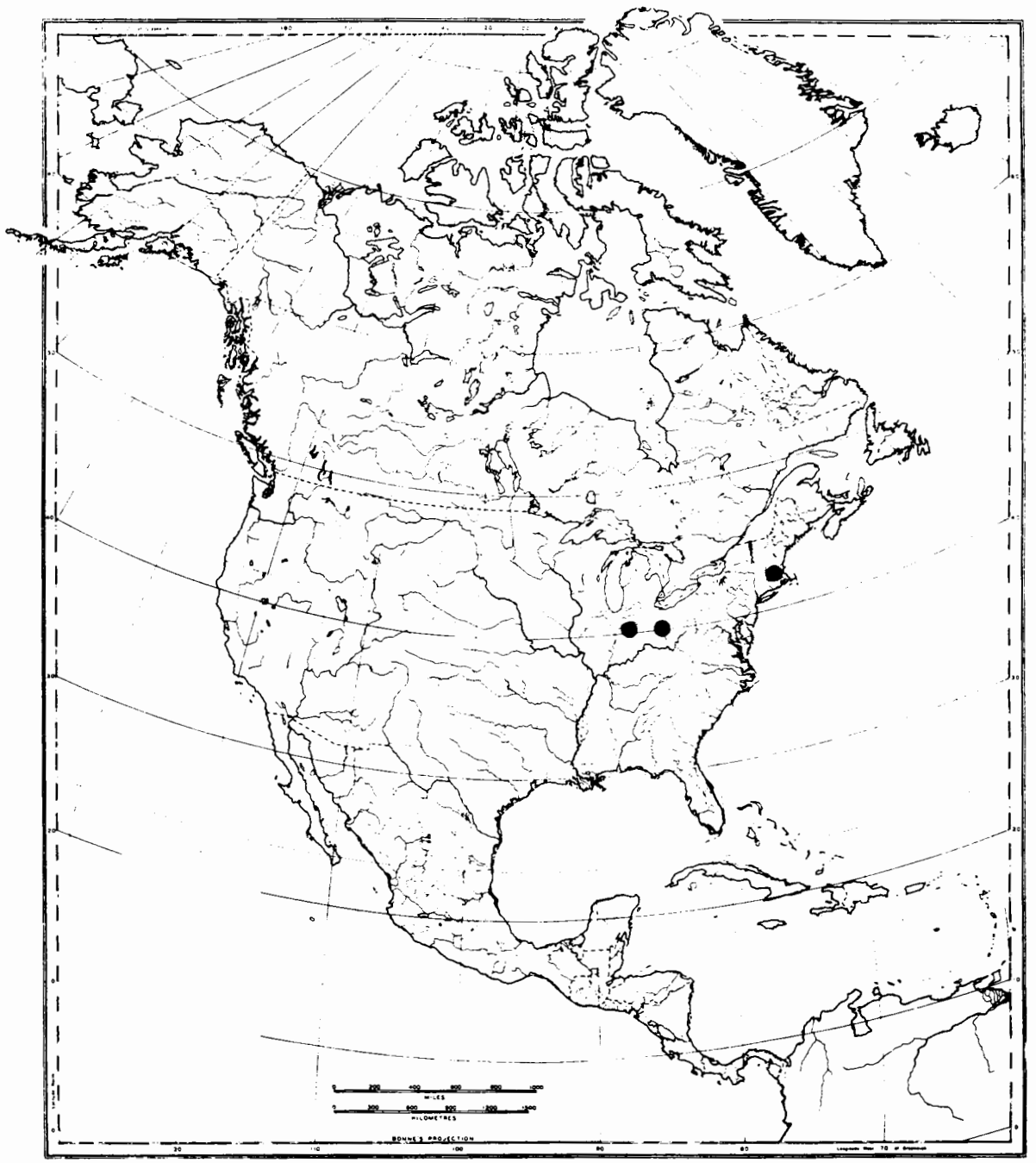


FIGURE 383.–Distribution of *Ferrissia novangliae* in North America.

FIGURE 384.–*Laevapex diaphanus*, magnified; after W. G. Binney (1865, pt. II, p. 141, fig. 235).

1865); New York (Maury, 1916, Naut. 30, p. 31); Ohio River in Pennsylvania, Illinois River, Tennessee River, Holston River (Walker, 1903, Naut. 17, p. 18); Michigan (Walker, 1893, Naut. 6, p. 137).

Distribution in Ohio (inset, fig. 385).–Sterki (1907a, p. 383) gives "Cincinnati; Tuscarawas Co. (St.)." These records are confirmed by Eggleston (ms. records). On this basis, the species should have a very wide range in the State but records are lacking to confirm this.

Geologic range.–Unknown.

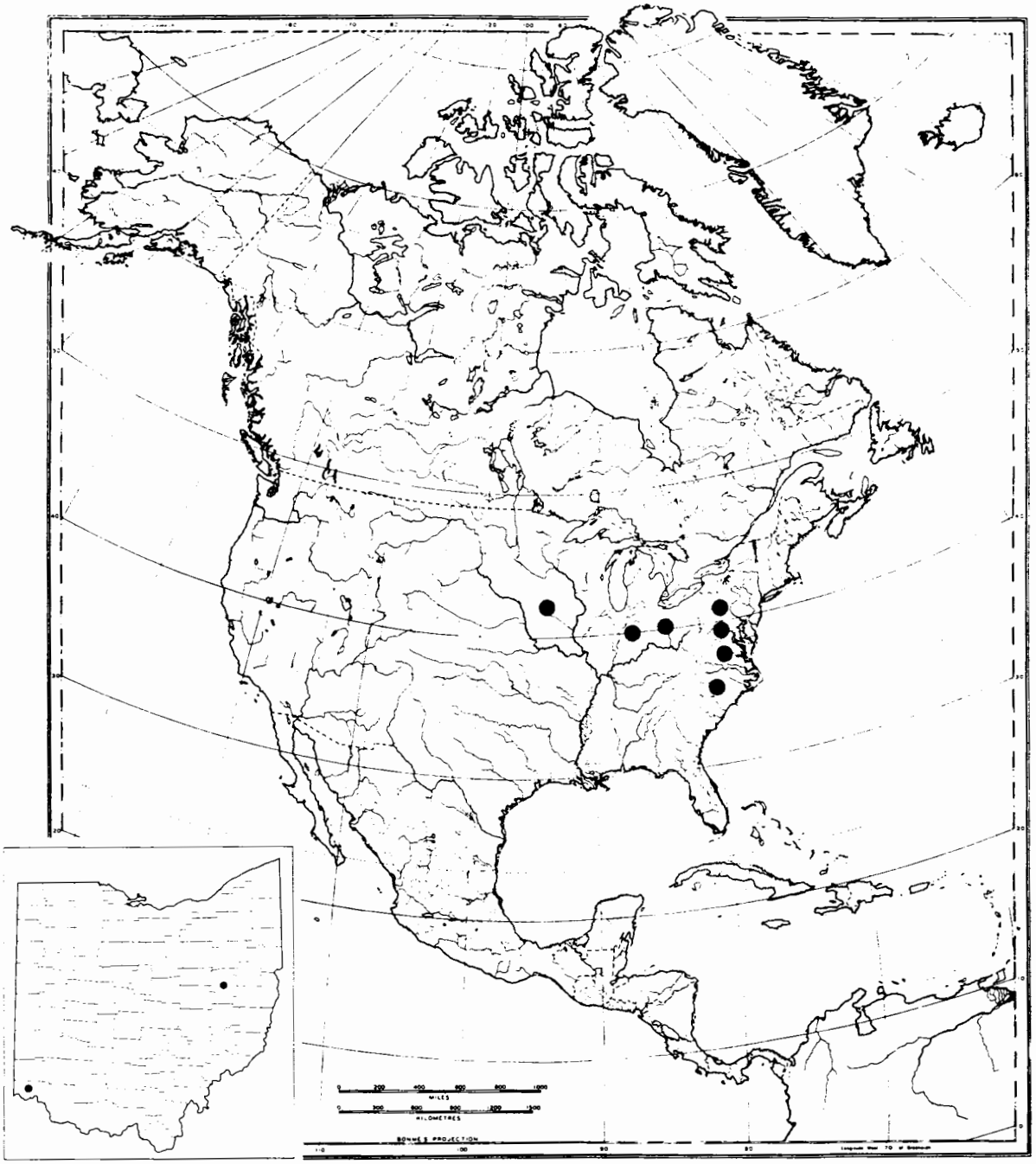


FIGURE 385.–Distribution of *Laevapex diaphanus* in North America; *inset*, distribution in Ohio.

Laevapex fuscus (C. B. Adams) 1840
Fig. 386

Ancylus fuscus Adams 1840, Boston Jour. Nat. History, v. 4, p. 329, pl. 3, fig. 17.
--- --- Binney 1865, Land and fresh water shells N. America, pt. II, p. 140, fig. 233.
--- --- Walker 1903, Nautilus, v. 17, p. 15, pl. 1, figs. 1-9.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
--- --- Johnson 1915, Fauna New England, p. 192.
Ferrissia fusca Walker 1918, Synopsis and cat. fresh-water Moll., p. 120.
Ancylus fuscus F. C. Baker 1920, Life of Pleistocene, p. 387.
Ferrissia fusca F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 404, pl. 24, figs. 10-13.
--- --- Dennis 1928, Aquatic gastr. Bass Is. region, p. 4.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 72, pl. 9, fig. 2.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 296.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 114.
--- --- Basch 1959, Mich. Univ. Mus. Zoology Misc. Pub. 108, p. 1-56.

FIGURE 386.–*Laevapex fuscus*, magnified; after W. G. Binney (1865, pt. II, p. 140, fig. 233).

Type locality.–Andover and Mansfield, Massachusetts.

Diagnosis.–Shell depressed, oval or slightly obovate, the right side somewhat flattened; anterior slope straight or slightly curved; posterior slope very slightly convex; right lateral slope straight; left lateral slope straight or slightly convex; apex obtuse, smooth, not rising above the general contour of the shell, placed behind the middle of the shell and somewhat to the right; surface sculpture of faint growth lines, occasionally with interrupted transverse lines which frequently form more or less irregular riblets; color horn, translucent and shining (modified from F. C. Baker, 1928a, pt. I, p. 404).

Ecology.–Found in creeks and lakes, attached to any convenient object: stones, floating logs, or waterweed. Dennis (1928, p. 34) states that wave action and the presence of vegetation are the two important requirements for this species in the Bass Islands region. On page 33 he states that the optimum conditions for the species are reached on mud bottom, without wave action, water 10 inches deep, on a flat gradient, with vegetation. Temperature was 27° C., water varying from 8 to 12 inches in depth (*ibid.*, p. 32). It may be assumed that his statement on page 34 relating to wave action is a *lapsus calami*, as he states (*ibid.*, p. 29) that the species was found only in quiet water, with vegetation.

Associations.–Living: MINNESOTA - 11c; NEW YORK - 36, 38; OHIO - 18, 19; WISCONSIN - 86. Fossil: W - 34.

General distribution (fig. 387).–"Massachusetts west to the Mississippi Valley, south to New Orleans" (Baker, 1928a, pt. I, p. 405). Its northern limits are poorly known.

Distribution in Ohio (inset, fig. 387).–Sterki 1907a, p. 383) gives "Cincinnati; Tuscarawas Co. (St.)." Dennis (1928, p. 4 ff.) obtained it from the Bass Islands region. Eggleston (ms. records) adds Portage County (fossil); Stark, Delaware, Licking, and Washington Counties.

Geologic range.–Taylor and Hibbard (1955, p. 11) and Hibbard and Taylor (1960, p. 114) have recorded this species for the Sangamon (Jinglebob local fauna) of Kansas. In Ohio it is known as a probably late Wisconsin fossil for only one locality in Portage County and from the Oakhurst deposit (Aukeman, 1960, p. 101).

Laevapex kirklandi (Walker) 1903
Pl. 13, fig. 20

Ancylus kirklandi Walker 1903, Nautilus, v. 17, p. 29, pl. 2, figs. 1-12.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 383.
Ferrissia (Laevapex) kirklandi Walker 1918, Synopsis and cat. fresh-water Moll., p. 120.
Ancylus kirklandi Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, 182.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 387.
Ferrissia kirklandi F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 406, pl. 24, figs. 19-21.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 293.
Laevapex kirklandi Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 114.

Type locality.–Grand Rapids, Michigan.

Diagnosis.–"Shell large for the genus, thin, translucent, horn-colored; broadly oval or obovate, sides nearly equally curved, ends broadly rounded; quite elevated; apex subacute, behind and to the right of the middle, and decidedly turned to the right; posterior and right slopes straight or slightly concave, anterior slope quite convex, left slope decidedly convex; surface with the growth lines regular and distinct and more or less rippled by transverse wrinkles, which frequently tend to form feeble, irregular radial riblets" (Walker, 1903, Naut. 17, p. 29, original description).

Ecology.–Apparently a species of creeks and small rivers, but present in rivers of fair size, *e.g.*, the Poto-

mac at Alexandria, Virginia. F. C. Baker (1928a, pt. I, p. 407) gave "Sturgeon Bay, on naiad shells near shore."

Associations.—Living: OHIO - 43; WISCONSIN - 98. Fossil: S - 6; W - 27, 28.

General distribution (fig. 388).—Not accurately known; Walker (1903, Naut. 17, p. 29) gives "Trenton, N. J., west to Hardy, Ark.," but he names only the states of Arkansas, Michigan, Ohio, Virginia, New Jersey, and the District of Columbia as definite localities; by the statement "From Michigan and several other western localities . . . " we may assume that Walker had material from other states, *e.g.*, Indiana, as indicated by Goodrich and van der Schalie's (1944) record for that State. Hibbard and Taylor (1960, p. 114) give Wisconsin and Michigan, south to eastern Kansas and Arkansas, east to New Jersey and Virginia.

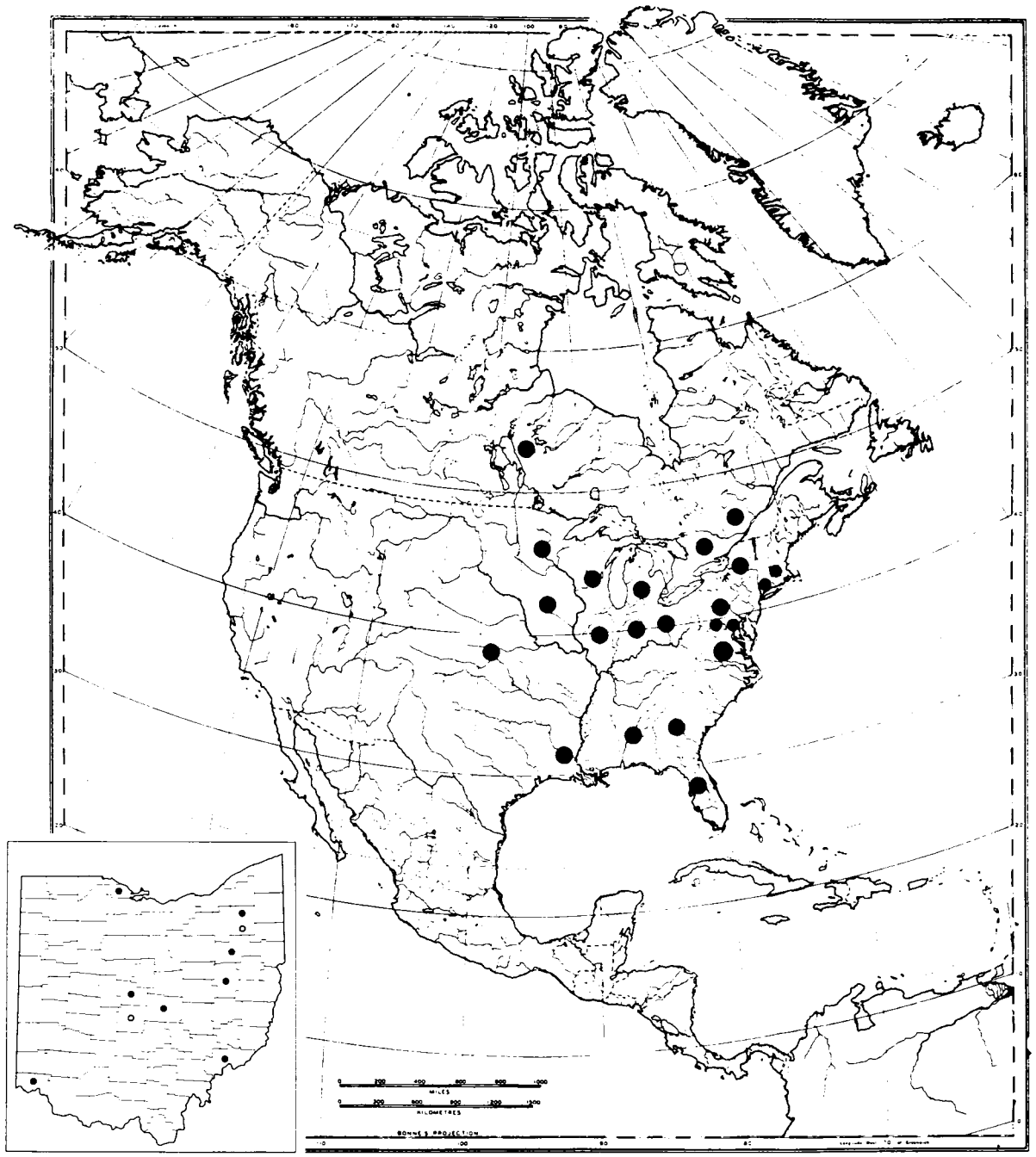


FIGURE 387.—Distribution of *Laevapex fuscus* in North America; *inset*, distribution in Ohio.

Distribution in Ohio (inset, fig. 388).—Walker (1903, Naut. 17, p. 31) gives only "Tuscarawas R., New Philadelphia, Ohio," but previously had mentioned that Sterki had collected it in the State from several localities. Sterki (1907a, p. 383) adds only Summit County to the list. Eggleston has no record of the species and I have seen no specimens.

Geologic range.—Illinoian of Kansas (Hibbard and Taylor, 1960, p. 114) to late Wisconsin ("Wabash") according to Baker (1920a, p. 387). Late Wisconsin marls in Ohio, from the Summit-Portage County line (Tinkers Creek marl) and from Erie County (Castalia marl), according to the records of Sterki (1920, p. 174, 182).

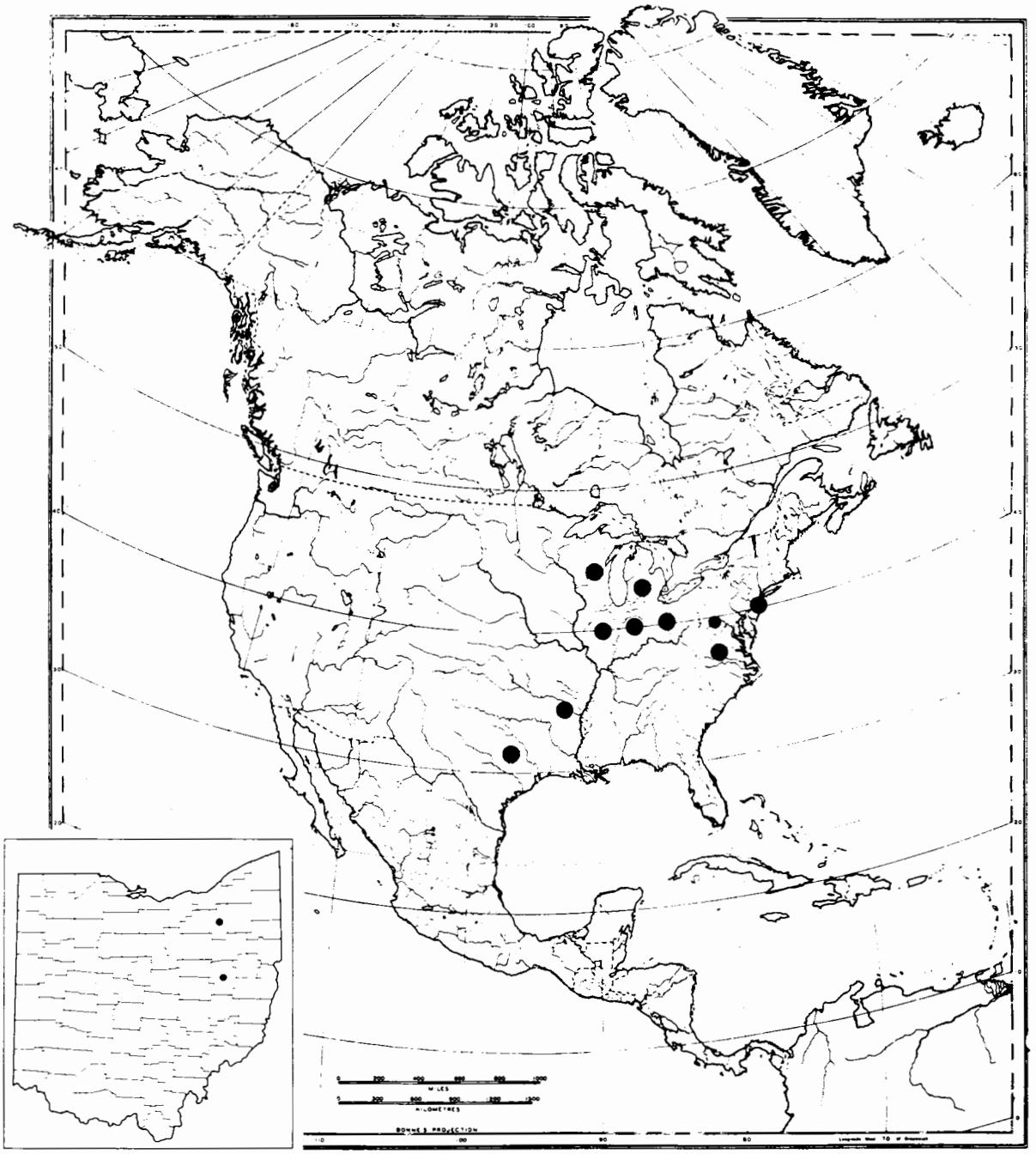


FIGURE 388.—Distribution of *Laevapex kirklandi* in North America; *inset,* distribution in Ohio.

Subfamily RHODACMEINAE Walker 1917

Rhodacmeinae Walker 1917, Nautilus, v. 31, p. 5.
Rhodacmeinae Walker 1918, Synopsis and cat. fresh-water Moll., p. 20.
Rhodacmeinae Walker 1923, Ancylidae S. Africa, p. 20.

Diagnosis.—Shell patelliform, conical, elevated or depressed, apex tinged with pink; other characteristics in the jaw and radula of the animal.

Remarks.—The subfamily contains a single genus, *Rhodacmea* Walker, of which one section and one species occur in Ohio.

Genus *Rhodacmea* Walker 1917

Rhodacmea Walker 1917, Nautilus, v. 31, p. 5.
Rhodacmea Walker 1918, Synopsis and cat. fresh-water Moll., p. 21, 122.
Rhodacmea Walker 1923, Ancylidae S. Africa, p. 20.

Type.—*Ancylus filosus* Conrad.

Diagnosis.—Shell and animal as in the subfamily.

Remarks.—Walker (1923, p. 20) divided this genus into two sections, *Rhodacmea s.s.* and *Rhodocephala* Walker 1917. Only the typical section is represented in the Ohio fauna.

Section *Rhodacmea s.s.*

Diagnosis.—Shell elevated; it is depressed in the other section, *Rhodocephala* Walker.

Remarks.—Species of this section are mainly inhabitants of the Coosa River system in Alabama, but representatives of it have spread northward into the Tennessee and Ohio River systems. Walker (1918, p. 122) enumerated the following species: *R. filosa* (Conrad), *R. cahawbensis* Walker, *R. elatior* (Anthony), and *R. hinkleyi* Walker. *R. elatior* occurs in the Green River, Kentucky, and Sterki thought it likely that it would eventually be found in Ohio. *R. hinkleyi* was described from the Ohio River at Golconda, Illinois, and may eventually be found in the Ohio River in Ohio.

[*Rhodacmea elatior* (Anthony) 1855]

Ancylus elatior Anthony 1855, N.Y. Lyceum Nat. History Annals, v. 6, p. 158, pl. 5, figs. 20, 21.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 400; not recorded for Ohio; probably, or possibly, to be found.
Rhodacmea elatior Walker 1917, Nautilus, v. 31, p. 8.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 122.

Type locality.—Green River, Kentucky.

Diagnosis.—"Shell very much elevated, ovate; lines of growth distant, conspicuous; color light green, opaque; apex decuticated, recurved, subcentral; anterior and posterior slopes convex; lateral slopes plane; apical region rose colored. *Hab.* Green River, Kentucky, adhering to small stones and dead shells. Very rare.... Length .26 inch (6½ mill.), breadth 0.21 inch (5 mill.), height .14 (3½ mill.)" (Anthony, 1855, original description).

Ecology.—The only known information is that given in the original description, above.

General distribution.—Kentucky, Alabama.

Distribution in Ohio.—Never recorded, but possible for the State.

Geologic range.—Unknown.

Family ANCYLIDAE *incertae sedis*

Ancylus sterkii "Walker MS" Sterki 1907

Ancylus sterkii Walker MS, Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384.

Remarks.—This is apparently a *nomen nudum*, possibly an identification in correspondence between Walker and Sterki, for which a formal description was never published.

Ancylus ohioensis "Walker (ms)"

In my copy of Sterki's Catalogue (1907a), which is annotated here and there in Walker's hand, in pencil, there is a single sheet of yellowed paper, 5½ x 8 7/8 inches, on which is typewritten a list headed "Additions to Ohio Catalogue--Sterki, 1913" and containing most of the names added to the Ohio Catalogue by Sterki in 1914. One entry, "Ancylus ohioensis Walker(ms)--Garretsville(Streator)," is my only clue to the existence of an ancylid with the specific name *ohioensis*. Apparently, the species was never described by Walker, perhaps because he found later that it was not new. The name is mentioned here in case material labeled *"Ancylus ohioensis"* exists in collections. Perhaps the species has been described but its description has escaped me.

Family PHYSIDAE Dall 1870

Physidae Dall 1870, N.Y. Lyceum Nat. History Annals, v. 9, p. 355.
Physidae Walker 1918, Synopsis and cat. fresh-water Moll., p. 15, 106.
Physidae F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 407.

Diagnosis.—Shell spiral, sinistral, oblong, thin, translucent, shining; spire acute, generally short; whorls convex; aperture ovate, rounded below; columella twist-

ed, lip thin, acute, in some specimens thickened within; ornamentation of very fine growth lines or impressed spiral lines, or shell almost entirely smooth.

Remarks.—Two genera of this family, *Physa* and *Aplexa*, are represented in the Ohio fauna, both living and Pleistocene; many others have been recorded for neighboring states and may be expected in Ohio. Only those species actually recorded for the State are noted here as the family is in need of thorough revision and many of the species are probably synonyms of others.

Genus *Physa* Draparnaud 1801

Physa Draparnaud 1801, Tableau Moll. France, pt. 31, p. 52.
Physella Haldeman 1842, Mon. Limniades N. America, pt. 8, p. 14, 38.
Physa Walker 1918, Synopsis and cat. fresh-water Moll., p. 15, 106.
Physella F. C. Baker 1928, Fresh water Moll. Wis., pt. 1, p. 408.
Physa La Rocque 1953, Cat. Recent Moll. Canada, p. 297.

Type.—*Bulla fontinalis* Linnaeus.

Diagnosis.—Shell sinistral, oblong or elongated, more or less translucent, surface dull to shining, spire acute or depressed, generally shorter than the aperture, which is contracted above and rounded below; columella with an obscure plait or thickening which gradually merges with the callus of the parietal wall; outer lip sharp, commonly thickened internally by a vertical callus; the inner lip is closely appressed to the columellar region, either completely closing the umbilical region or, rarely, leaving a small chink or perforation; sculpture consisting of coarse or subobsolete impressed spiral lines (modified from F. C. Baker, 1928a, pt. I, p. 408).

Speciation.—The species of *Physa* are legion and the genus has almost worldwide distribution. The North American list of described species would be an imposing one, combining that given by Walker (1918, p. 106-116) with that of W. G. Binney (1865, pt. II, p. 76-96) and including a few species described since 1918 by Baker (1928a, pt. I) and Clench (various papers). Various attempts have been made, notably by Crandall (1901, Naut. 15) and Wurtz (1949, Naut. 63), to bring order into this chaos but much remains to be done in order to reduce the species to manageable units that can be identified with some confidence. The species of the genus described herein are strictly those recorded for the State; many others have been recorded for neighboring states but are not included here as their status is somewhat in doubt. The references cited above will enable the reader to locate descriptions of these extralimital species if that is desired.

Physa anatina Lea 1864
Pl. 13, figs. 2, 3, 11, 12

Physa anatina Lea 1864, Acad. Nat. Sci. Philadelphia Proc. 1864, p. 115.
--- --- Crandall 1901, Nautilus, v. 15, p. 57.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 107.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 450.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 21, pl. 2, fig. F.
--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 7, 10.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 116.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 62.

Type locality.—Northern tributary of the Arkansas River, Kansas.

Diagnosis.—"Distinguished by its sub-fusiform and symmetrical shape, smooth and shining surface, pale color, six oblique whorls, impressed sutures, and the malleations on the lower part of the last whorl of all adult forms. Bi-annuan. Diameter 5/9 the length" (Crandall, 1901, Naut. 15, p. 57).

Ecology.—Almost any sort of perennial shallow water body, in either flowing or standing water (D. W. Taylor, 1960, p. 62).

General distribution (fig. 389).—Kansas; reported from Missouri, Arkansas, Nebraska, Michigan, and Ohio.

Distribution in Ohio (inset, fig. 389).—Doubtful. Sterki (1907a, p. 381) gave Tuscarawas River and Nimishillen Creek at Canton, but added: "May be a variety of *integra*." See also under *P. michiganensis* Clench.

Geologic range.—Lower Pliocene (Laverne Formation) to present (A. B. Leonard, 1950; Hibbard and Taylor, 1960, p. 116). The species has been recorded for Kansas and Oklahoma in recent years: Taylor and Hibbard (1955, p. 7, 10) identified it from "probably Illinoian," Sangamon, and Wisconsin deposits. Baker (1920b, p. 450) had previously identified this species from the Rush Lake late Wisconsin deposit in Ohio.

Remarks.—Sterki (1907a, p. 381) was not certain of the specific validity of this species and thought it might be a variety of *P. integra*. Clench (1926) transferred all records of *P. anatina* from states east of the Mississippi to his *P. michiganensis*, but the two species are so closely allied that *P. anatina* is described here in case the Ohio records should turn out to be correct.

[*Physa ancillaria* Say 1825]
Fig. 390

Physa ancillaria Say 1825, Acad. Nat. Sci. Philadelphia

Jour., v. 5, p. 124.
Physa subarata Menke 1830, Syn. Meth., p. 132.
Physa fragilis Mighels 1841, Boston Soc. Nat. History Proc., v. 1, p. 49.
Physa obesa De Kay 1843, Zoology N. Y., p. 78, pl. 5, fig. 86.
Physa ancillaria Call 1900, Moll. Ind., p. 409, pl. 8, fig. 4.
--- --- Crandall 1901, Nautilus, v. 15, p. 42.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 102.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
--- --- Johnson 1915, Fauna New England, p. 179.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 107.

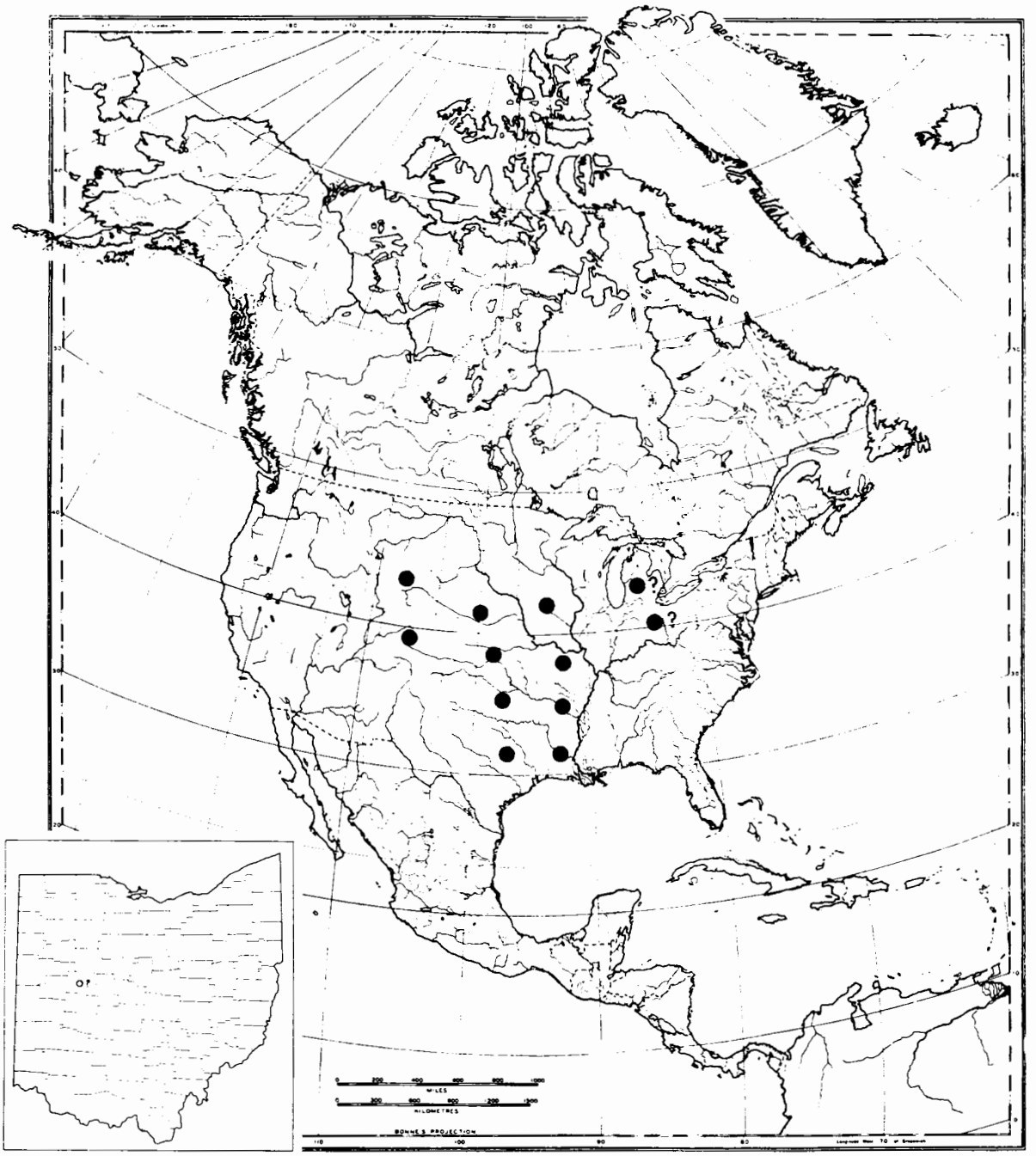


FIGURE 389.–Distribution of *Physa anatina* in North America; *inset*, distribution in Ohio.

Physella ancillaria F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 424, pl. 25, figs. 9-17, 22, 23.
Physa ancillaria Goodrich 1932, Moll. Mich., p. 70.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 291.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 73, pl. 6, fig. 15.
--- --- Wurtz 1949, Nautilus, v. 63, p. 21 ff. (as synonym of *P. heterostropha*).
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 297.

FIGURE 390.–[*Physa ancillaria*], X1; after W. G. Binney (1865, pt. II, p. 81, fig. 139).

Type locality.–Delaware River, near Easton, Pennsylvania, and Connecticut River, above Hartford, Connecticut.

Diagnosis.–Shell large, thin to solid, somewhat cylindrical, imperforate; color greenish or yellowish horn to brownish or reddish; surface shining, often more or less streaked with brown or black; sculpture of fine close-set lines of growth crossed by more or less distinct impressed spiral lines, which may become almost obsolete on the body whorl; whorls 4½ to 5, somewhat compressed, body whorl large and strongly shouldered; spire very short, broad, obtuse, the whorls slanting at an angle of 45°; aperture large, 7/10 to 4/5 total length of shell; outer lip compressed and flattened, its edge thin; inner lip thickened, especially on the umbilical side; columella straight, with a heavy impressed fold forming a distinct plait; L. 16.5, W. 11.5, Ap. L. 12.0, Ap. W. 6.0 mm., type form (modified from F. C. Baker, 1928a, pt. I, p. 424-425).

Ecology.–Exceptionally, but in the type locality in Pennsylvania, found on mud flats left bare at low tide; generally in lakes and streams, in water of all depths down to 40 feet, with little preference for one substratum over another.

Associations.–Living: MANITOBA - 13; OHIO - 8, 9, 10, 11, 13, 14, 15, 19, 20, 43 (including *magnalacustris*); ONTARIO - 3, 5; WISCONSIN - 1, 2, 3. As *P. ancillaria warreniana*, living: NEW YORK - 2b, 3b, 4a, 4c, 5a, 5b, 6, 7, 8, 9, 14, 15b, 16, 21, 22, 23, 26, 29, 30, 32, 34, 35, 36, 37, 40a, 41, 42, 43, 44.

General distribution (fig. 391).–New Jersey and Maine west to Minnesota, south to the Ohio River, north to Ontario and Manitoba.

Distribution in Ohio (inset, fig. 391).–Recorded for Summit County only by Sterki (1907a, p. 381); Eggleston (ms. records) has identified it from the Bass Islands, Ottawa County; Summit, Portage, Franklin, Guernsey, and Hamilton Counties.

Geologic range.–Sangamon (F. C. Baker, 1920a, p. 386).

Remarks.–Wurtz (1949, Naut. 63, p. 32) considers this as an absolute synonym of *P. heterostropha* and I am satisfied that he is correct in his conclusion. The specific name *P. ancillaria* is so well ingrained in the literature, however, that the preceding synonymy and discussion have been given here for the reader's guidance.

[*Physa ancillaria magnalacustris* Walker 1901]

Physa ancillaria var. *magnalacustris* Walker 1901, Nautilus, v. 14, p. 97.
Physa ancillaria magnalacustris Crandall 1901, Nautilus, v. 15, p. 42, 43.
--- --- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
--- --- --- Walker 1918, Synopsis and cat. freshwater Moll., p. 107.
Physella magnalacustris F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 435, pl. 26, figs. 1-6.
Physa ancillaria magnalacustris Dennis 1928, Aquatic gastr. Bass Is. region, p. 3.
--- --- --- Goodrich 1932, Moll. Mich., p. 70.
Physa magnalacustris La Rocque 1953, Cat. Recent Moll. Canada, p. 299.

Type locality.–Frankfort, Benzie County, Michigan; on Lake Michigan.

Diagnosis.–Shell thicker, more opaque, and with more irregular growth lines than in typical *P. ancillaria;* color purplish-horn, darker toward the apex; body whorl with one or more broad white varicose bands; whorls 5, rapidly expanding; spire slightly elevated, acute (modified from Walker, 1901, Naut. 14, and F. C. Baker, 1928a, pt. I).

Ecology.–Found on stones or ledges along the shores of the Great Lakes, always in shallow water.

General distribution (fig. 392).–Lakes Huron, Michigan, and Erie; possibly also the other Great Lakes. A few lakes in Michigan besides the Great Lakes.

Distribution in Ohio.–Sterki (1907a, p. 381) and Dennis (1928, p. 3) recorded this form from Lake Erie; I know of no other records for the State.

Geologic range.–Unknown.

Remarks.–The difficulties experienced by Clench and by Baker (1928a, pt. I, p. 436) in placing this form in relationship to a species (*P. ancillaria* versus *P. sayii*) are resolved if Wurtz' (1949, Naut. 63) conclusions are followed and these two "species" are considered synonyms of *P. heterostropha.* It seems unnecessary to raise *P. magnalacustris* to specific status; if the Great Lakes form must be given a name, it should be *P. heterostropha magnalacustris* but this trinomial appears totally superfluous to the writer.

[*Physa aplectoides* Sterki 1907]

Physa aplectoides Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381, 399.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 107.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 183.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.

Type locality.—Portage and Tuscarawas Counties, Ohio.

Diagnosis.—"Very small and slender; distinct, t. Walker" (Sterki, 1907a, p. 381, original "description").

Ecology.—No data available.

Associations.—Fossil: W-28.

General distribution (fig. 393).—Ohio and Michigan: Isle Royale and Schoolcraft County (Walker, 1918, p. 107).

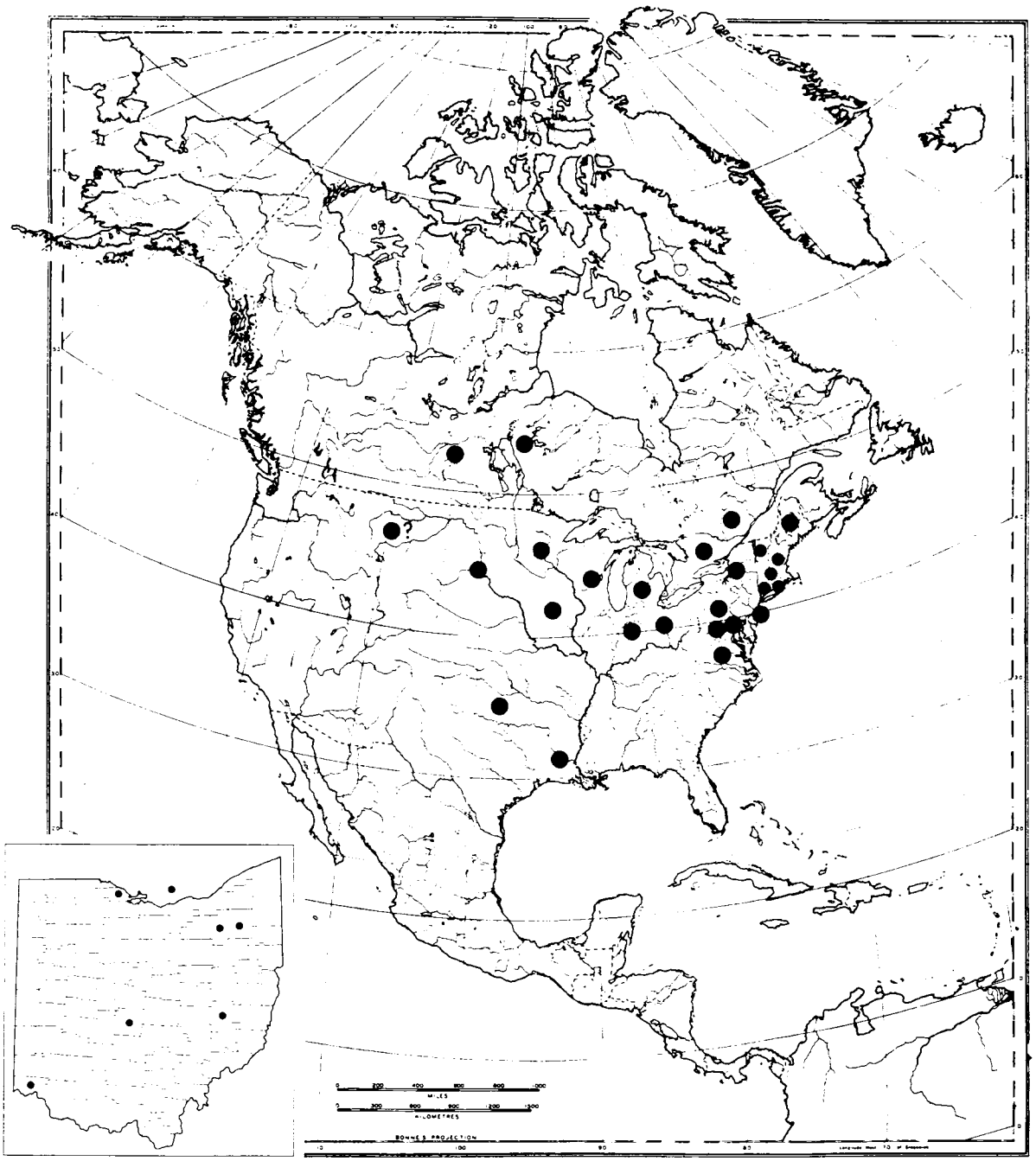


FIGURE 391.—Distribution of [*Physa ancillaria*] in North America; *inset,* distribution in Ohio.

Distribution in Ohio (inset, fig. 393).—Portage and Tuscarawas Counties (type locality) and Castalia marl (Sterki, 1920, p. 183), scarce.

Geologic range.—Late Wisconsin marl deposit (Castalia), Ohio. "Wabash" (F. C. Baker, 1920a, p. 386).

Remarks.—The characteristics quoted under "Diagnosis" above seem to constitute the entire original description of this species. Walker recognized it in his Catalogue (1918) but gave no reference other than that quoted above. Whether Sterki's brief remarks constitute a valid description appears doubtful. I have found no other reference to this species. It should be considered as probably a *nomen nudum*, in any case not a valid species.

FIGURE 392.—Distribution of [*Physa ancillaria magnalacustris*] in North America.

Physa elliptica Lea 1837
Fig. 394

Physa elliptica Lea 1837, Am. Philos. Soc. Trans., v. 5, p. 115, pl. 19, fig. 83.
Physa febigerii Lea 1864, Acad. Nat. Sci. Philadelphia Proc. 1864, p. 114.
Physa nicklinii Lea 1864, *ibid.*
Physa elliptica Crandall 1901, Nautilus, v. 15, p. 54.
Physa troostiana Lea, *fide* Crandall 1901, *ibid.*, p. 55.
Physa gyrina elliptica Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
Physa elliptica Johnson 1915, Fauna New England, p. 180.
Physa aurea Lea, *fide* Crandall 1901, Nautilus, v. 15, p. 55, and Walker 1918, Synopsis and cat. fresh-

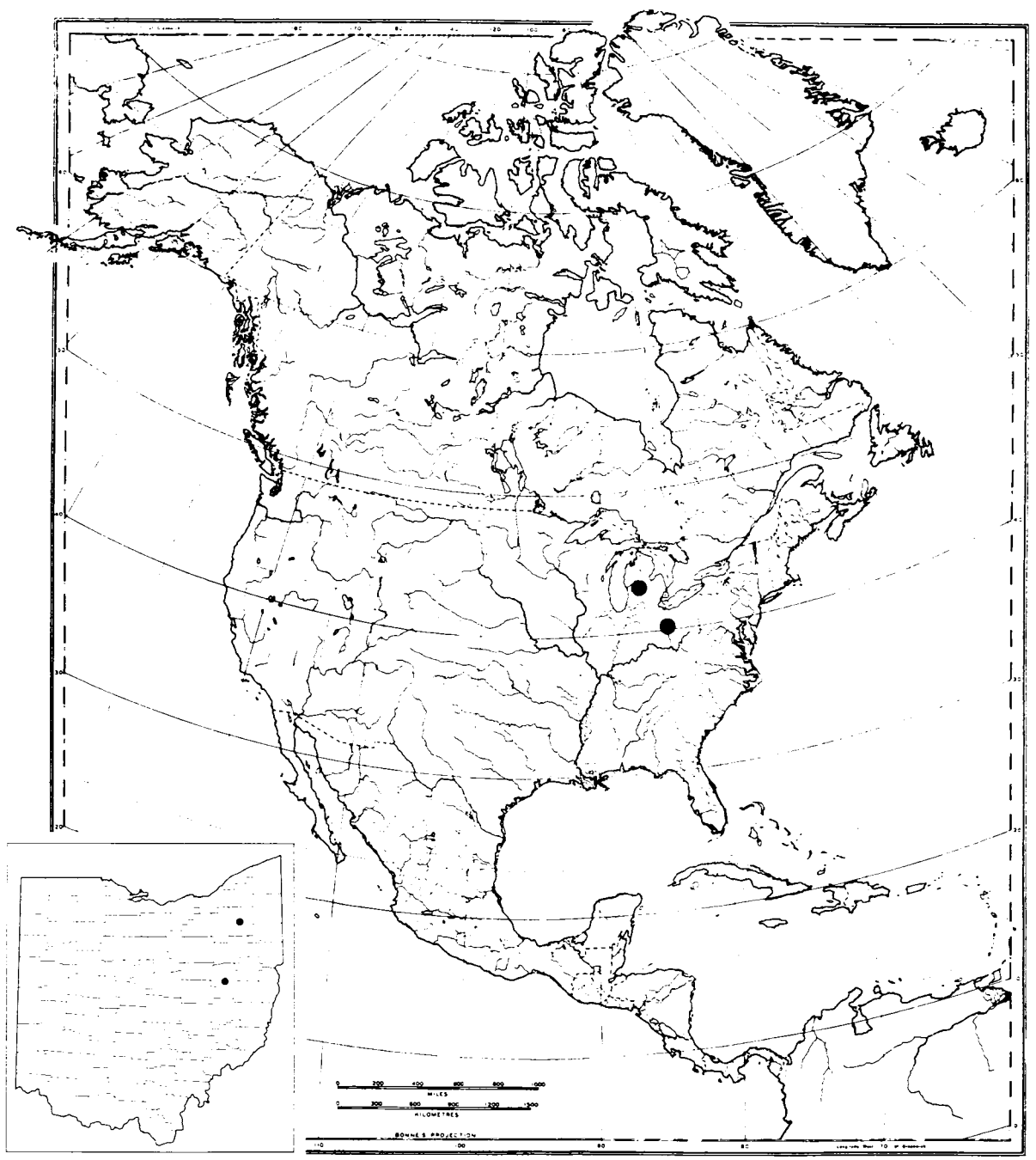


FIGURE 393.—Distribution of [*Physa aplectoides*] in North America; *inset*, distribution in Ohio.

water Moll., p. 108.
Physa elliptica Walker 1918, Synopsis and cat. fresh-water Moll., p. 110.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
Physella elliptica F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 455, pl. 28, figs. 15-18.
Physa gyrina elliptica Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 290.
Physa elliptica Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 77, pl. 6, figs. 18, 19.
Physa elliptica elliptica La Rocque 1953, Cat. Recent Moll. Canada, p. 298.

FIGURE 394.–*Physa elliptica,* X1; after W. G. Binney (1865, pt. II, p. 78, fig. 131).

Type locality.–For *P. elliptica,* unknown; for *P. febigeri,* Logan County, Ohio; for *P. nicklinii,* Callaghan's, Allegheny County, Virginia.

Diagnosis.–"Shell elliptical, thin, pellucid, smooth and generally shining, lines of growth scarcely perceptible, spire rather short and obtuse, sutures impressed, aperture elliptical, axis straight, with varicose bands when mature, and diameter from two-fifths to one-half the length. The outline is almost exactly that of an elliptic spring. All the varieties are small, not exceeding a half inch in length" (Crandall, 1901, Naut. 15, p. 55).

Associations.–Living: MICHIGAN - 10, 12; NEW YORK - 1; WISCONSIN - 79, 138. Fossil: K - 16, 21, 23, 24; S - 1 *(cf.)*; W - 28.

General distribution (fig. 395).–East of the Mississippi River and north to Tennessee (Crandall, 1901, Naut. 15). Possibly also New York west to Wisconsin, south to Ohio and Indiana.

Distribution in Ohio (inset, fig. 395).–Sterki (1907a, p. 381) gave Tuscarawas and Medina Counties; I have no other records, except for fossil specimens, see below.

Geologic range.–Yarmouth to Recent; Kansas and Oklahoma (A. B. Leonard, 1950, p. 21; D. W. Taylor and Hibbard (1955, p. 7, 10) identify the species from Illinoian and Sangamon deposits in Oklahoma and Kansas. Sterki (1920, p. 183) listed it as "frequent" from the Castalia marl in Erie County, Ohio.

Physa gyrina Say 1821
Fig. 396

Physa gyrina Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 171.
Physa gyrina Call 1900, Moll. Ind., p. 408, pl. 8, fig. 1.
--- --- Crandall 1901, Nautilus, v. 15, p. 45.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 101, fig. 79.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
--- --- Johnson 1915, Fauna New England, p. 179.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 110.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
Physella gyrina F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 449, pl. 27, figs. 30-35, 37-40; pl. 28, figs. 1, 5, 6.
Physa gyrina Goodrich 1932, Moll. Mich., p. 68.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 290.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 76, pl. 4, figs. 25, 26.
Physa gyrina gyrina La Rocque 1953, Cat. Recent Moll. Canada, p. 298.

Type locality.–Bowyer Creek, near Council Bluffs, Iowa.

Diagnosis.–Shell large, elongate or subcylindrical, rather thick, subperforate to perforate; color yellowish corneous to ashy, surface dull; sculpture of coarse growth lines crossed by conspicuous heavily impressed spiral lines; whorls 5-6, the last rather large, compressed or slightly inflated; spire rather long, acute, the whorls well rounded, the penultimate whorl very large; aperture 5/10 to 7/10 the length of the entire shell; outer lip flatly rounded, with thin edge, internally thickened with a callus which is bordered internally by a wide band of red; columella straight, thickened, the inner lip turned over and appressed to the umbilical region, forming a wide, flat columellar region, which is rarely twisted or with a plait; there are generally three white rest period marks on the shell (condensed from F. C. Baker, 1928a, pt. I, p. 450).

Ecology.–It appears to be characteristic of slow-moving and stagnant bodies of water, in shallow water, usually on a mud bottom. Also found in small ponds behind river and lake beaches.

Associations.–Living: MANITOBA - 7, 8, 9, 10, 17, 21, 25, 31; MINNESOTA - 9, 10, 11b, 11c, 13b, 14b, 14c, 16; NEW YORK - 9, 18b; OHIO - 30, 31, 32, 35, 36, 40, 42, 43; WISCONSIN - 4, 59, 66, 104, 125, 135. Fossil: N - 1, 2; S - 2, 6; W - 27, 28, 30, 31, 32, 35, 36, 37, 38, 39, 42, 48, 49, 50, 51, 56, 57, 58, 59.

General distribution (fig. 397).–United States east of the Mississippi except that it ranges into Texas; eastern Canada (Ontario, Quebec) northward to the Artic regions.

Distribution in Ohio (inset, fig. 397).–Sterki (1907a, p. 381) gives "over the state, common and variable." Plentiful records by Eggleston (ms. records) and in the University of Michigan collections confirm Sterki's statement. The species is also found as a Pleistocene fossil (see below).

Geologic range.—Baker (1920a, p. 386) gave Aftonian, Yarmouth, and "Wabash." Sterki (1920, p. 175, 183) records the species for the Tinkers Creek and Castalia marls. D. W. Taylor and Hibbard (1955, p. 7) record it for a "probably Illinoian" deposit in Oklahoma. It has been collected from the following Pleistocene deposits in Ohio: Humboldt (Reynolds, 1959, p. 155), Newell Lake (Zimmerman, 1960, p. 20), Aultman (Sheatsley, 1960, p. 99), Souder Lake (Cornejo, 1961, fig. 11), Castalia (Clark, 1961, p. 24), and Jewell Hill (Mowery, 1961, p. 11).

[*Physa gyrina hildrethiana* Lea 1841]
Pl. 13, figs. 4, 5, 9, 13

Physa hildrethiana Lea 1841, Am. Philos. Soc. Proc.,

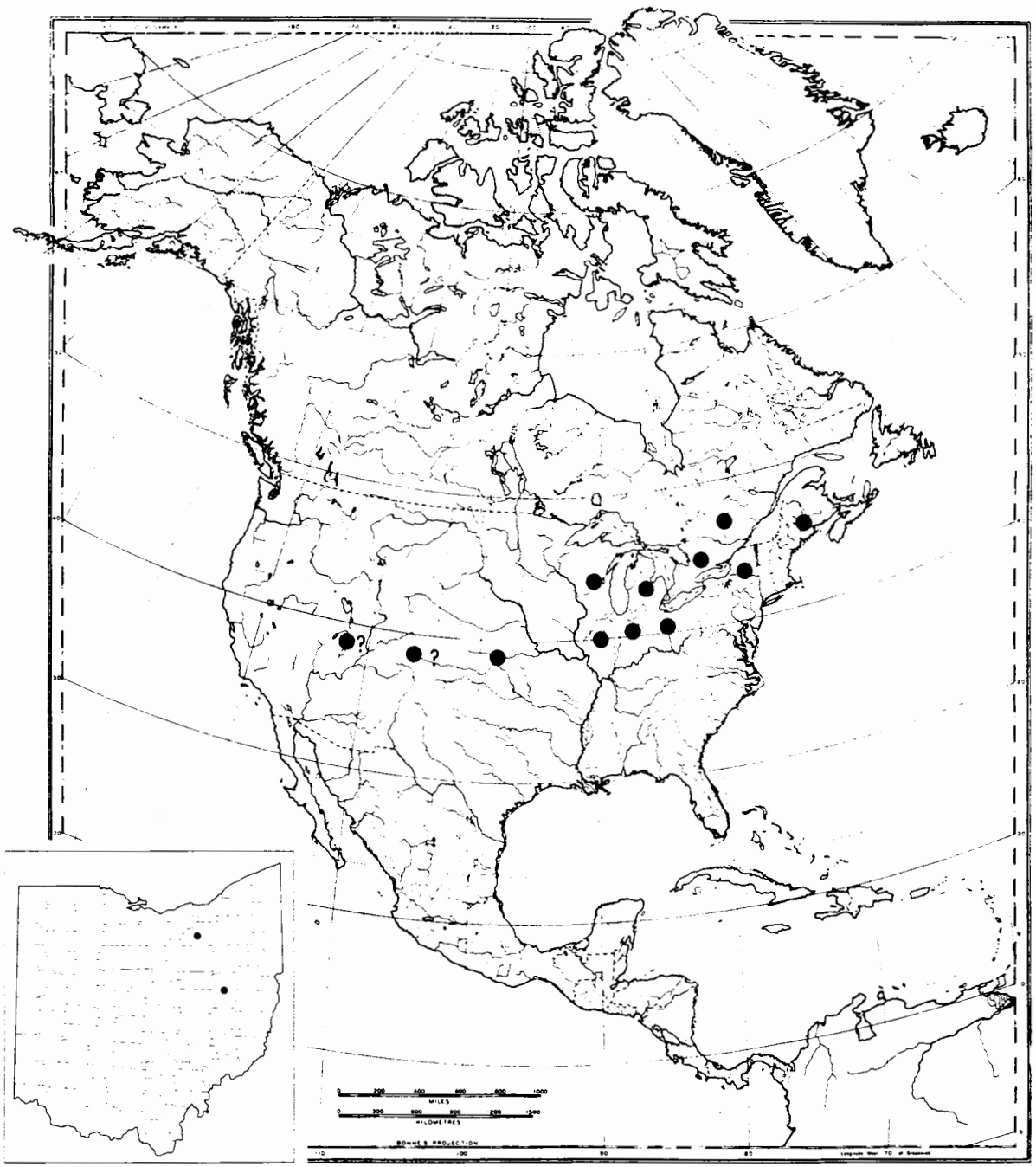


FIGURE 395.—Distribution of *Physa elliptica* in North America; *inset,* distribution in Ohio.

FIGURE 396.–*Physa gyrina*, magnified; after Call (1900, pl. 8, fig. 1).

v. 2, p. 32.

Physa altonensis Lea 1864, Acad. Nat. Sci. Philadelphia Proc. 1864, p. 114.

Physa oleacea auctt., non Tryon.

Physa gyrina hildrethiana Crandall 1901, Nautilus, v. 15, p. 45.

Physa hildrethiana Dall 1905, Harriman-Alaska Exped., v. 13, p. 102, fig. 79, a synonym of *P. gyrina*.

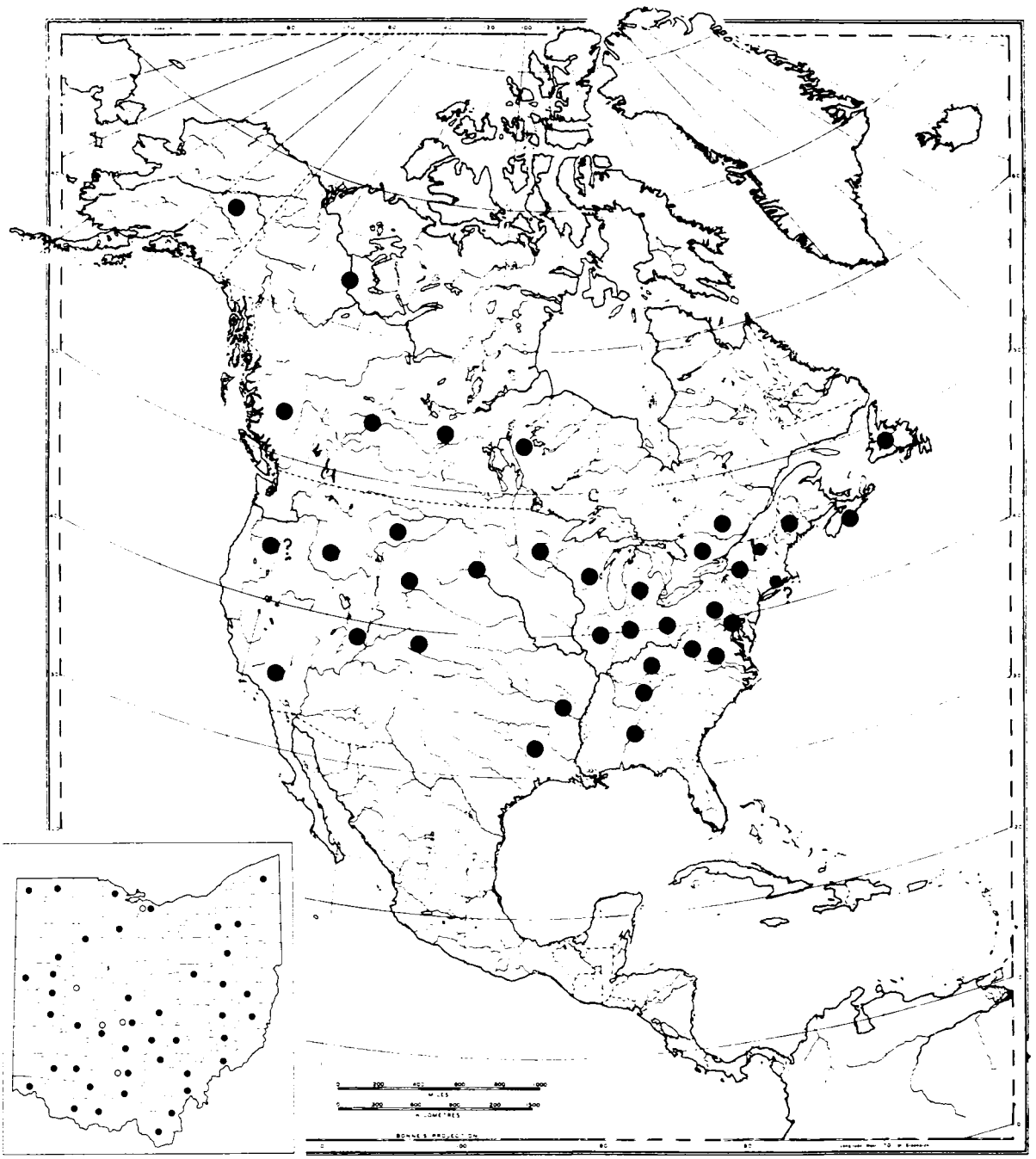


FIGURE 397.–Distribution of *Physa gyrina* in North America; *inset*, distribution in Ohio.

Physa gyrina hildrethiana Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
--- --- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
Physella gyrina hildrethiana F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 453, pl. 27, fig. 36; pl. 28, figs. 2-4, 7-14.
Physa gyrina hildrethiana Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 290.
--- --- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 77, pl. 6, fig. 6.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 298.
--- --- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 117.
Physa gyrina form *hildrethiana* Taylor 1960, U.S. Geol.

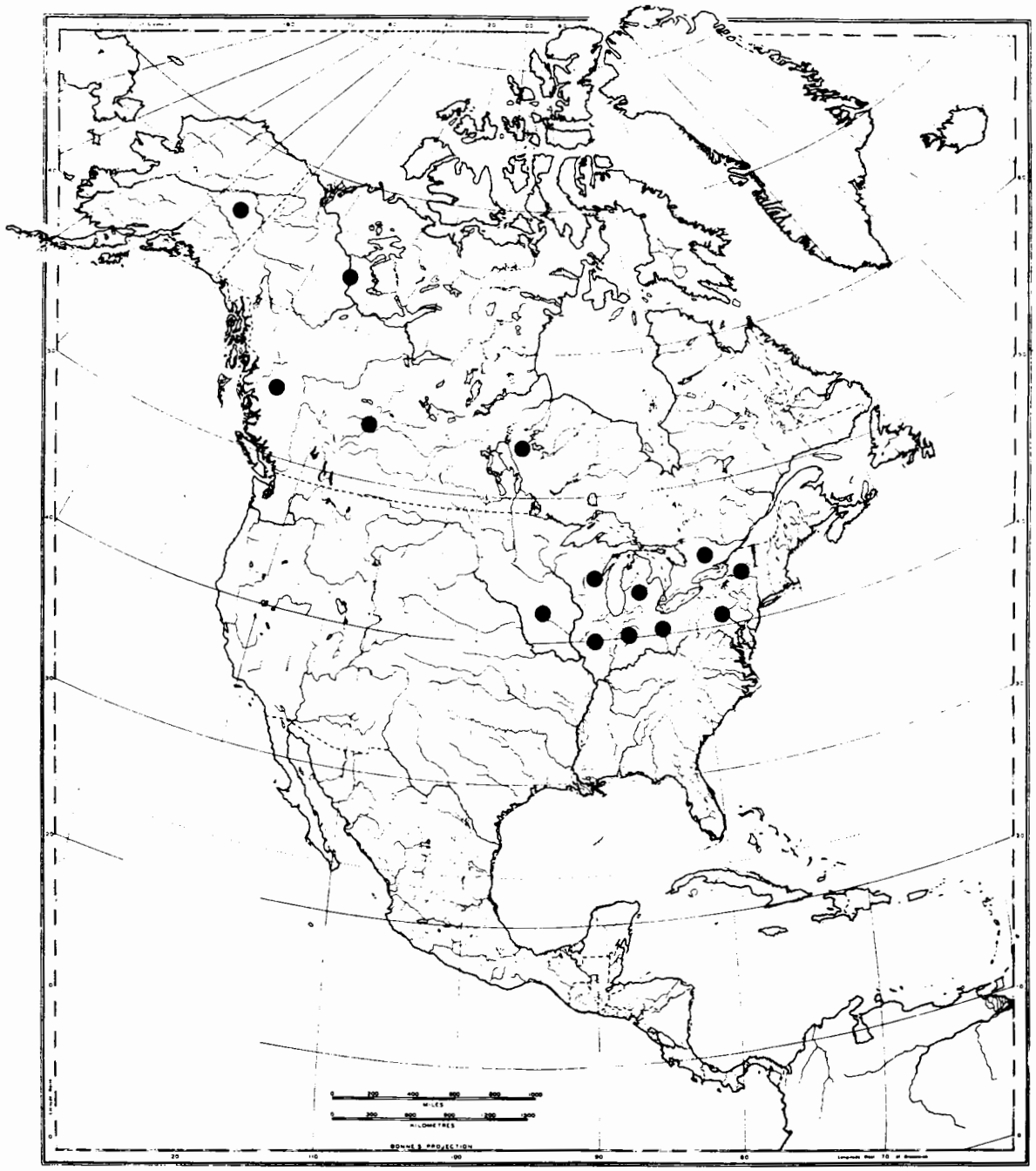


FIGURE 398.–Distribution of *Physa gyrina hildrethiana* in North America.

Survey Prof. Paper 337, p. 63.

Type locality.—"A lake in Illinois"; *P. altonensis*, Alton, Illinois.

Diagnosis.—Shell thinner, with finer spiral lines, more polished surface than the typical form; shell narrower, more elongate, the aperture not as distinctly loop-shaped; darker colored; the body whorl less swollen than in the typical form (modified from F. C. Baker, 1928a, pt. I, p. 453).

Ecology.—The form is characteristic of swales, summer-dry ponds, where it is forced to aestivate for part of the year. In these ponds, the majority of the individuals die when the pond dries out; a few manage to burrow into the mud at the bottom of the pool and to survive until the pond fills up again. In ponds where the water becomes low in summer but does not completely disappear, the species thrives remarkably and individual shells may show as many as four rest marks.

Associations.—Living: MANITOBA - 29.

General distribution (fig. 398).—Great Slave Lake and Port Clarence, Alaska southward; western New York and Pennsylvania, to Illinois and Iowa, south to Alabama.

Distribution in Ohio.—Sterki (1907a, p. 381) gives only "La Grange, Lorain Co. (Walker)." I have no other records for living specimens. It is also found in Ohio as a Pleistocene fossil.

Geologic range.—"Wabash" (Baker, 1920a, p. 386). Late Wisconsin marl deposit, Castalia, Erie County, Ohio (Sterki, 1920, p. 183). Early Pleistocene (Nebraskan) to Recent (Hibbard and Taylor, 1960, p. 118).

Physa heterostropha (Say) 1817
Fig. 399

Limnea heterostropha Say 1817, Nicholson's Encycl., Am. ed., pl. 1, fig. 6.
Physa heterostropha Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 172.
Physa fontana Haldeman 1841, Mon. Limniades N. America, pt. 2, p. 3 of cover.
Physa charpentieri Küster 1862, *in* Chemnitz, ed. 2, p. 23, pl. 4, figs. 1-6.
Physa heterostropha Call 1900, Moll. Ind., p. 409, pl. 8, fig. 3.
——— ——— Crandall 1901, Nautilus, v. 15, p. 28.
——— ——— Dall 1905, Harriman-Alaska Exped., v. 13, p. 101, fig. 78.
——— ——— Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
——— ——— Johnson 1915, Fauna New England, p. 179.
——— ——— Walker 1918, Synopsis and cat. fresh-water Moll., p. 111.
——— ——— F. C. Baker 1920, Life of Pleistocene, p. 103.
Physella heterostropha F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 447, pl. 27, figs. 21-24.
Physa heterostropha Goodrich 1932, Moll. Mich., p. 69.
——— ——— Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 290.
——— ——— Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 76, pl. 6, figs. 7, 8.
——— ——— Wurtz 1949, Nautilus, v. 63, p. 20-33.
——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 298.

FIGURE 399.—*Physa heterostropha*, slightly magnified; after W. G. Binney (1865, pt. II, p. 84, fig. 145).

Type locality.—Delaware River, near Philadelphia, Pennsylvania.

Diagnosis.—Shell of medium size, thin, elongate, somewhat cylindrical, some specimens inflated, more or less translucent, imperforate; color yellowish horn or chestnut, surface shining but rarely polished; sculpture of distinct growth lines; spiral sculpture subobsolete; whorls about 5, the last very large, compressed or flatly rounded; spire rather long, pointed, acute, the whorls flatly rounded; aperture large, 7/10 the length of the entire shell, the outer lip flattened and slightly shouldered above, broadly rounded below, narrowed above, horn color on the inside; lip with a slight callus bordered with red (modified from F. C. Baker, 1928a, pt. I, p. 447).

Ecology.—Found on mud bottom, in ditches and small brooks, as well as small rivers.

Associations.—Living: OHIO - 29, 43; ONTARIO - 7, 9. Fossil: W - 27, 33, 34.

General distribution (fig. 400).—Potomac and Ohio Rivers north and west to the Mississippi. Newfoundland, Quebec, Ontario, and Manitoba. Following the reduction of *P. ancillaria* and *P. sayii* to the synonymy of *P. heterostropha*, the distribution may be extended considerably.

Distribution in Ohio (inset, fig. 400).—Sterki (1907a, p. 381) gave "Cincinnati; Cleveland (Allen); Tuscarawas Co. (St.); probably over the state." Eggleston (ms. records) adds Ottawa, Erie, Lucas, Summit, Portage, Franklin, Hamilton, and Washington Counties. It has also been recorded as a fossil (see below).

Geologic range.—Sangamon(?), Peorian(?), and "Wabash" (Baker, 1920a, p. 386). Tinkers Creek marl, late Wisconsin, Summit-Portage Counties, Ohio (Sterki, 1920, p. 175). Oakhurst deposit (Aukeman, 1960, p. 103).

Physa integra Haldeman 1841
Fig. 401

Physa integra Haldeman 1841, Mon. Limniades N.

America, pt. 3, p. 3 of cover.

Physa integer Crandall 1901, Nautilus, v. 15, p. 56.

Physa integra Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.

--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 111.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.

Physella integra F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 460, pl. 28, figs. 24-31.

Physa integra Goodrich 1932, Moll. Mich., p. 71.

--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 291.

--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 78, pl. 6, figs. 11, 12.

Physa integra integra La Rocque 1953, Cat. Recent

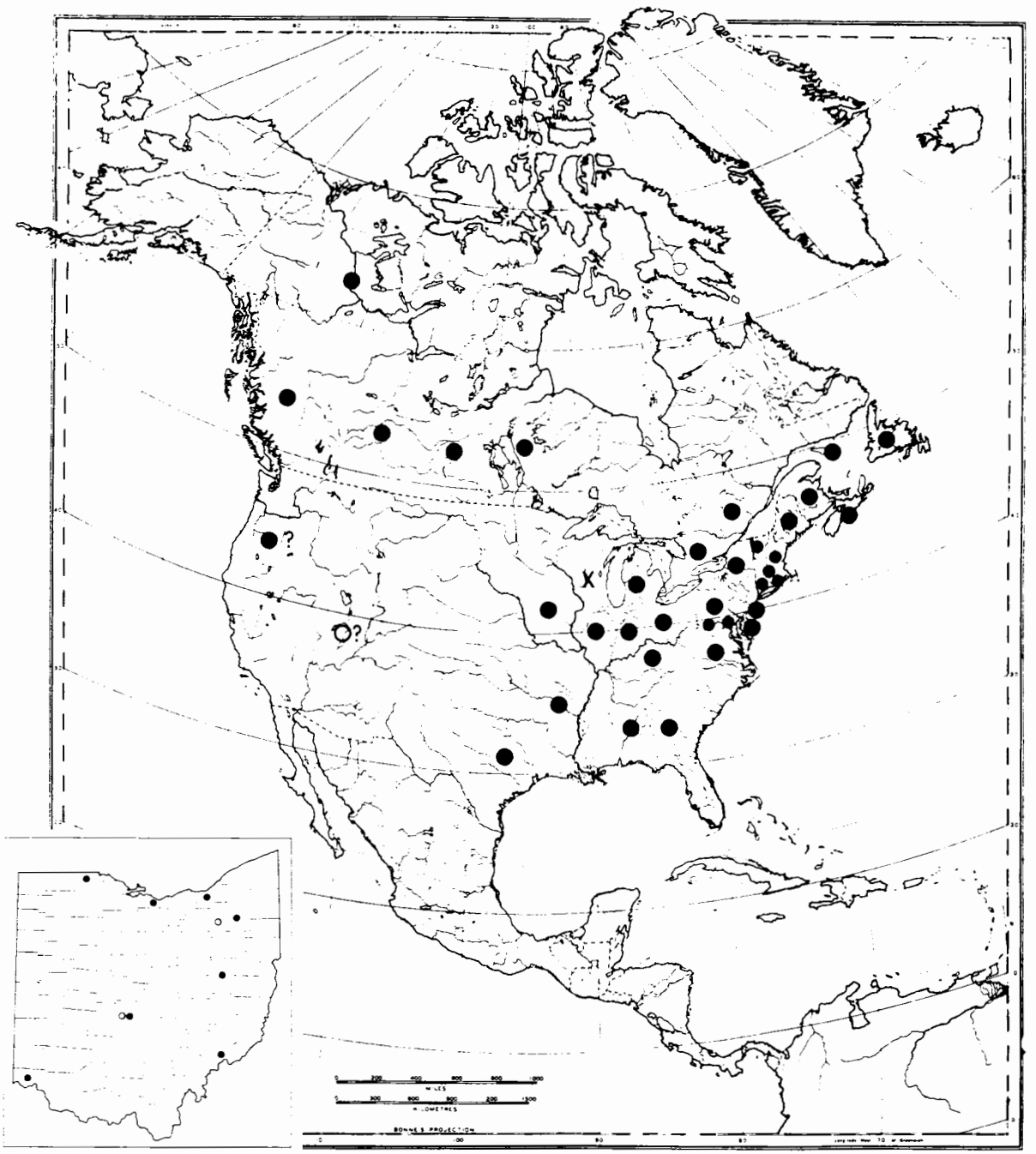


FIGURE 400.–Distribution of *Physa heterostropha* in North America; *inset,* distribution in Ohio.

FIGURE 401.–*Physa integra*, magnified; after W. G. Binney (1865, pt. II, p. 101, fig. 172).

Moll. Canada, p. 298.

Type locality.–Indiana.

Diagnosis.–Shell of good size, elongate-ovate, thick, more or less solid, imperforate; color yellowish corneous or white, some specimens brownish; surface commonly dull, but shining in light-colored specimens; rest marks as many as seven, white; sculpture coarse,

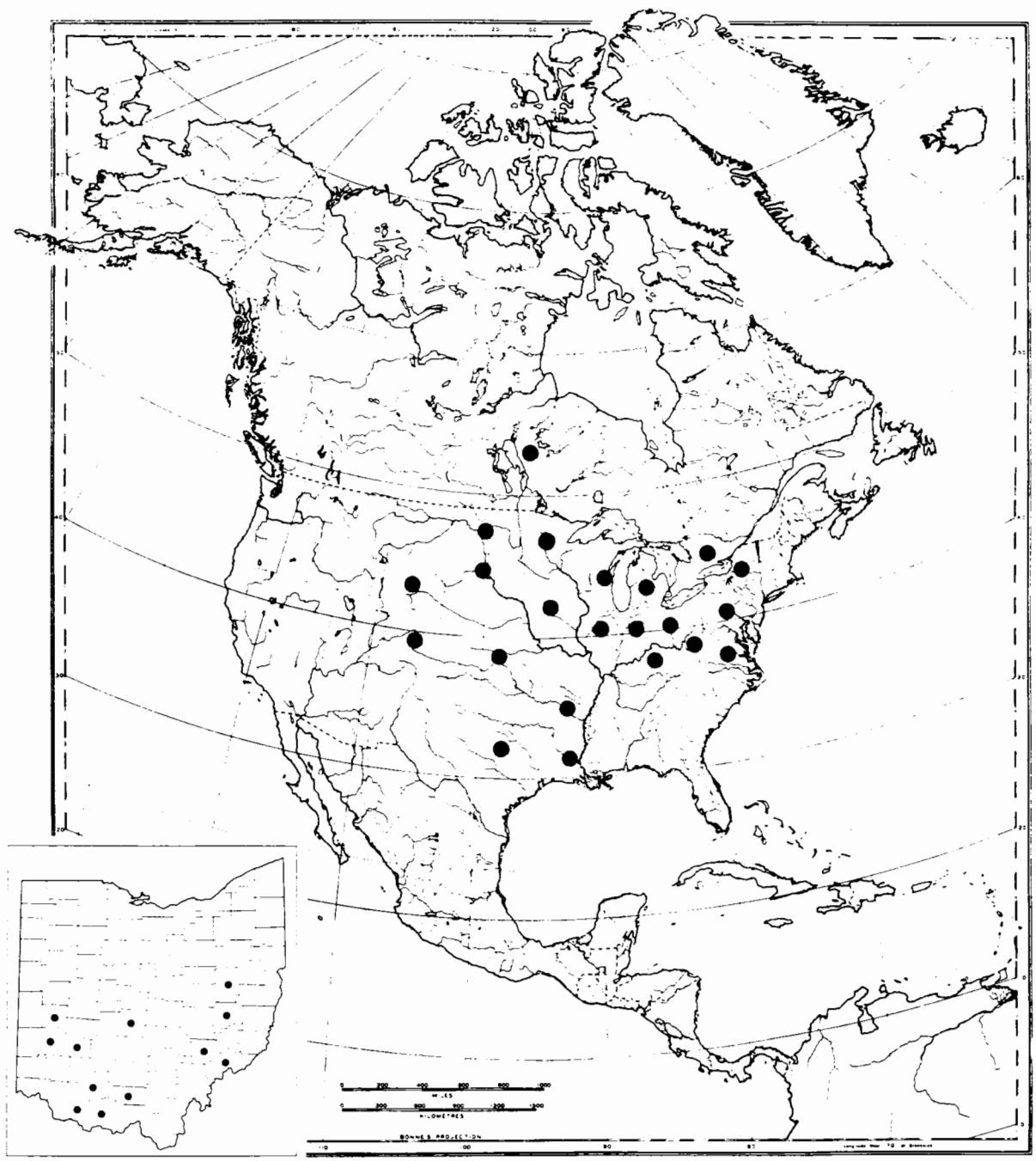


FIGURE 402.–Distribution of *Physa integra* in North America; *inset*, distribution in Ohio.

growth lines raised into coarse more or less equidistant ridges; spiral lines subobsolete but fairly well developed in some individuals; whorls 5, rounded, the last generally large, a little shouldered; aperture ear-shaped, angled above, well rounded below, 6/10 to 7/10 the length of the entire shell; outer lip thickened by a heavy wide white callus which may be lined inside with brown (modified from F. C. Baker, 1928a, pt. I, p. 460).

Ecology.—Found on a variety of bottoms (mud, sand, gravel, boulders, clay) in lakes, bays of the Great Lakes, and streams, in water less than 3 inches to 6 feet or more deep. A species widely adaptable to different environments and depths.

Associations.—Living: MANITOBA - 32, 36; NEW YORK - 3b, 15a, 31, 32; ONTARIO - 5; WISCONSIN - 17. Fossil: W - 27, 28.

General distribution (fig. 402).—Ontario, South Dakota, Minnesota, New York, south to Illinois, Indiana, and Ohio. It has not been reported from south of the Ohio River according to Baker (1928a, pt. I, p. 462) but Crandall gave its distribution as "Great Lakes to the Gulf."

Distribution in Ohio (inset, fig. 402).—Sterki (1907a, p. 381) gave merely "over the state" but Eggleston (ms. records) has it from the following counties: Miami, Montgomery, Greene, Highland, Brown, Pike, Adams, Franklin, Tuscarawas, Guernsey, Morgan, and Washington. There is a close parallel between this distribution and the glacial boundary but it may be due to accidents of collecting rather than actual absence from the northwestern and eastern parts of the State. It is also reported as a fossil (see below) from localities within the glacial boundary.

Geologic range.—Aftonian and "Wabash" (Baker, 1920a, p. 386). Late Wisconsin marls (Tinkers Creek and Castalia) in Ohio (Sterki, 1920, p. 175, 183).

Physa michiganensis Clench 1926
Fig. 403

Physa michiganensis Clench 1926, Mich. Univ. Mus. Zoology Occas. Papers, no. 168, p. 4, pl. 1, fig. 4.
Physella michiganensis F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 469, pl. 19, figs. 5-7, 16.
Physa michiganensis Goodrich 1932, Moll. Mich., p. 72.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 291.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 78, pl. 6, fig. 9.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 299.

Type locality.—Stream one mile west of Geddes, Washtenaw County, Michigan.

Diagnosis.—"Shell sinistral, medium in size, elongate-ovate. Color light horn to straw yellow, surface shining in young specimens. Whorls 5, slightly convex, nuclear whorl not noticeably darker than remaining whorls. Spire produced, acute. Aperture rounded to slightly ovate, interior yellowish white. A decided flaring at the base and lower half of the palatal area. Palatal lip thin, labiate a little below margin. Parietal lip consisting of a thin deposit on the body whorl. Columella inclined slightly to the left, narrow, slightly twisted, terminating rather abruptly at the central portion of the body whorl. Suture rather deeply impressed but not indented. Sculpture of fine, irregularly spaced growth lines. Varicose bands few or absent. When present, yellowish white to white in color. Not noticeably colored on the outside" (Clench, 1926, original description).

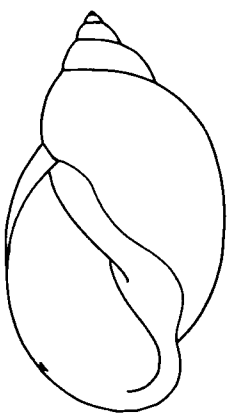


FIGURE 403.—*Physa michiganensis*, magnified; after Clench (1926, pl. 1, fig. 4).

Ecology.—"Confined mostly to small creeks and usually found on the under side of leaves in the more quiet water along the edges" (Clench, 1926, p. 6).

Associations.—Living: WISCONSIN - 27.

General distribution (fig. 404).—Michigan, Ontario (Grand River), New York (Niagara County), and probably Wisconsin, northern Illinois, Indiana, and Ohio.

Distribution in Ohio (inset, fig. 404).—The record of this species from Ohio rests on Clench's (1926, p. 6) statement that all material from Ohio and Indiana seen by him has been referred to his new species; and that the Pleistocene record of *P. anatina* given by F. C. Baker for a deposit in Logan County, Ohio (the Rush Lake marl deposit), may be based on specimens of *P. michiganensis*.

Geologic range.—Doubtfully, Pleistocene, Logan County, Ohio, discussed above.

[*Physa sayii* Tappan 1839]
Fig. 405

Physa sayii Tappan 1839, Am. Jour. Sci., 1st ser., v. 35, p. 369, pl. 3, fig. 3.
Physa warreniana Lea 1864, Acad. Nat. Sci. Philadelphia Proc. 1864, p. 115.

Physa sayi Crandall 1901, Nautilus, v. 15, p. 43.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
Physa sayii Johnson 1915, Fauna New England, p. 179.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
Physella sayii F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 430, pl. 25, fig. 18; pl. 26, figs. 19-32; pl. 27, figs. 17-20.
Physa sayii Goodrich 1932, Moll. Mich., p. 69.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 291.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 73, pl. 6, figs. 27-30.
--- --- Wurtz 1949, Nautilus, v. 63, p. 31, synonym of *P. heterostropha*.

FIGURE 404.–Distribution of *Physa michiganensis* in North America; *inset*, distribution in Ohio.

Physa sayii sayii La Rocque 1953, Cat. Recent Moll. Canada, p. 300.

Type locality.—Lake Pepin, Portage County, Ohio.

Diagnosis.—"Thin, shouldered, the apex very thin and dark. Whorls 5-6, the last one very large and rounded, though occasionally a little flattened; of a shining appearance and having minute waving lines as in

FIGURE 405.—[*Physa sayii*], magnified; after W. G. Binney (1865, pt. II, p. 80, fig. 136).

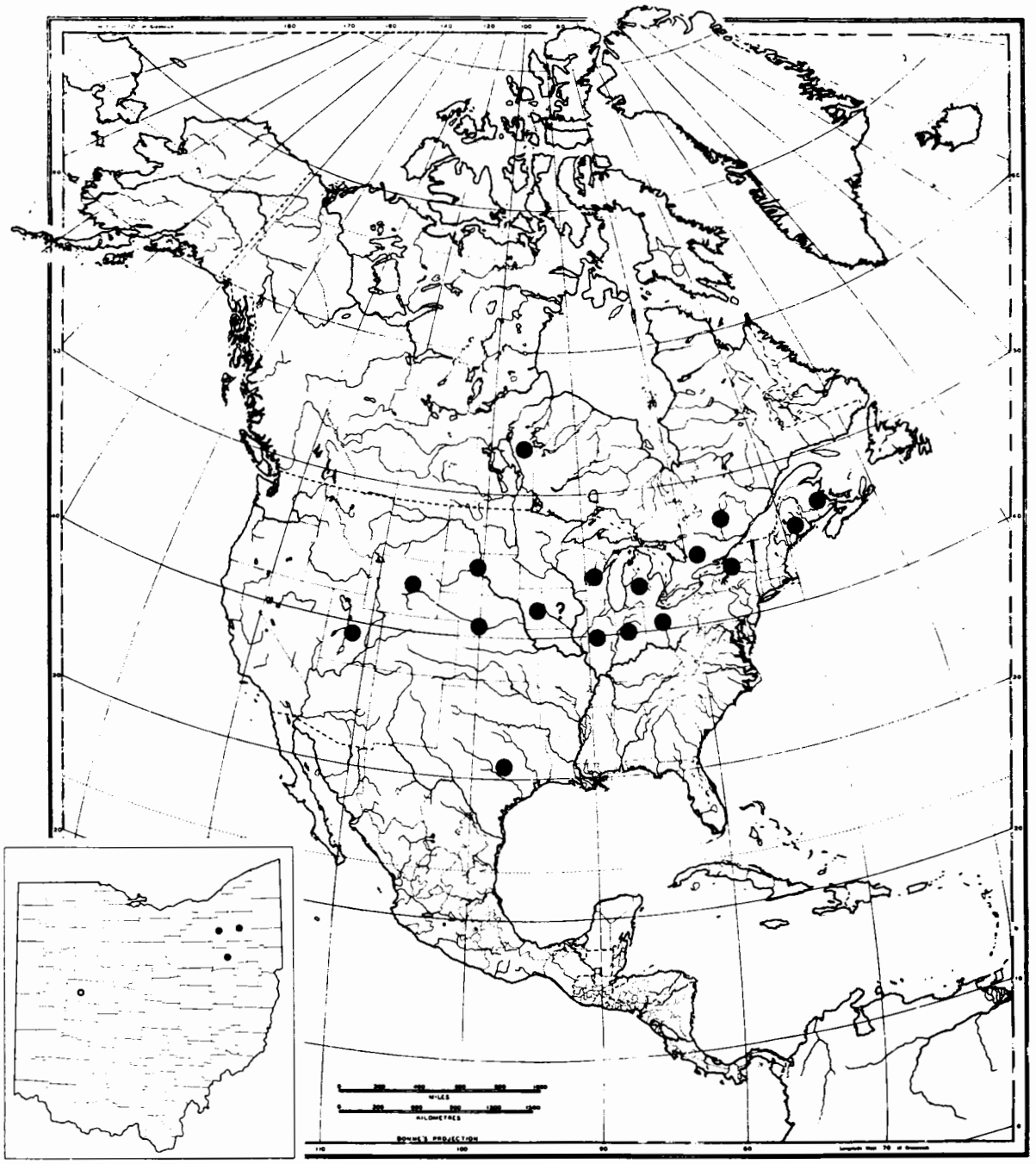


FIGURE 406.—Distribution of [*Physa sayii*] in North America; *inset*, distribution in Ohio.

gyrina. Outer lip thin, bordered by a black or purple deposit of callus. Aperture large and distinctly ovate. Callus of the columella white to brown and with a noticeable plait at the bottom. Measurements as given by F. C. Baker: 'Height 16 to 22, diameter 11 to 13.5 mm.' " (Goodrich, 1932, p. 69).

Ecology.—Generally considered a small-lake species, but also found in the Great Lakes, with the possible exception of Lake Superior. Wurtz (1949, Naut. 63, p. 31) showed that it is merely a form of *P. heterostropha*, physically isolated in places from the general genetic stock, but not specifically distinct. The name may be applied, for ecological purposes, to the lake form of *P. heterostropha* but it should not be given even subspecific rank.

Associations.—Living: WISCONSIN - 15, 23, 24, 28, 30, 36, 37, 38, 39, 42, 44, 50, 54, 58, 62, 67, 74, 93, 98, 106, 117, 123, 124, 128. Fossil: W - 27, 45, 46, 47.

General distribution (fig. 406).—New York west to Nebraska, Ontario south to the Ohio River. Pleistocene.

Distribution in Ohio (inset, fig. 406).—Sterki (1907a, p. 381) gave "Meyer's Lake, Canton (St.)" in addition to the type locality, which, incidentally, he spells Pippin. Eggleston (ms. records) adds Summit County to the list.

Geologic range.—Pleistocene: Aftonian(?), "Wabash" (Baker, 1920a, p. 386); interglacial, Toronto, Ontario, Canada. Late Wisconsin: Tinkers Creek marl, Summit-Portage Counties, Ohio (Sterki, 1920, p. 175). Newell Lake deposit (Zimmerman, 1960, p. 20).

Genus *Aplexa* Fleming 1820

Aplexa Fleming 1820, *in* Brewster's Edinburgh Encycl., v. 14, p. 617 (*fide* Neave).
Aplexa Walker 1918, Synopsis and cat. fresh-water Moll., p. 16.
Aplexa F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 470.
Aplexa La Rocque 1953, Cat. Recent Moll. Canada, p. 301.

Type.—*Bulla hypnorum* Linnaeus.

Diagnosis.—Shell sinistral, elongated, slender, smooth, shining; spire acute; lip simple, sharp, columella but slightly twisted.

Remarks.—Species as old as Cretaceous have been assigned to this genus but there is some doubt whether they belong here or in other genera. For an account of fossil species, exclusive of the Pleistocene, see Henderson (1935, p. 262 ff.). In the Pleistocene, as in the living fauna of the glaciated areas of North America, the genus is represented by two species, *A. hypnorum* (Linnaeus) east of the Rockies and *A. hordacea* Lea on the Pacific slope.

Aplexa hypnorum (Linnaeus) 1758
Fig. 407

Bulla hypnorum Linnaeus 1758, Syst. Nat., 19th ed., p. 727.
Physa elongata Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 171.
Physa elongatina Lewis 1855, Boston Soc. Nat. History, v. 5, p. 122, 298.
Bulinus hypnorum Call 1900, Moll. Ind., p. 410, pl. 8, fig. 2.
Aplexa hypnorum Dall 1905, Harriman-Alaska Exped., v. 13, p. 106, fig. 81.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
--- --- Johnson 1915, Fauna New England, p. 180.
--- --- Walker 1918, Synopsis and cat. fresh-water Moll., p. 116.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 386.
--- --- F. C. Baker 1928, Fresh water Moll. Wis., pt. I, p. 473, pl. 19, figs. 1-4.
--- --- Goodrich 1932, Moll. Mich., p. 72.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 291.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 79, pl. 6, figs. 3, 4.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 301.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 121.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 64.

FIGURE 407.—*Aplexa hypnorum*, magnified; after Call (1900, pl. 8, fig. 2).

Type locality.—Europe.

Diagnosis.—Shell of medium size, elongate, thin, transparent, imperforate; color light brownish horn, commonly with narrow streaks or a glint of copper; surface polished, glistening; sculpture faint, of fine growth lines only; whorls more than six, the last long, narrow, compressed; spire long and pointed, whorls rounded; aperture of medium size, about half the length of the shell; columella oblique, narrow, arched below, slightly twisted (condensed from F. C. Baker, 1928a, pt. I, p. 473).

Ecology.—Found in temporary pools, swamps, and intermittent streams; prefers woodland pools that are

dry in summer, but will also live in small clean creeks on a mud bottom. Mortality is high during the summer but some individuals manage to survive by burrowing in the mud. Mating and egg laying take place in a very short period while water is in the pools and the eggs are probably also able to withstand desiccation.

Associations.—Living: MANITOBA-1, 2, 3, 4, 7, 11, 25, 35; MICHIGAN-11, 12, 13, 37; MINNESOTA-20; NEW YORK-1; OHIO-32, 33, 43; WISCONSIN-4, 136. Fossil: N-1; A-1; K-4; Y-7, 11, 12, 13, 14; S-1, 6; W-28.

General distribution (fig. 408).—Northern Europe, Asia, and America. Northern United States from the Cascades to the Atlantic, southward to the vicinity of the Ohio River, Colorado, Utah, and Kansas. As a Pleistocene fossil it ranges much farther south.

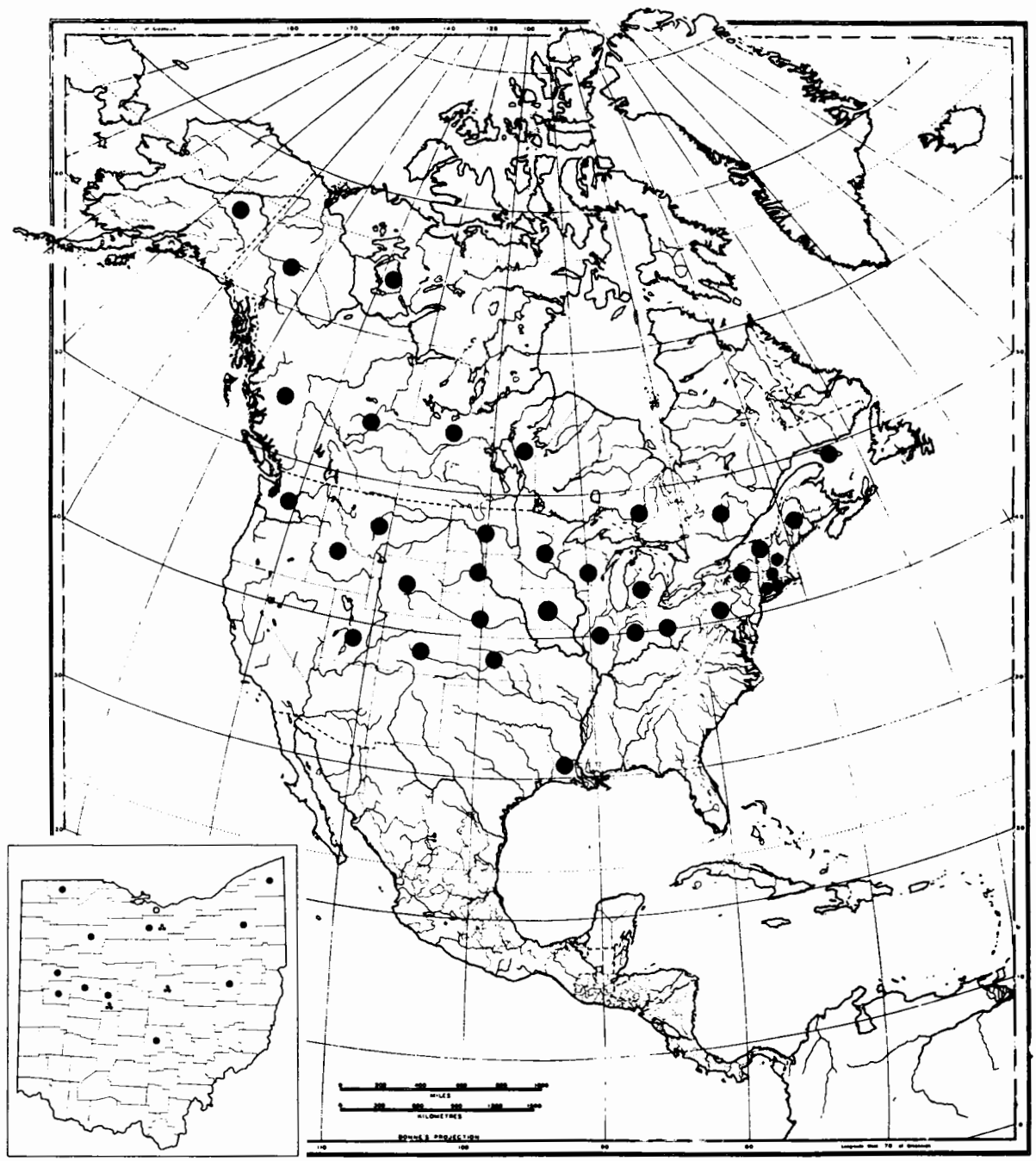


FIGURE 408.—Distribution of *Aplexa hypnorum* in North America; *inset,* distribution in Ohio.

Distribution in Ohio (inset, fig. 408).—Sterki (1907a, p. 381) gave "over the state" which is probably correct, wherever its environmental conditions exist; Eggleston (ms. records) added Ashtabula and Fairfield Counties to the record, and the University of Michigan collections contain specimens from Fulton, Hancock, and Auglaize Counties.

Geologic range.—Henderson (1935, p. 265) records it from the "Early Tertiary, Brook River, Arctic Canada" and A. B. Leonard (1950, p. 22, pl. 2, fig. H) gives "Yarmouth to Recent, Kansas;" Taylor and Hibbard (1955, p. 7, 10) have it from probable Illinoian deposits in Oklahoma and from Illinoian, Sangamon, and Wisconsin deposits in Kansas; finally, Sterki (1920, p. 183) records it as rather scarce from the Castalia marl, late Wisconsin, Erie County, Ohio. Hibbard and Taylor (1960, p. 121) give "Early Pleistocene (Nebraskan) to Recent."

PLATES

9 THROUGH 14

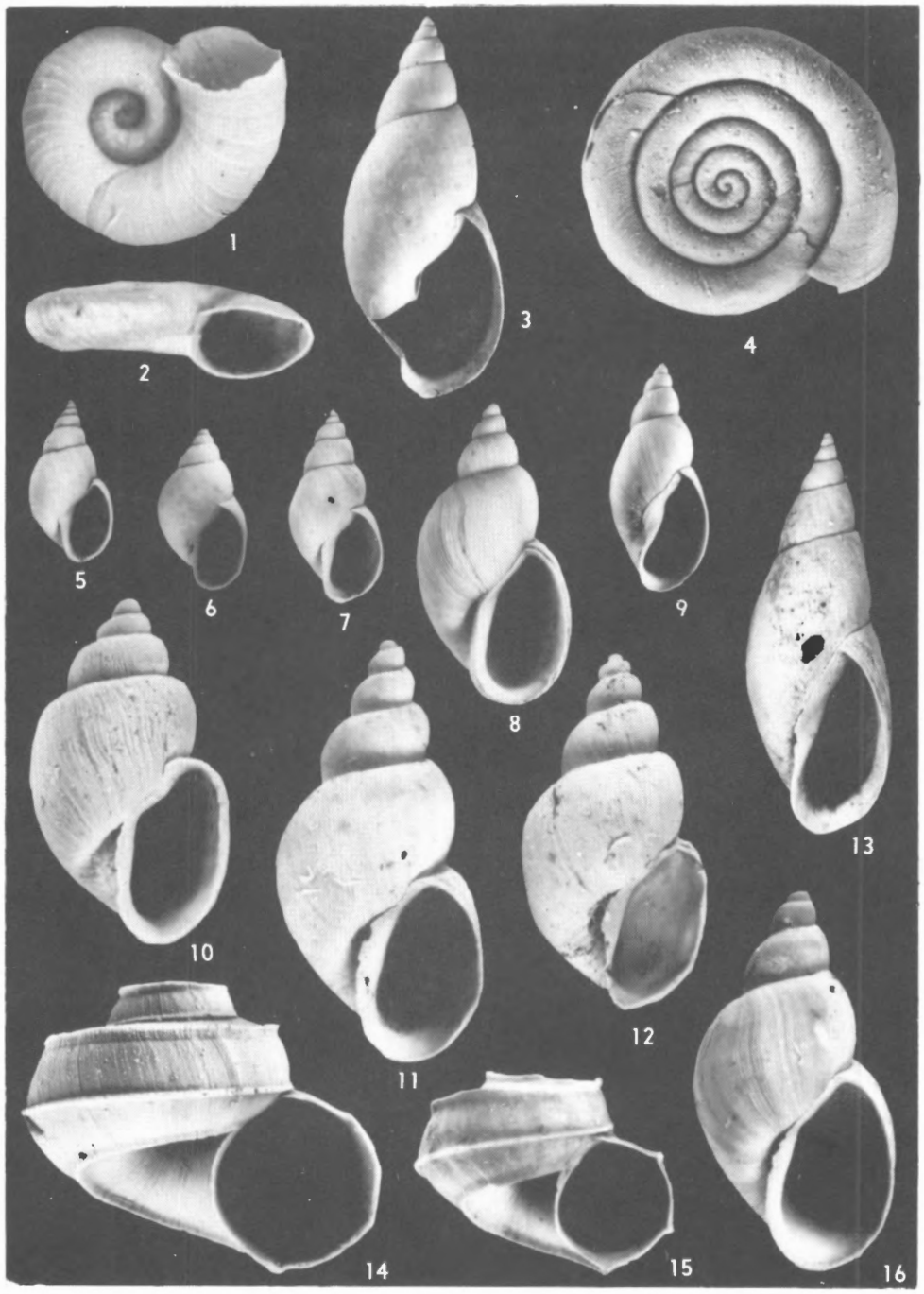
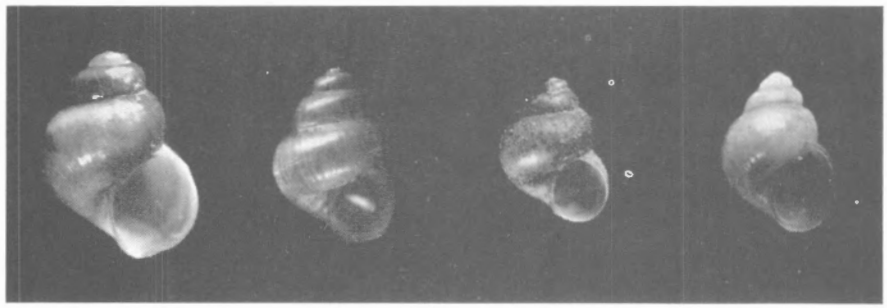


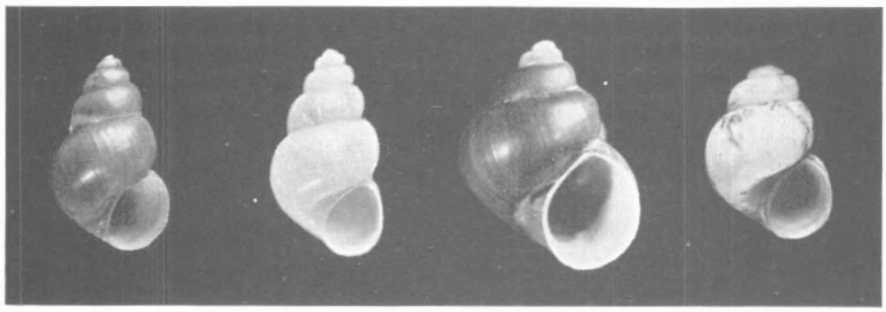
PLATE 9

Shells of *Anisus, Armiger, Fossaria, Stagnicola,* and *Valvata* (after Hibbard and Taylor, 1960, pl. V; Pleistocene, Kansas)

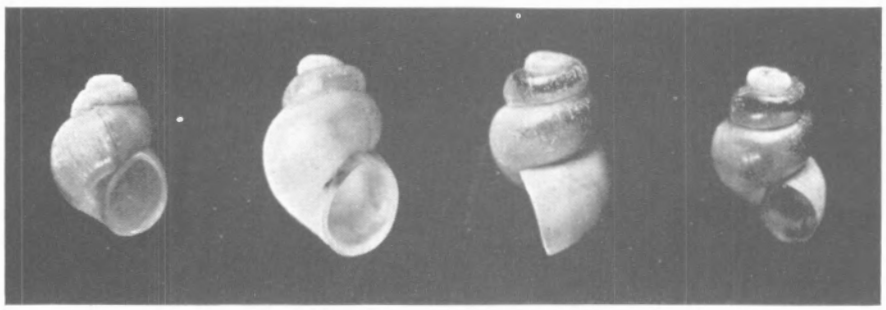
1. *Armiger crista,* X20
2. *Armiger crista,* X20
3. *Stagnicola reflexa,* X3
4. *Anisus pattersoni,* X10
5. *Stagnicola caperata,* X3
6. *Stagnicola caperata,* X3
7. *Stagnicola caperata,* X3
8. *Fossaria obrussa,* X5
9. *Stagnicola reflexa,* X3
10. *Fossaria dalli,* X10
11. *Fossaria dalli,* X10
12. *Fossaria dalli,* X10
13. *Stagnicola exilis,* X3
14. *Valvata tricarinata,* X10
15. *Valvata tricarinata,* X10
16. *Fossaria obrussa,* X10



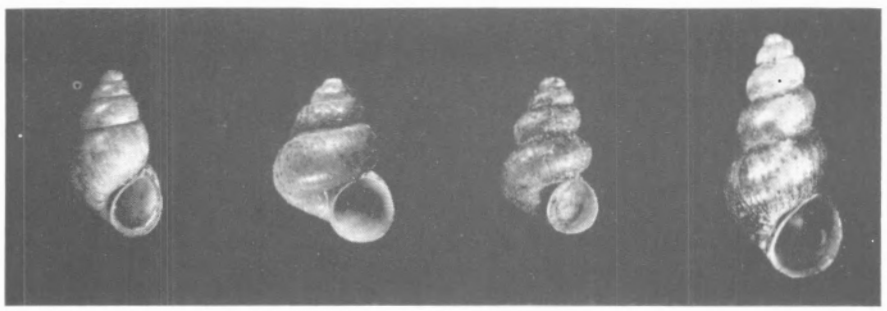
1 2 3 4



5 6 7 8



9 10 11 12

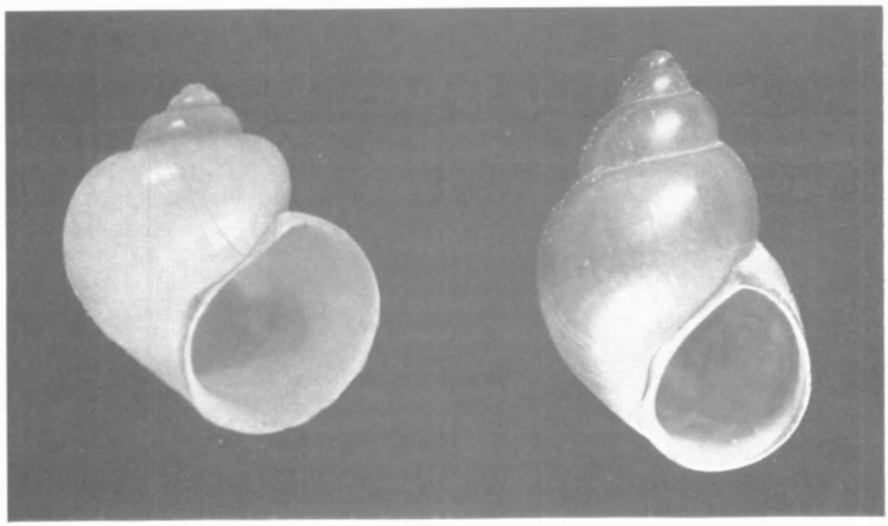


13 14 15 16

PLATE 10

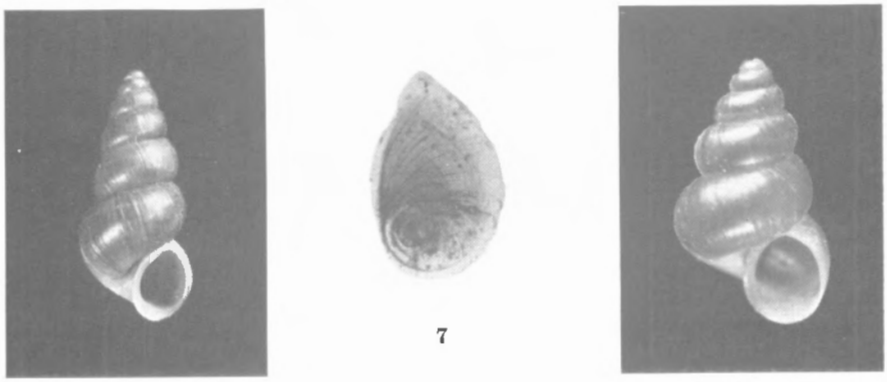
Shells of *Amnicola, Hydrobia, Lyogyrus,* and *Pyrgulopsis* (after Berry, 1943, pl. I; all shells from recently living animals; all figures considerably magnified)

1. *Amnicola limosa*
2. *Amnicola walkeri*
3. *Amnicola walkeri*
4. *Amnicola lustrica*
5. *Amnicola lustrica*
6. *Amnicola lustrica*
7. *Amnicola integra*
8. *Amnicola lacustris*
9. *Amnicola lacustris*
10. *Amnicola lacustris*
11. *Amnicola lacustris*
12. *Amnicola lacustris*
13. *Pyrgulopsis letsoni*
14. *Lyogyrus pupoideus*
15. *Lyogyrus brownii*
16. *Hydrobia nickliniana*



1 2

3 4 5



6 7 8

PLATE 11

Shells of *Bulimus, Lyogyrus, Pomatiopsis, Pyrgulopsis,* and *Somatogyrus* (after Berry, 1943, pl. II; all shells from recently living animals; all figures considerably magnified)

1. *Somatogyrus subglobosus*
2. *Bulimus tentaculatus*
3. *Somatogyrus subglobosus,* operculum
4. *Lyogyrus pupoideus,* operculum
5. *Bulimus tentaculatus,* operculum
6. *Pomatiopsis lapidaria*
7. *Pyrgulopsis letsoni,* operculum
8. *Pomatiopsis cincinnatiensis*

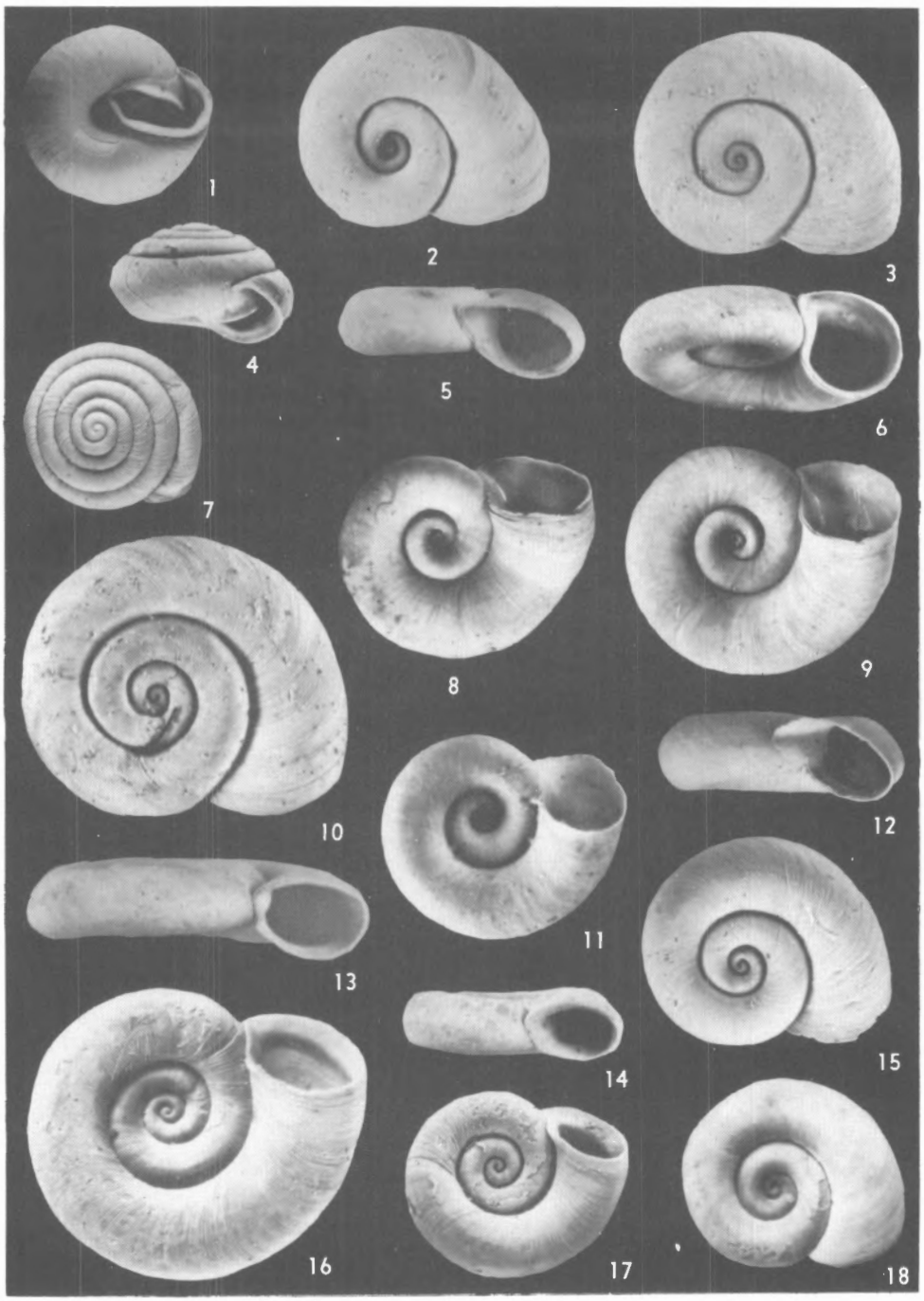


PLATE 12

Shells of *Gyraulus* and *Stenotrema* (after Hibbard and Taylor, 1960, pl. VI; Pleistocene, Kansas)

1. *Stenotrema leaii*, X3
2. *Gyraulus parvus*, X20
3. *Gyraulus parvus*, X20
4. *Stenotrema leaii*, X3
5. *Gyraulus parvus*, X20
6. *Gyraulus parvus*, X20
7. *Stenotrema leaii*, X3
8. *Gyraulus parvus*, X20
9. *Gyraulus parvus*, X20
10. *Gyraulus circumstriatus*, X20
11. *Gyraulus parvus*, X20
12. *Gyraulus parvus*, X20
13. *Gyraulus circumstriatus*, X20
14. *Gyraulus circumstriatus*, X20
15. *Gyraulus parvus*, X20
16. *Gyraulus circumstriatus*, X20
17. *Gyraulus circumstriatus*, X20
18. *Gyraulus circumstriatus*, X20

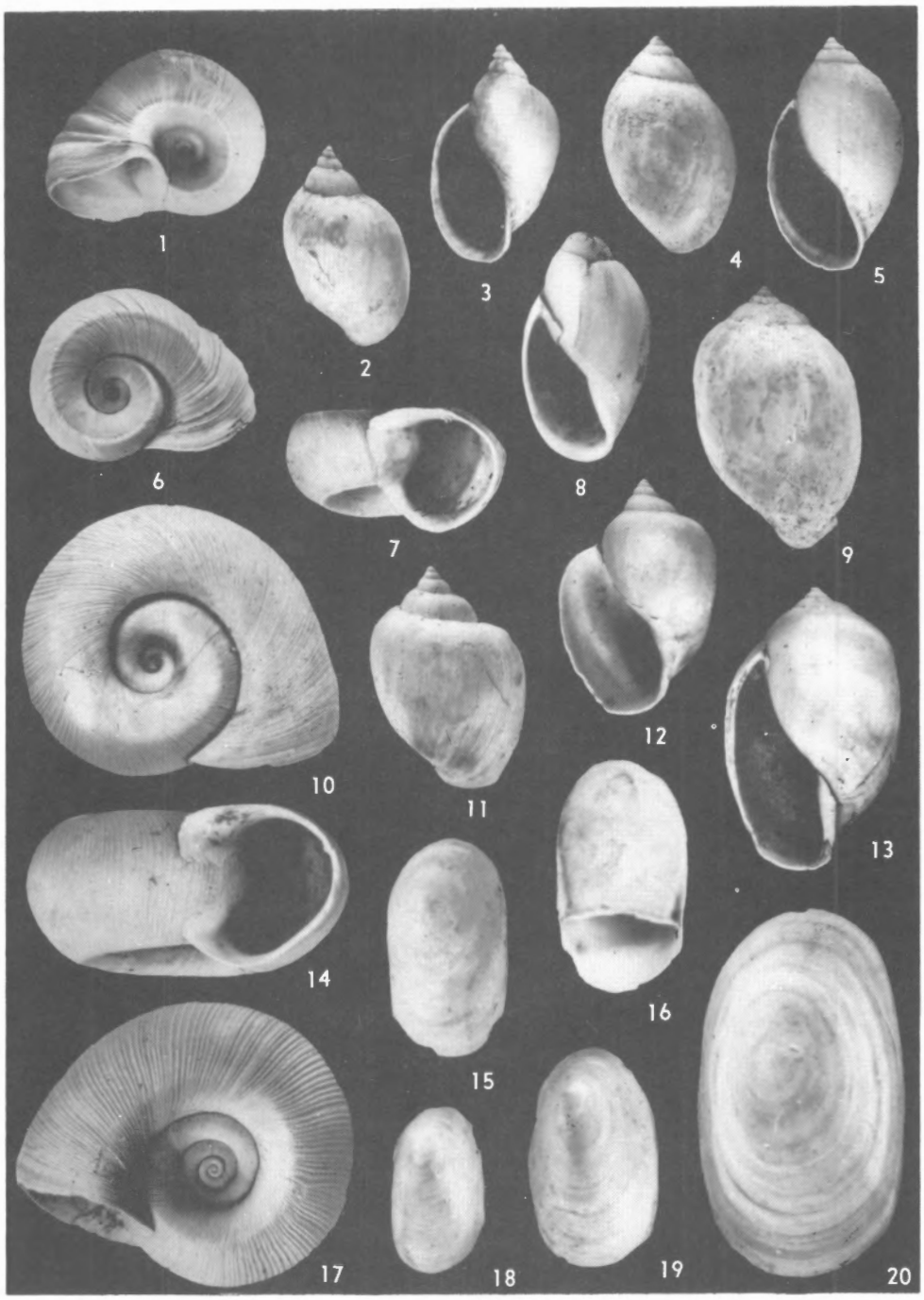


PLATE 13

Shells of *Ferrissia, Helisoma, Laevapex,* and *Physa* (after Hibbard and Taylor, 1960, pl. X; Pleistocene, Kansas)

1. *Helisoma anceps,* X3
2. *Physa anatina,* X3
3. *Physa anatina,* X3
4. *Physa gyrina* form *hildrethiana,* X3
5. *Physa gyrina* form *hildrethiana,* X3
6. *Helisoma anceps,* X3
7. *Helisoma anceps,* X3
8. *Physa skinneri,* X10
9. *Physa gyrina* form *hildrethiana,* X3
10. *Helisoma trivolvis,* X3
11. *Physa anatina,* X3
12. *Physa anatina,* X3
13. *Physa gyrina* form *hildrethiana,* X3
14. *Helisoma trivolvis,* X3
15. *Ferrissia meekiana,* X20
16. *Ferrissia meekiana,* X20
17. *Helisoma trivolvis,* X3
18. *Ferrissia meekiana,* X10
19. *Ferrissia meekiana,* X10
20. *Laevapex kirklandi,* X10

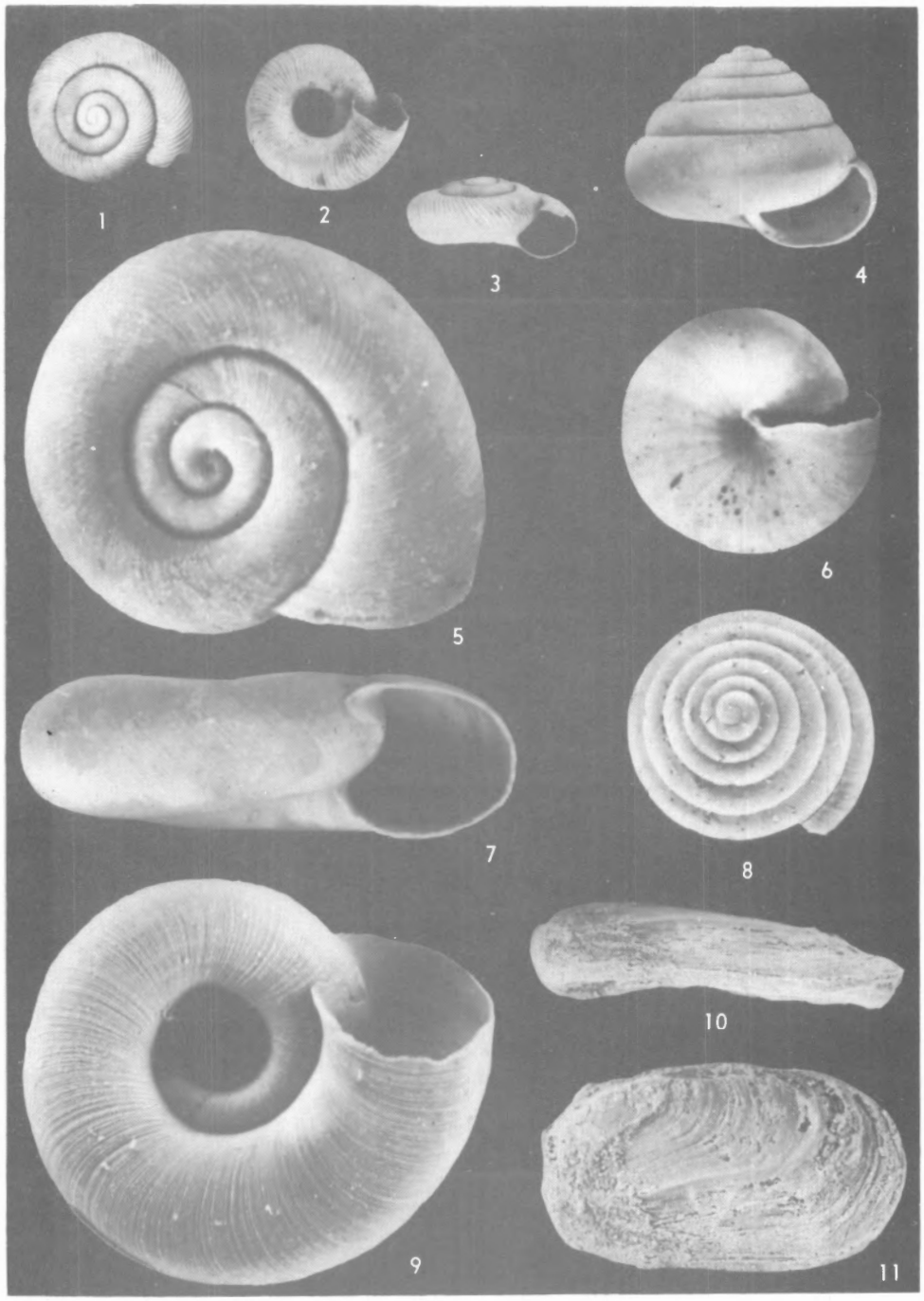


PLATE 14

Shells of *Deroceras*, *Discus*, *Euconulus*, and *Promenetus* (after Hibbard and Taylor, 1960, pl. XIII; Pleistocene, Kansas)

1. *Discus cronkhitei*, X5
2. *Discus cronkhitei*, X5
3. *Discus cronkhitei*, X5
4. *Euconulus fulvus*, X10
5. *Promenetus umbilicatellus*, X20
6. *Euconulus fulvus*, X10
7. *Promenetus umbilicatellus*, X20
8. *Euconulus fulvus*, X10
9. *Promenetus umbilicatellus*, X20
10. *Deroceras aenigma*, X10
11. *Deroceras aenigma*, X10