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

BULLETIN 62

PART 4
(OF 4 PARTS)

PLEISTOCENE MOLLUSCA OF OHIO

by

Aurèle La Rocque

COLUMBUS
1970

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Chapter 7

TERRESTRIAL GASTROPODA

Class GASTROPODA

The land snails do not belong to a separate order but are members of several orders which are also represented in aquatic habitats. They are treated separately here purely for convenience but it should be borne in mind that they are closely related at the subordinal level to aquatic species, some of which are represented in Ohio. The families are distinct in all cases so it has been possible to separate the aquatic groups from the terrestrial ones. Characteristics of the shell alone do not distinguish a land snail from an aquatic snail; in fact, some species sometimes termed amphibious because of their habits have been included under Freshwater Gastropoda (Chapter 6) in this report whereas others are included with the terrestrial gastropods.

Order ARCHAEOGASTROPODA
Family HELICINIDAE

Helicinadae Guilding 1828, Zool. Jour., v. 3, p. 528.
Helicinidae Gray 1842, Syn. Brit. Mus., p. 91.
Helicinidae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1078 (references).

Members of this family have a shell that is strongly depressed to conic, composed of rather few whorls, imperforate, the umbilical region occupied by a callus pad; operculum with thin or moderate calcareous layer, mainly concentric, may be paucispiral; radula rhipidoglossate; foot not divided; locomotion rhythmic and retrograde.

General distribution.—"Tropical and north temperate America; eastern border of Asia, from Japan south; many islands of the Pacific" (Pilsbry, 1948, p. 1078).

Remarks.—In the United States, the family is represented by three genera and five species. Only one species reached Ohio in Pleistocene time and it appears to be extinct in the State now.

Genus *Hendersonia* A. J. Wagner 1905

Hendersonia A. J. Wagner 1905, Denkschr. K. Akad. Wiss. Wien, v. 77, p. 364.
Hendersonia Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1086.

Type.—*Helicina occulta* Say.

Diagnosis.—Shell conic, of 4½ to 5 flattened whorls, increasing slowly and regularly; peripheral carina sharp in the early whorls, more or less obsolete in the last whorl; sculpture of sharp, close, retractively axial striae; operculum with a very thin calcareous layer and a spiral basocolumellar nucleus.

General distribution.—The typical subgenus is found in the upper Mississippi Valley east to the Alleghenies in Pennsylvania and North Carolina; other subgenera in Japan and China. In North America, the type species is very sporadically distributed. It has been recorded for Ohio but the record for the living species has not been substantiated in the last 25 years and the older records were doubtful.

Geologic range.—Recorded for the Paleocene and Miocene of western North America, with some doubt. The type species is a living form and goes back in the Pleistocene to Yarmouth time, though not in Ohio.

Hendersonia occulta (Say) 1831
Fig. 409

Helicina occulta Say 1831, Transylvania Jour. Medicine, v. 4, p. 528.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 384; "has been cited, but I have seen no specimens."
--- --- F. C. Baker 1920, Life of Pleistocene, p. 385.
Hendersonia occulta van der Schalie 1939, Mich. Univ. Mus. Zoology, Occas. Papers, no. 399.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 282.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1087, fig. 581.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 38, pl. 4, fig. F.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 21, pl. 3, fig. C; fig. 15.
--- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.
--- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
--- --- La Rocque and Conley 1956, Hunter's Run, p. 326 ff.

Type locality.—South of New Harmony, Indiana.

Diagnosis.—Shell somewhat depressed, with conic spire, rather solid, of 4½ to 5 nearly flat whorls with scarcely impressed suture; surface dull, with fine axial striae after the smooth embryonic whorl; periphery rather sharply keeled in early whorls, less so in later whorls; aperture oblique, subtriangular to semicircular; peristome narrowly expanded, thickened (modified from Pilsbry, 1948).

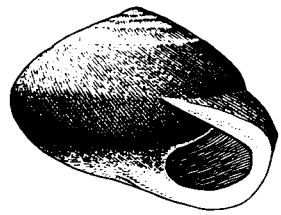

FIGURE 409.—*Hendersonia occulta,* magnified; after F. C. Baker (1939a, p. 39).

Ecology.—Found on well-shaded, leafy, and rather humid slopes, on limestone terranes. See also van der Schalie (1939b).

In Crawford County, Wisconsin, Morrison (1929, p. 43-44) found this species in three stations, as follows: Station III. That portion of the floodplain of Trout Creek that is above the reach of ordinary high waters. This station includes the very mesophytic slopes of the sides of the creek valley that are rather heavily overgrown with brush and small trees. The snails were found under small logs (not drift logs) and in the leaf mold. Station IV. Wooded portions of the ravines that branch off Trout Creek Valley; the exposure of the slopes studied (on the Himley Farm) was mostly to the northeast. The ravine studied in detail is about one mile up from the mouth of Trout Creek, and nearly two miles out of town. Station V. Slopes of northern exposure in the valley of the Kickapoo. These were studied on Asper Heims Hill, which is an outlier, just to the west of the town. The slope here is very steep, and heavily wooded, with a good many fallen logs. Snails were collected from the leaf mold and from under the logs, which were mostly in stage three of decay, with the heartwood still solid.

In Iowa, Jones (1930, Naut. 43, p. 119) found this species alone, under stones, high up on the hill just north of the old stone quarry at East Bluffs. Two dozen specimens were taken. The boundaries of the colony were very limited. F. C. Baker (1925, Naut. 39, p. 40) reported the species abundant in the deep limestone gorge at the base of the Virginia Natural Bridge, but quite absent from the rich forests of the surrounding hills, just as it is from most parts of its remarkably discontinuous range.

Dawley (1955, Naut. 69, p. 61) found it in several places on the wooded hills and wet rocky ravines along the Mississippi River and its tributaries in Houston and Winona Counties, Minnesota. Teskey (1954, Naut. 68, p. 25) found it in three widely separated, ecologically distinct stations in Brown County, Wisconsin: (1) in woods pool not over 10 feet in diameter; abundant, 300 specimens; (2) in dry detritus on limestone ledges of the escarpment overlooking Green Bay; (3) on shoulder of a secondary road under loose gravel which in turn was drifted over with recently fallen leaves.

Associations.—Living: MICHIGAN-40; WISCONSIN-140, 141, 142. Fossil: K-2, 4, 6, 9, 14; Y-1; I-5; S-7; W-4, 5, 60, 61, 62, 64, 65, 73.

General distribution (fig. 410).—Living specimens have been collected in the following states: Pennsylvania, Virginia, North Carolina, Tennessee, Illinois, Michigan, Wisconsin, Minnesota, and Iowa.

Distribution in Ohio (inset, fig. 410).—The species has been cited but Sterki had seen no specimens; no record for the living form is known to me.

Geologic range.—F. C. Baker (1920a, p. 385) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash." Pilsbry (1948) quoted Shimek's data on the distribution of this species as a fossil. Shimek gave records for the following states: Nebraska, Iowa, Illinois, Indiana, Missouri, Tennessee, and, by implication, Kansas. Leonard (1950) gave its range as Yarmouth to Recent, Kansas and elsewhere. Leonard (1952) recorded it from the Sappa silts, Peoria Loess, and Bignell Loess in Kansas. Later (1953) he recorded it as a fossil from Ohio (Cleveland area, Sangamon, Farmdale? Loess, lower and upper pro-Tazewell loess). Wayne (1954) obtained it from pro-Kansan loess in Indiana; La Rocque and Conley (1956) from a late Wisconsin deposit in Fairfield County, Ohio.

Order PULMONATA

The majority of the Pulmonata are terrestrial and are treated in this chapter. The freshwater Pulmonata have been described in Chapter 6, starting on page 357.

Suborder BASOMMATOPHORA

Most of the members of this suborder are aquatic and have been dealt with in Chapter 6. The terrestrial forms are described in the following pages.

Family CARYCHIIDAE "Leach" Jeffreys 1829

Carychiadae 'Leach,' in part, Jeffreys 1829, Trans. Linnaean Soc., v. 16, p. 324, 362.

Carychiidae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1051.

The Carychiidae are very minute terrestrial snails with long-ovate to cylindric thin shells of several whorls, the axis and internal whorl partitions of the spire absorbed in the adult stage; axis perforate or closed; aperture oblong or ovate, the lip commonly expanded, often thick; foot rounded posteriorly, not divided, tentacles short and blunt (modified from Pilsbry, 1948).

General distribution.—The four genera of this family inhabit the northern continents; all four occur in Europe, only two in North America. Of the latter, *Carychium* is represented by numerous species, *Coilostele* by only one, which is recorded only for Mexico.

Remarks.—Within the State, this is the only group of basommatophores that may be described as truly terrestrial. The character of sessile eyes at the base

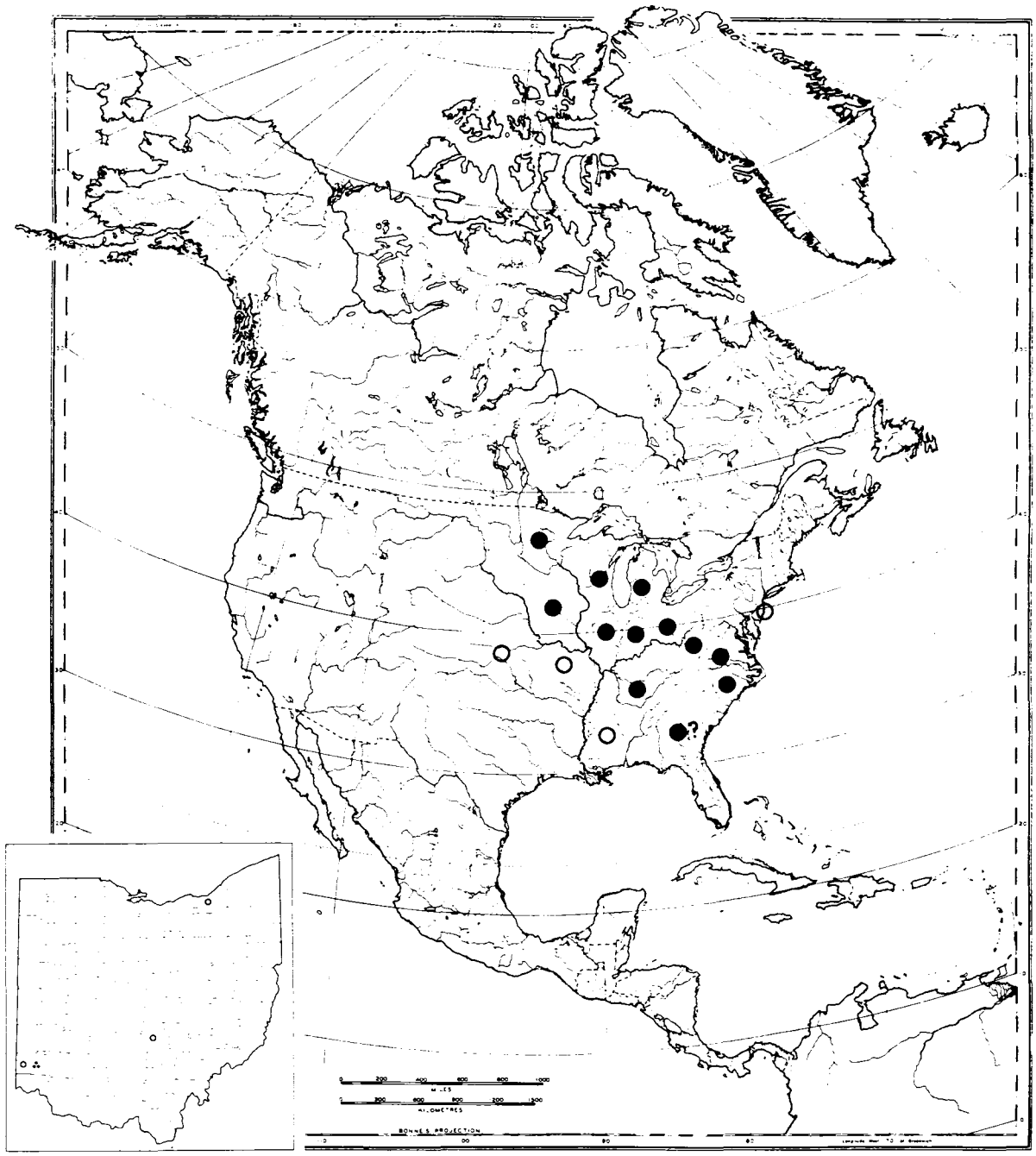

FIGURE 410.—Distribution of *Hendersonia occulta* in North America; *inset*, distribution in Ohio.

of the tentacles is useful in the identification of living material.

Genus *Carychium* Müller 1774

Carychium Müller 1774, Verm. Terr. et Fluv. Hist., p. 125.
Carychium Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1051.
Carychium La Rocque 1953, Cat. Recent Moll. Canada, p. 339.

Type.—*Carychium minimum* Müller.

Diagnosis.—Shell perforate or rimate, oblong or turreted, pupiform, thin, uniform whitish or corneous and somewhat transparent; of 4 to 5½ whorls, the first obtuse, smooth; aperture oval or ovate, the outer lip expanded or reflected, thickened, narrower in its upper third; columella armed with a low entering lamella near the base and a prominent lamella above, which expands within the last whorl; internal partitions and axis absorbed in the upper whorls.

General distribution.—Holarctic mainly, but extending into the oriental region (Philippine Islands, Java), and into the North American tropics (Jamaica, Mexico to Costa Rica). The present distribution is not entirely natural; one European species (*C. minimum* Müller) has been widely introduced into North America and the southern records both in Asia and North America may be due to comparatively recent human introductions.

Geologic range.—Paleocene to present.

Remarks.—Harry (1952, p. 5-7) has intimated that there is only one species of *Carychium* in the Michigan area where he studied the species. Hibbard and Taylor (1960, p. 85) stated that "hence, by implication *C. exile* and *C. exile canadense* are to be added to the synonymy of *C. exiguum.*" This seems logical and there is reason to believe that only one species is represented in the Ohio area as well. All those who have worked on the genus in Pleistocene deposits have had difficulty separating the two species and some of them have expressed doubt on the soundness of their final identification. Hubricht (1963, p. 108-109) has registered his disagreement with this opinion and finds no real difficulty in separating the species on shell characters. The distribution of the species is so extensive that the named forms may well be separable in one area and not in another. A similar case, discussed earlier (p. 224) is that of *Lampsilis radiata* and of *L. radiata siliquoidea.* Clarke's argument for joining these two forms under one specific name has been accepted in this report on the basis of his careful analysis of the problem. In the case of *Carychium* the arguments are not as clear cut and some doubt remains. I have therefore treated the two species separately in this report without being entirely convinced of their specific distinctness.

Carychium exiguum (Say) 1822
Pl. 8, fig. 3

Pupa exigua Say 1822, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 375.
Carychium exiguum Call 1900, Moll. Ind., p. 405.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 116, fig. 83.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
--- --- Johnson 1915, Fauna New England, p. 177.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, 181.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Goodrich 1932, Moll. Mich., p. 40.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 282.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 77.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1052, figs. 561a, b; 562.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 50, pl. 4, fig. 13.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 17, pl. 4, fig. G.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 339.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 84 (*C. exile* and *C. perexiguum* as synonyms).
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 51.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 2.

Type locality.—"Harrigate, Philadelphia."

Diagnosis.—Shell rimate, oblong, whitish-corneous, somewhat pellucid, thin, glossy; spire convexly conic, the penultimate whorl nearly as wide as the last, summit obtuse; whorls about 4½, convex, those of the spire nearly smooth, the last two whorls more or less, but usually quite weakly, striate; aperture decidedly over one-third the total length of the shell, ovate; outer lip expanded, sinuous, thickened in its lower two-thirds, its upper part narrower, very strongly arcuate; horizontal entering lamella below the middle of the nearly straight inner margin, the lamella within the last whorl becoming higher and waved or undulating on the ventral side, a half whorl in; a low, obtuse, very obliquely entering lamella near the base of the short columella, the lamella ascending in a long spiral curve within the last whorl (Pilsbry, 1948).

Ecology.—Found in shady, protected situations, such as in moist dead leaves, in crevices of rotten logs, and under sprung bark of dead trees and stumps; on floodplains of rivers and creeks, on the edges of

swamps and marshy areas.

A species of moist leaf mold and plant debris, found under logs and bark, or among leaves, moss, or grass, in moist situations not far from water (Taylor). Oughton (1948, p. 94 ff.) collected it in wet locations and from stream drift; it lives along margins of ponds, streams, and marshes; on seeping hillsides; and on sandy flats that receive water by percolation. H. B. Baker (1922b) collected it from the following habitats in Dickinson County, Michigan: (44) ash-cedar swamp, snails in humus around bases of trees; (47) floodplain of a creek, about 2 feet above July water level; (48) floodplain of river, in a damp hollow, with brush of tag alders, dogwoods, hazels, and small ashes. He found it much less numerous than *C. exile canadense.*

Burch (1955, Naut. 69, p. 66) gave a very instructive table showing the relationships of this species to soil factors in eastern Virginia. Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. In Virginia, it is generally distributed under and among leaves in damp places, but is not common (Burch, 1954, Naut. 68, p. 31).

Harry (1952, p. 5-7) studied this species in Lower Michigan. He obtained live specimens from more than 60 localities and concluded that *C. exiguum* and *C. exile* are not specifically distinct. He found that *C. exiguum* has a short phenological period in July; immature specimens in nature are in quantities greater than 10 percent only until November. Darkness, constant high moisture, and decaying vegetation appear to be essential factors in their environment; in microhabitats, chiefly in *Thuja* forests, open grassy areas, and some hardwood forests.

Associations.—Living: MICHIGAN - 2, 20, 22, 25; OHIO - 1, 6, 43; ONTARIO - 7. Fossil: P - 3; N - 2; S - 1 (cf.), 2, 3, 4, 6; W - 6, 16, 27, 28, 56, 57, 58, 59.

General distribution (fig. 411).—Newfoundland to British Columbia, south to Florida and New Mexico.

Distribution in Ohio (inset, fig. 411).—Over the State (Sterki, 1907a, p. 381); records are few and do not cover all counties but this is due rather to lack of collecting than to actual absence. This is one of the commonest species in stream drift.

Geologic range.—F. C. Baker (1920a, p. 388) recorded this species from Aftonian, Yarmouth, Sangamon, and "Wabash" beds. Crete-Loveland sediments and Peoria silts of Kansas to present (A. B. Leonard, 1952, p. 17); Sangamon of Kansas (Taylor and Hibbard, 1955, p. 10). In Ohio, it is a common species in late Wisconsin deposits such as the Tinkers Creek and Castalia marls (Sterki, 1920, p. 174, 181). Castalia marl (Clark, 1961, p. 27).

Carychium exile H. C. Lea 1842
Fig. 412

Carychium exile H. C. Lea 1842, Am. Jour. Sci., 1st ser., v. 42, p. 109, pl. 1, fig. 5.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 116.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 381.
--- --- Johnson 1915, Fauna New England, p. 177.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 181.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Goodrich 1932, Moll. Mich., p. 40.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 282.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1058, figs. 561c, 566a.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 50.
Carychium exile exile La Rocque 1953, Cat. Recent Moll. Canada, p. 339.
Carychium exile Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 3.

Type locality.—Wissahickon Creek, near Philadelphia, Pennsylvania.

Diagnosis.—Shell rimate, slender and long, whitish or clear corneous, thin; spire long, gradually tapering, its outlines convex, summit obtuse; whorls 5 to 5½, convex, regularly increasing, the last two closely, distinctly, and regularly striate; aperture small, oblique, about one-third the length of the shell; outer lip slightly expanded, thickened, thickest near the middle; small horizontal lamella at the junction of the columellar and parietal margins, the lamella, one whorl within, expanding into a broad warped plate which ascends almost vertically, abruptly diminishing again above the plate; columellar lamella obtuse, ascending in a long spiral curve within, where it is more or less dilated on the ventral side (Pilsbry, 1948).

Ecology.—Similar to that of *C. exiguum.* Oughton (1948, p. 94 ff.) characterizes this as a species of damp woodlands, especially those of deciduous trees. Vanatta (1928, Naut. 42, p. 20-21) found this species in leaf mold collected at "The Devil's Mill Hopper" and "Buzzards Roost" near Gainesville, Alachua County, Florida. In the northern part of its range, Morrison (1929, p. 43-44) found it at three of his stations, as follows: Station III. Crawford County, Wisconsin, that portion of the floodplain of Trout Creek that is above the reach of ordinary high waters. This station includes the very mesophytic slopes of the sides of the creek valley that are rather heavily overgrown with brush and small trees. The snails were found under small logs (not drift logs) and in the leaf mold. Station IV. Same state and county, wooded portions of the ravines that branch off Trout Creek Valley; the exposure of the slopes studied (on the Himley Farm) was mostly to the northeast. The ravine studied in detail is about one mile up from the mouth of Trout Creek, and nearly

two miles out of town. Station VI. Same state and county, smaller ravines branching directly off the valley of the river. These ravines have no permanent streams in them; they are covered with rather open woods and brush. The exposure is to the north. Snails were found under logs, under rocks, and in the rather dry and loose leaf mold. Morrison (1939, Naut. 53, p. 45-47) recorded an unusual occurrence of this species in a cave (Skyline Caverns) one mile south of Front Royal, Warren County, Virginia, in stream drift deposited on the roof of a cave chamber. The same species was living nearby in the leaf mold on the upper slopes of Dickey's Hill just above one of the sinkhole entrances, through which the drift was washed into the cave. Hubricht (1941, Naut. 54, p. 111) also found it in a cave in Missouri.

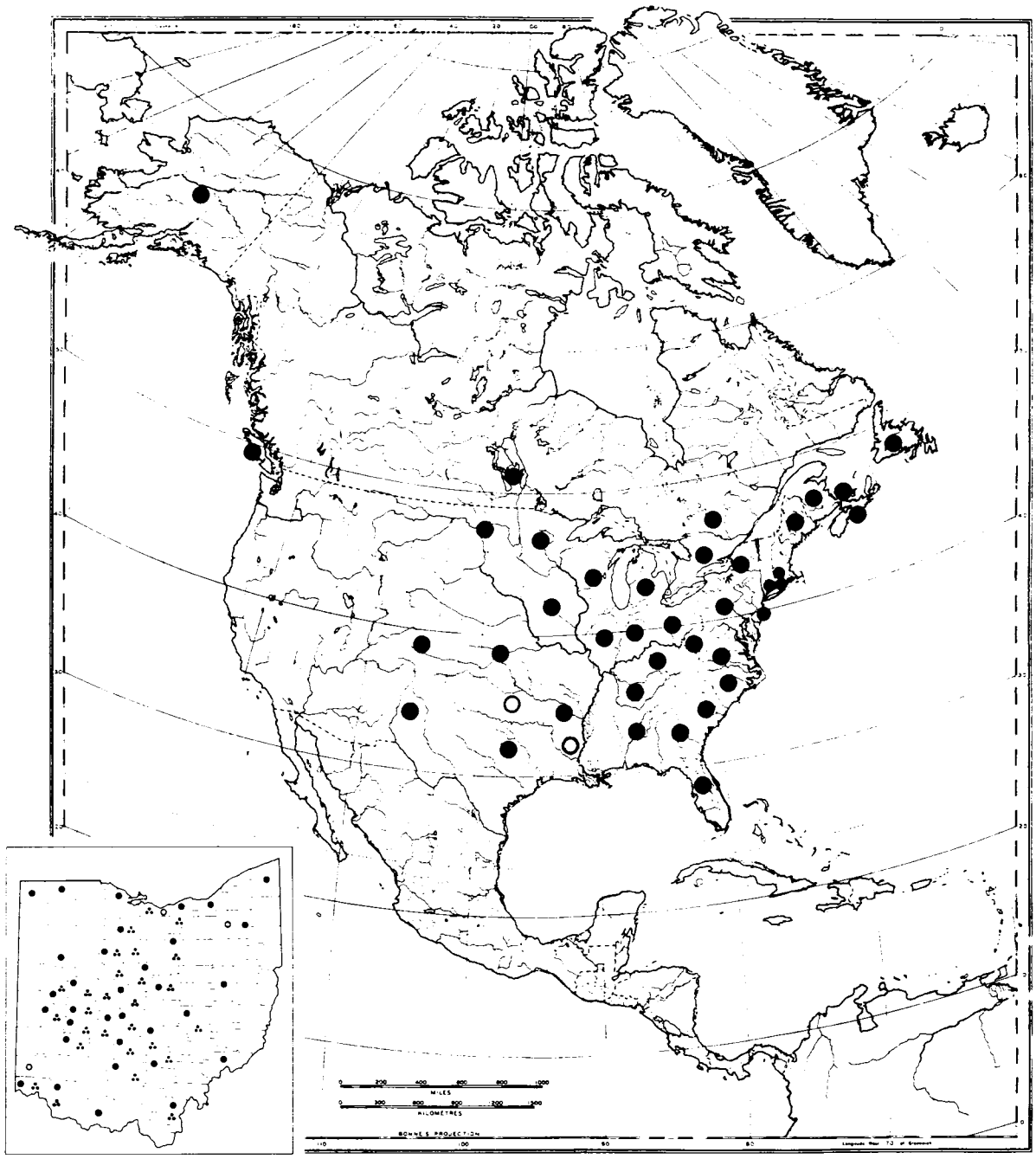

FIGURE 411.–Distribution of *Carychium exiguum* in North America; *inset,* distribution in Ohio.

Associations.—Living: OHIO-43; ONTARIO-3; WISCONSIN-140, 141, 143. Fossil: W-28?, 51, 58, 73.

General distribution (fig. 413).—Maine west to Manitoba, south to Texas and Alabama. Pilsbry gave no records for the upper Mississippi drainage, from which the type form may be absent. Presence of the form in Manitoba and South Dakota raises the possibility that the lack of records for the Mississippi drainage is due rather to lack of collection or recognition than to actual absence.

Distribution in Ohio (inset, fig. 413).—Sterki (1907a, p. 381) gave "over the state." Actual records available are only for Fulton and Auglaize Counties (University of Michigan records); Adams and Washington Counties (Eggleston, ms. records).

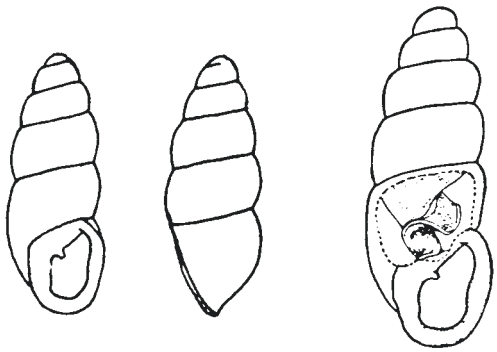

FIGURE 412.—*Carychium exile,* magnified; after Walker (1928, p. 173, figs. 275, 276).

Geologic range.—Pleistocene; possibly only late Wisconsin. F. C. Baker (1920a, p. 388) gave Aftonian, Yarmouth, Sangamon, Peorian and "Wabash." The majority of fossil specimens are referred to the variety *canadense* Clapp; the only other records I have for fossil *C. exile* are those of Sterki (1920, p. 181) for the Castalia marl (late Wisconsin) of northern Ohio, and of Mowery (1961, p. 13) for the Jewell Hill deposit.

Remarks.—This species may be a synonym of *C. exiguum* (Say). See remarks under genus *Carychium.*

Carychium exile canadense Clapp 1906

Carychium exile canadense Clapp 1906, Nautilus, v. 19, p. 139, pl. 8, figs. 1, 2, 6, 7.

--- --- --- Johnson 1915, Fauna New England, p. 177.

--- --- --- Winslow 1922, Mich. Univ. Mus. Zoology, Occas. Papers, no. 128, p. 4, pl. 2, figs. 6, 7.

--- --- --- Goodrich 1932, Moll. Mich., p. 40.

Carychium exile canadensis Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 282.

Carychium exile canadense Oughton 1948, Zoögeogr. study, Ontario, p. 78.

--- --- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1059.

--- --- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 50, pl. 4, fig. 10.

--- --- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372.

--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 340.

--- --- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.

--- --- --- La Rocque and Forsyth 1957, Sidney Cut, p. 85 ff.

Type locality.—Kennebunkport, Maine.

Diagnosis.—Shell larger than that of *C. exile,* length 2.15 mm., diameter 0.75 mm., to length 2 mm., diameter 0.7 mm.; the type 2.1 mm. by 0.75 mm.; folds similar to those of *C. exile,* but with downward bend farther from the aperture, *i.e.,* after about 1¼ turns of the lamella around the columella (Pilsbry, 1948, and Winslow, 1922).

Ecology.—"Found in much drier situations than *C. exiguum,* always, in my experience, some distance from water" (G. H. Clapp, quoted by Pilsbry, 1948, p. 1059). H. B. Baker (1922b) found this species most abundant on stream flats and in swamps. He notes the following specific habitats: (40) hardwoods of Menominee Trough, a stand of virgin hardwoods; (41) maple logs, in hardwoods of the Calumet Trough; (42) a cedar-tamarack bog, under bark of freshly cut cedar stumps; (44) an ash-cedar swamp, snails in humus around bases of trees; (47) stream flats of Hancock Creek, about 2 feet above July water level; (48) stream flats in a damp hollow of Menominee River floodplain, with brush of tag alders, dogwoods, hazels, and small ashes. Dawley (1955, Naut. 69, p. 61) found it common in leaf siftings from all parts of Minnesota.

Associations.—Living: MINNESOTA-3, 4, 5. Fossil: K-6; Y-1; I-5, 6; W-43, 44, 56, 57, 59, 60, 64.

General distribution (fig. 414).—"Canadian Zone, Maine to Ontario to Michigan and Manitoba, and reported by Dr. Hanna from Vancouver Island" (Pilsbry, 1948). In Canada, known from the provinces of Quebec, Ontario, Manitoba, and British Columbia (La Rocque, 1953). In the United States, probably the northern tier of states; recorded for New York (Robertson and Blakeslee, 1948); Ohio (University of Michigan records); and Michigan (Goodrich, 1932, and Pilsbry, 1948). Its occurrence as a fossil is much more extensive (see below).

Distribution in Ohio (inset, fig. 414).—One record only, for Auglaize County (University of Michigan records). Here also it is more widespread in Pleistocene deposits.

Geologic range.—Indiana, in pro-Kansas loess (Wayne, 1954); Ohio, in Farmdale? loess (A. B. Leonard, 1953); in early Wisconsin deposits (La Rocque and Forsyth, 1957). Castalia deposit (late Wisconsin), Ohio (Clark, 1961, p. 28).

[Suborder STYLOMMATOPHORA A. Schmidt]

This suborder is composed of animals with two tentacles, the upper pair cylindrical and bearing the eyes at their tips, the lower sensory, cylindrical; both pairs of tentacles retractile; shell external, partly or completely imbedded in the mantle, or almost entirely absent, though represented by a few calcareous granules in some genera; no operculum; terrestrial in habitat.

Family POLYGYRIDAE Pilsbry

Polygyrinae Pilsbry 1895, Man. Conch., v. 9, Index to Helices, p. 123.

Polygyridae Pilsbry 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 310.

Polygyridae Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 575.

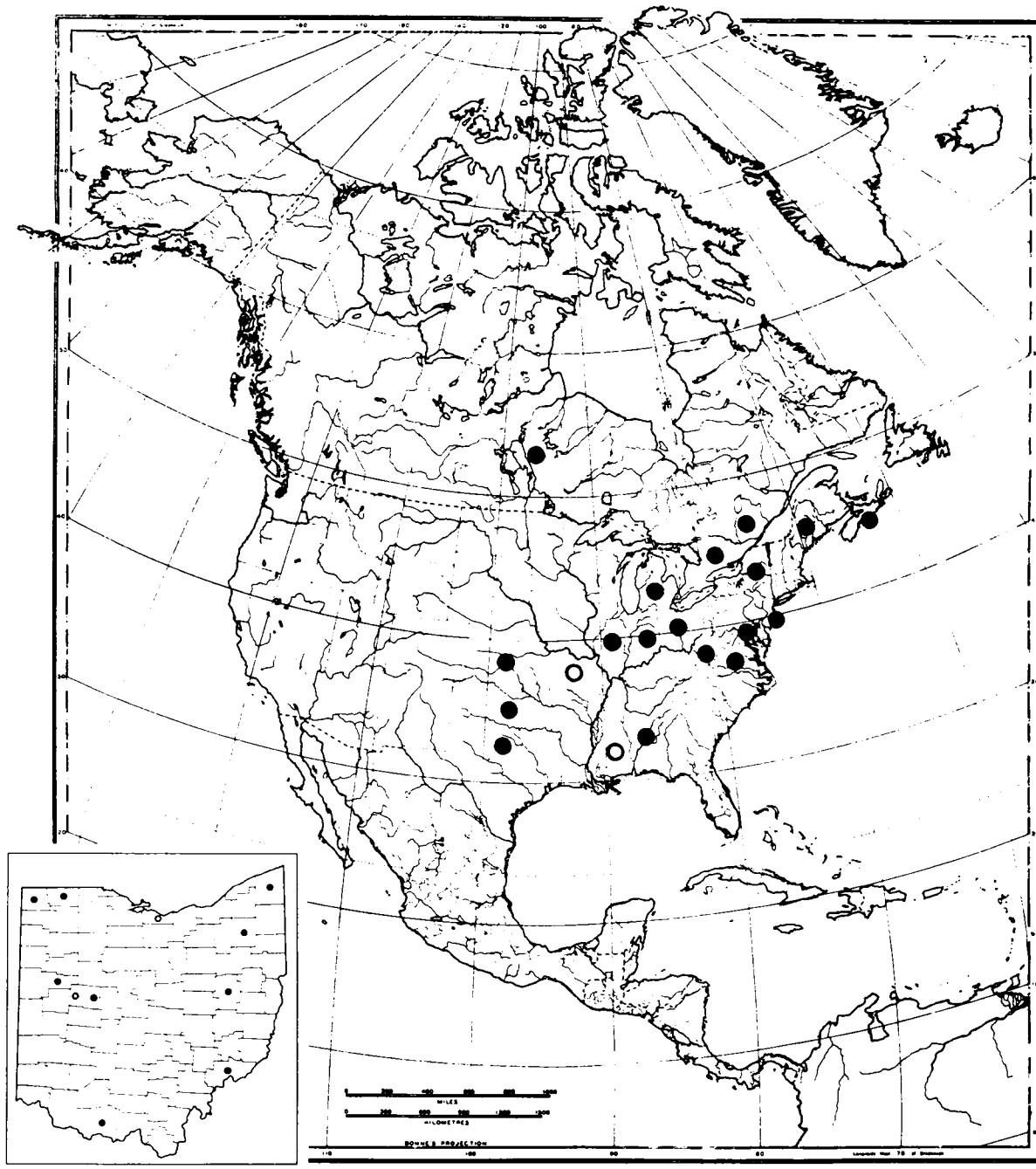

FIGURE 413.–Distribution of *Carychium exile* in North America; *inset,* distribution in Ohio.

Members of this family have the shell one-colored, rarely banded, discoidal or lens-shaped to globose-conic; aperture with reflected lip, toothed in many genera.

Remarks.—The diagnostic characters of the family are in the soft parts; the shell resembles that of many other families in North America, although the toothed forms are characteristic. The family is typically North American and is not known on other continents. The genera and species recognized to 1948 are listed by Pilsbry (1948, p. xviii ff.). The typical genus of the family does not occur in Ohio, although earlier records list under that genus, *Polygyra,* species which have been assigned to other genera *(Stenotrema, Mesodon, Triodopsis,* and *Allogona)* in Pilsbry's system, here adopted.

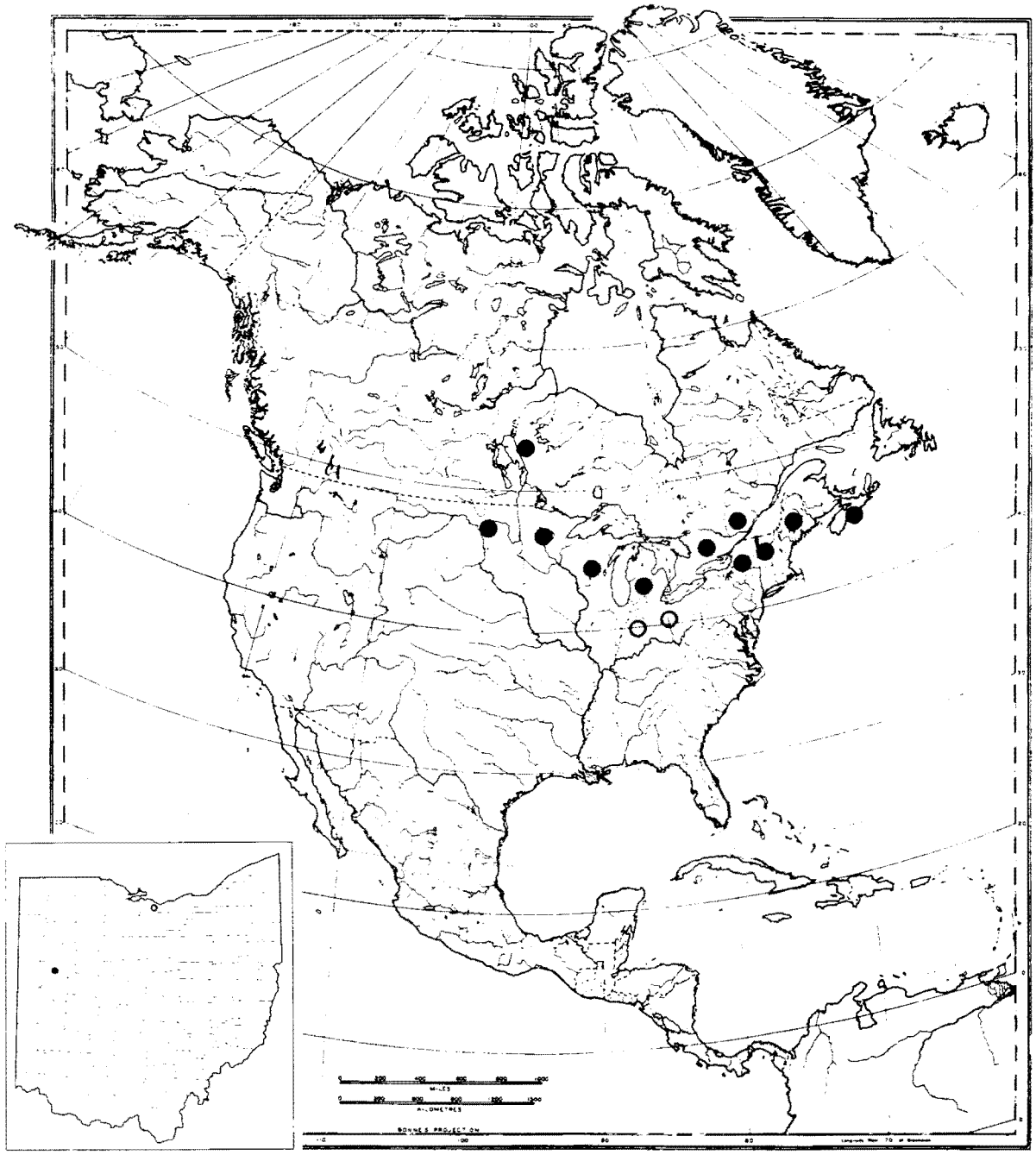

FIGURE 414.—Distribution of *Carychium exile canadense* in North America; *inset,* distribution in Ohio.

Genus *Stenotrema* Rafinesque 1819

Stenotrema Rafinesque 1815, Analyse, p. 136 *(nomen nudum);* 1819, Jour. Physique, v. 88, p. 425 *(fide* Neave).
(?)*Chimotrema* Rafinesque 1819, Jour. Physique, v. 88, p. 425.
Toxotrema Rafinesque 1819, *ibid.*
Stenostoma Rafinesque 1831, Enum. and acct., p. 3.
Toxostoma Rafinesque 1831, *ibid.*
Stenotrema Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 639.
Stenotrema La Rocque 1953, Cat. Recent Moll. Canada, p. 304.

Type.—*S. convexa* Rafinesque =*S. stenotrema* (Pfeiffer).

Diagnosis.—Shell globose-conic to lens-shaped, compact, close-whorled, with a narrow basal aperture, having a long radial parietal tooth and calloused basal lip, which is often notched in the middle or bluntly toothed; axis with a vertical buttress (the "fulcrum") within the last whorl at its last fourth; embryonic whorls generally with a dense pattern of radially lengthened granules, or sometimes radially striate (Pilsbry, 1940).

General distribution.—Humid eastern Canada and the United States, from the boreal zone (at James Bay) to the Gulf of Mexico.

Geologic range.—Pleistocene: Aftonian to present.

Remarks.—The truly diagnostic characters are those of the soft parts but the shell characters permit distinction of the species of this genus from others. Members of other genera of Polygyridae have complex lip armature and plentiful epidermal hairs, but minor shell characters distinguish them specifically from members of the genus *Stenotrema.*

According to Pilsbry (1940, p. 639), Rafinesque first used the name *Stenotrema* in 1815 for a serpulid annelid for which he gave no description. He used it again in 1819, this time for a land snail, the single species *S. convexa,* which automatically becomes the type, although not defined at the time of naming. Pilsbry has shown that *S. convexa* is the same as *Helix stenotrema* Pfeiffer 1842, which is the name used by Pilsbry for the species. The specific name *convexa* cannot be used as it was first defined by Deshayes (1830) and based on another species, *S. fraternum* (Say), which has priority.

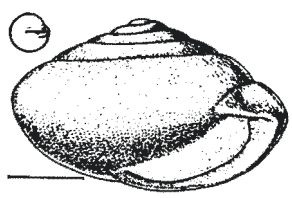

FIGURE 415.—*Stenotrema stenotrema,* magnified; after F. C. Baker (1939a, p. 58).

Pilsbry (1940, p. 643 ff.) has divided the genus into groups but separates sections *Maxillifer* (p. 674) and *Euchemotrema* (p. 675). The species are given in the same order as in Pilsbry's work but the sections are not named.

Stenotrema stenotrema (Pfeiffer) 1842
Fig. 415

Stenotrema convexa Rafinesque 1819, Jour. Physique, v. 85, p. 425 (not defined).
Stenostoma convexa Rafinesque 1831, Enum. and acct., p. 2; not *Helix convexa* Raf., Deshayes 1830, Encycl. Meth., v. 2, p. 253 (=*H. fraterna* Say); *cf.* Pilsbry 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 325-326, footnotes.
Helix stenotrema (Fēr. Mus.) Pfeiffer 1842, Symbolae ad Hist. Hel., v. 2, p. 39.
Stenotrema stenotremum Call 1900, Moll. Ind., p. 383, pl. 5, fig. 6.
Polygyra stenotrema Billups 1902, Nautilus, v. 16, p. 51.
Polygra (sic) *stenotrema* Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376.
Polygyra stenotrema F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 457.
Stenotrema stenotrema Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 655, figs. 409a-e.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 266.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 26.

Type locality.—Indiana.

Diagnosis.—Shell imperforate, depressed-globose, with low conoid spire, strongly convex base and rounded periphery, of some shade of brown; postembryonic whorls with uneven striae bearing short hairs in forwardly descending trends; aperture narrow, with buff to brown borders; parietal tooth high, but not rising to the level of the basal lip, leaning towards the latter, gently curved, its outer end turning into the interdenticular sinus (and often curved into a very short hook at the end); a low and inconspicuous buttress between parietal tooth and termination of outer lip; basal lip with a thin, wholly adnate outer margin; inner margin nearly straight in basal view, with a small but well-marked median notch, with slightly raised callous border; interdenticular sinus moderately deep and rather narrow; outer lip with a low tooth or none; fulcrum well developed, with convex edge.

Ecology.—This species was found in Kentucky on the bushy and forested slopes and creek bottoms with

highly calcareous soil (Conkin, 1957, Naut. 71, p. 11). In West Virginia, Wurtz (1948, Naut. 61, p. 83) found it on planks and stones bordering a dirt road along a hillside. Teskey (1955, Naut. 69, p. 70-71) recorded it for two localities in the Warm Springs area of Georgia: in forest on slope at base of Pine Mountain fire tower and from detritus in crannies of stone walls and rotting timbers of an old mill, Parkman Pond. In Tennessee, Lutz (1950, Naut. 63, p. 102) found it on the bluff on the bank of the Clinch River; red and black oak communities; rocky rubble, bluff overlooking the Clinch River. Hubricht (1950, Naut. 64, p. 7) listed it as common along Roanoke River bluffs, Pittsylvania County, Virginia.

Associations.—Fossil: W-24.

General distribution (fig. 416).—Virginia west to

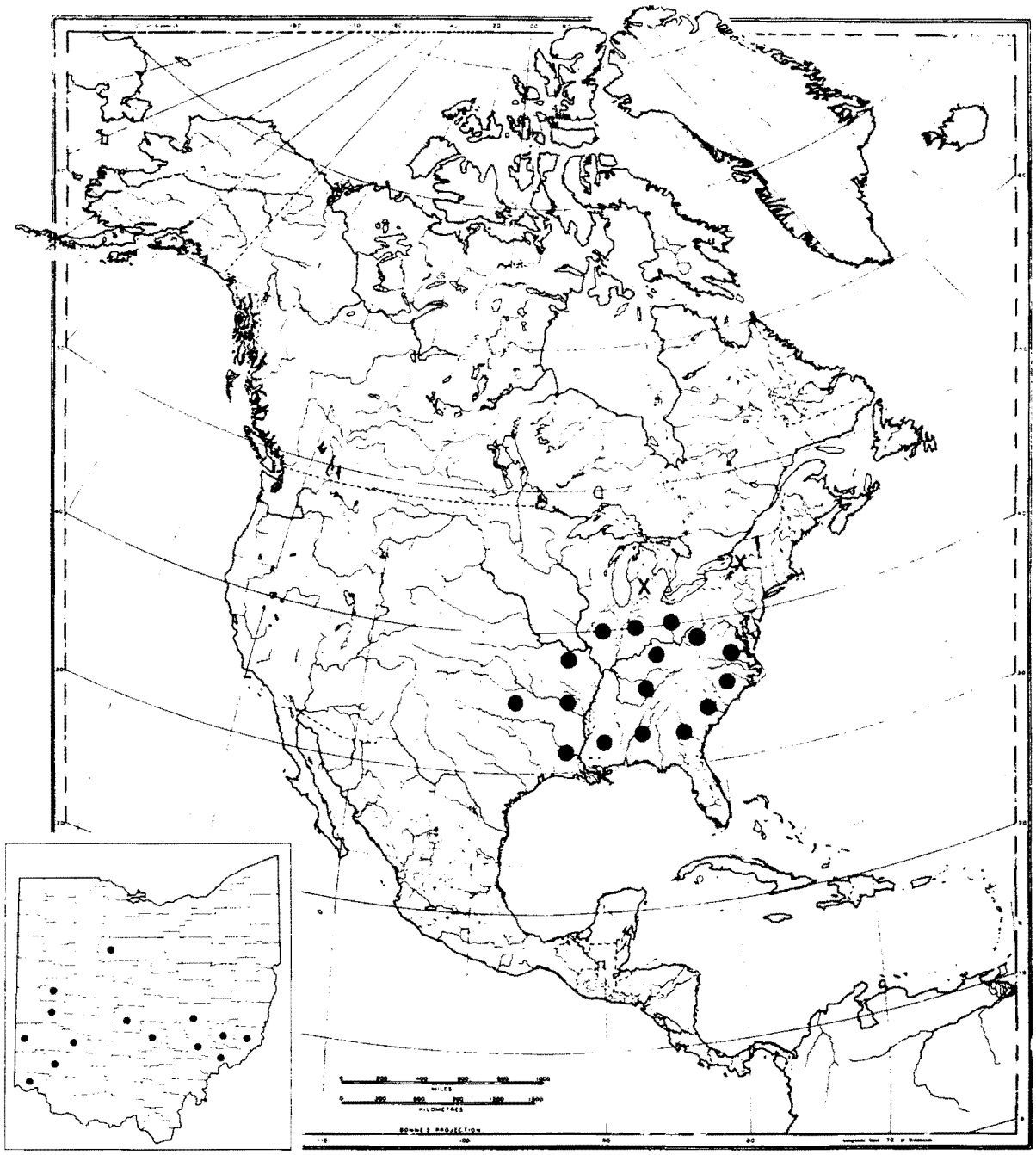

FIGURE 416.—Distribution of *Stenotrema stenotrema* in North America; *inset*, distribution in Ohio.

Missouri and Oklahoma, south to Louisiana, Mississippi, Alabama, and Georgia.

Distribution in Ohio (inset, fig. 416).—Pilsbry (1948, p. 656) gave only Hamilton and Warren Counties, in the extreme southwestern corner of the State. Eggleston (ms. records) collected it in Morgan, Noble, Monroe, and Washington Counties. Sterki (1907a, p. 376) gave only Hamilton County.

Geologic range.—Pleistocene: F. C. Baker (1920a, p. 390) gave Sangamon. Wisconsin and perhaps older, in Indiana: "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51) and Sangamon?, Flat Rock River, Bartholomew County, Indiana (Baker, 1920b, p. 457). The species has not so far been recorded as a fossil in Ohio but the "Old Forest bed" or similar deposits are represented in Ohio and it may well occur in them.

Stenotrema hirsutum (Say) 1817
Fig. 417

Helix hirsuta Say 1817, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 17; v. 2, p. 161.
Stenotrema hirsutum Call 1900, Moll. Ind., p. 383, pl. 5, fig. 7.
Polygyra hirsuta Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 377, 401, 402.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 179.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Goodrich 1932, Moll. Mich., p. 19.
Stenotrema hirsutum Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 662, fig. 412.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 10.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 14, pl. 1, figs. 4, 5.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 304.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 24.

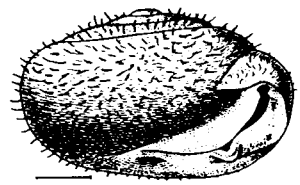

FIGURE 417.—*Stenotrema hirsutum,* magnified; after F. C. Baker (1939a, p. 59).

Type locality.—Wissahickon Creek, Germantown, Philadelphia (Pilsbry, 1940, p. 664).

Diagnosis.—Shell depressed-globose with rather low convexly conoid spire, rounded periphery and strongly convex base; cinnamon-buff to clay color; postembryonic whorls with close radially lengthened granules, on later whorls short moderately stiff hairs with rounded bases, arranged in oblique series; parietal tooth slightly bowed, rather high but lower than the level of the basal lip, slightly sinuous in the outer third, the end not turning toward the interdenticular sinus; basal lip rather broad, its outer edge closely appressed, the calloused inner edge with a large and deep slightly oblique notch with slightly raised edges; interdenticular sinus rather broadly rounded; tooth in the outer lip rather well developed, bluntly conic (modified from Pilsbry, 1940, p. 662).

Ecology.—In Ontario, the species occurs in wet locations and is abundant in stream drift, according to Oughton (1948, p. 94 ff.). Burch (1955, Naut. 69, p. 66) has given data on its relationships to soil factors in eastern Virginia. Ingram (1944, Naut. 57, p. 135-137) has noted that its enemies include shrews *(Blarina)* at Ithaca, New York. He (1941, Naut. 55, p. 14-15) has collected the species under stones on the floodplain of a creek and (1944, Naut. 58, p. 25-27) in beech–yellow-birch and sycamore woodlands in the Ithaca, New York, region, where he studied its winter habits. In West Virginia, Wurtz (1948, Naut. 61, p. 83) recorded it from a very steep hillside covered with leaf mold. Hubricht (1950, Naut. 64, p. 7) found it abundant throughout Pittsylvania County, Virginia, on dry oak ridges, preferring a southern exposure. Burch (1954, Naut. 68, p. 33) found it only in the woods surrounding a lake in Virginia, but very common there; these were a small race, averaging somewhat less than 7 mm. in diameter. In North Carolina, Rehder (1949, Naut. 62, p. 123) collected it among stones, bricks, etc., along the sea wall bordering Albemarle Sound; common. In Maryland, Grimm (1959, Naut. 72, p. 123) recorded it for quarries and woods. Its mating habits are described by Webb (1947, p. 224).

Associations.—Living: MICHIGAN - 21, 25, 28, 29, 36; OHIO - 23, 24, 25, 26, 27, 29, 43; WISCONSIN - 140. Fossil: Y - 1; I - 5; W - 25, 26, 28.

General distribution (fig. 418).—Massachusetts, New York, Ontario, Michigan, Wisconsin, and Minnesota, south to Kansas, Missouri, Louisiana, Mississippi, Georgia, and North Carolina.

Distribution in Ohio (inset, fig. 418).—Sterki (1907a, p. 377) gave "over the state," which is substantiated by later records, although the species has not been as yet recorded for all counties.

Geologic range.—F. C. Baker (1920a, p. 389) gave Yarmouth, Sangamon, Peoria, and "Wabash." Loess of Indiana, Illinois, Iowa, Missouri, and Mississippi (Pilsbry, 1940, p. 662); in Ohio, Middletown "preglacial deposits," "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 401, 402), and Castalia marl (Sterki, 1920, p. 179).

Stenotrema leaii (Binney) 1842
Fig. 419; pl. 12, figs. 1, 4, 7

Helix monodon Rackett 1821, Trans. Linnaean Soc., v. 13, p. 42 (*non* Férussac 1807).
Helix leai "Ward, Ms." A. Binney 1840, Boston Jour. Nat. History, v. 3, p. 362; 1851, Terr. Moll., v. II, p. 149, pl. 41, 4th to 9th figs.
Stenotrema monodon Call 1900, Moll. Ind., p. 384, pl. 5, fig. 8.
Polygyra monodon Billups 1902, Nautilus, v. 16, p. 51.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 26, fig. 3.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 377, 401.
--- --- F. C. Baker 1920, Life of Pleistocene,

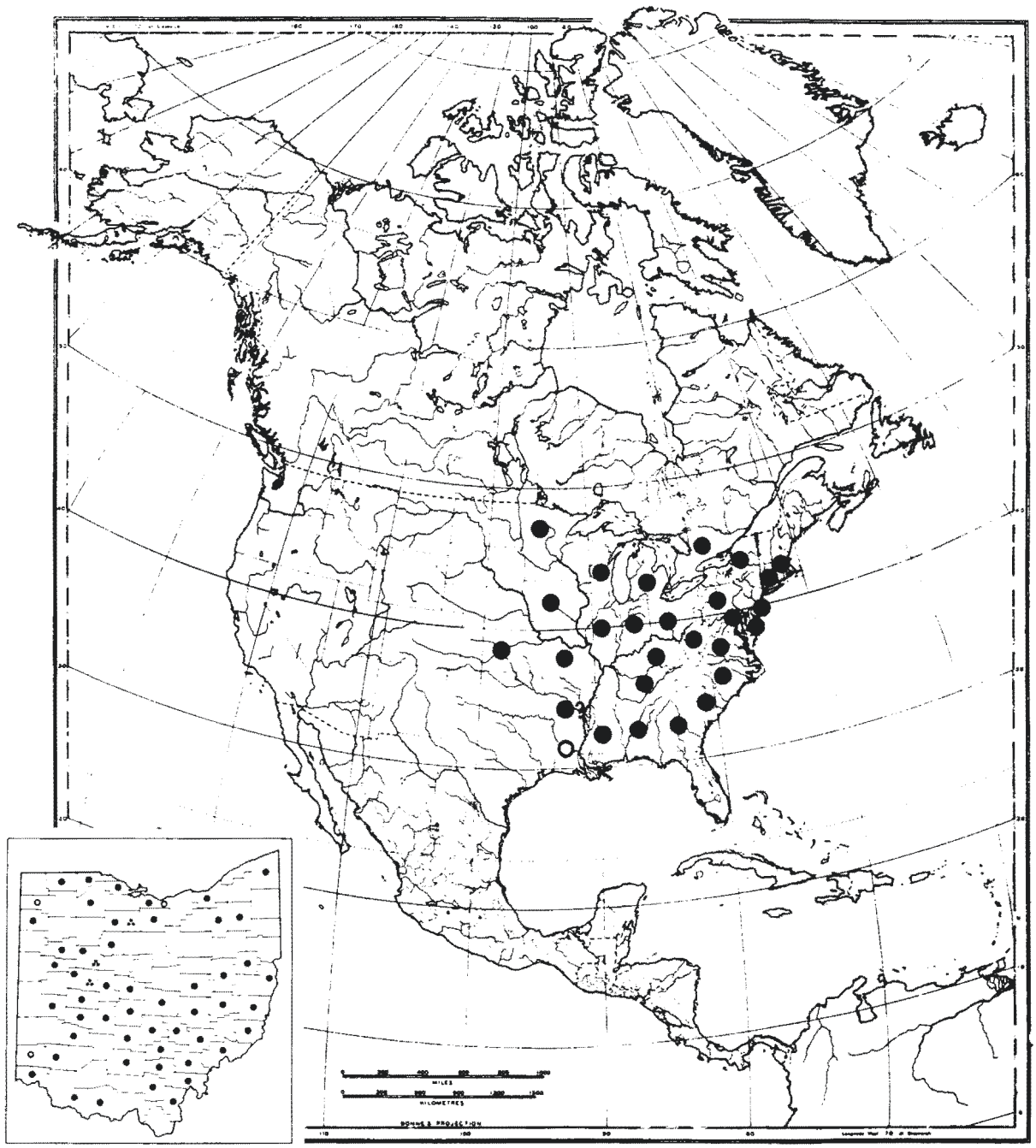

FIGURE 418.–Distribution of *Stenotrema hirsutum* in North America; *inset*, distribution in Ohio.

p. 389.
Polygyra monodon Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 44.
--- --- Goodrich 1932, Moll. Mich., p. 17.
Stenotrema monodon Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 676, figs. 421a, b.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 266.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 10.
Stenotrema leai Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1099.
Stenotrema monodon Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 14, pl. 1, figs. 6, 7.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 35, pl. 4, fig. D.
--- --- La Rocque 1952, Moll. Orleton site, p. 12ff.
Stenotrema leai Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.
Stenotrema monodon La Rocque 1953, Cat. Recent Moll. Canada, p. 304.
Stenotrema leai leai Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 150.
--- --- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 83.
Stenotrema monodon Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 25.

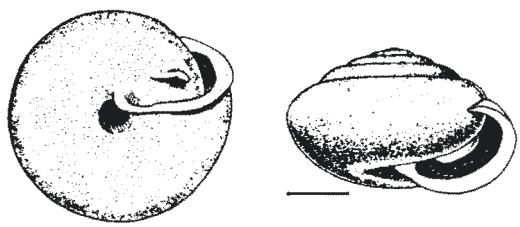

FIGURE 419.–*Stenotrema leaii*, magnified; after F. C. Baker (1939a, p. 60).

Type locality.–Alpena County, Michigan (*H. monodon* Rackett).

Diagnosis.–Shell depressed, with low convexly conoid spire of narrow, very closely coiled whorls; bluntly subangular or rounded at periphery, which is above the middle; base convex; postembryonic whorls with faint lines of growth, the last with very short, delicate hairs rising from little acute bases, which alone remain in most adult shells; aperture oblique, ovate-lunate, with brownish or white peristome, thickened within, well reflected on its outer and basal margins; parietal tooth short, white, straight, standing obliquely on the thin parietal callus, and typically not prolonged towards the columella; fulcrum quite short, with convex edge (modified from Pilsbry, 1940, p. 677).

Ecology.–Found in damp places near the water (as opposed to drier situations for *S. fraternum, q.v.*). Taylor summarized the habitat of this species as follows: Wooded area: in leaf litter or under logs and bark in wooded spots. In Ontario, Oughton (1948, p. 94 ff.) found it in the wetter locations, abundant in stream drift. Solem (1952, Naut. 65, p. 129) collected it in a large tract of virgin pine timber with some deciduous growth and undergrowth of thimbleberry, and in an exceedingly damp area on the shore line, where piles of reeds were tossed up after storms, in the Door County area of Wisconsin. In Minnesota, Dawley (1955, Naut. 69, p. 58) listed it as abundant in a moist, shady glen on the banks of the Mississippi, and in damp places elsewhere in Minnesota. Mating habits are described by Webb (1947, p. 223).

Associations.–Living: MICHIGAN-6, 30; OHIO-4, 7, 43; ONTARIO-7, 8; QUEBEC-6. Fossil: K-1, 3, 6, 12, 14, 15, 18, 19, 20, 23; Y-1; I-4, 5, 7; S-1, 2, 3, 4, 5, 6; W-24, 25, 28, 35, 61, 64, 65, 67, 73.

General distribution (fig. 420).–New York west to Minnesota (including southern but not northern Ontario) and South Dakota, south to Kansas, Missouri, Illinois, Indiana, Ohio, Pennsylvania, and Maryland.

Distribution in Ohio (inset, fig. 420).–Sporadically recorded (perhaps due to insufficient collecting) from Ottawa, Erie, and Cuyahoga Counties in the north to Hamilton, Brown, Adams, Meigs, and Washington Counties in the south. The southwestern and southeastern records are from Eggleston (ms. records).

Geologic range.–F. C. Baker (1920a, p. 389) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash." A. B. Leonard (1950, p. 35) gave the range of the species as Yarmouth to Recent, Kansas and Oklahoma. D. W. Taylor and Hibbard (1955, p. 8) recorded it for the Bar M local fauna, probably Illinoian, of Oklahoma. In Ohio Billups (1902b, p. 51) listed it for the "Old Forest bed of the Ohio River," Sterki (1907a, p. 401) for the "Middletown 'pre-glacial deposits,'" and (1920, p. 179) for the Castalia marl; A. B. Leonard (1953, p. 372) recorded it for lower and upper pro-Tazewell loess in the Cleveland region; La Rocque (1952, p. 12) identified it from the Orleton site, late Wisconsin, of Madison County.

Stenotrema fraternum (Say) 1824
Fig. 421

Helix fraterna Say 1824, Long's Exped., p. 257, pl. 15, fig. 3.
Polygyra fraterna Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 377.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 457.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Polygyra monodon fraterna Goodrich 1932, Moll. Mich., p. 18.

Stenotrema fraternum Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 681, fig. 422a.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 9.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 14, pl. 1, figs. 8, 9.
Stenotrema fraternum fraternum La Rocque 1953, Cat. Recent Moll. Canada, p. 304.
Stenotrema fraternum Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 23.

Type locality.—Pennsylvania.

Diagnosis.—Shell imperforate or nearly so, with convexly conoid spire of closely coiled whorls, which

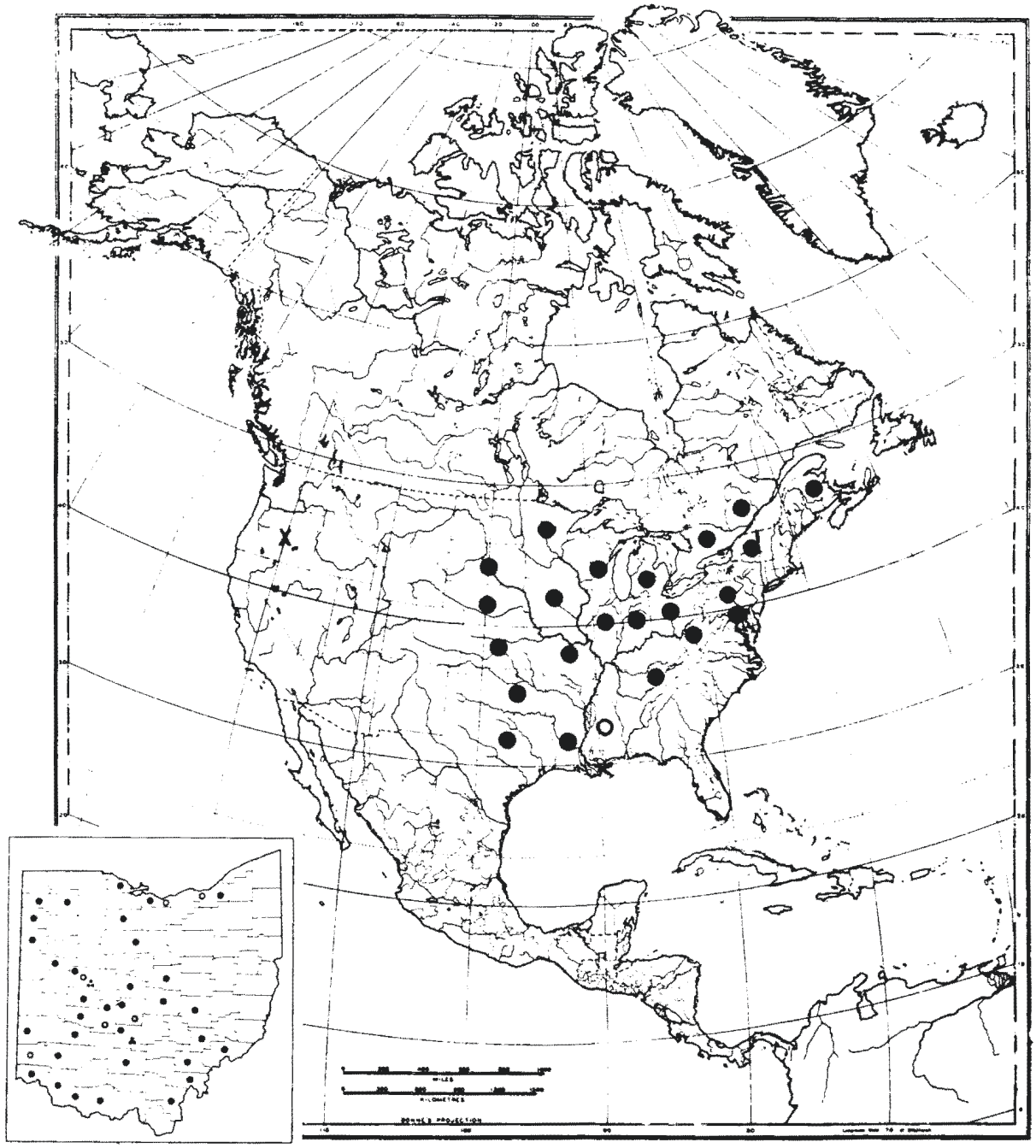

FIGURE 420.—Distribution of *Stenotrema leaii* in North America; *inset,* distribution in Ohio.

are noticeably wider than in *S. leaii;* the rather strongly convex base impressed around the axis; the rounded periphery above the middle; postembryonic whorls densely covered with short hairs on their bases; parietal tooth short, rather low, nearly straight but with the ends commonly a trifle turned towards the basal lip; basal lip well thickened within, fulcrum rather short.

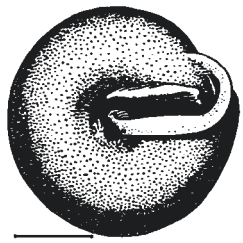

FIGURE 421.—*Stenotrema fraternum,* magnified; after F. C. Baker (1939a, p. 61).

Ecology.—In Ontario, this species occurs in woodlands, especially those of deciduous trees, both in damp situations and drier, more open woods or fields. H. B. Baker (1922b) has found it in the drier habitats in Dickinson County, Michigan, specifically: (37) outcrop of Sturgeon quartzite: cliffs along Fern Creek, scattered hardwoods and plants; (38) sandy outwash plains, pines and second growth; (41) higher moraines with fine hardwood cover; snails particularly in maple logs. Muchmore (1959, Naut. 72, p. 85-88) recorded it under stones in various woodland areas in New York State. Ingram (1940, Naut. 54, p. 87) has noted its daylight activity. He (1944, Naut. 58, p. 25-27) has also studied its winter habits at Ithaca, New York, in beech–yellow-birch and sycamore woodlands. Solem (1952, Naut. 65, p. 129) found it in a large tract of virgin pine timber with some deciduous growth, undergrowth of thimbleberry, in Door County, Wisconsin. Archer (1934c, p. 139) found a few unusually large specimens at the base of the bluffs, among herbs, on Mackinac Island, Michigan. The process of egg laying, the eggs, and the young were studied by Ingram (1944, p. 91-93). In Virginia, the species is common in the hills above the Dan and Roanoke Rivers, Pittsylvania County (Hubricht, 1950, Naut. 64, p. 7). Webb (1948, Naut. 62, p. 8-12) studied the mating habits of specimens collected from a level woodland in Hancock County, Indiana.

Ingram (1946, Naut. 59, p. 89) gave the following data: "Individuals were generally collected from beneath logs and on stumps in the beech-hemlock, beech-maple, and maple areas. They were rarely found in the humus layer. Young individuals were occasionally found in hedgerows adjoining forest strips. They were marginal forms in flood-plain areas. The short tailed shrew and the white-footed deermouse feed on this species."

Associations.—Living: MICHIGAN - 1, 2, 3, 4, 7, 8, 9, 21, 23, 25, 26, 27, 29, 31, 32, 33, 34, 39, 40; OHIO - 1, 23, 24, 25, 26, 28; ONTARIO - 11; WISCONSIN - 138, 139, 140, 141, 142.

General distribution (fig. 422).—New Hampshire, Vermont, Ontario, Michigan, and Minnesota, south to Missouri, Alabama, and North Carolina.

Distribution in Ohio (inset, fig. 422).—"Throughout the state" (Sterki, 1907a; Pilsbry, 1940); county records so far available indicate presence of the species in the western part of the State in Williams, Fulton, Hancock, Allen, Auglaize, Mercer, and Hamilton Counties (all University of Michigan records); in southern Ohio in Brown, Pike, Ross, Athens, Washington, and Noble Counties (Wurtz, 1949; Eggleston, ms. records).

Geologic range.—F. C. Baker (1920a, p. 389) gave Yarmouth, Sangamon, Peorian, and "Wabash." He (Baker, 1920b, p. 457) also recorded it doubtfully for the Sangamon in Indiana. Wayne (1954, p. 1320) listed it from pro-Kansan loess in Indiana. Apparently there is no Ohio record although its occurrence in our Pleistocene is likely.

[*Stenotrema fraternum cavum* (Pilsbry and Vanatta) 1911]

Polygyra monodon cava Pilsbry and Vanatta 1911, Nautilus, v. 25, p. 12.

Polygyra fraterna cava Vanatta 1920, Nautilus, v. 33, p. 97.

Stenotrema fraternum cavum Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 684, fig. 422d.

Stenotrema fraternum cavum Oughton 1948, Zoögeogr. study, Ontario, p. 9.

--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 304.

Type locality.—Cazenovia, Madison County, New York.

Diagnosis.—Shell larger and more depressed than *S. fraternum;* more openly umbilicate, deeply impressed or excavated around the umbilicus; parietal tooth either straight or slightly curved, short, its ends about equally remote from the terminations of the lip; internal "fulcrum" well developed, notched above and below as in *S. fraternum* (modified from Pilsbry, 1940, p. 684).

Ecology.—Archer (1941, Naut. 54, p. 113-116) noted that *S. fraternum* and *S. fraternum cavum* occupy separate territories in Michigan and that the latter is more northern in its distribution. He found it not only in the uplands, but also along streams, under drift on lake shores, and in cedar bogs.

General distribution (fig. 423).—New Brunswick, Quebec, Ontario, and Minnesota, south to Iowa, Indiana, Pennsylvania, and Massachusetts.

Distribution in Ohio (inset, fig. 423).—Not as yet recorded, but probable, because of the Indiana and Pennsylvania records.

Geologic range.—Unknown.

Remarks.—Pilsbry's (1940, p. 685) remarks are worth noting: "When typically developed this form is easily distinguishable from *fraternum;* but the glaciated region it inhabits is new snail territory, and *cavum* has not yet been fully differentiated; the assigned characters are variable. So many lots of intermediate character are found that I am now inclined to think that its recognition as a subspecies is of little practical utility. However, the data are given for what they may be worth." In view of these observations, the subspecies or form is listed here but so far there are no definite records for Ohio. The subspecies should be found in late Pleistocene deposits in Ohio but the fact is that it has not. Could this possibly indicate that its Pleistocene history has been different from that of other

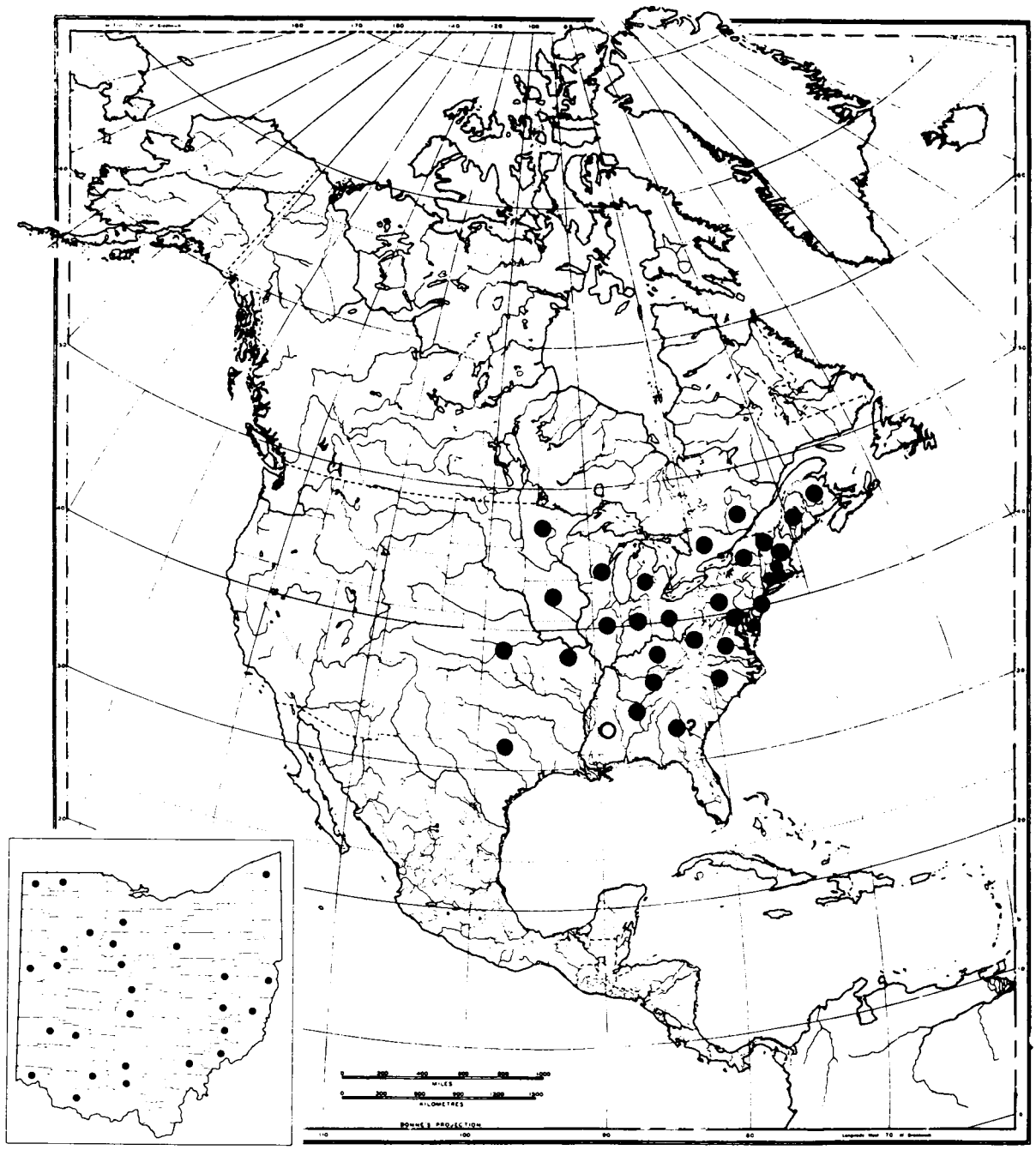

FIGURE 422.—Distribution of *Stenotrema fraternum* in North America; *inset,* distribution in Ohio.

land snails of the family Polygyridae and that its migration route or routes did not include Ohio? The point is worth bearing in mind as fossil *Stenotremas* from the Midwest are studied.

Genus *Mesodon* Rafinesque 1821

Mesodon Rafinesque 1821, *in* Férussac, Tabl. Syst. Fam. Limaçons, p. 33, no. 96 (*fide* Pilsbry, 1940, p. 702).

Odomphium Rafinesque 1831, Enum. and acct., p. 3.

Odontophalum Agassiz 1846, Nomenclator Zool., Index Univ., p. 255 (emendation of *Odomphium*).

Mesodon Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 702.

Mesodon La Rocque 1953, Cat. Recent Moll. Canada, p. 304.

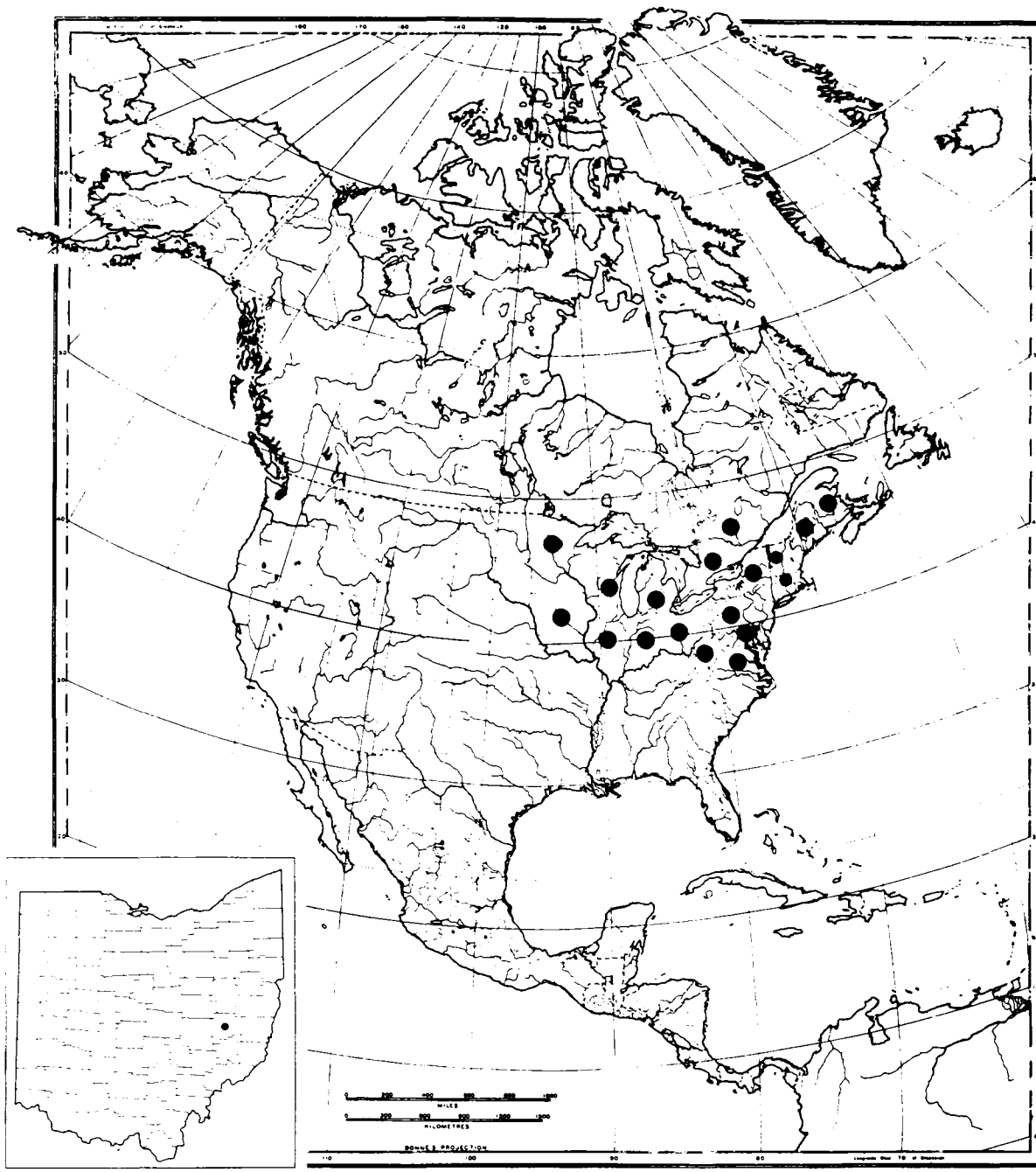

FIGURE 423.–Distribution of *Stenotrema fraternum cavum* in North America; *inset*, distribution in Ohio.

Type.—*Helix thyroidus* Say, by subsequent designation of Pilsbry, 1930.

Diagnosis.—Shell of medium or large size, umbilicate or closed, in shape from globose with conoid spire to strongly depressed; aperture with reflected lip, toothless or with one or two teeth (or in the subgenus *Inflectarius,* three teeth).

General distribution.—Eastern United States and Canada, west to eastern Nebraska and Texas.

Geologic range.—Pleistocene to present.

Remarks.—The shell characteristics are not diagnostic for identification of the genus. Fortunately, the Pleistocene species all have living representatives and can be placed indirectly in the correct genus.

Mesodon thyroidus (Say) 1816
Fig. 424

Helix thyroidus Say 1816, Nicholson's Encycl., 1st. ed., v. 2, art. Conchology, under *Helix albolabris.*
Mesodon thyroidus Call 1900, Moll. Ind., p. 394, pl. 6, figs. 5, 5a, b.
Polygyra thyroides Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376, 401, 402.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 456.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 44.
--- --- Goodrich 1932, Moll. Mich., p. 19.
Mesodon thyroidus Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 706.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 267.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 7.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 15, pl. 1, figs. 11, 12.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 305.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 21.

Type locality.—Near the mouth of Wissahickon Creek, near Philadelphia, Pennsylvania.

Diagnosis.—Shell half-covered umbilicate, depressed-globose, rather thin, ivory yellow, with the back of the lip cream buff; surface somewhat glossy, with oblique striae and microscopic spiral lines which may be obsolescent; aperture rotund-lunate, somewhat dished; peristome rather widely reflected in its outer and basal margins, dilated about half over the narrow umbilicus; parietal wall bearing a short, obliquely placed tooth, but this is frequently wanting (modified from Pilsbry, 1940, p. 707).

Ecology.—Pilsbry (1940, p. 710) has noted that the food of this species is chiefly woods nettles *(Laportea canadensis)* but also that the species is mycophagous, preferring fungi of any kind to green plants.

In Ontario, occurs in damp woodlands, especially those of deciduous trees; the species is confined to Paleozoic terranes (mainly limestones) in that area, according to Oughton (1948, p. 94 ff.). Archer (1935, p. 82) recorded it from banks above a road, rare, in the Asheville, North Carolina, region. It thrives in deciduous woods, even sparse stands of second growth, in the Columbus area, on limestone soils or glacial drift.

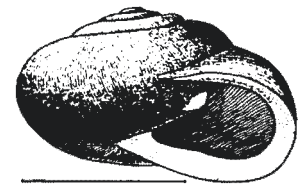

FIGURE 424.—*Mesodon thyroidus,* magnified; after F. C. Baker (1939a, p. 56).

Conkin (1957, Naut. 71, p. 11) collected it in Kentucky on bushy and forested slopes and creek bottoms with highly calcareous soil. Solem (1952, Naut. 65, p. 129) found it near a small freshwater lake on Washington Island, Door Peninsula, Wisconsin. Wurtz (1941, Naut. 54, p. 142-143) listed this as one of the species in a winter agglomeration of snails in the soil of a northward sloping hillside in Allegheny County, Pennsylvania. Ingram (1944, Naut. 58, p. 25-27) has described its winter habits at Ithaca, New York, in beech–yellow-birch and sycamore woodlands. Burch (1955, Naut. 69, p. 66) has shown its relationships to soil factors in eastern Virginia. Teskey (1955, Naut. 69, p. 70-71) has collected it in the Warm Springs area of Georgia from detritus in crannies of old stone walls and rotting timbers of an old mill at Parkman Pond. Rehder (1949, Naut. 62, p. 125-126) has recorded it around fallen logs and leaves, under boards and around planks near the boardwalk, Myrtle Beach, South Carolina. In North Carolina, he (1949, Naut. 62, p. 123) found it among stones, bricks, etc., along the sea wall bordering Albemarle Sound; rather common.

Foster (1936) described the biology of this snail; Van Cleave and Foster (1937, p. 50-54) gave details on its seasonal life history. According to Foster (1936) there is little doubt that the long extended breeding season is a characteristic which enables this species to maintain itself as an abundantly represented species on a flood plain. Additional data on copulation and egg laying are given by Ingram (1941, Naut. 54, p. 143).

Additional habitat notes are plentiful in the literature; only a few are given here. Wurtz (1948, Naut. 61, p. 83) found the species in West Virginia on a flood-

plain which had been flooded four years earlier. Lutz (1950, Naut. 63, p. 103) listed it from woody slopes of hardwood forests and bluffs of the Clinch River in Tennessee. Hubricht (1950, Naut. 64, p. 7) stated that it is generally distributed over Pittsylvania County, Virginia, but is commonest in the floodplains of the Dan and Roanoke Rivers. In Virginia, Burch (1954, Naut. 68, p. 32) found it most generally associated with woodlands having a predominance of oaks. In Maryland, Grimm (1959, Naut. 72, p. 123) found it around foundations of old burned houses, in a quarry, in woods, and along railroad tracks.

This species is preyed upon by shrews *(Blarina)*, as recorded by Ingram (1944, Naut. 57, p. 135) for Ithaca, New York.

Associations.—Living: MICHIGAN-1; OHIO-5, 7,

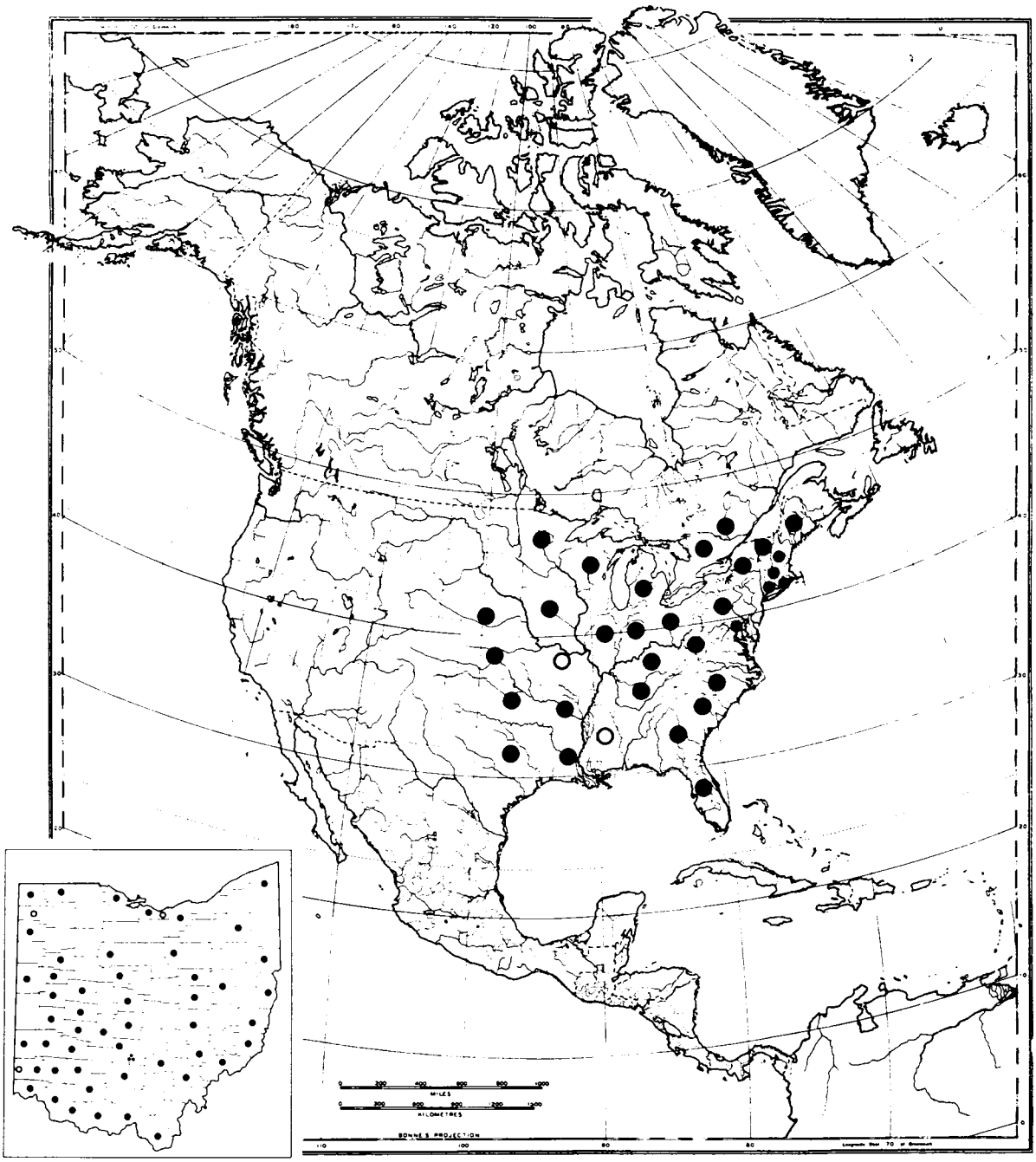

FIGURE 425.—Distribution of *Mesodon thyroidus* in North America; *inset*, distribution in Ohio.

23, 24, 29, 43; ONTARIO - 7, 12; WISCONSIN - 141. Fossil: W - 24, 25, 26, 28.

General distribution (fig. 425).—Massachusetts and Ontario west to Minnesota, eastern Nebraska, Kansas, and Oklahoma; south to the Gulf of Mexico and eastern Texas.

Distribution in Ohio (inset, fig. 425).—In all parts of the State: Fulton, Paulding, Mercer, and Hamilton Counties (University of Michigan records; Eggleston, ms. records); Ashtabula, Tuscarawas, Belmont, Monroe, Washington, Athens, Lawrence, Scioto, Adams, Brown, Clermont, and Hamilton Counties (Eggleston, ms. records; Wurtz, 1949). The map shows no records for some counties but this is probably due merely to lack of collecting.

Geologic range.—F. C. Baker (1920a, p. 390) gave Yarmouth, Sangamon, Peorian, and "Wabash." "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); Middletown and Defiance deposits (Sterki, 1907a, p. 401, 402); Castalia marl (Sterki, 1920, p. 179).

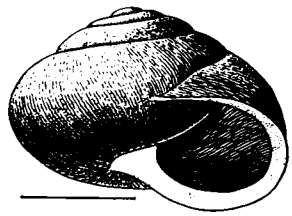

FIGURE 426.—*Mesodon clausus*, magnified; after F. C. Baker (1939a, p. 57).

Mesodon clausus (Say) 1821
Fig. 426

Helix clausa Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 154.
Mesodon clausus Call 1900, Moll. Ind., p. 392, pl. 6, figs. 6, 6a.
Polygyra clausa Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376, 402.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 457.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Goodrich 1932, Moll. Mich., p. 18.
Mesodon clausus Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 712, figs. 434a, b.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 267.
--- --- La Rocque 1952, Moll. Orleton site, p. 12 ff.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 304.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 16.

Type locality.—Illinois.

Diagnosis.—Shell narrowly umbilicate, the umbilicus half or almost entirely covered; depressed-globose, with conoidal spire; glossy, finely, closely striate, with microscopic spiral lines; last whorl descending very little in front, and with a furrow behind the lip; peristome typically rather narrow, white, reflected and thickened within; parietal callus very thin and transparent (modified from Pilsbry, 1940, p. 712).

Ecology.—In Tennessee, this species occurs in the foothills of the Cumberland Mountains, in red and black oak forests (Lutz, 1950, Naut. 63, p. 102).

Associations.—Living: OHIO - 24; WISCONSIN - 140. Fossil: W - 26, 35.

General distribution (fig. 427).—Ohio, Michigan, Wisconsin, Iowa, and Kansas, southward to Georgia, Alabama, Arkansas, and Oklahoma.

Distribution in Ohio (inset, fig. 427).—Records for the State are surprisingly few. Sterki (1907a, p. 376) gave Lorain, Franklin, and Hamilton Counties; Eggleston (ms. records) added Clark County. See also distribution of the species in the State as a fossil.

Geologic range.—F. C. Baker (1920a, p. 389) gave Yarmouth, Sangamon, Peorian, and "Wabash." Sangamon? of Indiana (Baker, 1920b, p. 456); "Defiance sandy deposit (loess?)," Defiance County, Ohio (Sterki, 1907a, p. 402); late Wisconsin, Orleton deposit, Madison County (La Rocque, 1952, p. 12 ff.).

Mesodon mitchellianus (Lea) 1839
Fig. 428

Helix mitchelliana Lea 1839, Am. Philos. Soc. Trans., v. 6, p. 87; pl. 23, fig. 71.
Mesodon mitchellianus Call 1900, Moll. Ind., p. 391, pl. 6, fig. 2.
Polygyra mitchelliana Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376, 402.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Goodrich 1932, Moll. Mich., p. 18.
Mesodon mitchellianus Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 715, fig. 435.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 267.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 6.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 15, pl. 1, figs. 29, 30.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 305.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 19.

Type locality.—Ohio.

Diagnosis.—Shell imperforate, depressed-globose, rather thin, translucent, buff; surface glossy, regularly

thread striate, with microscopic spiral lines, the apical whorl smooth; last whorl descending in front, guttered behind the lip; peristome white, reflected, thickened within, dilated and appressed over the umbilical region; columellar margin concave; parietal callus thin and transparent (modified from Pilsbry, 1948, p. 716).

Ecology.—Cahn and Kemp (1929, p. 66-67) found only four specimens of this species in Turkey Run State Park, Indiana. They did not specify the particular habitat from which the specimens came but in general it may be described as hardwood forest (white oak, sugar maple, tulip, and elm) with occasional deep ravines through sandstone bluffs. The "bottoms" support gigantic sycamores, walnuts, and elms. The ground is well covered with rich humus and a wealth of moss holds the moisture and makes the area particularly

FIGURE 427.—Distribution of *Mesodon clausus* in North America; *inset,* distribution in Ohio.

FIGURE 428.–*Mesodon mitchellianus*, magnified; after Call (1900, pl. 6, fig. 2).

ideal for terrestrial mollusks. Other species of *Mesodon* are abundant in the area as are also species of *Triodopsis*. On the other hand, Blakeslee (1947, Naut. 60, p. 78-81) found it abundant in Illion Gorge, Herkimer County, New York. Here the species was found under thick vegetation, on the undersides of large leaves on which the animals were feeding, and in grass by the side of the road near a stream.

Associations.–Living: OHIO-43. Fossil: W-24, 26.

General distribution (fig. 429).–New York west to Michigan; south to Illinois, Kentucky, and Pennsylvania.

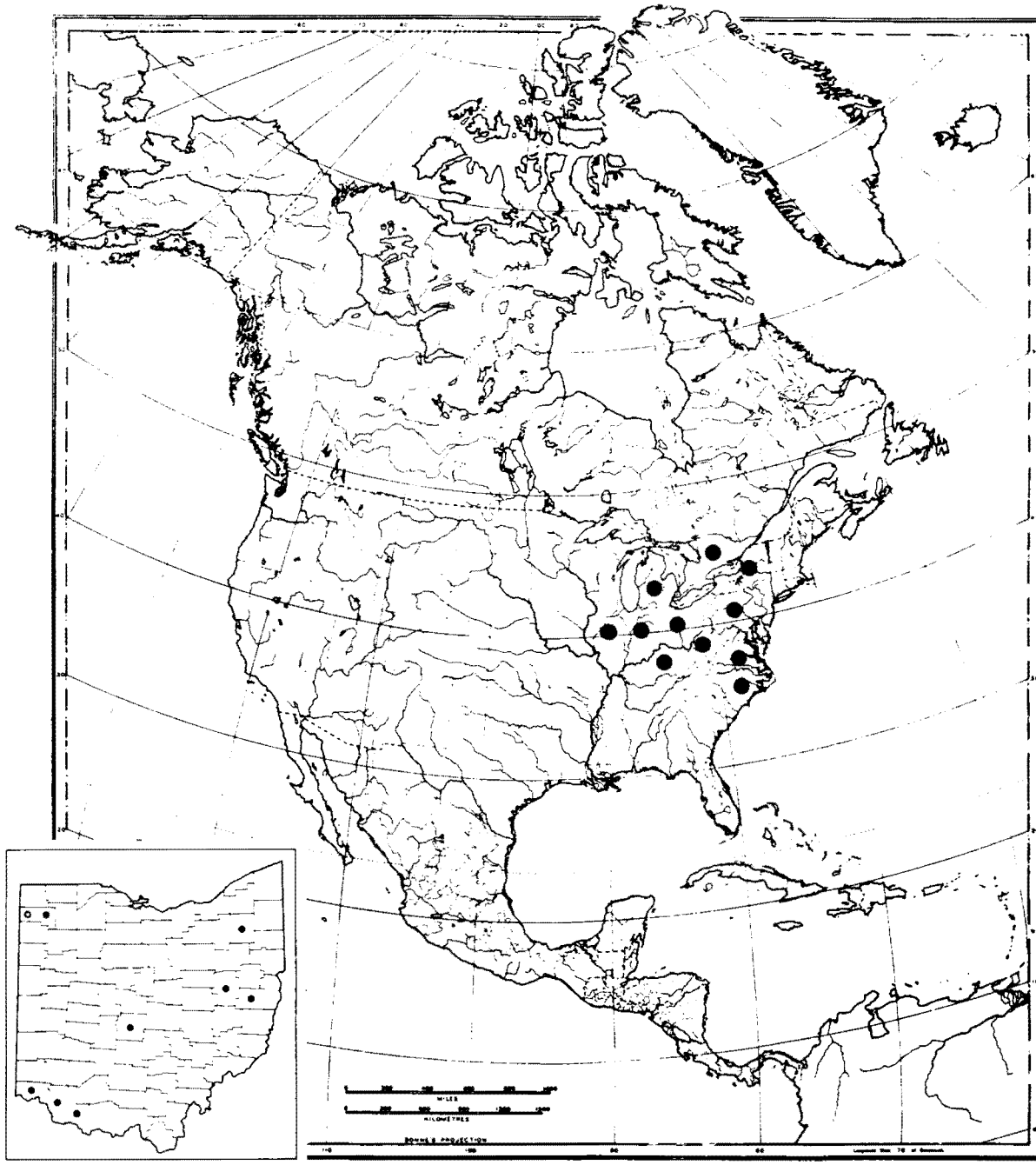

FIGURE 429.–Distribution of *Mesodon mitchellianus* in North America; *inset*, distribution in Ohio.

Distribution in Ohio (inset, fig. 429).—Defiance, Portage, Tuscarawas, Harrison, Franklin, and Hamilton Counties (Sterki, 1907a, p. 376); Clermont and Brown Counties (Eggleston, ms. records; Wurtz, 1949).

Geologic range.—F. C. Baker (1920a, p. 389) gave Sangamon and "Wabash." "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402). The species may be expected in Pleistocene deposits in Ohio and elsewhere, at least in the present southern extent of its range, but it is likely to be rare, as it is now.

Mesodon zaletus (Binney) 1837
Fig. 430

Helix zaleta Say, MS., A. Binney 1837, Boston Jour. Nat. History, v. 1, p. 492, pl. 20.
Mesodon exoletus Call 1900, Moll. Ind., p. 393, pl. 6, fig. 4.
Polygyra exoleta Billups 1902, Nautilus, v. 16, p. 51.
Polygyra zaleta Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376, 402.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 456.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Goodrich 1932, Moll. Mich., p. 16.
Mesodon zaletus Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 722.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 267.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 8.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 18, pl. 1, figs. 13, 14.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 306.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 22.

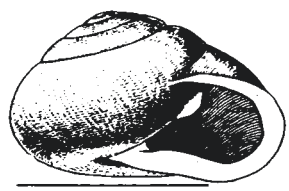

FIGURE 430.—*Mesodon zaletus,* magnified; after F. C. Baker (1939a, p. 50).

Type locality.—Cincinnati, Ohio (Pilsbry, 1940, p. 723).

Diagnosis.—Shell imperforate, depressed-globose, rather solid; cream colored to deep buff, rather glossy; apex smooth; embryonic whorls with striae radiating from the suture, at first short, gradually becoming longer; later whorls with sculpture of fine oblique striae and microscopic spiral lines which are typically rather weak or subobsolete but in some specimens distinct; spire moderately elevated, with somewhat convex outlines; aperture shaped much as in *Triodopsis albolabris;* lip white, flatly reflected, and nearly 3 mm. wide, its basocolumellar margin straightened or weakly toothed; parietal wall bearing a white oblique tooth (rarely wanting) (modified from Pilsbry, 1940, p. 723).

Ecology.—Found "on leaves along the trail" in Pisgah Forest, North Carolina (Winslow, 1921, Naut. 35, p. 42). The species is eaten by shrews *(Blarina brevicauda talpoides)* in the Ann Arbor, Michigan, area, according to Clench (1925, Naut. 39, p. 28). Near Vinton, Iowa, Jones (1930, Naut. 43, p. 118) recorded it from the City Park. Richards (1934, Naut. 47, p. 147) recorded it on a limestone outcrop at a "Disappearing Falls" near the Tennessee River, in Tennessee. Pinney and Coker (1934, Naut. 48, p. 57) found it common on mountain slopes along the entire course of Quaker Run in Allegany State Park, New York. Here it occurs in the same localities as *P. albolabris* but is more widely distributed.

Associations.—Living: OHIO-1, 2, 5, 7; ONTARIO-11, 12, 13, 14. Fossil: W-24, 26.

General distribution (fig. 431).—New York west to Minnesota and Iowa; south to North Carolina, Tennessee, Alabama, and Arkansas.

Distribution in Ohio (inset, fig. 431).—Entire State. Records are not available for all counties but they are numerous enough to show general distribution and to cover the four corners of the State (Williams, Ashtabula, Washington, and Hamilton Counties).

Geologic range.—F. C. Baker (1920a, p. 390) gave Yarmouth, Sangamon, and "Wabash." "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402); Sangamon? of Indiana (Baker, 1920b, p. 456).

Mesodon pennsylvanicus (Green) 1827
Fig. 432

Helix pennsylvanicus Green 1827, Maclurean Lyceum Nat. History Contr., v. 1, p. 8.
Mesodon pennsylvanicus Call 1900, Moll. Ind., p. 391, pl. 6, fig. 1.
Polygyra pennsylvanica Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Goodrich 1932, Moll. Mich., p. 15.
Mesodon pennsylvanicus Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 726, fig. 439.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 267.

Mesodon pennsylvanicus La Rocque 1953, Cat. Recent Moll. Canada, p. 305.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 20.

Type locality.—Near Chartier's Creek, Washington County, Pennsylvania.

Diagnosis.—Shell imperforate, subglobose with convexly conic spire; thin but moderately strong; buff to yellow in color; last whorl rounded at the periphery, descending in front, contracted behind the lip; first half whorl smooth, next half whorl closely striate below the suture, the striae extending about one-third across the whorl; surface of later whorls slightly glossy, closely, regularly striate, the striae nearly smooth except for rather close, strongly engraved spiral

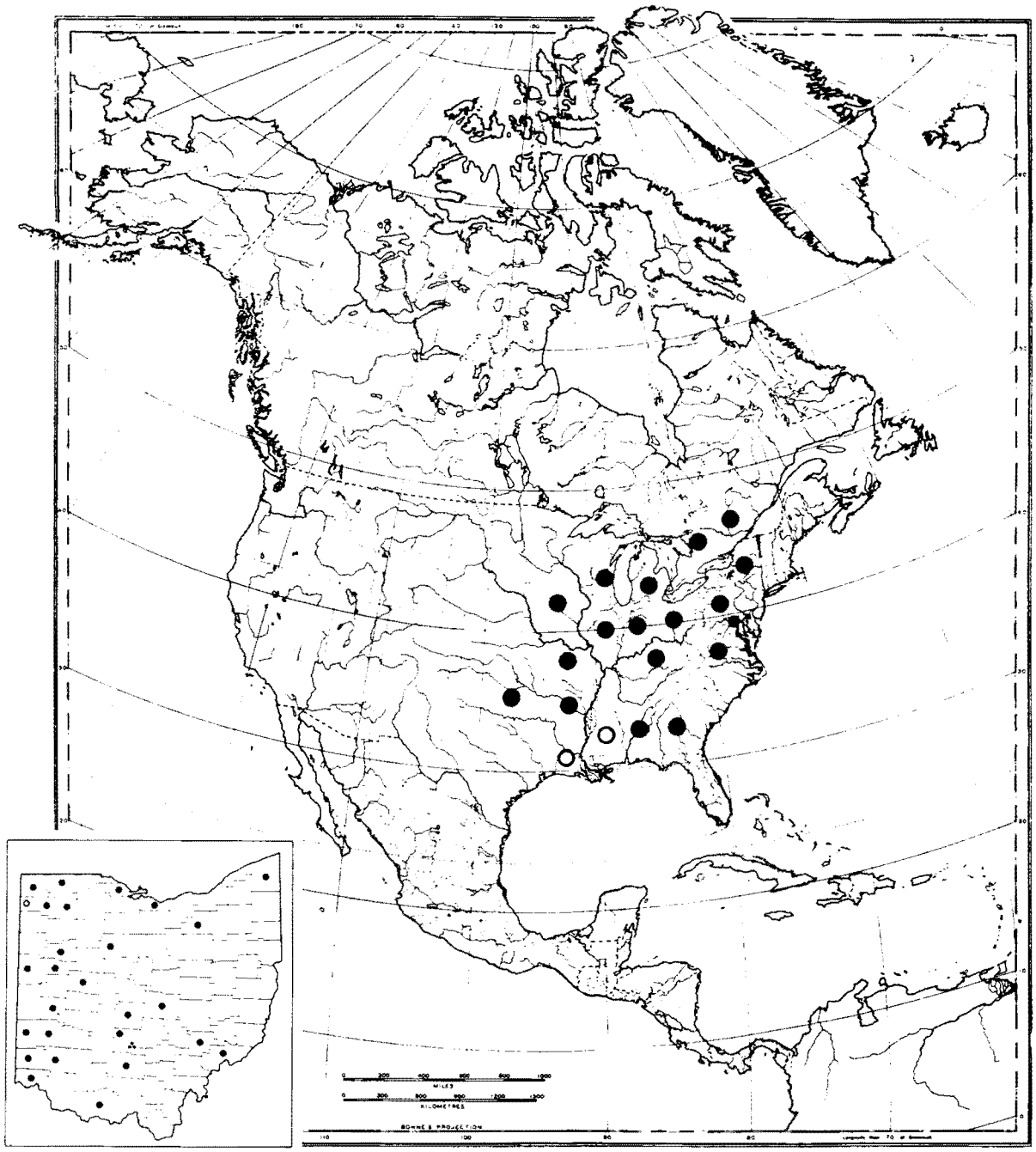

FIGURE 431.—Distribution of *Mesodon zaletus* in North America; *inset*, distribution in Ohio.

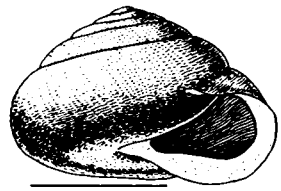

FIGURE 432.–*Mesodon pennsylvanicus*, magnified; after F. C. Baker (1939a, p. 55, lower fig.).

lines; aperture somewhat triangular; peristome white, rather narrowly reflected, thickened within, the outer margin strongly arched above, basocolumellar margin oblique, straightened, with a low prominence on the inner rim (modified from Pilsbry, 1940, p. 726).

Ecology.–Cahn and Kemp (1929, p. 67) listed the species as very rare, only three specimens, in Turkey Run State Park, Indiana, which would seem to be an

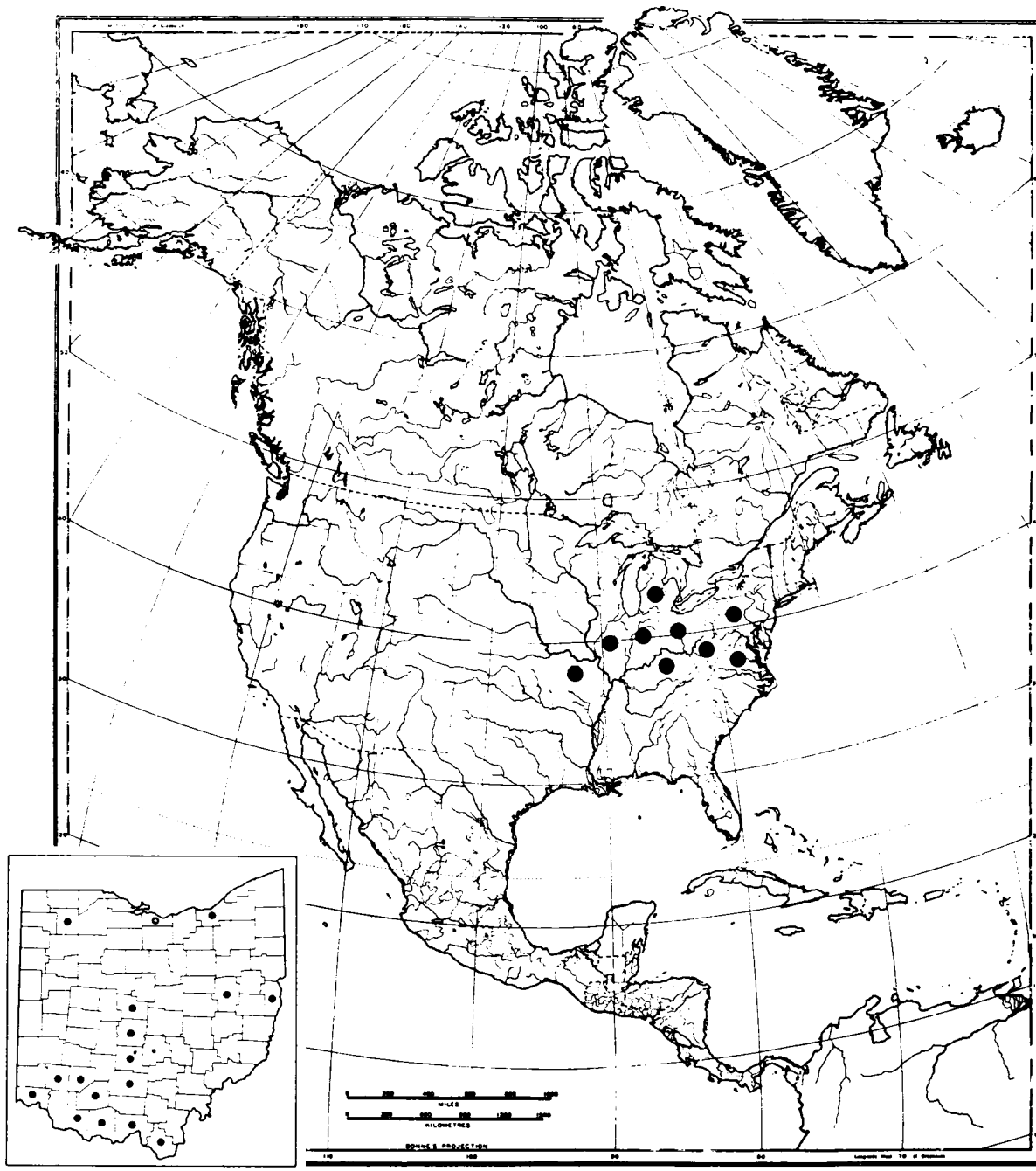

FIGURE 433.–Distribution of *Mesodon pennsylvanicus* in North America; *inset*, distribution in Ohio.

ideal habitat for it. F. C. Baker (1935, Naut. 48, p. 106) thought these specimens were so small that they almost deserved varietal recognition. Archer (1937, Naut. 50, p. 119) found it living among rocks in a wet pasture in Adams County, Ohio. The most detailed account of the habitat is that of Webb (1943, Naut. 57, p. 42-45) who called attention to two previously known areas where this snail was abundant, one the Cincinnati area of Ohio and the other the Monroe, Michigan, region. He noted two other similar areas near Indianapolis, Indiana, both along railroad tracks, one disused, the other still in use. He pointed out four factors that may influence the abundance of *M. pennsylvanicus* in these two areas: (1) the repeated occurrence of a graveled road bed at the localities; (2) the presence of a stream nearby; (3) the repeated occurrence of relatively undisturbed wooded areas adjacent to the abundance areas; and (4) the relative absence of other species of *Mesodon* in the populated areas. Wurtz (1945, Naut. 58, p. 128) recorded it along a road one mile east of Owingsville, Bath County, Kentucky, but without ecologic notes.

Associations.—Living: OHIO-43. Fossil: W-24, 28.

General distribution (fig. 433).—Michigan, Pennsylvania, Ohio, Indiana, Illinois, and Missouri.

Distribution in Ohio (inset, fig. 433).—Cuyahoga, Tuscarawas, Franklin, and Hamilton Counties (Sterki, 1907a, p. 376); Pilsbry gave only Franklin, Hamilton, and Adams Counties; Eggleston (ms. records) has specimens from Delaware, Clinton, Brown, Adams, Scioto, and Lawrence Counties; Wurtz (1949) collected it in Brown County. If Pilsbry rejected the northeastern county records, he has not explained his reason for doing so. These records need confirmation, nevertheless.

Geologic range.—Baker (1920a, p. 390) gave Sangamon, Peorian, and "Wabash." "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); Castalia marl (Sterki, 1920, p. 179), only one specimen. This last record is far to the north of the known distribution of the species at present in Ohio, but it is not anomalous since the species is known for Michigan, which is even farther to the north.

Mesodon elevatus (Say) 1821
Fig. 434

Helix elevata Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 154.
Mesodon elevatus Call 1900, Moll. Ind., p. 392, pl. 6, fig. 3.
Polygyra elevata Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376, 401, 402.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 456.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Goodrich 1932, Moll. Mich., p. 15.
Mesodon elevatus Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 727, figs. 440a, 441.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 267.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 6.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 305.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 17.

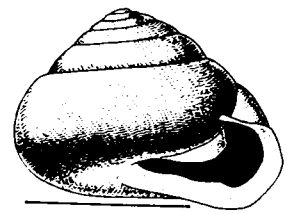

FIGURE 434.—*Mesodon elevatus,* magnified; after F. C. Baker (1939a, p. 55, upper fig.).

Type locality.—Cincinnati, Ohio (Pilsbry, 1940, p. 728).

Diagnosis.—Shell solid, imperforate, globose-conic, with elevated, convexly conic spire of closely coiled whorls and rounded periphery; embryonic shell with a smooth tip, finely and closely striate radially; last whorl finely striate, striae cut by close engraved spiral lines, some specimens with scattered malleations; little or no contraction behind the lip; aperture angularly lunate; peristome white, broadly reflected, thickened within, nearly flat or commonly concave along the basal lip, which is a rather wide plate, obliquely truncate at junction of basal and outer margins; parietal callus bearing a very strong, curved, obliquely entering tooth (modified from Pilsbry, 1940, p. 727).

Ecology.—Conkin (1957, Naut. 71, p. 11) recorded this species in Kentucky from bushy and forested slopes and creek bottoms with highly calcareous soil.

Associations.—Living: OHIO-1. Fossil: W-24, 25, 26.

General distribution (fig. 435).—New York west to Michigan, Illinois, and Missouri, south to South Carolina, Alabama, Louisiana (fossil record only), and Arkansas.

Distribution in Ohio (inset, fig. 435).—Sterki (1907a, p. 376) gave only "Cincinnati; Columbus; Defiance (St.); probably over at least the southern and western parts of the state." Pilsbry (1940, p. 728) added Miami County and Eggleston (ms. records) had it from Gallia and Washington Counties. This points to a much more extensive distribution than that supposed by Sterki; this species may be expected in the southern half of the State and in the northwestern portion; its eastward

extension is undetermined but its occurrence in New York and Michigan makes it probable that it could exist in the entire State.

Geologic range.—F. C. Baker (1920a, p. 390) gave Yarmouth, Sangamon, Peorian, and "Wabash." Sangamon? of Indiana (Baker, 1920b, p. 456); "Old Forest bed of the Ohio River" (Billups, 1920b, p. 51); "Middletown 'preglacial deposits'" (Sterki, 1907a, p. 401); "Defiance sandy deposit (loess?)" (*ibid.*, p. 402).

Mesodon appressus (Say) 1821
Fig. 436

Helix appressa Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 151.

Helix linguifera Ferussac 1821, Tabl. Syst. Fam. Limacons, p. 33, no. 95.

Triodopsis appressa Call 1900, Moll. Ind., p. 386, pl. 5, figs. 11, 11a, b.

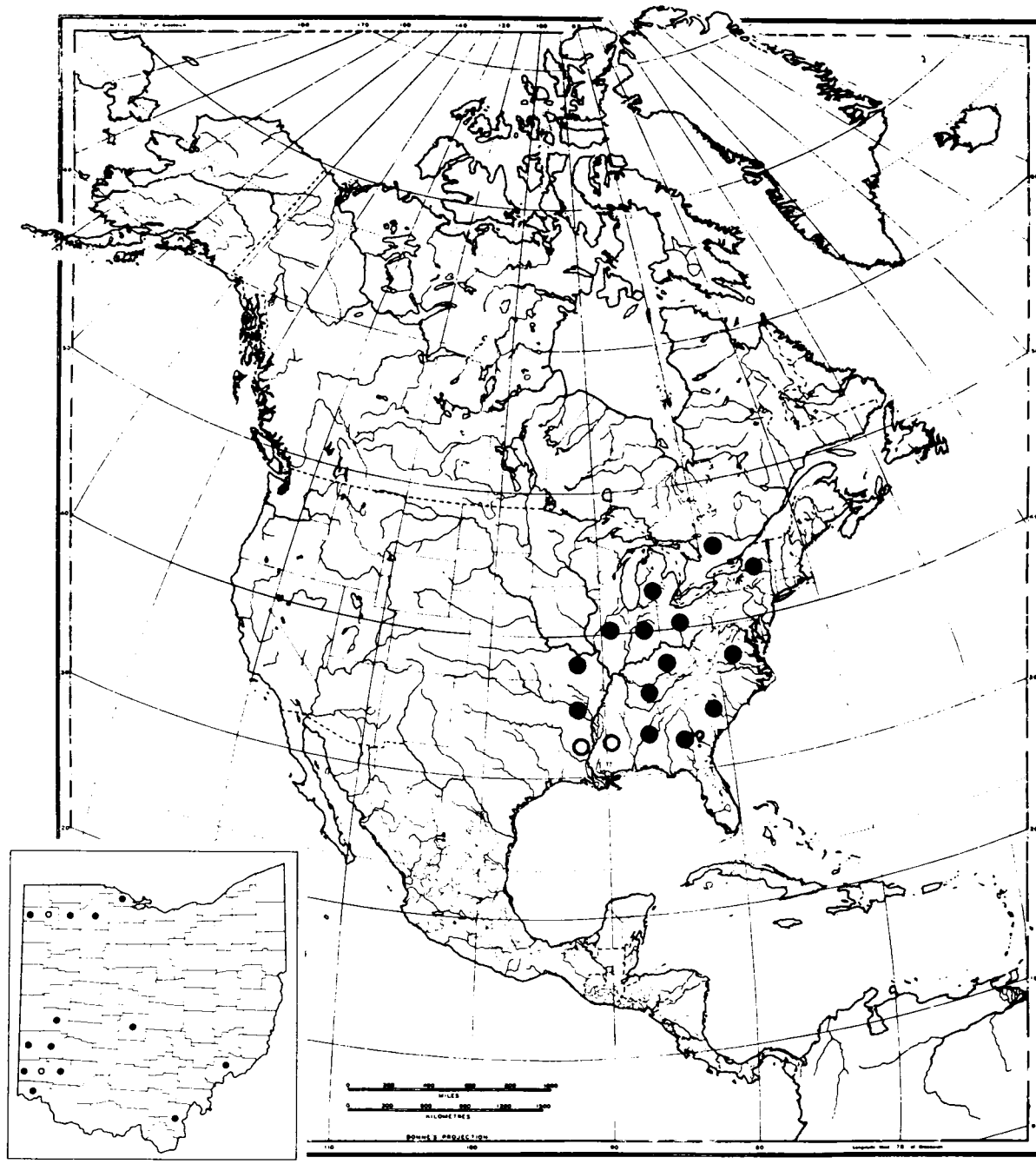

FIGURE 435.—Distribution of *Mesodon elevatus* in North America; *inset*, distribution in Ohio.

Polygyra appressa Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
Mesodon appressus Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 749, fig. 425A, a-c.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 267.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 15.

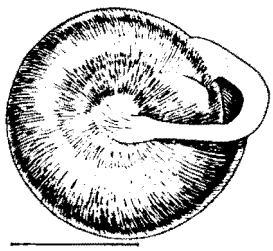

FIGURE 436.—*Mesodon appressus*, magnified; after F. C. Baker (1939a, p. 54).

Type locality.—Gallipolis, Gallia County, Ohio.

Diagnosis.—Shell depressed, brownish horn; whorls five, weakly convex above, the last decidedly angular in front, less so behind, contracted close behind the lip; embryonic whorl striate, the striae becoming coarser and papillose, the papillae spirally aligned on the upper part of the last whorl, scattered on the base; aperture lunate, strongly oblique; peristome broad, flattened, white with tinted edge, strongly thickened within, with a bladelike rim within the basal margin, which is truncate at the junction of the basal and outer margins; no trace of a tooth within the outer arc of the lip; dilated columellar end of the lip concave and appressed over the umbilicus; parietal wall with a rather long, curved, obliquely entering tooth, high at its outer third, sloping down toward, but usually not connected with, the axial callus (condensed from Pilsbry, 1940).

Ecology.—In Alabama, very abundant in urban stone walls and on weedy lots, chiefly confined to calcareous soils (Archer, quoted by Pilsbry, 1940). Webb (1942, Naut. 56, p. 61-62) has found it in Indiana on and about weed-covered manmade gravel hills; least plentiful on the more nearly level areas adjacent to the hills. In West Virginia, Wurtz (1948, Naut. 61, p. 84) found it on the ceilings of disused coal mines, and along the Kanawha River, on a railroad embankment opposite Montgomery. Lutz (1950, Naut. 63, p. 103) recorded it in Tennessee for foothills of hardwood forests, rocky rubble, and under logs. It was found under debris in a lumber yard in Maryland (Grimm, 1959, Naut. 73, p. 21).

The form *laevior* Pilsbry is recorded for Virginia by Hubricht (1950, Naut. 64, p. 8), who states that, judging by the samplings he has made, it must occur abundantly in every backyard in Danville. It does not occur outside the city, and is probably introduced.

Burch (1954, Naut. 68, p. 32) stated that the form *sculptior* Chadwick is common along cliffs on the Chesterfield County side of the James River, but in only one locality in Henrico County, on the other side of the same river. He (1955, Naut. 69, p. 66) has shown the relationships of this form to soil factors in eastern Virginia.

Hubricht (1950, Naut. 64, p. 7) has an interesting observation on this form in Virginia. He found it common on the cliffs along the Roanoke and Dan Rivers, Pittsylvania County. He stated that the absence of *M. appressus* in the Blue Ridge suggests that this species came down the Roanoke River, from the Great Valley, to the mouth of the Dan, thence up the Dan into Pittsylvania County.

Associations.—Fossil: W-24.

General distribution (fig. 437).—Virginia westward to southern Ohio and Indiana, southward through Kentucky and Tennessee to Alabama.

Distribution in Ohio (inset, fig. 437).—Southwestern counties (Hamilton, Brown, Adams, Gallia) and Auglaize County (University of Michigan records). Pilsbry (1940, p. 751) gave only Hamilton and Gallia Counties; Wurtz (1949) added Brown County; the Auglaize County record indicates that the species probably has a much larger range in the State.

Geologic range.—F. C. Baker (1920a, p. 390) gave Yarmouth, Sangamon, and Peorian. "Old Forest bed of the Ohio River" (Billups, 1920b); the locality is in Indiana, just next to the Ohio line and it is probable that the species will eventually be found in similar deposits within Ohio.

[*Mesodon sayanus* (Pilsbry) 1906]

Helix diodonta Say 1824, Long's Exped., v. 2, p. 257, pl. 15, fig. 4 (*non* Megerle v. Muhlfeld, Férussac, 1822).
Helix sayi A. Binney 1840, Boston Jour. Nat. History, v. 3, p. 379, pl. 16 (*non* Wood, 1828).
Polygyra sayana Pilsbry 1906, Acad. Nat. Sci. Philadelphia Proc. 1906, p. 127.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 375.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Goodrich 1932, Moll. Mich., p. 13.
Mesodon sayanus Oughton 1948, Zoögeogr. study, Ontario, p. 7.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 18, pl. 1, figs. 15, 16.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 305.

Type locality.—"Inhabits the state of New York" (Say, 1824).

Diagnosis.—Shell umbilicate, umbilicus one-seventh the diameter; depressed, thin, pale yellow, glossy; embryonic 1½ whorls smooth, the rest finely striate, with microscopic spiral lines; spire low, convex-conoid; whorls 4½ to 5¾, convex, rather narrow, the last descending slightly in front, rounded at the periphery, very slightly contracted behind the lip; aperture rounded lunate, the lip white, narrow, reflexed throughout, bearing a small, acute tooth on the basocolumellar margin, another small tooth obliquely on the parietal wall.

Ecology.—Oughton (1948, p. 94 ff.) found the species in damp woodlands, especially those of deciduous trees, in Ontario. It occurs in such habitats in the Ottawa region, but is never as plentiful as other polygyrids of the region. Dimelow (1962, Naut. 76, p. 49) found it in Nova Scotia, in climax deciduous forest on a gentle well-drained slope. Muchmore (1959, Naut. 72, p. 88) noted this as one of the few species not occur-

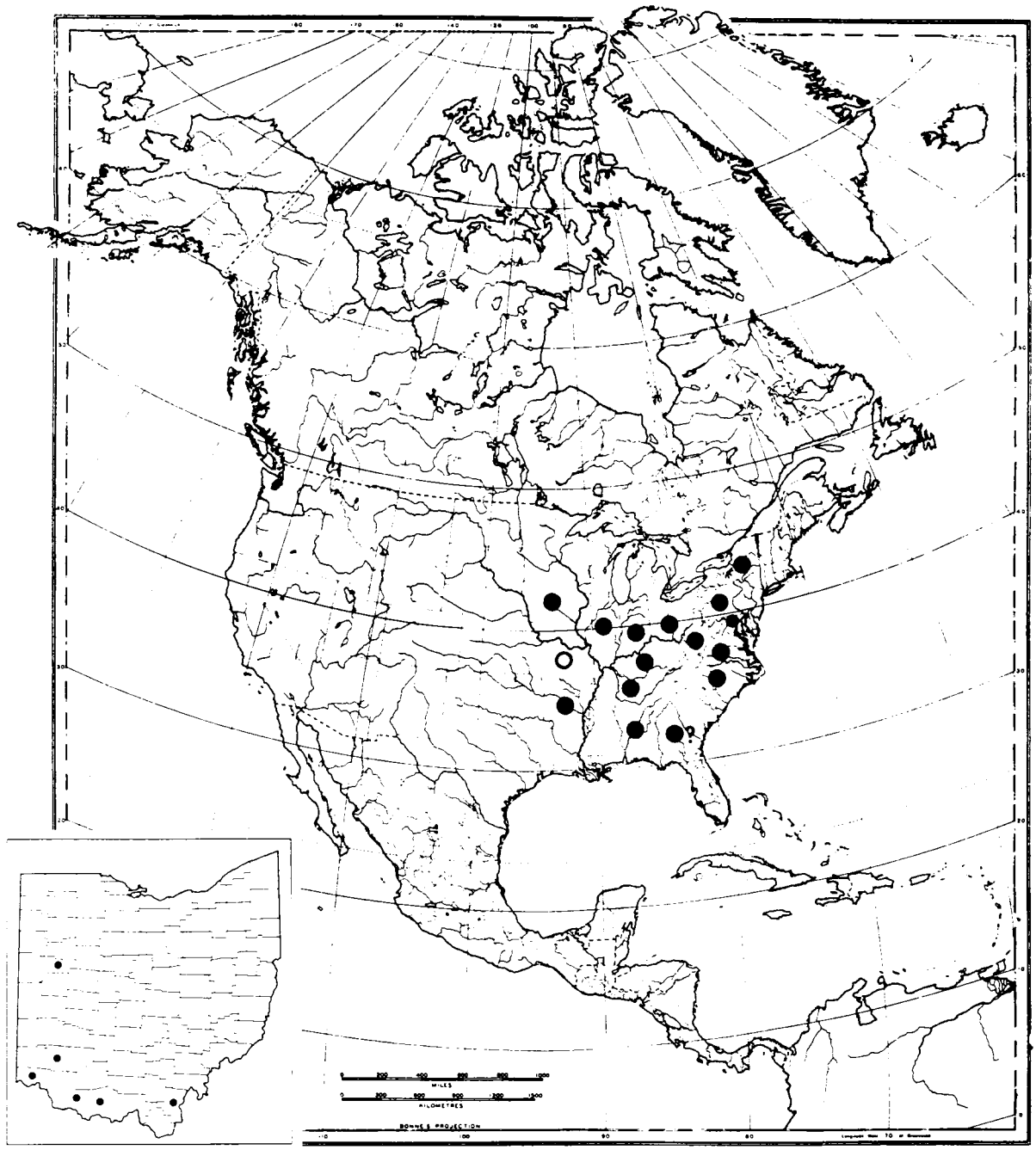

FIGURE 437.—Distribution of *Mesodon appressus* in North America; *inset,* distribution in Ohio.

ring under stones in the Huyck Preserve in New York State.

General distribution (fig. 438).—Maine west to Ontario and Michigan; south to New York, Pennsylvania, Tennessee, and North Carolina. Erroneously recorded for Ohio (Cincinnati).

Distribution in Ohio.—So far, the only Ohio record has been shown to be erroneous. The general distribution would, at first sight, indicate that Ohio should be included in the range of the species but it should be noted that all the Michigan records are far north of the Ohio line, in the vicinity of Saginaw Bay and northward; that all the Pennsylvania records are east of Pittsburgh; and that the Tennessee records are for the mountainous eastern part of the State. The species may be found in Ohio, the most likely places being the northeastern counties, near the Pennsylvania line.

Geologic range.—F. C. Baker (1920a, p. 390) gave

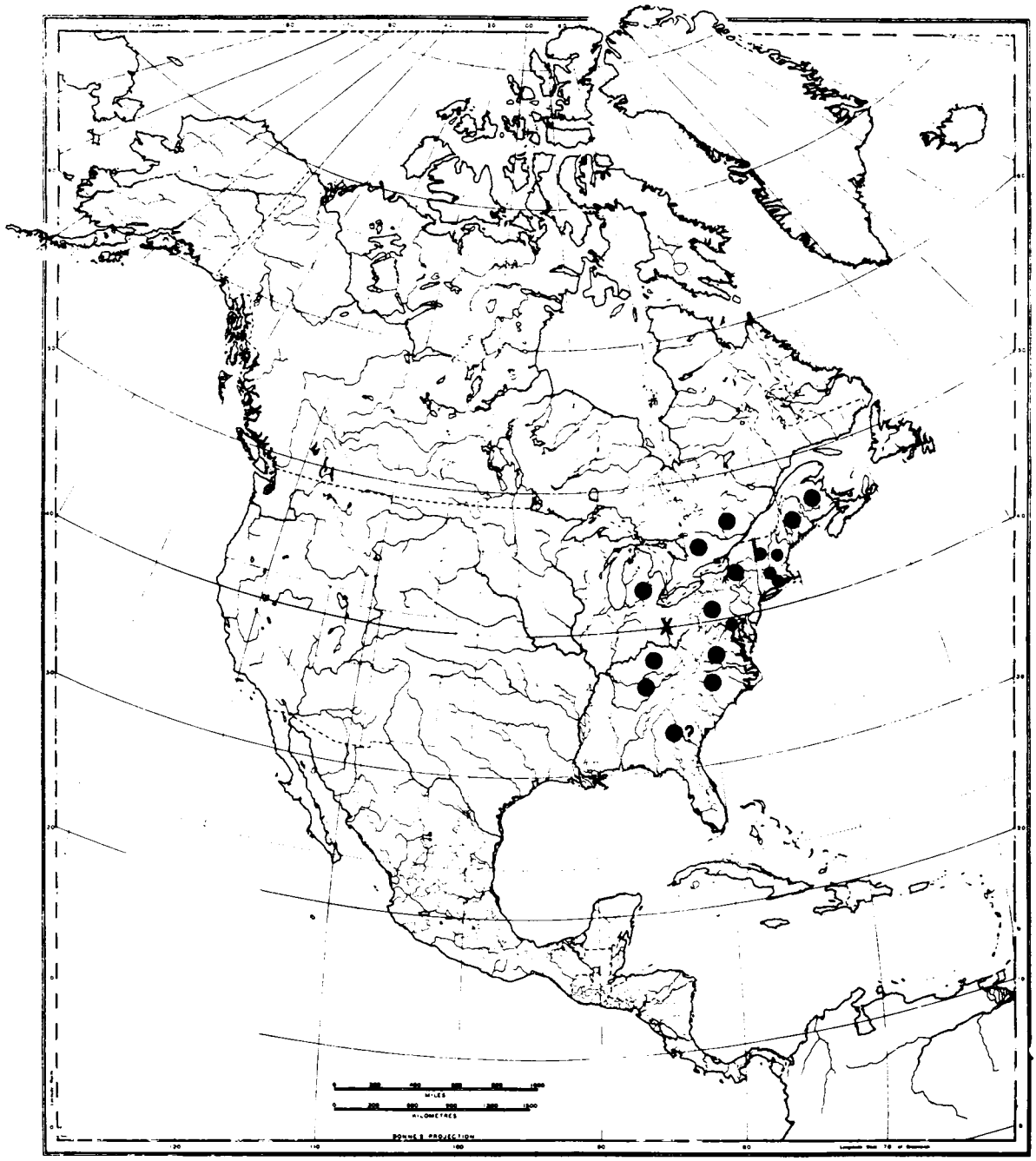

FIGURE 438.—Distribution of *Mesodon sayanus* in North America.

only "Wabash." "Deposit of sand and gravel, in bank of Pretty River, near Collingwood, Ontario" (Bell, 1861, p. 50); McKay Lake marl, Ottawa, Ontario, Canada. These deposits are probably late Wisconsin in age, but Bell's record needs confirmation.

Mesodon inflectus (Say) 1821
Fig. 439

Helix inflecta Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 153.
Triodopsis inflecta Call 1900, Moll. Ind., p. 387, pl. 5, fig. 12.
Polygyra inflecta Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, 376, 402.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 456.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 44.
--- --- Goodrich 1932, Moll. Mich., p. 12.
Mesodon inflectus Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 770, figs. 462a-e.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 6.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 18, pl. 1, fig. 10.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 305.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 18.

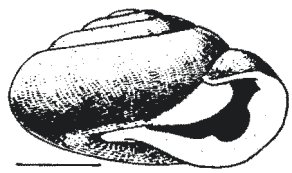

FIGURE 439.—*Mesodon inflectus,* magnified; after F. C. Baker (1939a, p. 47).

Type locality.—"Lower Missouri."

Diagnosis.—Shell depressed, imperforate, with a convex or low conoidal spire of rather slowly increasing whorls, the last rounded peripherally, abruptly descending in front, and deeply guttered behind the outer and basal margins of the lip; apical half whorl with few radial wrinkles, the next whorl closely covered with fine, retractively radial striae which are interrupted into long granules; last whorl lightly striate, and set with short curved periostracal processes, partly with short projecting points, between them a network of microscopic wrinkles, mainly in the direction of lines of growth; obsolete in the middle of the base; aperture three-lobed; outer lip reflected, thickened within, bearing a blunt, slightly receding tooth in the outer arc, a narrow, tubercular tooth in the basal lip; parietal tooth long, somewhat curved (modified from Pilsbry, 1940, p. 771).

Ecology.—Archer (1935, p. 82) found this species under logs and in leaf mold in the Asheville, North Carolina, region; often present under charred logs and in dead leaves among rocks. Conkin (1957, Naut. 71, p. 11) recorded it in Kentucky from bushy and forested slopes and creek bottoms with highly calcareous soil. Teskey (1955, Naut. 69, p. 70-71) collected it in the Warm Springs area of Georgia, from forest on slope at the base of Pine Mountain fire tower and from detritus in crannies of stone walls and rotting timbers of an old mill, Parkman Pond. In Tennessee, Lutz (1950, Naut. 63, p. 102) found it in hardwood forests.

Associations.—Living: OHIO-1, 2, 3, 5, 7, 27, 28, 43; ONTARIO-11, 12, 13, 14. Fossil: W-24, 26.

General distribution (fig. 440).—Michigan, Illinois, Oklahoma, southeastward to Louisiana, Mississippi, Alabama, Georgia, North and South Carolina.

Distribution in Ohio (inset, fig. 440).—"Over the state" (Sterki, 1907a, p. 376), substantiated by a long list of counties given by Pilsbry (1940, p. 772) and records in the Eggleston and University of Michigan collections, which nevertheless do not cover the northeastern part of the State in an area bounded by Ashtabula, Erie, Ashland, and Columbiana Counties. This may be due to lack of collecting or to nature of the soil.

Geologic range.—F. C. Baker (1920a, p. 390) gave Yarmouth, Sangamon, Peorian, and "Wabash." Sangamon? of Indiana (Baker, 1920b, p. 456); "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402).

Remarks.—Taft (1961, p. 18-19) also listed the two forms *M. inflectus edentatus* (Sampson) and *M. inflectus medius* Pilsbry from Ohio, living.

Genus *Triodopsis* Rafinesque 1819

Triodopsis Rafinesque 1819, Jour. Physique, v. 88, p. 425; 1831, Enum. and acct., p. 3 (*fide* Neave).
Menomphis Rafinesque 1831, Enum. and acct., p. 3.
Triodontopsis Agassiz 1846, Nomenclator Zool., Index Univ., p. 378.
Triodopsis Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 790.
Triodopsis La Rocque 1953, Cat. Recent Moll. Canada, p. 306.

Type.—*Triodopsis lunula* Rafinesque, =*Helix tridentata* Say.

Diagnosis.—Shell of moderate or large size, either umbilicate or imperforate, varying in form from depressed and carinate to subglobose-conic; surface striate, with or without spiral lines, or hirsute; aperture trilobed or lunate; peristome reflected, thickened within, with three teeth or none; parietal tooth, when present, not V-shaped.

General distribution.—Humid eastern United States and Canada, east of the 100th meridian; the subgenus *Cryptomastix* from Montana west of the continental divide to British Columbia and Oregon; the range of the eastern herd of *Triodopsis* is nearly coincident with that of *Stenotrema* and *Mesodon* but, unlike the former, the species are not more numerous in mountainous districts (Pilsbry, 1940, p. 790).

Geologic range.—Late Pleistocene of North America.

Triodopsis tridentata (Say) 1816

Helix tridentata Say 1816, Nicholson's Encycl., 1st Ed., art. Conchology, Helix no. 3, pl. 2, fig. 1.
Triodopsis tridentata Call 1900, Moll. Ind., p. 387, pl. 5, figs. 13, 13a.
Polygyra tridentata Billups 1902, Nautilus, v. 16, p. 50.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, 376, 401.

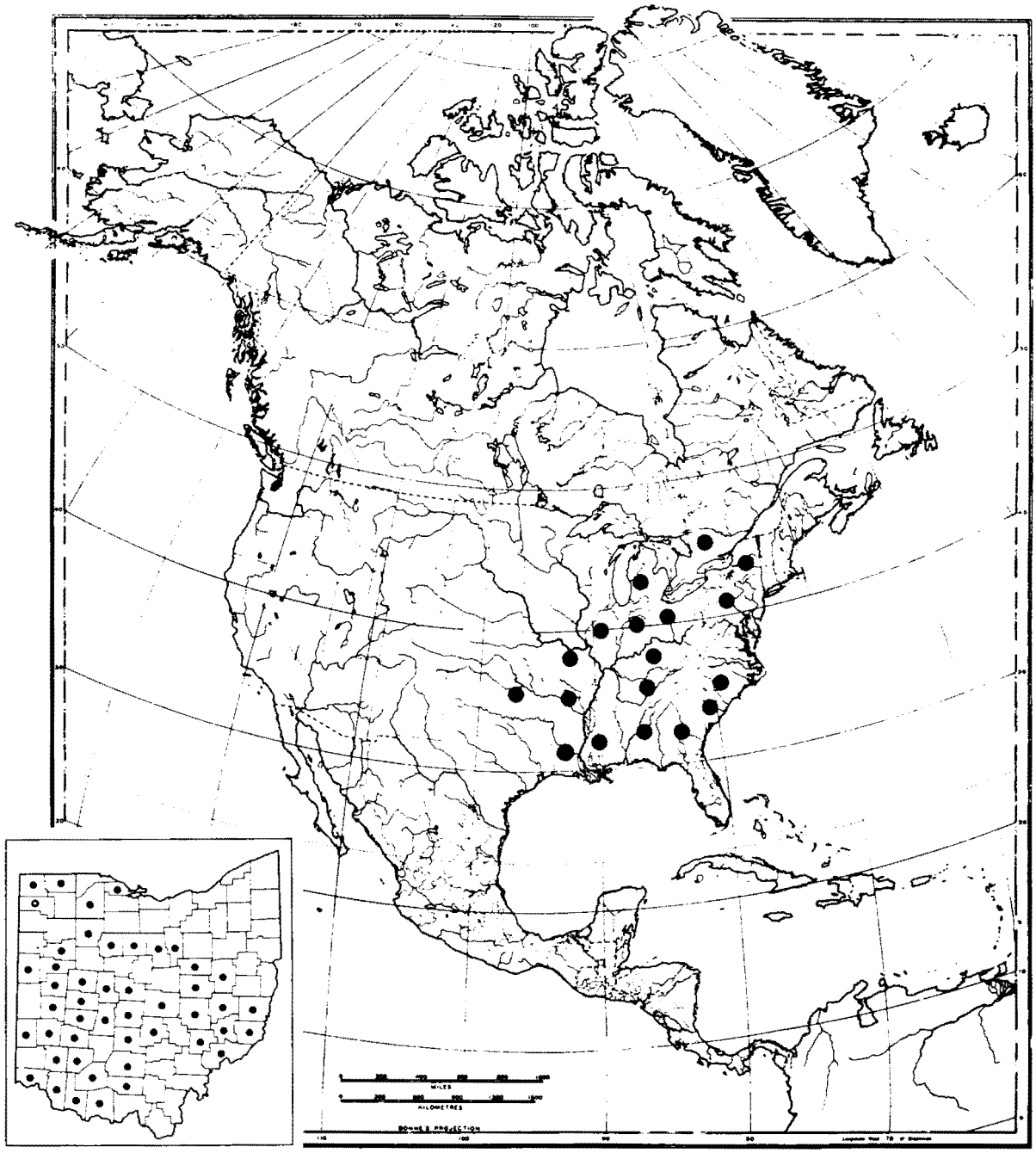

FIGURE 440.—Distribution of *Mesodon inflectus* in North America; *inset*, distribution in Ohio.

Polygyra tridentata Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 456.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Goodrich 1932, Moll. Mich., p. 11.
Triodopsis tridentata Pilsbry 1940, Land Moll. N. America, v. 1, p. 792, figs. 474a-i; 476a.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 268.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 16.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 19, pl. 1, figs. 21, 22.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 308.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 33.

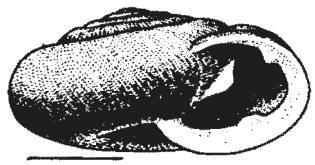

FIGURE 441.—*Triodopsis tridentata,* magnified; after F. C. Baker (1939a, p. 45).

Type locality.—Philadelphia, Pennsylvania (Pilsbry, 1948, p. 796).

Diagnosis.—Shell umbilicate, umbilicus one-seventh the diameter, depressed, buff, slightly glossy; embryonic 1½ whorls with fine curved radial striae extending across the whorl in some specimens, in others striae short, partly obsolete, leaving a smooth outer band; last whorl with close threadlike rounded striae, equal to their intervals, the latter nearly smooth except around the umbilicus where they are minutely papillose (some specimens with papillae on the upper surface also); last whorl rounded at periphery, scarcely descending in front, and contracted behind the lip; aperture trilobed with a rather flatly reflected lip, thickened within, divided into three subequal parts by two small teeth on the outer and the basal margins; parietal callus with an oblique tooth, the distal end of which is directed towards a part of the peristome below the upper tooth (modified from Pilsbry, 1940, p. 792).

Ecology.—More abundant on limestone soils but lives wherever there is some shade, with moderate moisture and vegetation, dead leaves or wood shelter.

In Ontario, this species is found in both damp and drier, more open woodlands, expecially those of deciduous trees, where it is confined to Paleozoic terranes, mainly limestones (Oughton, 1948, p. 89 ff.). Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. In the Asheville region of North Carolina, Archer (1935, p. 82) found it under slabs of gneiss, on mountain slopes. Ingram (1940, Naut. 54, p. 87) has described its daylight activities, and listed shrews as one of its enemies (Ingram, 1944, Naut. 57, p. 135-137). It has been found under stones on a creek floodplain by Ingram (1941, Naut. 55, p. 14-15) and its winter habits have been studied by the same author (1944, Naut. 58, p. 25-27) in beech–yellow-birch and sycamore woodlands in New York State. Wurtz has described a winter agglomeration of snails, which included this species, in the soil of a northward sloping hillside in Allegheny County, Pennsylvania. The eggs have been studied by Ingram (1944, p. 94-95) and mating habits observed by Webb (1948, Naut. 61, p. 97). In Tennessee, it occurs on hilly terrain of red and black oak forests (Lutz, 1950, Naut. 63, p. 104).

Ingram (1946, Naut. 59, p. 88-89) gave the following details from observations in the Huyck Preserve in New York State: "This species was the third most common of the five species of Polygyridae. It was the only one of the family at all common in pure hemlock stands; here it was always taken from beneath the sprung bark of fallen logs. It was the most abundant in the beech-hemlock and maple stands. Here it was commonly found at rest on top of humus on the open forest floor; when found in such a situation individuals were usually taken from depressions in the humus. Its local distribution is apparently affected by man's cultivation efforts, for it never was found in grass or berry-covered fields or in old apple orchards. Individuals were rare in hedgerows and on flood plains. Opened 'fresh' shells of this species in the feeding chambers of the short-tailed shrew were commonly found."

Associations.—Living: OHIO-22, 23, 24, 25, 26, 29, 43. Fossil: W-24, 25, 28. *T. tridentata discoidea,* fossil: W-24.

General distribution (fig. 442).—New Hampshire and Massachusetts west to Michigan and Illinois, south to Mississippi, Alabama, and Georgia.

Distribution in Ohio (inset, fig. 442).—Sterki (1907a, p. 376) recorded the species "over the state." Pilsbry (1940, p. 794) gave a list of counties from northeastern to southeastern and southwestern Ohio; these are confirmed by Eggleston's manuscript records; specimens in the University of Michigan collection fill in the distribution for northwestern Ohio (Fulton, Paulding, Allen, and Auglaize Counties).

Geologic range.—F. C. Baker (1920a, p. 390) gave only Sangamon and "Wabash." Pleistocene: Sangamon? and Wisconsin. "Old Forest bed of the Ohio River" (Billups, 1902b, p. 50); "Middletown 'preglacial deposits'" (Sterki, 1907a, p. 401); Castalia marl (Sterki, 1920, p. 179). Sangamon? of Indiana (Baker, 1920b, p. 456). "Postglacial, Angus, Simcoe Co.," and "Nipissing Great Lakes deposits," Ontario (Oughton, 1948, p. 16).

Variation.—Pilsbry (1940, p. 792 ff.) has recog-

nized 5 trinomials for this species, in addition to the typical form. Three of these appear to be local races or subspecies of restricted distribution; the other two, *T. tridentata juxtidens* (Pilsbry) and *T. tridentata discoidea* Pilsbry, are more widespread and both occur in Ohio.

Triodopsis tridentata juxtidens (Pilsbry) 1894

Polygyra tridentata juxtidens Pilsbry 1894, Acad. Nat. Sci. Philadelphia Proc., p. 20, pl. 1, fig. 8.

--- --- --- Archer 1934, Nautilus, v. 48, p. 24, pl. 1, fig. 2.

Triodopsis tridentata juxtidens Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 798, figs. 474k, l, n; 476b.

--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 268.

Type locality.—Cavetown, Washington County, Maryland.

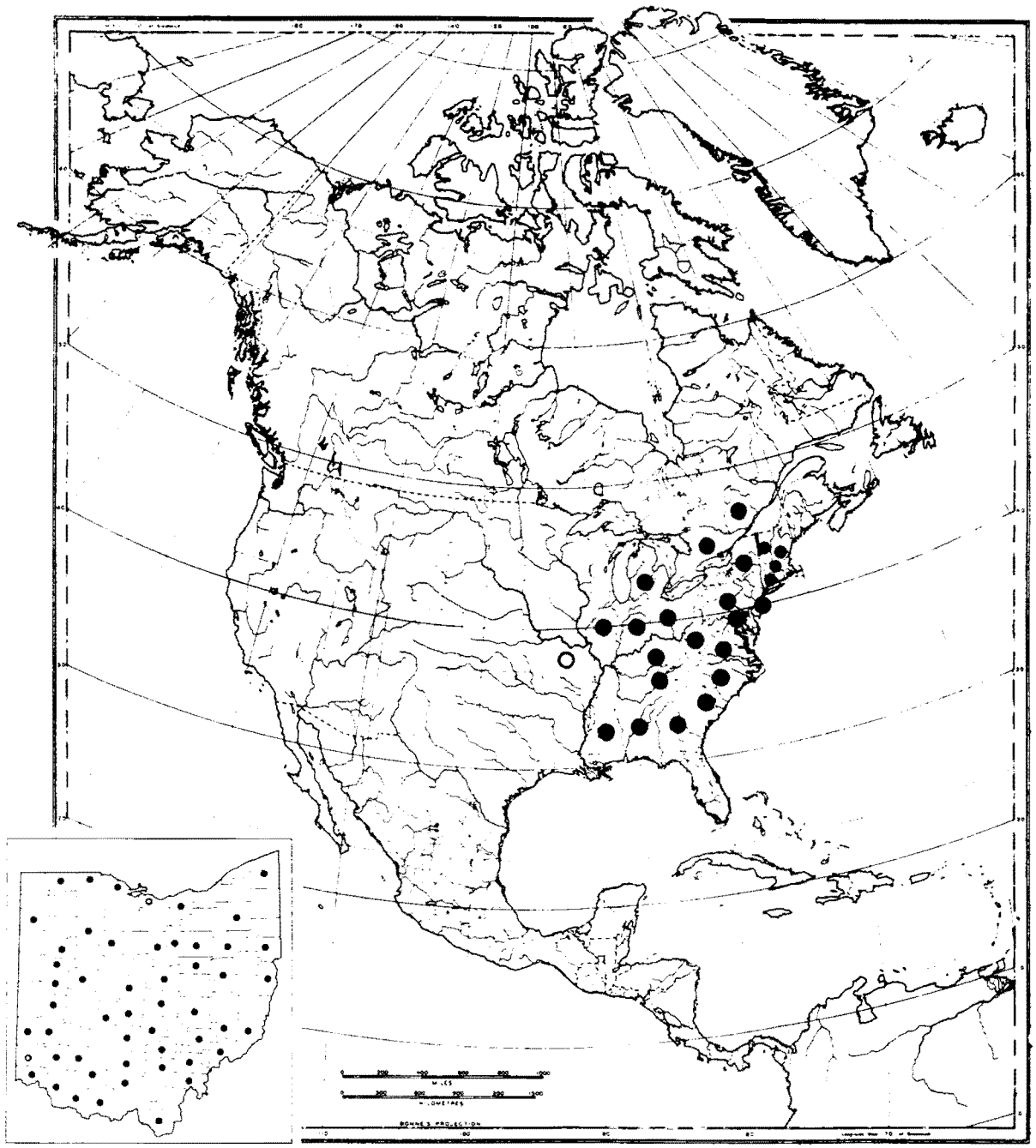

FIGURE 442.—Distribution of *Triodopsis tridentata* in North America; *inset,* distribution in Ohio.

Diagnosis.—Shell as the typical form except that the upper tooth is situated lower, bringing the two lip teeth closer together, the distance on the lip between them being shorter than the distance from either tooth to the end of the lip; the peripheral end of the parietal tooth slants toward or above the upper lip tooth, the chief recognition mark of the subspecies (modified from Pilsbry, 1940, p. 798).

Ecology.—In Virginia, according to Rehder (1949, Naut. 62, p. 122), this form is fairly common under old boards, bricks, and debris, not far from a beach. Hubricht (1950, Naut. 64, p. 8) recorded the following from Pittsylvania County, Virginia: There are two distinct forms of this species in Pittsylvania County; the small form, running between 11 and 13 mm. in diameter, is common in upland oak woods in the Outer Piedmont. It is the common waste ground snail in Gretna, Chatham, and Dry Fork, but is not found in Danville. The large form, running between 14 and 18 mm. in diameter, is of Blue Ridge stock which has come down the Dan and Roanoke Rivers and is abundant on the bluffs along these rivers. Burch (1954, Naut. 68, p. 33) found it abundant over all of Henrico County, Virginia, and noted that, unlike *T. fallax*, it is generally restricted to the woodlands. In Maryland, Grimm (1959, Naut. 72, p. 123) found it in the foundations of an old burned house; along railroad tracks, and in woods near a river. Burch (1955, Naut. 69, p. 66) showed the relationships of this form to soil factors in eastern Virginia.

General distribution.—New York, Pennsylvania, New Jersey, Maryland, West Virginia, Ohio, North and South Carolina.

Distribution in Ohio.—A single record, Gallipolis, Gallia County, collected by Goodrich and cited by Pilsbry (1940, p. 798).

Geologic range.—Late Wisconsin, Castalia deposit, Ohio (Clark, 1961, p. 25).

Triodopsis tridentata discoidea Pilsbry 1904

Helix tridentata polita Wetherby 1894, Nautilus, v. 8, p. 44 (*non Helix polita* Pulteney 1797 *nec* Müller 1774).

?Polygyra tridentata Say, var., Billups 1902, Nautilus, v. 16, p. 51.

Polygyra tridentata discoidea Pilsbry 1904, Nautilus, v. 17, p. 142.

--- --- --- Daniels 1904, Nautilus, v. 18, p. 92.

--- --- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376.

Polygyra tridentata frisoni F. C. Baker 1933, Nautilus, v. 47, p. 58.

Triodopsis tridentata discoidea Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 799, fig. 474o-s.

--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 268.

Type locality.—Cincinnati, Hamilton County, Ohio.

Diagnosis.—Shell larger and more widely umbilicate than *T. tridentata juxtidens*, the umbilicus one-sixth the diameter; in apical view last whorl wider than in that subspecies and the surface more glossy, the striations weaker and finer; aperture as in *T. t. juxtidens;* parietal tooth short to rather long, nearly reaching the columellar insertion, its peripheral end pointing towards the upper lip tooth, or a little above it; lip teeth quite small to rather strong (modified from Pilsbry, 1940, p. 799).

Ecology.—Similar to that of the type subspecies.

Associations.—Fossil: W-24?

General distribution.—Ohio west to Missouri (Pilsbry, 1940).

Distribution in Ohio.—Pilsbry (1940, p. 799) gave only Hamilton and Franklin Counties. Sterki (1907a, p. 376) gave only Hamilton County. Wurtz (1949) added Brown County; Eggleston (ms. records) confirmed the Hamilton County record. I have no other records.

Geologic range.—Pleistocene(?), if the variety mentioned by Billups (1902b, p. 51) belongs here.

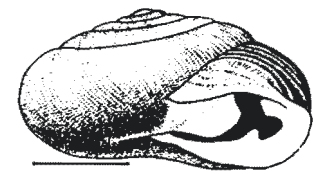

FIGURE 443.—*Triodopsis fraudulenta vulgata*, magnified; after F. C. Baker (1939a, p. 46).

Triodopsis fraudulenta vulgata Pilsbry 1940
Fig. 443

Helix tridentata Say, in part, A. Binney 1851, Terr. Moll., v. 3, p. 183, pl. 28, upper, middle, and lower figs.

Helix fallax Say, W. G. Binney, 1869, Land and fresh water shells N. America, v. 1, p. 131, fig. 222; and of many other authors, not of Say.

Triodopsis fallax Call 1900, Moll. Ind., p. 388, pl. 5, fig. 14.

Polygyra fraudulenta Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376, 402.

--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 390 (part).

--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 456.

--- --- Goodrich 1932, Moll. Mich. p. 11.

Triodopsis fraudulenta vulgata Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 805, figs. 478b, c.

--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 268.

--- --- --- Oughton 1948, Zoögeogr. study, Ontario, p. 14.

Triodopsis fraudulenta vulgata Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 19, pl. 1, figs. 17, 18.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 307.
Triodopsis fraudulenta Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 29.

Type locality.—Columbus, Franklin County, Ohio.

Diagnosis.—Shell buff to yellow; differs from *T. tridentata* and its variety *juxtidens* by having the upper lip tooth wider than its fellow, and distinctly bent inward, and the peristome more or less dished; teeth not so large as in typical *T. fraudulenta* and the aperture more open; parietal tooth straight or nearly so and not as long as in the typical form, leaving much more space between it and the two lip teeth; basal lip well thickened within, but without the prominent straight callus of the typical form; bay between the lip teeth more symmetrical than in the typical form; umbilicus somewhat well-like beyond the enlargement at the last whorl, and wider than in *T. tridentata juxtidens*, showing the first whorl plainly at the bottom (modified from Pilsbry, 1940, p. 805).

Ecology.—Conkin (1957, Naut. 71, p. 11) found *T. fraudulenta* (probably *T. fraudulenta vulgata*) in Kentucky on bushy and forested slopes and creek bottoms with highly calcareous soils. *T. f. vulgata* is recorded by Lutz (1950, Naut. 63, p. 103) from Tennessee, on hills of red and black oak forests.

Associations.—Living: OHIO-5, 7, 27, 28, 43. Fossil: W-26, 28.

General distribution (fig. 444).—New York west to Michigan, Illinois, and Missouri; south to Alabama and North Carolina.

Distribution in Ohio (inset, fig. 444).—Over the State; Fulton, Mercer, and Auglaize Counties (University of Michigan records); Hamilton, Brown, Adams, Gallia, Washington, Coshocton, and Portage Counties (Eggleston, ms. records). We have as yet no records for the extreme northeastern part of the State (Lake, Ashtabula, Geauga, Trumbull Counties) but the presence of the subspecies in Pennsylvania indicates that this is due more to lack of collecting than to actual absence.

Geologic range.—The following records are included under the subspecies although they were published before the latter was described. This action leaves a small element of doubt in the vicarious identification, but there is every likelihood that it is correct. "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402); Castalia marl (Sterki, 1920, p. 179); Sangamon? of Indiana (F. C. Baker, 1920b, p. 456). Baker's (1920a, p. 390) record for *Polygyra fraudulenta* is for "Wabash" only; it may include representatives of the subspecies.

Subgenus *Xolotrema* Rafinesque 1819

Xolotrema Rafinesque 1819, Jour. Physique, v. 88, p. 425; not *Xolotrema* Rafinesque 1831.
Xolotrema Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 823.

Type.—*T. notata* (Deshayes) (=*T. denotata* Fér.) by designation of Pilsbry (1940).

Diagnosis.—"*Triodopses* in which the inner margin of the basal lip has a long bladelike lamella, terminating at a notch where it joins the outer arc of the lip; the embryonic whorls are covered with close retractive radial striae (subobsolete in *T. fosteri*)" (Pilsbry, 1940, p. 823).

Triodopsis denotata (Férussac) 1823
Fig. 445

Helix palliata Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 152; not *Helix palliata* Hartmann 1807.
Helix denotata Férussac 1821, Tabl. Syst. Fam. Limaçons, p. 34, no. 102 (nude name); 1823, Hist. Nat. Moll. Terr., cover, no. 19, pl. 49A, fig. 5.
Helix notata "Fér." Deshayes 1830, Encycl. méth., v. 2, p. 224.
Triodopsis palliata Call 1900, Moll. Ind., p. 385, text fig. 6.
Polygyra palliata Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
--- --- Goodrich 1932, Moll. Mich., p. 12.
Triodopsis notata Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 824.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 268.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 15.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 20, pl. 1, figs. 25, 26.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 308.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 31.

Type locality.—None given for *H. notata;* Say gave "Illinois and Ohio" for *H. palliata.*

Diagnosis.—Shell imperforate (locally slightly perforate), depressed, with convex or low conoidal spire; olive to brown; last whorl obtusely angular in front, rounded behind, scarcely contracted behind the lip; embryonic shell closely sculptured with radial, slightly curved fine striae; later whorls rather weakly,

coarsely striate, and covered with fine wrinkles, the last whorl with close-set papillae bearing flattened triangular periostracal asperities, arranged in irregular retractive trends; the surface between them more or less covered with fine wrinkles, oblique or radiating from the papillae; aperture trilobed; peristome white, broadly reflected in the outer and basal margins, its face flattened or concave; outer lip bearing a strong conic or obtuse tooth at the inner edge, the basal margin of the lip thickened bladelike within, truncate at its junction with outer margin; parietal wall bearing a very strong, long and curved tooth, which extends to the umbilical callus (modified from Pilsbry, 1940, p. 824).

Ecology.—Near the northern limit of its range in Ontario, Oughton (1948, p. 94 ff.) found this species in damp woodlands, especially those of deciduous trees. Here, it is confined to Paleozoic terranes,

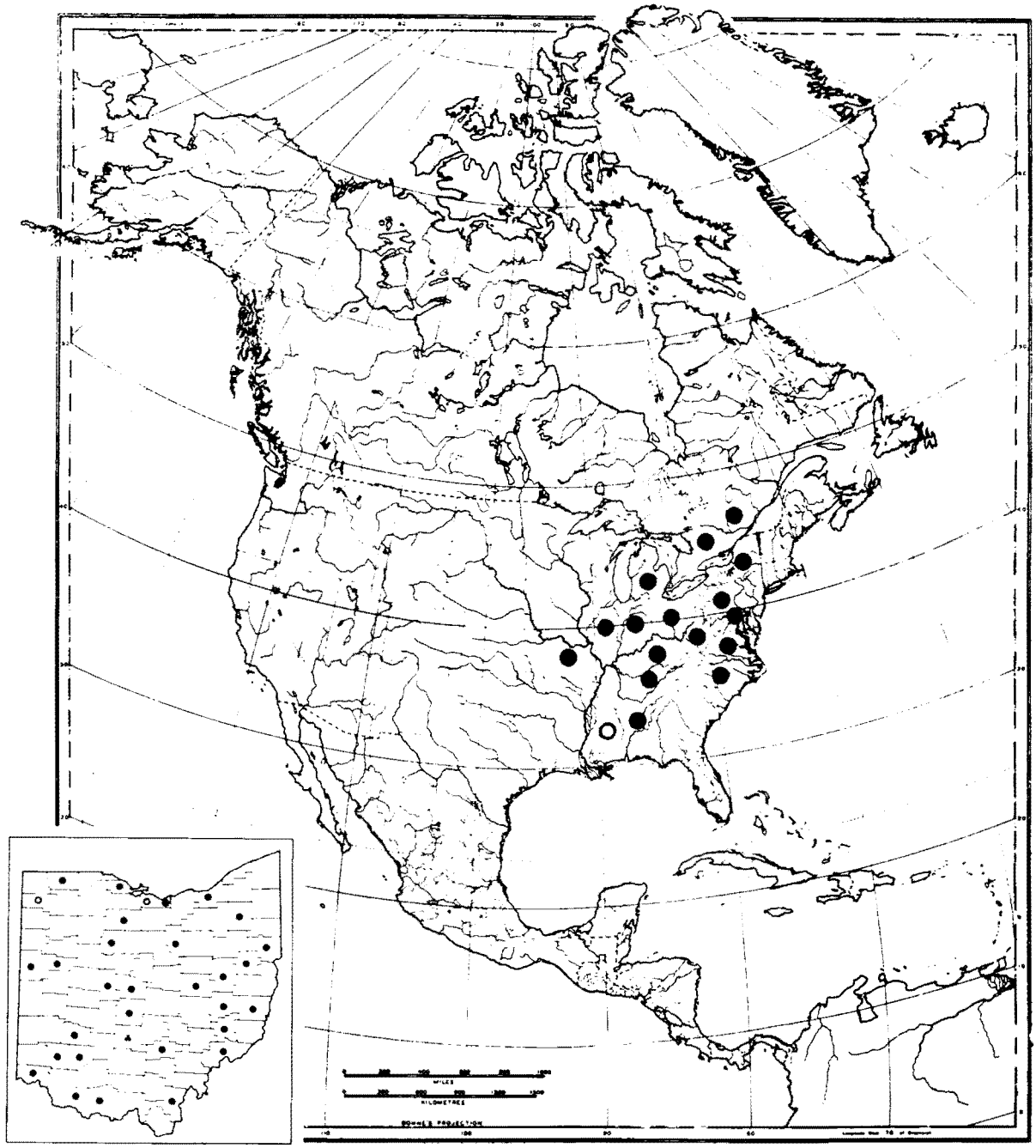

FIGURE 444.—Distribution of *Triodopsis fraudulenta vulgata* in North America; *inset,* distribution in Ohio.

mainly limestones. Muchmore (1959, Naut. 72, p. 88) listed this as one of the few species not occurring under stones in the Huyck Preserve in New York State. Ingram (1944, Naut. 57, p. 135-137) listed this species among those hoarded by shrews and he (1944, Naut. 58, p. 25-27) has studied its winter habits at Ithaca, New York, in beech–yellow-birch and sycamore woodlands. Mating observations have been recorded by Webb (1948, Naut. 61, p. 98).

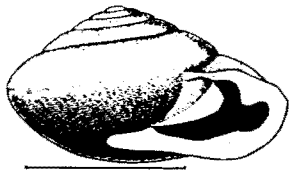

FIGURE 445.–*Triodopsis denotata*, magnified; after F. C. Baker (1939a, p. 52).

Ingram (1946, Naut. 59, p. 89) gave the following data: "Only one individual was collected during the summer from beneath the sprung bark of a yellow birch log. Although other yellow birch logs were examined none revealed the presence of this species. At Ithaca, New York, this mollusk is abundant beneath the sprung bark of yellow birches in the Sapsucker woods; here too it has often been taken from beneath yellow birch and beech logs."

Associations.–Living: OHIO-23, 43; ONTARIO-7, 11. Fossil: W-24, 28.

General distribution (fig. 446).–Massachusetts and Vermont west to Michigan, Illinois, and Arkansas; south to Mississippi, Alabama, and South Carolina.

Distribution in Ohio (inset, fig. 446).–"Over the state" (Pilsbry, 1940, quoting Sterki). Records are not abundant enough to accept the statement; they are most numerous for the southern part of the State and there are none north of Auglaize County in the western part of the State or north of Stark and Mahoning Counties in the eastern part. In view of the presence of the species in the surrounding states, especially Michigan and Ontario to the north, this is rather surprising and worth further investigation. Perhaps its absence in the northern counties may have had something to do with post-Wisconsin events.

Geologic range.–F. C. Baker (1920a, p. 390) gave Sangamon and "Wabash" for this species. "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); Castalia marl (Sterki, 1920, p. 179); postglacial deposits, Angus, Simcoe County, Ontario (Oughton, 1948, p. 15).

Triodopsis obstricta (Say) 1821
Fig. 447

Helix obstricta Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 154.

Triodopsis obstricta Call 1900, Moll. Ind., p. 386, pl. 5, fig. 10.

Polygyra obstricta Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376.

Triodopsis obstricta Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 827, figs. 485f, g.

--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 268.

--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 32.

Type locality.–Ohio.

Diagnosis.–Shell depressed, with a peripheral carina or angulation, spire very low to moderately high and dome-shaped; embryonic 1½ whorls finely striate, later whorls with low rather widely spaced rib striae, and minutely, closely wrinkled in the direction of growth lines, the wrinkles more or less broken into granules; commonly with ill-defined spiral lines on the upper surface of the last whorl; periostracal laminae or erect scales few, in some specimens scattered over the whole last whorl, more commonly absent except just above and below the carina; carina beginning on the second whorl and continuing strong to the end.

Ecology.–No precise data available.

General distribution (fig. 448).–Ohio, Indiana, and Illinois, south to Louisiana, Alabama, and South Carolina.

Distribution in Ohio (inset, fig. 448).–Until recently, the Ohio record for the species appeared doubtful as all records were rather old. Taft (1961, p. 32) has confirmed its presence in the State with specimens from Pickaway County, collected in 1959.

Geologic range.–Unknown.

Remarks.–Pilsbry (1940, p. 828) noted that this species is "typically very distinct" but that some forms suggest intergradation with *T. denotata* and *T. carolinensis*. He is "tempted to return to the view of A. Binney, that they are extremes of one polymorphic species." As far as the Pleistocene of Ohio is concerned, this is a species to be looked for in the deposits of the southern counties of the State, but identifications should be made only after careful comparison with *T. denotata*.

Subgenus *Neohelix* von Ihering 1892

Neohelix H. von Ihering 1892, Zeitschr. für Wiss. Zool., v. 54, p. 482.

Neohelix Pilsbry 1930, Acad. Nat. Sci. Philadelphia Proc., v. 326, *Helix albolabris* Say designated type.

Neohelix Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 834.

Type.–*Triodopsis (Neohelix) albolabris* (Say).

Diagnosis.–"Capacious, depressed or depressed-globose, imperforate shells with rather large, lunate aperture, toothless or with a parietal tooth and sometimes a low, blunt prominence of the basal lip near the

columella. Embryonic whorls are radially striate below the suture or practically smooth throughout. Later whorls striate, with minute spiral lines" (Pilsbry, 1940, p. 834).

Remarks.—Externally, the shell characteristics of the species of this subgenus are identical with those of *Mesodon* but anatomically they belong to the genus *Triodopsis*. Some of the species of *Neobelix* are the most widespread and hardy forms of the family Polygyridae.

Triodopsis albolabris (Say) 1816
Fig. 449; pl. 15, figs. 16, 18

Helix albolabris Say 1816, Nicholson's Encycl., 1st Am. Ed., art. Conchology, sp. no. 1, pl. 1, fig. 1.

Mesodon albolabris Call 1900, Moll. Ind., p. 389, pl. 5, figs. 15, 15a.

Polygyra albolabris Dall 1905, Harriman-Alaska Exped., v. 13, p. 26, figs. 4-6.

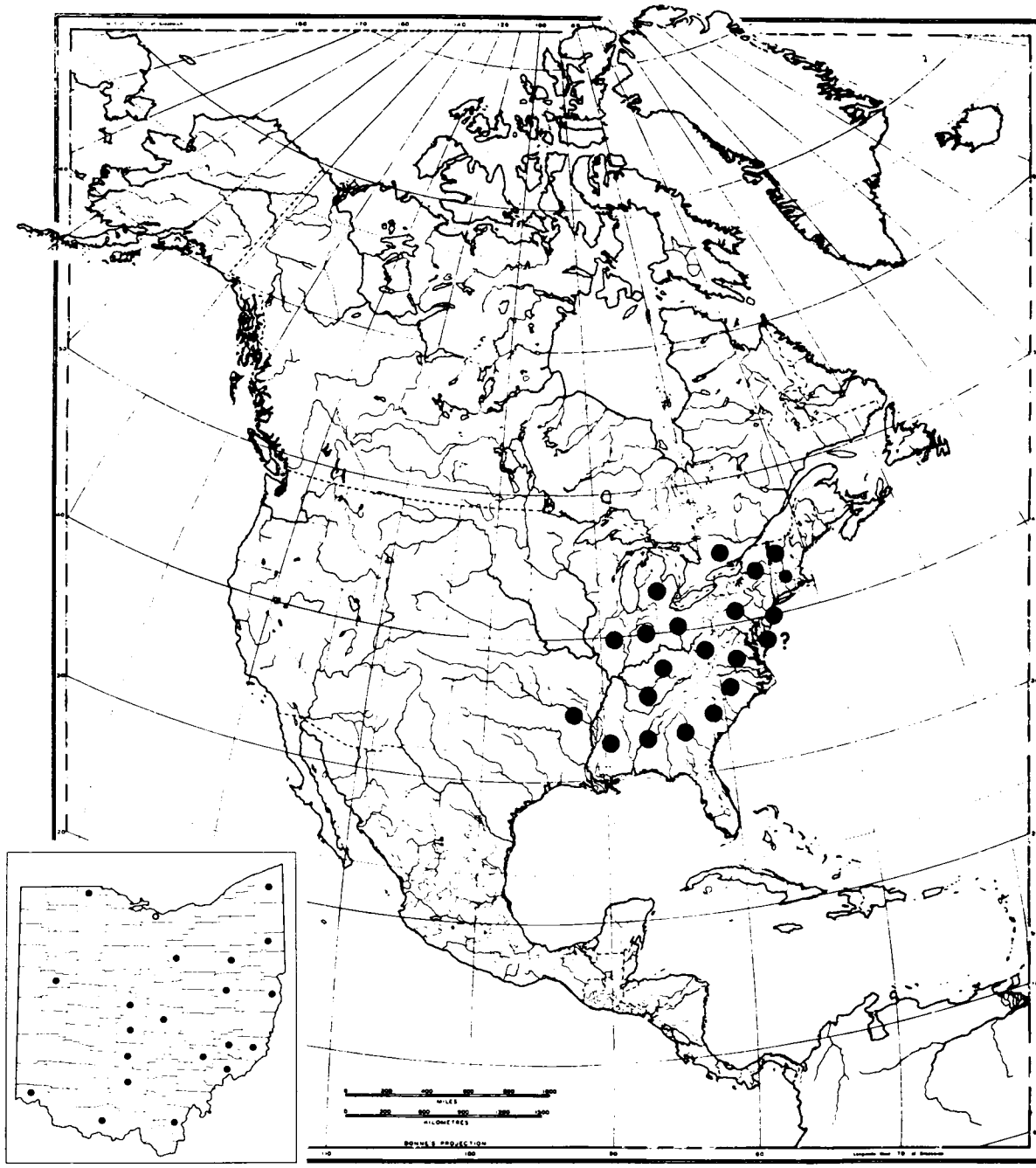

FIGURE 446.—Distribution of *Triodopsis denotata* in North America; *inset*, distribution in Ohio.

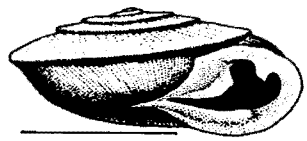

FIGURE 447.–*Triodopsis obstricta,* magnified; after F. C. Baker (1939a, p. 53).

Polygyra albolabris Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376, 402.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 44.
--- --- Goodrich 1932, Moll. Mich., p. 14.
Triodopsis albolabris Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 835, fig. 489, 2-6, 8.

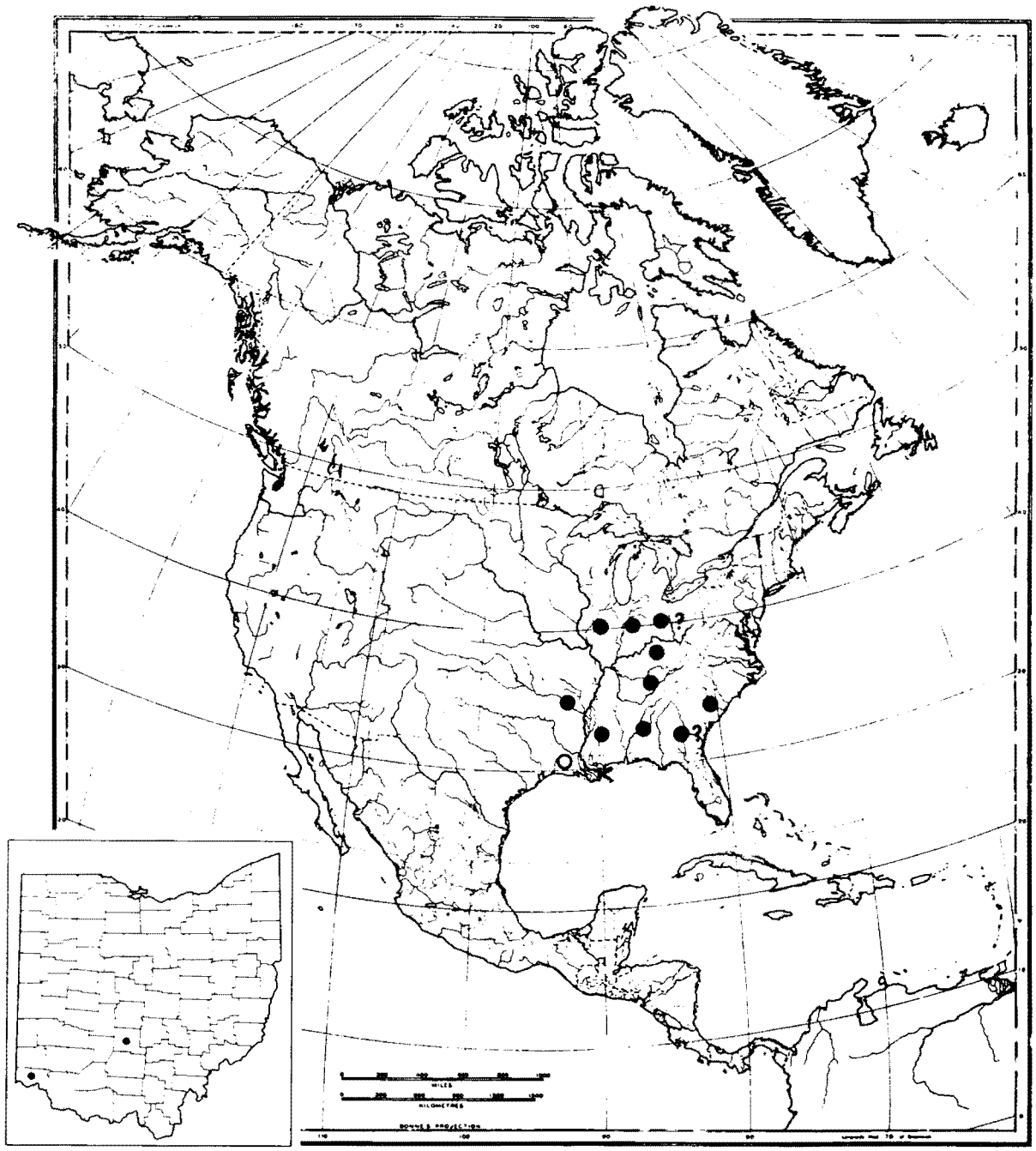

FIGURE 448.–Distribution of *Triodopsis obstricta* in North America; *inset,* distribution in Ohio.

Triodopsis albolabris Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 268.

--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 12.

--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 20, pl. 1, figs. 23, 24.

Triodopsis albolabris albolabris La Rocque 1953, Cat. Recent Moll. Canada, p. 306.

Triodopsis albolabris Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 27.

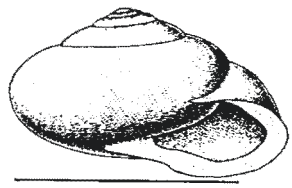

FIGURE 449.—*Triodopsis albolabris*, magnified; after F. C. Baker (1939a, p. 49).

Type locality.—Philadelphia, Pennsylvania.

Diagnosis.—Shell depressed-globose, imperforate, rather solid, typically some shade of buff; surface nearly matte; embryonic shell with a band of fine striae radiating below the suture, elsewhere smooth; later whorls with sculpture of fine oblique striae and minute, crowded, incised spiral lines; peristome wide, white, flatly reflected, the columellar margin straightened or slightly convex within, with a shallow notch near the insertion (Pilsbry, 1940, p. 835).

Ecology.—In Ontario, Oughton (1948, p. 94 ff.) recorded this species for damp woodlands, and from forest litter, dried but still alive after more than one week. H. B. Baker (1922b) found it in the drier habitats in Dickinson County, Michigan, on outcrops of Quinnesec schist and Sturgeon quartzite, on sandy outwash plains with pine and second growth, and in hardwoods on higher moraines, especially in maple logs. Muchmore (1959, Naut. 72, p. 85-88) collected it under stones in various woodland areas in New York State. Burch (1955, Naut. 69, p. 66) has recorded the relationships of this species to soil factors in eastern Virginia. Solem (1952, Naut. 65, p. 129) found it in Wisconsin, in a large tract of virgin pine timber with some deciduous growth and undergrowth of thimbleberry; in an exceedingly damp spot along the shoreline, in piles of reeds tossed up during storms. Ingram (1944, Naut. 57, p. 135-137) listed shrews as one of its enemies. He found it under stones on a creek floodplain in the Ithaca, New York, area (1941, Naut. 55, p. 14-15) and studied its habits (1944, Naut. 58, p. 25-27) in beech–yellow-birch and sycamore woodlands in the same area. He has also described its daylight activity (Ingram, 1940, Naut. 54, p. 87); the process of shell cleaning and epiphragm removal (1944, Naut. 57, p. 138-141); and the fact that carabid beetles of the genus *Calosoma* are known to feed on this species (1950, Naut. 63, p. 142). In Kentucky, Conkin (1957, Naut. 71, p. 11) found it on bushy and forested slopes and creek bottoms with highly calcareous soil. Archer (1934c, p. 139) recorded it as rather common in hardwoods on Mackinac Island, Michigan, where numbers of dead shells gnawed by rodents were noted. In North Carolina, Rehder (1949, Naut. 62, p. 124) found it under logs and boards at a settlement on the north shore of Lake Waccamaw. Lutz (1950, Naut. 63, p. 103-104) collected it in Tennessee from hills of hardwood forests, among leaf mold. Hubricht (1950, Naut. 64, p. 8) listed it as common over Pittsylvania County, Virginia, and noted that Blue Ridge stock in the valleys of the Dan and Roanoke Rivers averaged somewhat larger than Piedmont stock. Burch (1954, Naut. 68, p. 33) listed it as generally distributed over Henrico County, Virginia, but not very common. Archer (1935, p. 79) found only one dead specimen in honeysuckles, Asheville region of North Carolina (form *major*). Teskey (1955, Naut. 69, p. 70-71) also gave details on form *major* in the Warm Springs area of Georgia. H. B. Baker (1922b) noted that the form *maritima* is abundant throughout sandy outwash plains in Dickinson County, Michigan.

Ingram (1946, Naut. 59, p. 88) found this to be the most abundant large snail of the natural forest areas of the Huyck Preserve in New York State. "It preferred beech-hemlock, beech-maple and maple areas where the humus and wet-rot logs were abundant. It was almost absent from the pure hemlock forest and from decadent farmed land overgrown with wild black and raspberry bushes. It was occasionally found in deserted apple orchards. Individuals were often taken in maple and oak hedgerows which ran between cultivated fields from wooded areas. Individuals were found to be active throughout the daylight hours. When at rest they were collected from beneath the sprung bark of logs, from beneath logs, and from beneath the upper humus layer of the forest floor. Occasionally they were found during the day inactive on the surface of the forest floor. This snail was typically terrestrial except during summer rainy periods when they were found to ascend trees. Individuals generally avoid flood-plain forest areas where a rich humus covering was absent." Ingram also, as a result of trapping and stomach analysis, found it to be used as food by the short-tailed shrew and two species of deer mice.

Associations.—Living: MICHIGAN-1, 2, 4, 7, 8, 9, 21, 22, 25, 26, 27, 28, 29, 32, 33, 34, 36, 40; OHIO-1, 3, 4, 5, 22, 25, 26, 43; ONTARIO-7, 8, 10. Fossil: W-24, 26, 28.

General distribution (fig. 450).—New Brunswick, Maine, Quebec, Ontario, Michigan, Minnesota, and Manitoba, southward to eastern Iowa, Illinois, Tennessee, and Louisiana, eastward to Alabama and Georgia.

Distribution in Ohio (inset, fig. 450).—Sterki (1907a, p. 376) recorded the species for the entire State and this may turn out to be correct. At present, records

available to me are scattered over every part of the State but there are large blocks of counties from which no specimens are available.

Geologic range.—Pleistocene; late Wisconsin and perhaps older. "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); "Defiance sandy deposit (loess?)," exact age unknown (Sterki, 1907a, p. 402); Castalia marl (Sterki, 1920, p. 179). It is also known as a Pleistocene fossil elsewhere, notably in the McKay Lake marl, Ottawa, Ontario, Canada. F. C. Baker (1920a, p. 390) recorded the typical form for the Yarmouth, Sangamon, Peorian, and "Wabash," and form *alleni* for the Peorian and form *dentata* for "Wabash."

Remarks.—This species is extremely variable and a number of forms and subspecies have been described (see Pilsbry, 1940, p. 838 ff.). It has been confused with *Mesodon thyroidus* and *M. zaletus* as well as

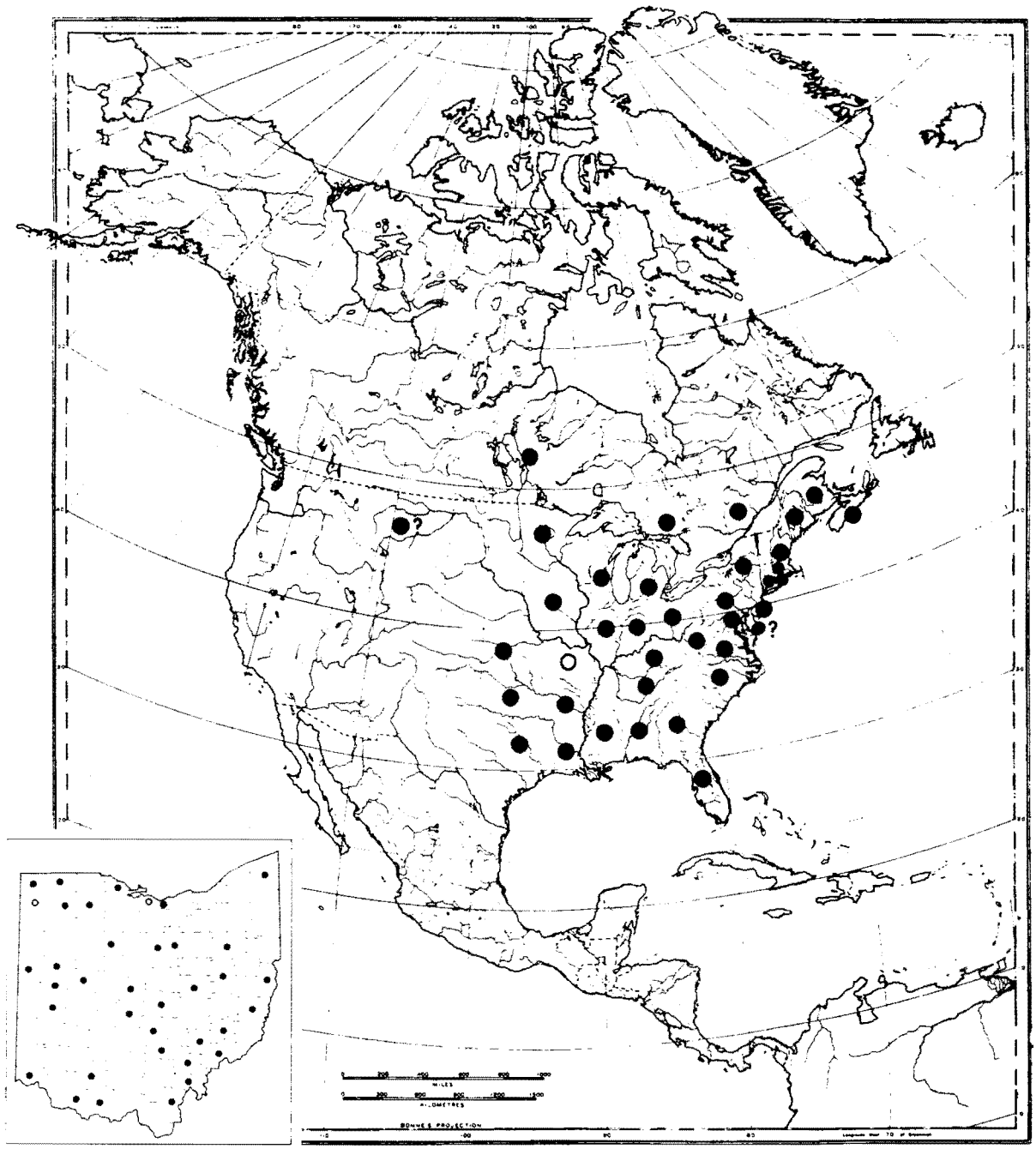

FIGURE 450.—Distribution of *Triodopsis albolabris* in North America; *inset*, distribution in Ohio.

T. dentifera. Taft (1961, p. 27) recognizes the forms *alleni* ('Wetherby' Sampson) and *goodrichi* (Clapp).

[*Triodopsis dentifera* (Binney) 1837]

Helix dentifera A. Binney 1837, Boston Jour. Nat. History, v. 1, p. 494, pl. 21.
Polygyra dentifera Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 376.
Triodopsis dentifera Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 844, fig. 490.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 14.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 20, pl. 1, figs. 27, 28.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 307.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 28.

Type locality.—Eastern slope of Green Mountains, Vermont.

Diagnosis.—Shell imperforate, depressed, thin, light olive; embryonic 1 1/3 whorls with radial striae below the suture, short at first, but later extending half across the whorl; later whorls not glossy, finely striate, with very minute wrinkles parallel to the striae, cut by spiral lines; last whorl rounded at the periphery, descending slightly in front, contracted behind the lip; peristome white, rather broadly, flatly reflected, thickened at the inner edge; parietal callus transparent, bearing a short, obliquely set tooth (modified from Pilsbry, 1940, p. 844).

Ecology.—The most extensive account of the ecology of this species is that of Ingram (1946, Naut. 59, p. 89), who has also described its daylight activity (1940, Naut. 54, p. 87) and the process of egg laying, the eggs, and the young (1944, p. 93-94).

Muchmore (1959, Naut. 72, p. 88) listed this as one of the few species not occurring under stones in the Huyck Preserve in New York State. This proved to be the second most common polygyrid on the Huyck Preserve. "It reached its greatest abundance in the beech-hemlock forest, but was not generally taken with *T. albolabris.* Gathered data indicate that this species is possibly a marginal snail; it was commonly found along the edges of the various forest strips and in hedgerows bordering pasture land and abandoned fields. The species was apparently well established in maple and oak hedgerows, for egg masses and young were generally encountered here" (Ingram, 1946, Naut. 59, p. 89).

General distribution (fig. 451).—Ontario, Quebec, Maine, New Hampshire, and Vermont, south to West Virginia, Virginia, and South Carolina.

Distribution in Ohio.—The only record known to me is cited by Sterki (1907a, p. 376) as follows: "Cincinnati (Byrnes); 'Ohio,' t. W. G. Binney." Pilsbry (1940, p. 845) did not list it for the State and explained in a footnote that the old record for Cincinnati was later discredited. Eggleston (ms. records) had no specimens; there are none in the University of Michigan collections; it has not turned up in later collecting.

Geologic range.—Unknown.

Triodopsis multilineata (Say) 1821
Fig. 452

Helix multilineata Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 150.
Mesodon multilineatus Call 1900, Moll. Ind., p. 390, pl. 5, figs. 16, 16a.
Polygyra multilineata Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 375, 402.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
Polygyra multilineata altonensis F. C. Baker 1920, Nautilus, v. 34, p. 65; 1931, Jour. Paleontology, v. 5, p. 273; *cf.* Shimek, Nautilus, v. 49, p. 124.
Polygyra multilineata Ahlstrom 1930, Nautilus, v. 44, p. 44.
--- --- Goodrich 1932, Moll. Mich., p. 16.
Triodopsis multilineata Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 847, fig. 493.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 269.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 15.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 21, pl. 1, fig. 19.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 24, pl. 2, figs. D, F.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 307.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 30.

Type locality.—"Illinois and Missouri" (Say).

Diagnosis.—Shell imperforate, depressed-globose, rather thin, yellow to olive, with many (commonly only a few, or none) reddish-brown spiral bands of variable width, unevenly spaced; surface rather glossy, the first 1¼ whorls smooth, the rest with fine sculpture of oblique striae, with rather weak spiral engraved lines in their intervals; spire moderately elevated, H/D index commonly 60 to 70; peristome white or pink tinted, rather narrow, with rounded face; parietal callus typically plain, but commonly with a low, oblique tooth.

Ecology.—Found on wet ground, in marshes, on river floodplains. Members of this species migrate to drier ground in the late fall and gather together in large

groups in shallow excavations hidden under dead grass, where they form an epiphragm and lie dormant until the following spring. They can survive in areas regularly flooded by a stream. The species has been recorded by J. A. Allen (1915) for two islands in Lake Erie, South Bass and Kelleys, where it occurs in hardwoods over highly calcareous soil. The mating habits of the species have been observed by Webb (1948, Naut. 61, p. 99).

This species was observed to feed on *Succinea* in captivity (Crabb, 1928, p. 35-36) at Ann Arbor, Michigan. Whether it has the same habit in nature has not been verified. Shimek (1936, Naut. 49, p. 119-120) described its habitat as follows: "The usual larger form (approaching or embracing the type) is usually found in rather low alluvial woods, even where subject to annual inundation, favoring particularly the places occupied by the soft maple (*Acer saccharinum* L.)

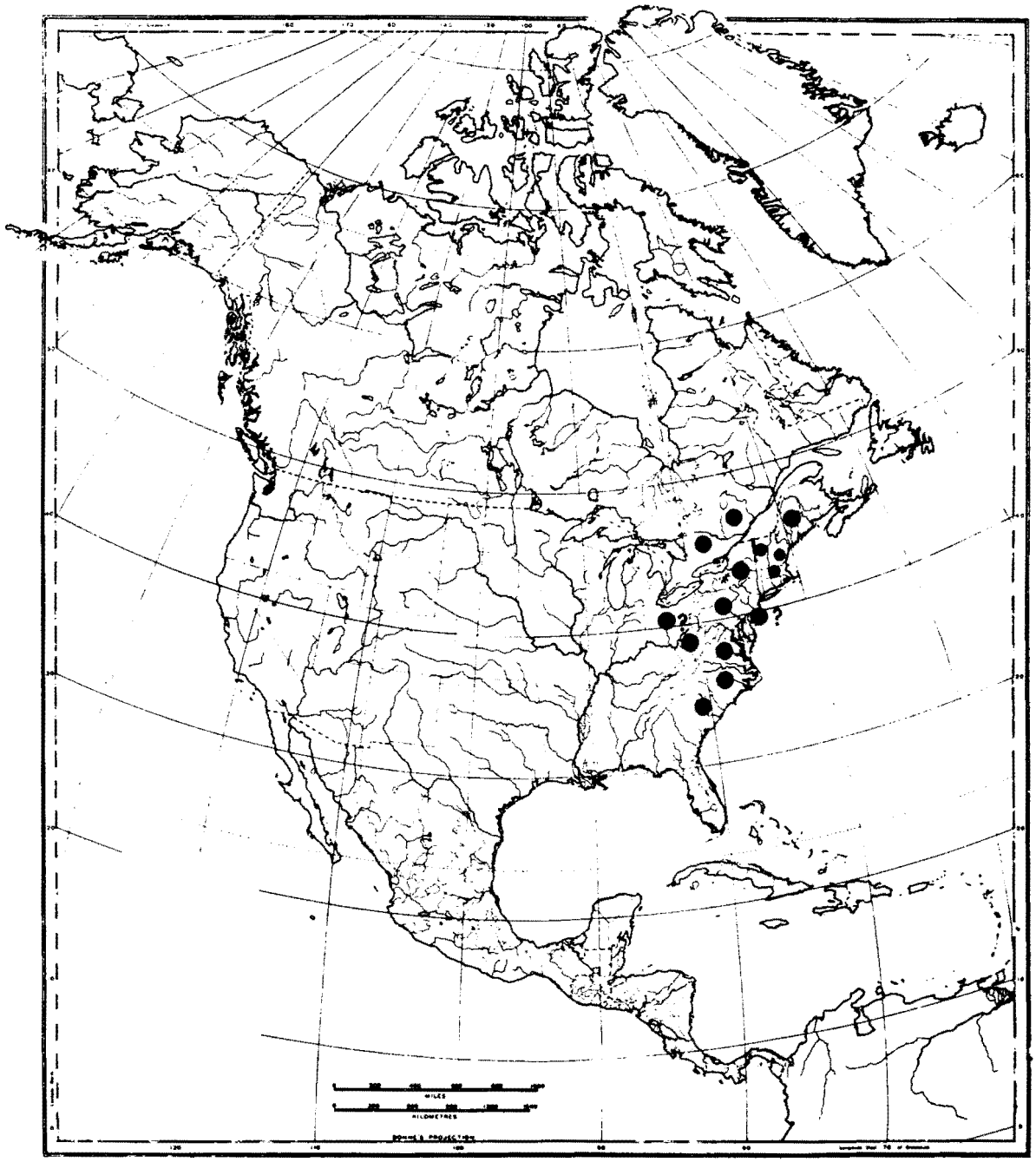

FIGURE 451.—Distribution of *Triodopsis dentifera* in North America.

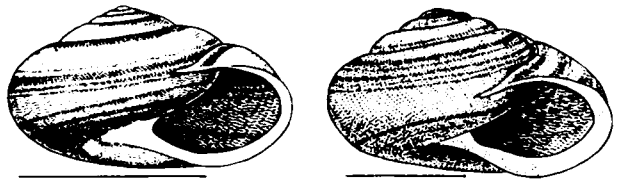

FIGURE 452.–*Triodopsis multilineata,* magnified; after F. C. Baker (1939a, p. 51).

and its associates. It may, however, also extend to higher ground where it grades into a form approaching the smaller form known as *var. algonquinensis* of Nason. The latter ... usually inhabits the thickets or groves which border the margins of prairie swamps – less frequently entering similar emerging places within the swamp itself."

Associations.–Living: OHIO-4, 7, 43. Fossil: W-24, 26, 28.

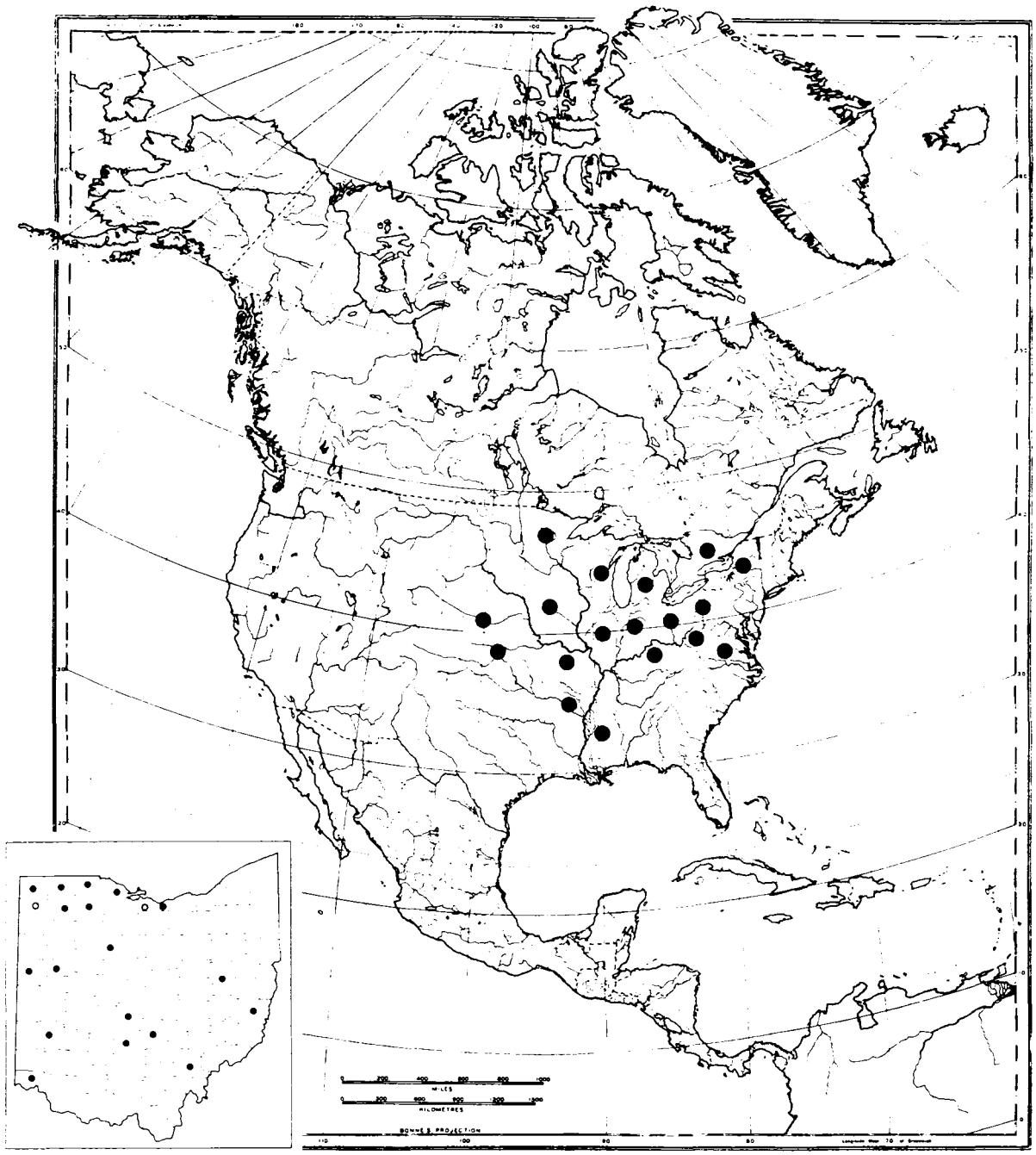

FIGURE 453.–Distribution of *Triodopsis multilineata* in North America; *inset,* distribution in Ohio.

General distribution (fig. 453).—Western New York, Ontario, and Minnesota, south to Nebraska, Kansas, Arkansas, Mississippi, Indiana, and Ohio. Pilsbry gave no records for Kentucky, West Virginia, or Tennessee.

Distribution in Ohio (inset, fig. 453).—Sterki (1907a, p. 375) gave "over the state" and Pilsbry repeated the information. Eggleston (ms. records) gave records for Defiance, Ottawa, Erie, Tuscarawas, Franklin, Fairfield, Pickaway, Athens, and Hamilton Counties; the University of Michigan collections contain specimens from Fulton and Auglaize Counties. This leaves large blocks of counties in the northeastern and southeastern parts of the State unaccounted for, but this is probably due to lack of collecting.

Geologic range.—F. C. Baker (1920a, p. 390) gives Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash" for this species. Pleistocene: "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402); Castalia marl, late Wisconsin (Sterki, 1920, p. 179); Bignell Loess of northeastern Kansas (A. B. Leonard, 1952, p. 24).

Remarks.—A number of trinomials have been given to ecologic forms of this species by various authors. Pilsbry (1940, p. 848 ff.) noted color mutations (*rubra* Witter, *alba* Walker) and ecologic forms (*altonensis* F. C. Baker, *algonquinensis* Nason, and *chadwicki* (Ferriss), with a few synonyms), all of which are scarcely entitled to recognition.

Genus *Allogona* Pilsbry 1939

Allogona Pilsbry 1939, Land Moll. N. America, v. 1, pt. 1, p. xvii; 1940, pt. 2, p. 875.
Allogona La Rocque 1953, Cat. Recent Moll. Canada, p. 308.

Type.—*Helix profunda* Say.

Diagnosis.—Shell rather large, umbilicate, depressed-globose or strongly depressed, with rounded periphery, smooth embryonic whorls and striate to malleate later sculpture, commonly with minute, impressed spiral lines; rounded aperture with a reflected white peristome, its inner edge generally having a blunt tooth or a low callus in the basocolumellar curve; no other teeth (modified from Pilsbry, 1940, p. 875).

General distribution.—Upper and middle Mississippi, Ohio, and lower Missouri valleys, for the typical subgenus, and Oregon to British Columbia and to western Montana for the subgenus *Dysmedoma* (Pilsbry, 1940, p. 875).

Geologic range.—Pleistocene to present.

Remarks.—This genus provides another illustration of the complex geologic history of the land snails of North America. Two groups of species, undeniably closely allied because of the nature of their soft parts, are now separated geographically by hundreds of miles. The geologic record is far from satisfactory and leaves us with two possible explanations of this discontinuous range. Either the genus is an offshoot of an eastern polygyrid stock which migrated westward and northward in late Tertiary or early Pleistocene times and penetrated into British Columbia, Washington, and Oregon at the westernmost limits of its range, or *Allogona* originated in the northwestern region of North America and migrated eastward and southward into the metropolis of the polygyrid stock in the southeastern United States. In either case, the range was interrupted by glaciation of the region from eastern Montana to the Great Lakes and partly repopulated later by migrants from the south, both in the Rocky Mountain and midwestern areas. The separation of the two stocks must have taken place at least in early Pleistocene time to permit development of two distinct subgenera but the exact details of the separation and migration are unknown.

Allogona profunda (Say) 1821
Fig. 454

Helix profunda Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 160.
Mesodon profundus Call 1900, Moll. Ind., p. 395, pl. 6, fig. 7.
Polygyra profunda Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, 375, 401, 402.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 390.
Polygyra profunda alba F. C. Baker 1920, Jour. Geology, v. 28, p. 456.
Polygyra profunda Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, 179.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 44.
--- --- Goodrich 1932, Moll. Mich., p. 13.
Allogona profunda Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 877, fig. 507.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 269.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 6.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 308.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 14.

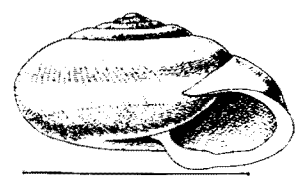

FIGURE 454.—*Allogona profunda*, magnified; after F. C. Baker (1939a, p. 48).

Type locality.—"Near Cincinnati and at Engineer Cantonment on the Missouri" (Say, quoted by Pilsbry, 1940, p. 877).

Diagnosis.—Shell openly umbilicate, umbilicus about one-fifth the diameter of the shell, depressed, the diameter about twice the height; spire low, rather solid, buff, with a cinnamon band above the periphery, and spiral lines on the base, both of which may be wanting; embryonic shell with a few wrinkles following the smooth tip, after which the whorl is smooth except for quite short striae radiating from the suture; last whorl finely and regularly sculptured with thread-like striae, and rather close spiral impressed lines, which are commonly punctate in places; last whorl rounded, descending but little in front, and somewhat contracted behind the basal lip; aperture lunate, the peristome wide, reflected and thickened within, with a short callus or low tooth projecting within the basal

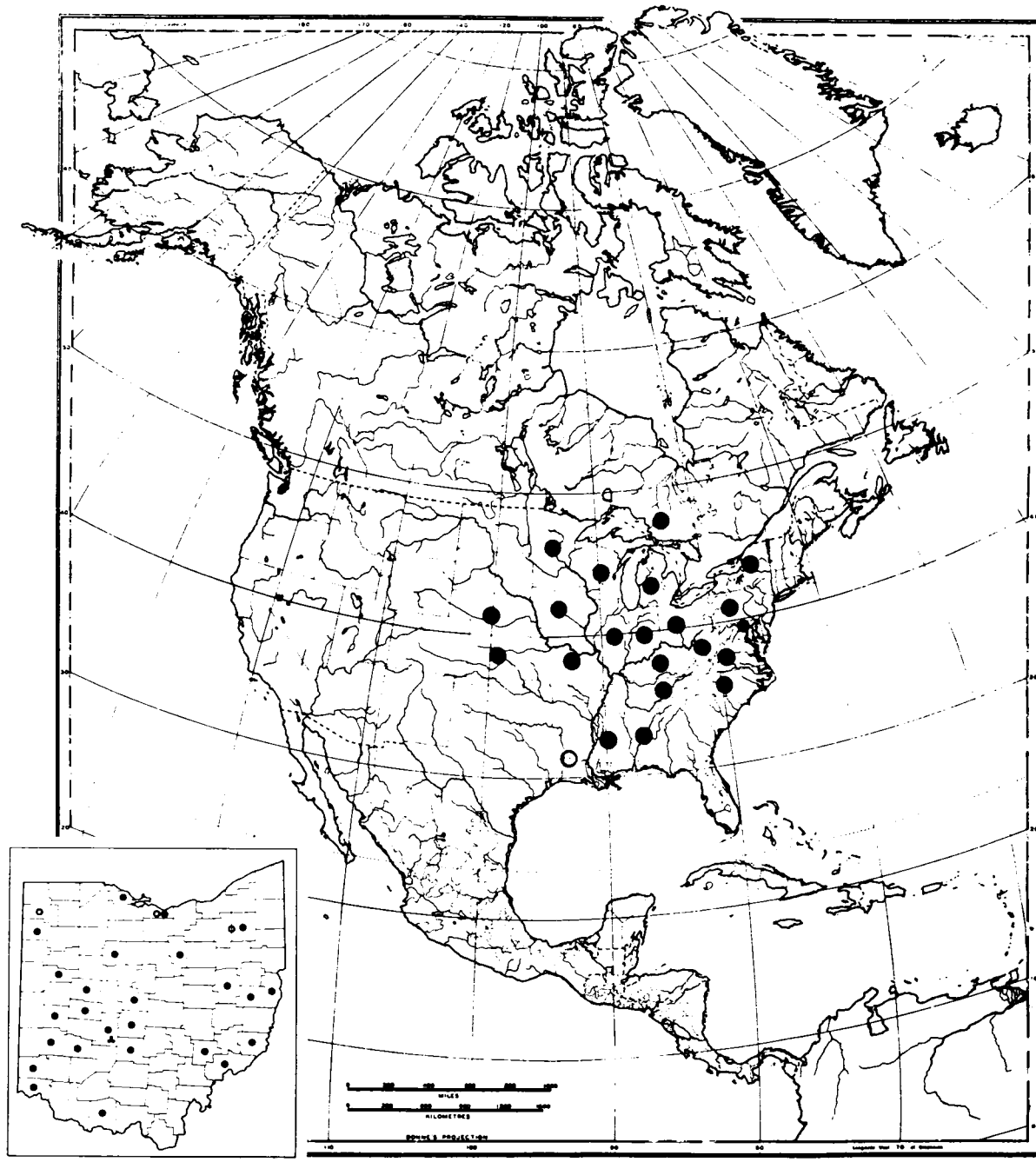

FIGURE 455.—Distribution of *Allogona profunda* in North America; *inset,* distribution in Ohio.

margin; parietal callus thin, plain (modified from Pilsbry, 1940, p. 878).

Ecology.—Lives in deep, chiefly upland, woods, especially on bluffs, but also in prairie groves which suffer the summer drought, where it is usually smaller than the type (condensed from Shimek, quoted by Pilsbry, 1940, p. 879). Its optimum environment may be that of deep woods but the species can accommodate itself to quite different conditions on the islands in Lake Erie. For example, on Kelleys Island, Ohio, it lives on limestone exposures with only sparse cover of second-growth woods. It thrives there, possibly because its moisture requirements are met by the nearness of the lake, its lime requirements are met by the limestone outcrop, and its safety from disturbance by domestic animals, such as pigs and chickens, is pretty well assured.

H. B. Baker (1922b) has collected this species on sandy outwash plains, in pine and second growth; and in hardwoods on moraines with fine hardwood cover, in northern Michigan. The shells from hardwoods were of greater diameter and more flattened than those of sandy outwash plains, where they were more diffusely colored so that in some specimens the stripes were practically obscured.

Solem (1952, Naut. 65, p. 129) has taken the species in the following Wisconsin habitats: a large tract of virgin pine timber with some deciduous growth and undergrowth of thimbleberry; an exceedingly damp area along shore, covered with piles of reeds tossed up during storms; shores of a small freshwater lake on Washington Island, northern end of the Door Peninsula.

Webb (1948, Naut. 61, p. 100) has observed the mating of this species and described the anatomy at copulation.

Associations.—Living: MICHIGAN-40; OHIO-3, 5, 7, 22, 23, 43; ONTARIO-11, 14; WISCONSIN-140, 141, 142. Fossil: W-24, 25, 26, 27, 28.

General distribution (fig. 455).—New York (introduced), extreme tip of southwestern Ontario, Michigan, Wisconsin, and Minnesota, south to Iowa, Nebraska, Kansas, Missouri, Mississippi, Alabama, and North Carolina.

Distribution in Ohio (inset, fig. 455).—Scattered over the State, from the islands of Lake Erie to Hamilton, Washington, and Monroe Counties in the south. It has not been recorded from every county but the only blank area on the map is for the north-central part of the State.

Geologic range.—Pleistocene: F. C. Baker (1920a, p. 390) gives Aftonian, Yarmouth, Peorian, and "Wabash." "Old Forest bed of the Ohio River" (Billups, 1920b, p. 51); Middletown "pre-glacial deposits" (Sterki, 1907a, p. 401); "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402); Tinkers Creek marl (Sterki, 1920, p. 174); Castalia marl (Sterki, 1920, p. 179); Sangamon? of Indiana (F. C. Baker, 1920b, p. 456).

Allogona profunda strontiana (Clapp) 1916
Pl. 15, figs. 13-15

Polygyra profunda strontiana Clapp 1916, Carnegie Mus. Annals, v. 10, p. 537, pl. 32, figs. 13-15.
--- --- --- Ahlstrom 1930, Nautilus, v. 44, p. 44.
Allogona profunda strontiana Pilsbry 1940, Land Moll. N. America, v. 1, pt. 2, p. 877, 880, fig. 507d.
--- --- --- Oughton 1948, Zoögeogr. study, Ontario, p. 6.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 309.
--- --- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 15.

Type locality.—Green (formerly Strontian) Island, Lake Erie, Ohio.

Diagnosis.—"Shell small, elevated, compact, dull-colored; umbilicus small, partly covered by the reflected lip, and contained about six times in the diameter of the shell. Whorls 5" (Clapp).

Ecology.—See *A. profunda.*

Associations.—Living: OHIO-1, 2; ONTARIO-12, 13.

General distribution.—Islands of Lake Erie: Green and West Sister in Ohio, North Harbor and Middle Sister in Ontario.

Distribution in Ohio.—Green and West Sister Islands in Lake Erie.

Geologic range.—Unknown.

FIGURE 456.—*Subulina octona,* after Burch (1960, pl. II, fig. C).

Family ACHATINIDAE
Subfamily SUBULININAE
Genus *Subulina* Beck 1837
Subulina octona Bruguière 1792
Fig. 456

This snail has been recorded by Sterki (1914, p. 272) as an introduced species in greenhouses at Painesville and Akron. It is most improbable that it will be found as a Pleistocene fossil in Ohio but it

may turn up from time to time in greenhouses and in their immediate vicinity. For details on the family, subfamily, genus, and species, see Pilsbry (1946, p. 169, 170, 172, and 173). The species is small, about 17 mm. long, with a very slender spire of numerous whorls; in this respect it is proportionately higher and narrower than any Ohio land species and has more whorls (9 to 11) than any of them. See figure 457 for distribution.

Family HAPLOTREMATIDAE
H. B. Baker 1930

Selenitidae Fischer 1883, Manuel de Conchyl., p. 456.
Circinariidae Pilsbry 1898, Nautilus, v. 11, p. 127.
Haplotrematidae H. B. Baker 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 405.
Haplotrematidae Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 201.

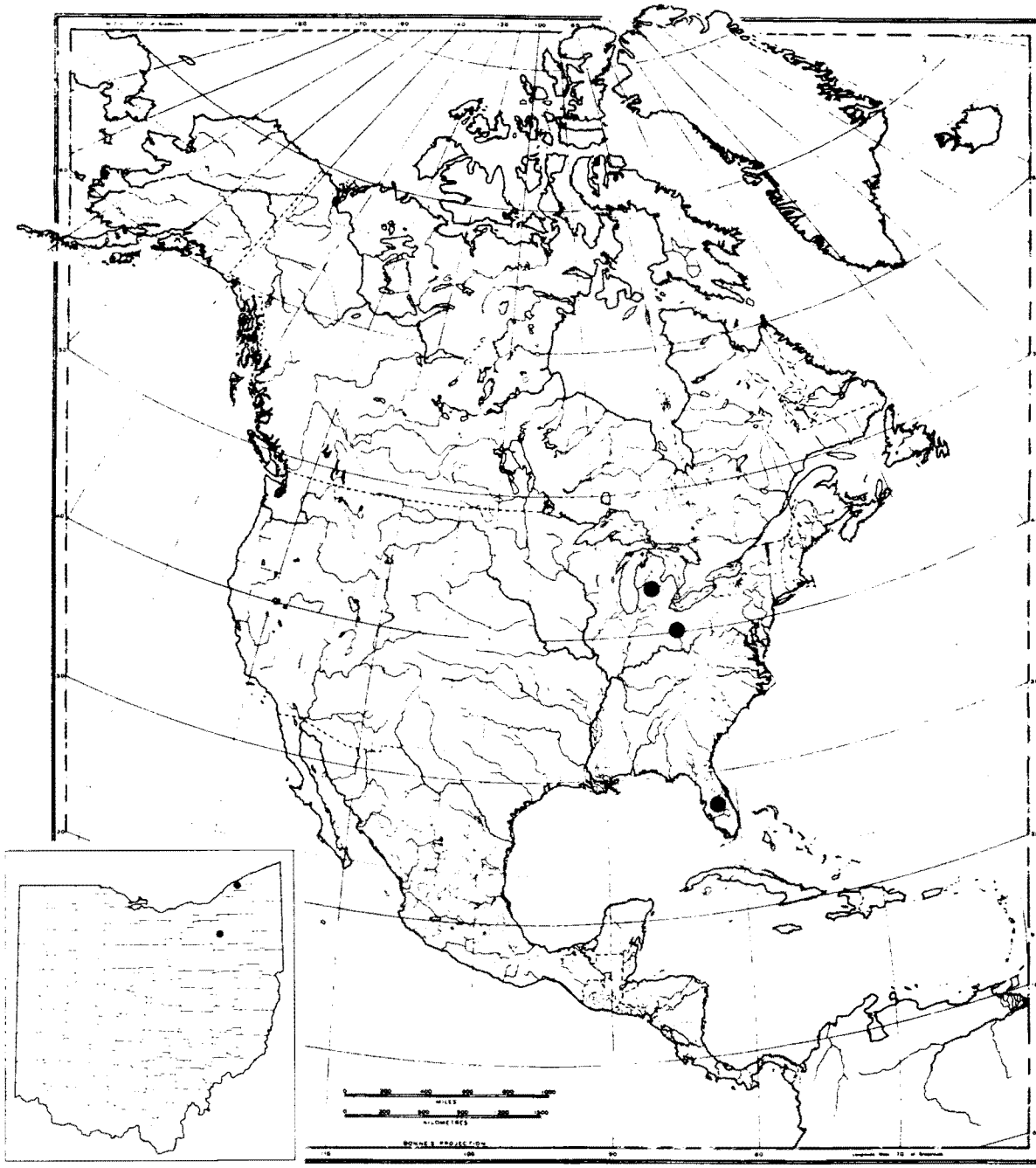

FIGURE 457.–Distribution of *Subulina octona* in North America; *inset*, distribution in Ohio.

Shell characters for this family are as in the genus *Haplotrema*, below.

Genus *Haplotrema* Ancey 1881

Haplotrema Ancey 1881, Le Naturaliste, v. 1, no. 57, p. 453.
Haptotrema (*err. pro Haplo-* Ancey 1881) W. G. Binney 1885, U.S. Natl. Mus. Bull., no. 28, p. 474.
Macrocyclis Binney and Bland 1869, Land and fresh water shells N. America, v. 1, p. 53 (*non* Beck 1837).
Mesomphyx Gray 1841, Syn. Brit. Mus., 43d ed., p. 127, name only; misspelling of *Mesomphix* Rafinesque.
Selenites Fischer 1878, *in* Shuttleworth's Notitiae Malac., v. 2, p. 8 (*non* Hope 1840).
Circinaria Beck, Pilsbry 1898, Nautilus, v. 11, p. 127, and of other American authors up to about 1920; not *Circinaria* Beck 1837 as restricted by Herrmannsen, 1847.
Haplotrema Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 202.
Haplotrema La Rocque 1953, Cat. Recent Moll. Canada, p. 310.

Type.—*Selenites durantii* (Newcomb).

General distribution.—Alaska and southern Canada southward to Lower California.

Geologic range.—Late Pleistocene; Sangamon? of Indiana; Wisconsin of Ohio and Indiana.

Speciation.—The species of the United States and Canada are divided into two subgenera of which one, *Ancotrema*, occurs only in the Pacific Coast area. The typical subgenus, *Haplotrema s.s.*, has two sections, *Haplotrema s.s.*, also western, and *Geomene*, of the eastern United States and Canada, including Ohio. The western species are rather numerous but in the east there is only one species, with two poorly differentiated forms.

Haplotrema concavum (Say) 1821
Fig. 458

Helix concava Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 159.
Macrocyclis concava Call 1900, Moll. Ind., p. 371, pl. 4, figs. 4, 7.
Circinaria concava Billups 1902, Nautilus, v. 16, p. 51.
--- --- Sterki 1907, Proc. Ohio Acad. Sci., v. 4, p. 375, 401, 402.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 456.
Haplotrema (Geomene) concavum concavum H. B. Baker 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 411, pl. 33, fig. 8.
Circinaria concava Goodrich 1932, Moll. Mich., p. 26.
Haplotrema concavum Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 269.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 208.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 47.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 21, pl. 2, figs. 12, 13.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 310.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 12.

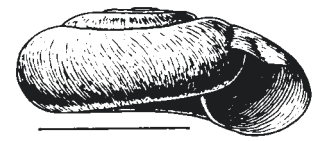

FIGURE 458.—*Haplotrema concavum*, magnified; after F. C. Baker (1939a, p. 92).

Type locality.—Illinois and Missouri (to "Council bluff").

Diagnosis.—Shell depressed, umbilicus broadly open, glossy, some shade of yellow, rather smooth, irregularly striate, some specimens with fine spiral lines; whorls convex, the last well rounded, slightly or not descending in front; aperture rotund-lunate; peristome narrowly expanded in the outer and basal margins, generally brownish or rust tinted; upper margin somewhat straightened or slightly depressed; parietal callus slightly thickened, yellowish (modified from Pilsbry, 1946, p. 208).

Ecology.—This species has long been known to be a carnivore, feeding on other snails. This fact restricts its distribution to areas where snails are abundant, specifically lime-rich areas; it may therefore be described as an indirect calciphile. Oughton (1948, 94 ff.) has recorded it as confined to the Paleozoic terranes in Ontario, in damp woodlands, especially those of deciduous trees. Archer (1935, p. 80) noted its presence in hardwoods, under leaf mold, in the Asheville, North Carolina, region. In Ohio, it is present in all but a few northeastern counties and a few others where the bedrock is mainly shale or sandstone; this may be pure coincidence but it is more likely that it is related to the food requirements of this snail.

Muchmore (1959, Naut. 72, p. 85-88) found the species living under stones in various woodland areas in New York State. Burch (1955, Naut. 69, p. 66) has shown its relationships to soil factors in eastern Virginia. Ingram (1940, Naut. 54, p. 87) has described its daylight activity. He (1941, Naut. 55, p. 14-15) recorded it for a creek floodplain, under stones, near Ithaca. Ingram (1944, Naut. 58, p. 25-27) described its winter habits at Ithaca, in beech–yellow-birch and

sycamore woodlands. Conkin (1957, Naut. 71, p. 11) has collected it in Kentucky from bushy and forested slopes and creek bottoms with highly calcareous soil. In South Carolina, Rehder (1949, Naut. 62, p. 125-126) found it around fallen logs, near a creek; under fallen leaves, and on the bank of a small stream. In North Carolina he (1949, Naut. 62, p. 123) found it among stones, bricks, etc., along the sea wall bordering Albemarle Sound. Webb (1943, p. 341-345) has described its mating habits. He also (1950, Naut. 63, p. 141-142) noted that it resists attack by its own kind. He described how living specimens of *Stenotrema hirsutum* and of *Mesodon inflectus* were eaten by attack through the aperture of the victims, so that the apertural armature of these two species is occasionally ineffective against the predator. The eggs have been studied by Ingram (1944, p. 94).

In Tennessee, Lutz (1950, Naut. 63, p. 104-105) has found it on rolling hills of hardwood forests. In Virginia (Burch, 1954, Naut. 68, p. 32) it is extremely common wherever the habitat is favorable for other snails. In Maryland (Grimm, 1959, Naut. 72, p. 124) it occurs in quarries, especially marble quarries, and in woods near towns.

This predator is in turn preyed upon by shrews *(Blarina)* as recorded in New York State by Ingram (1944, Naut. 57, p. 135). The same author (1946, Naut. 59, p. 91) gave the following data from the Huyck Preserve, New York State: "This mollusk was found in all plant associations except in grassy fields and bogs. Individuals were rather sparsely distributed in all areas but the flood plains; here individuals were commonly found concealed beneath water-carried debris piles with *Anguispira alternata* and *Ventridens intertextus*. Throughout its distributional range on the preserve individuals preferred to seek shelter beneath stick debris piles and logs to humus." Based on field observations, Ingram (1942, Naut. 55, p. 98-102) reported *Haplotrema* using the following snails as food: *Triodopsis albolabris* (Say), *Triodopsis dentifera* (Binney), *Mesomphix cupreus* (Rafinesque), *Zonitoides arboreus* (Say), and *Anguispira alternata* (Say).

Associations.—Living: MICHIGAN-1, 2; OHIO-22, 23, 24, 25, 26, 43; ONTARIO-7, 8, 11, 12, 13; QUEBEC-6. Fossil: W-24, 25, 26, 28.

General distribution (fig. 459).—Maine, Quebec, Ontario, and Michigan, west and south to Iowa, Missouri, Arkansas, Mississippi, and Florida.

Distribution in Ohio (inset, fig. 459).—Probably over the State, but records at hand are clustered in the southern two-thirds of the State; the northernmost counties recorded are Paulding, Allen, Holmes, and Harrison. This is probably due to lack of collecting, as the species occurs in Michigan and Ontario to the north and the fossil distribution (see below) in the State is much more extensive.

Geologic range.—"Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); Middletown "pre-glacial deposits" (Sterki, 1907a, p. 401); "Defiance sandy deposit (loess?)" (*ibid.*, p. 402); Castalia marl (Sterki, 1920, p. 178, and Clark, 1961, p. 25). Sangamon? of Indiana (F. C. Baker 1920b, p. 456). Sangamon, Peoria, and "Wabash" (Baker, 1920a, p. 389).

Family ZONITIDAE

Zonitidae Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 233.

Diagnosis.—Shell spiral, partly or wholly external, generally helicoid but varying from discoidal to conic, umbilicate or rarely imperforate, the aperture with thin, unexpanded lip; foot with conspicuous pedal furrows, commonly with a mucous pit at their caudal meeting; sole either tripartite or uniform (condensed from Pilsbry, 1946, p. 233).

Subdivisions.—Pilsbry (1946, p. 233) accepts four subfamilies, Euconulinae, Zonitinae, Gastrodontinae, and Vitrininae, of which the first three are represented in the Ohio fauna and the last may eventually be added to our catalogue.

Remarks.—The shell form in this family is extremely variable and it is easier to identify species and genera than suprageneric categories. In specimens with the soft parts preserved, the characteristics of the family are easily ascertained but valid identifications can nevertheless be made without them. In general, the zonitid shell is remarkable for its thinness, its shining surface, and its relatively wide umbilicus. There are exceptions to all three of these statements in the genera and species of the Ohio fauna and it is therefore simpler for the worker on Pleistocene land snails to identify his material to species and accept the suprageneric classification on the basis of previous malacological work, which is well established thanks to the work of Pilsbry (1946, p. 233 ff.) and H. B. Baker (several papers, mentioned under individual genera and species).

Subfamily EUCONULINAE H. B. Baker 1928

Conulinae Strebel and Pfeiffer 1880, Beitr. Mex. Conchyl., v. 4, p. 23.

Euconulinae H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 9.

Euconulinae H. B. Baker 1941, B. P. Bishop Mus. Bull. 166, p. 208, 212.

Euconulinae Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 233.

Diagnosis.—Small or minute zonitid snails with conic or biconvex narrowly perforate shells of slowly

increasing whorls. Diagnostic characters of the subfamily are those of the radula and genital system.

Subdivision.—Two genera occur in North America north of Mexico and both of them are represented in the Ohio fauna. They are *Euconulus* and *Guppya,* whose animals are distinguishable by the rather unusual feature of *Guppya,* a little horn on the tail over the meeting of the pedal furrows, a feature which is not present in *Euconulus.* The shells are also distinguishable; that of *Euconulus* has close microscopic axial striation whereas that of *Guppya* has no axial striation.

Genus *Euconulus* Reinhardt 1883

Conulus Fitzinger 1833, Beitr. Landesk. Oesterr., v. 3, p. 94 (*non* Rafinesque 1814).

Euconulus Reinhardt 1883, Sitzber, Ges. Naturf. Fr. Berlin, 1883, p. 86.

Arnouldia Bourguignat 1890, Bull. Soc. Malac. France,

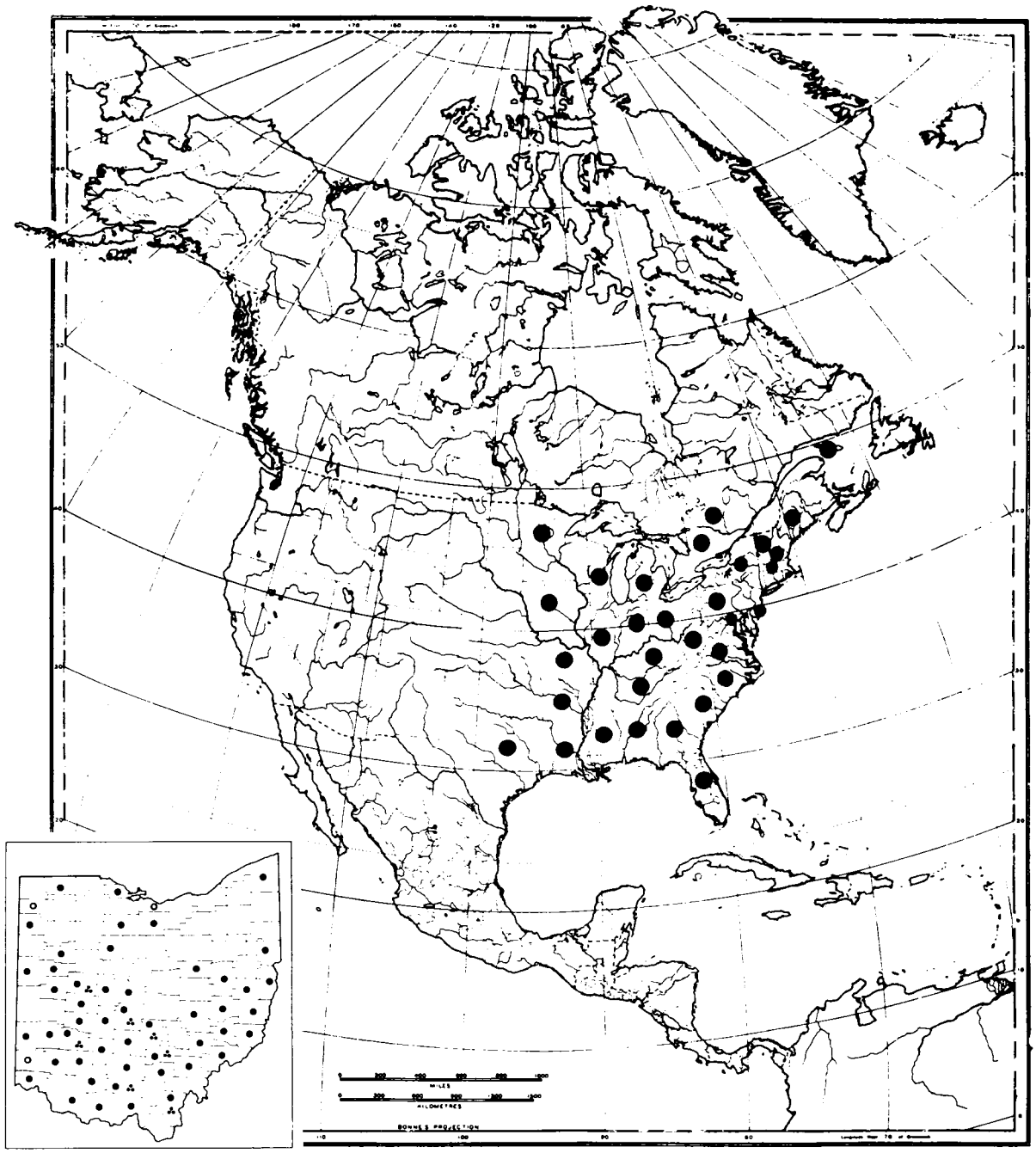

FIGURE 459.—Distribution of *Haplotrema concavum* in North America; *inset,* distribution in Ohio.

v. 7, p. 328.
Petasia Beck 1837, in part, Index Moll., p. 21.
Trochulus Westerlund 1886, Fauna Paläarct. Binnenconch., v. 1, p. 26 (*non* Christ).
Petasina Gude and Woodward 1921, Malac. Soc. London Proc., v. 14, p. 177 (*non* Beck).
Euconulops H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 11.
Euconulus Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 234.
Euconulus La Rocque 1953, Cat. Recent Moll. Canada, p. 311.

Type.—*Euconulus fulvus* (Müller).

Diagnosis.—Shell very small, minutely or scarcely perforate, conic, or convexly conic, thin, fragile, of 5½ to 7 convex, closely coiled whorls, the last angular in the neanic stage, subangular or rounded in the adult; apparently smooth, but having a microscopic sculpture of close, regular vertical striae; aperture crescentic or lunate; lip thin, its insertions widely separated (Pilsbry, 1946, p. 234).

General distribution.—Holarctic realm generally; common in high latitudes (Pilsbry, 1946).

Geologic range.—Widespread in the Pleistocene. Recorded for the Tertiary but the species have been referred to other genera.

Euconulus fulvus (Müller) 1774
Fig. 460; pl. 14, fig. 4

Helix fulva Müller 1774 (part), Verm. Terr. et Fluv. Hist., v. 2, p. 56.
Zonites (Conulus) fulvus Call 1900, Moll. Ind., p. 376, pl. 4, fig. 2.
Euconulus trochiformis Dall 1905, Harriman-Alaska Exped., v. 13, p. 40, fig. 28.
Euconulus fulvus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Goodrich 1932, Moll. Mich., p. 31.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 272.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 235.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 18.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 22, pl. 3, fig. 17.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 37, pl. 5, fig. F.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 19, pl. 4, fig. I.
--- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.
Euconulus fulvus fulvus La Rocque 1953, Cat. Recent Moll. Canada, p. 311.
Euconulus fulvus Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
?Euconulus sp. La Rocque and Forsyth 1957, Sidney Cut, p. 85 ff.
Euconulus fulvus Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 146.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 80.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 66.

FIGURE 460.—*Euconulus fulvus*, magnified; after Walker (1928, p. 93, fig. 128).

Type locality.—Fridrichsdal, Denmark.

Diagnosis.—Shell thin, minutely perforate or closed, conic, cinnamon or dilute tawny, the summit paler; spire conic with slightly convex outlines and obtuse apex, the periphery rounded or weakly angular, base convex; surface glossy, with close microscopic striae along lines of growth, and faint spiral striae; aperture lunate; peristome thin, dilated near the columellar insertion (modified from Pilsbry, 1946, p. 236).

Ecology.—Found among damp leaves in well-shaded places, especially under hardwood trees; in damp wood and bark chips; under damp started bark and logs. The small size of the species makes it inconspicuous but its true abundance is revealed when leaf mold is sifted. It is also common in stream drift derived from suitable habitats.

Taylor summarized the habitat as: wooded area, in leaf litter or under logs and bark in wooded spots; woodland habitat, in moist, protected spots among plant debris in wooded area, or associated with dead wood on the floodplain. Oughton (1948, p. 94 ff.) found it in both damp and drier, more open woods or fields, especially woodlands of deciduous trees, but he also found it occasionally in *Sphagnum* bogs in Ontario. H. B. Baker (1922b) listed it for Dickinson County, Michigan, in the following habitats: (36) outcrop of Quinnesec schist, in dead leaves and humus, collected in hollows of the rocks, thickly overgrown with bearberries and scattered hardwoods and conifers; (40) virgin hardwoods of the Menominee Trough; (41) hardwood covered moraine ridges; snails particularly in maple logs; (46) clearing near Foster City, in and around old stumps and logs; one of the drier alluvial habitats; (47) floodplain of Hancock Creek, about 2 feet above July water level; (48) floodplain of Menominee River, with brush of tag alders, dogwoods, hazels, and small ashes.

Muchmore (1959, Naut. 72, p. 85-88) found it under

stones in various woodland areas in New York State. Wayne (1959b, p. 92) recorded it beneath trunks of fallen spruce trees, pieces of paper, and cardboard from water level at the margins of tundra pools to about 3 meters above the water on a dry slope at Churchill, Manitoba. In Ontario, Lindeborg (1949, Naut. 62, p. 129) collected it mostly under logs but also from moss on trees after a rain. In Virginia, Hubricht (1953, Naut. 67, p. 23) found it only on bluffs along the Roanoke River.

Ingram (1946, Naut. 59, p. 90) gathered the following data in the Huyck Preserve, in New York State: "This small mollusk was occasionally found beneath maple humus, and beneath old boards on the banks of Myosotis lake."

Associations.—Living: MANITOBA-39; MICHIGAN-1, 9; MINNESOTA-1, 2, 4, 5, 7; OHIO-43; ONTARIO-7, 8, 10; WISCONSIN-140, 141, 143. Fossil: K-2, 6, 8, 12, 13, 14, 15, 17, 19, 20, 21, 24; Y-1; I-5; S-1, 2, 3, 4, 7; W-2, 4, 5, 6, 9, 10, 12, 15, 16,

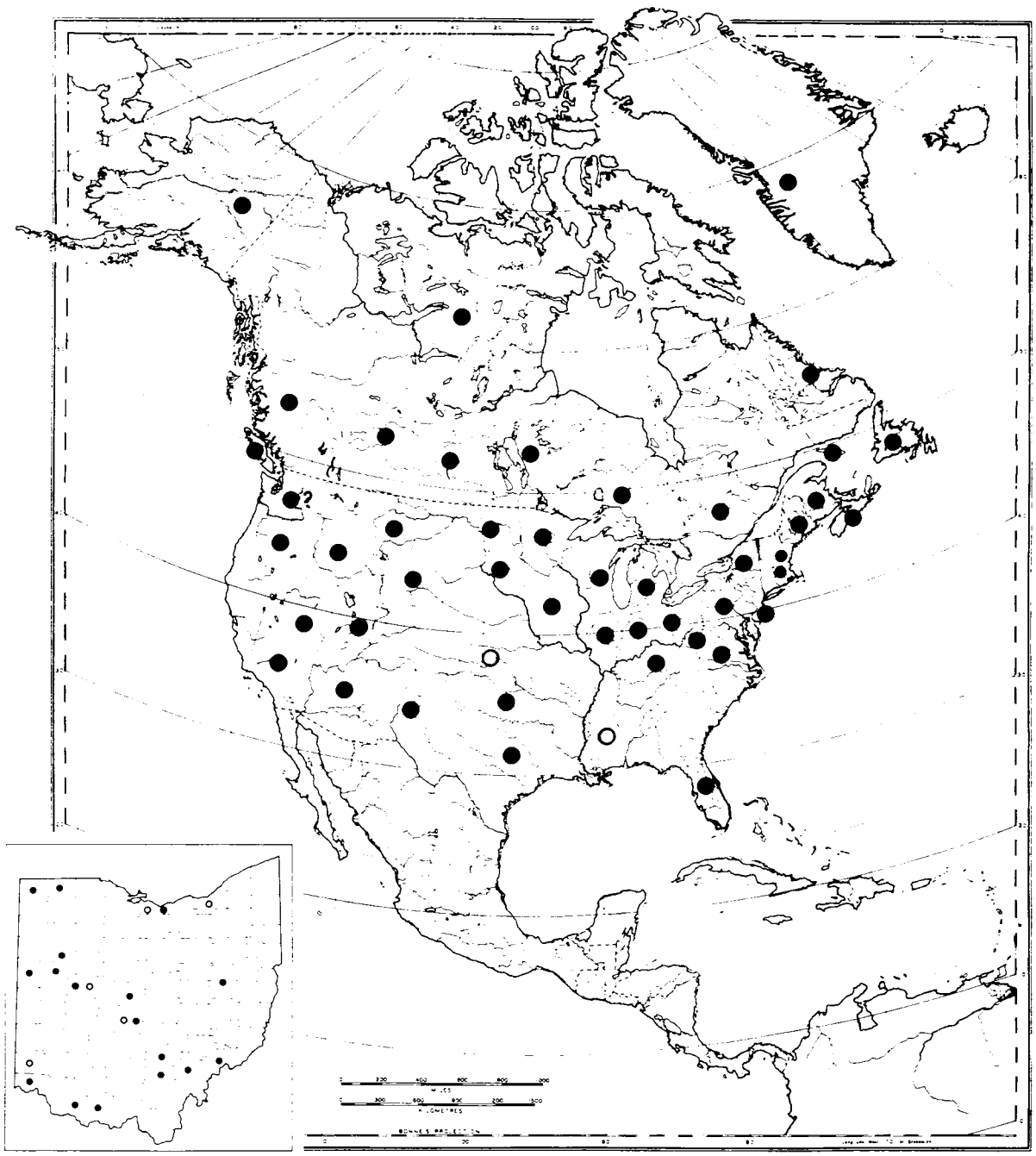

FIGURE 461.—Distribution of *Euconulus fulvus* in North America; *inset,* distribution in Ohio.

17, 19, 20, 21, 22, 28, 56, 57, 58, 60, 61, 62, 64, 65, 66, 67, 69, 73.

General distribution (fig. 461).—"Almost throughout the Holarctic realm, but wanting in the Gulf and South Atlantic States from Texas to North Carolina" (Pilsbry, 1946, p. 236).

Distribution in Ohio (inset, fig. 461).—"Over the state" (Sterki, 1907a, p. 374). Records from several sources substantiate Sterki's statement except for the northeastern part of the State but this may be due more to lack of collecting than to actual absence.

Geologic range.—"Middle Pliocene, Montpellier, France" (Pilsbry, 1946, p. 236). In North America, Yarmouth to Recent (A. B. Leonard, 1950, p. 37); Sappa silts, Peoria Loess to Recent (Leonard, 1952, p. 19); Illinoian and Wisconsin of Kansas (Leonard and Frye, 1943, p. 457); pro-Kansan loess of Indiana (Wayne, 1954, p. 1320); Hibbard and Taylor restrict the geologic range to "middle Pleistocene (Kansan)"; Sangamon, Farmdale? loess, lower and upper pro-Tazewell loess of the Cleveland region, Ohio (Leonard, 1953, p. 372); late Wisconsin Castalia marl (Sterki, 1920, p. 178). Mowery (1961, p. 11) has recorded it for the Jewell Hill deposit and Clark (1961, p. 25) for the Castalia deposit, both in Ohio.

Euconulus chersinus (Say) 1821
Fig. 462

Helix chersina Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 156.
Euconulus chersinus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 375.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Goodrich 1932, Moll. Mich., p. 31.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 272.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 239, fig. 119a, b.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 16.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 311.
?*Euconulus* cf. *chersinus* Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
Euconulus chersinus Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 65.

Type locality.—Sea Islands of Georgia.

Diagnosis.—Shell subglobose-conic, pale yellowish-white, pellucid, convex beneath; volutions about six, wrinkles not distinct; spire convex-elevated; suture moderate; body whorl slightly carinate on the periphery; aperture nearly transverse; lip simple, sharp; umbilicus closed.

Ecology.—In Ontario, Oughton (1948, p. 94 ff.) found this species in damp woodlands, especially those of deciduous trees, but also in drier, more open woods and fields. In North Carolina, Archer (1935, p. 80) listed it from hardwoods, under logs, and in leaf mold in the oak-hickory woods near the top of Sunset Mountain.

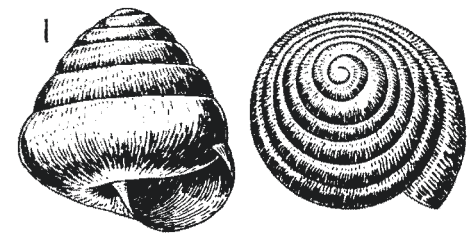

FIGURE 462.—*Euconulus chersinus,* magnified; after F. C. Baker (1939a, p. 76, upper figs.)

Burch (1955, Naut. 69, p. 66) has shown the relationships of this species to soil factors in eastern Virginia. Teskey (1955, Naut. 69, p. 70-71) has collected it in the Warm Springs, Georgia, area, in the following habitats: Cascade Falls, leaf mold on loose shale, and Dowdell's Knob, scenic lookout, outcrop of granite boulders on mountain top, with an occasional rotting log. In Virginia, Hubricht (1953, Naut. 67, p. 23) found it generally distributed over Pittsylvania County, in upland oak woods. The variety *dentata* is also generally distributed over the county, but prefers drier situations than the typical form.

Associations.—Living: MICHIGAN-1, 9, 17, 18, 20, 21, 22, 23, 25, 26, 28, 31, 32, 33, 34, 38, 39. Fossil: W-28.

General distribution (fig. 463).—"Florida to littoral New Jersey, west to Illinois and Louisiana" (Pilsbry, 1946, p. 240); reported from Ontario, Quebec, New York, but possibly not the typical form.

Distribution in Ohio (inset, fig. 463).—Sterki (1907a, p. 375) gave "over the state" but the records appear to be for the eastern and southwestern part only, although this may be due to lack of collecting.

Geologic range.—F. C. Baker (1920a, p. 389) gave only "Wabash" (late Wisconsin). Doubtfully from pro-Kansan loess in Indiana (Wayne, 1954, p. 1320); late Wisconsin Castalia marl, Ohio (Sterki, 1920, p. 178).

Remarks.—There is some intergradation between typical *E. chersinus* and *E. chersinus polygyratus,* a factor which led Pilsbry at one time to consider the subspecies invalid, but in his latest revision (1946, p. 241) he recognized it and gave for it a much wider range than for the typical form.

Euconulus chersinus polygyratus (Pilsbry) 1899
Fig. 464

Conulus chersinus polygyratus Pilsbry 1899, Nautilus, v. 12, p. 116.
Euconulus chersinus polygyratus F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- --- H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 11, pl. 2, fig. 3 (anatomy).
Euconulus chersinus polygratus Goodrich 1932, Moll. Mich., p. 31.
Euconulus chersinus polygyratus Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 272.
--- --- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 240, fig. 119c.
--- --- --- Oughton 1948, Zoögeogr. study, Ontario, p. 17.

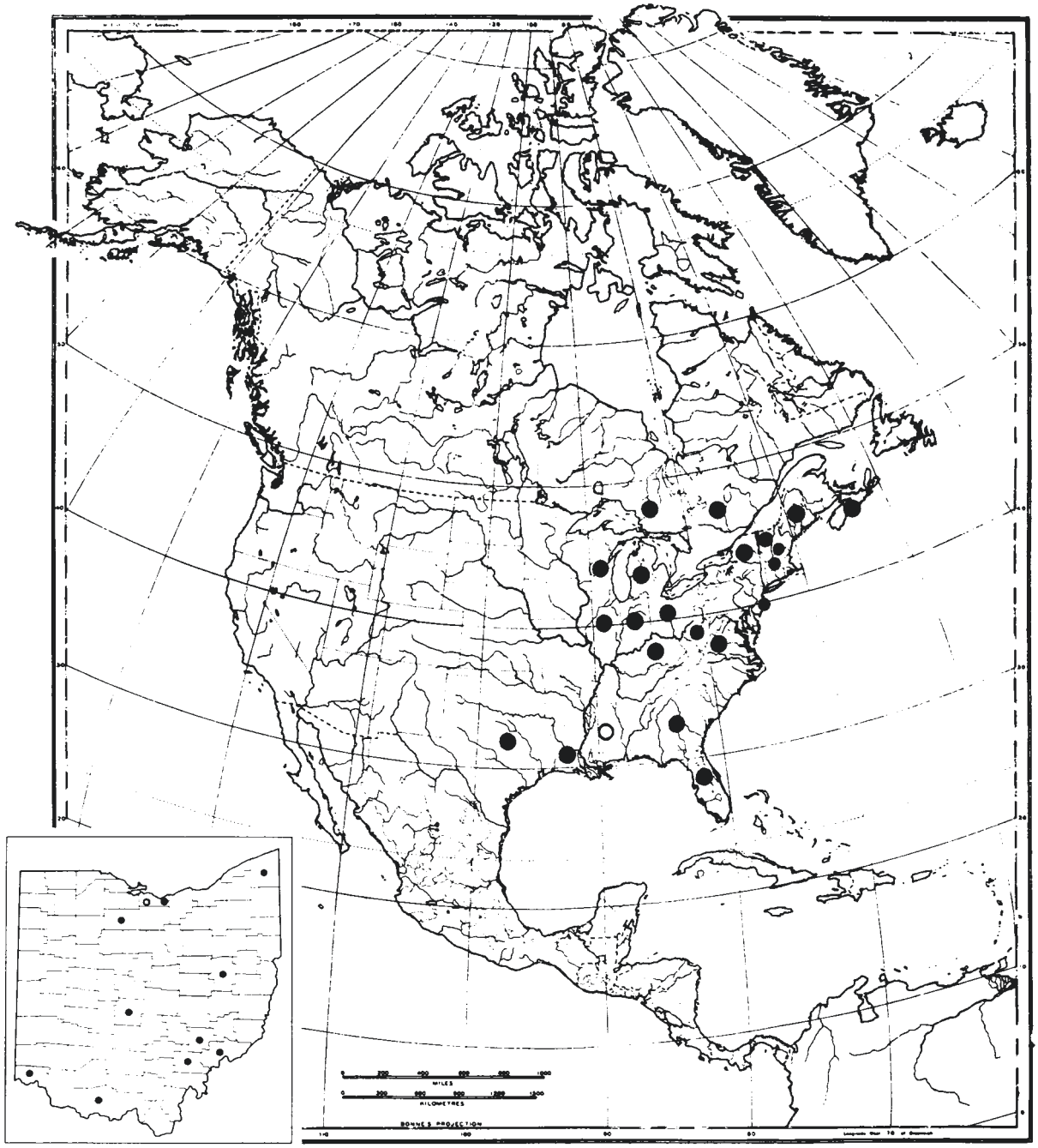

FIGURE 463.–Distribution of *Euconulus chersinus* in North America; *inset,* distribution in Ohio.

Euconulus chersinus polygyratus Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 22.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 311.

FIGURE 464.–*Euconulus chersinus polygyratus,* magnified; after F. C. Baker (1939a, p. 76, lower fig.).

Type locality.–Grand Rapids, Michigan.

Diagnosis.–Shell with more strongly convex whorls than the typical form, the last with sharply angular periphery in immature shells, but becoming rounded in full-grown specimens; aperture narrowly lunate, the basal margin well curved (condensed from Pilsbry, 1946, p. 240).

Ecology.–H. B. Baker (1922b) listed this species as numerous locally in Dickinson County, Michigan, in hardwoods, specifically from the following three habitats: (39) young hardwoods, in small hollow between two granitic ridges; partially burned, some low-growing plants; (41) hardwood covered moraine ridges, snails particularly in maple logs; (43) arbor vitae swamp, in a swampy thicket near the mouth of a small creek, with arbor vitae and deciduous trees. On Mackinac Island, Archer (1934c, p. 138) found it rather common in hardwood tracts in the interior of the island.

Associations.–Living: MICHIGAN - 40.

General distribution (fig. 465).–Ontario and Maine, west in the northern tier of states to Wisconsin and to northern Ontario and Saskatchewan.

Distribution in Ohio.–No record, but implied by the general range.

Geologic range.–F. C. Baker (1920a, p. 389) recorded the species for beds of "Wabash" (late Wisconsin) age.

Genus *Guppya* Mörch 1867

Guppya Mörch 1867, Jour. Conchyliol., v. 15, p. 256.
Guppya H. B. Baker 1925, Mich. Univ. Mus. Zoology, Occas. Papers, no. 156, p. 7.
Guppya H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 7.
Guppya Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 243.

Type.–*Guppya gundlachi* (Pfeiffer).

Diagnosis.–Shell similar to that of *Euconulus* with a somewhat lower spire; the initial whorl or all the whorls either spirally striate or smooth, but without the crowded microscopic threadlike axial striae of *Euconulus.*

General distribution.–Tropical and subtropical America, a single species north to New York and Ohio.

Geologic range.–Unknown.

Guppya sterkii (Dall) 1888
Fig. 466

Hyalina sterkii Dall 1888, U.S. Natl. Mus. Proc., v. 11, p. 214, figs. 1-3.
Conulus sterkii Sterki 1893, Nautilus, v. 6, p. 106.
Euconulus sterkii Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 375.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Guppya sterkii H. B. Baker 1922, Mich. Univ. Mus. Zoology, Occas. Papers, no. 106, p. 46, pl. 17, fig. 2.
Guppya sterkii Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 245, fig. 121.
Euconulus sterkii Oughton 1948, Zoögeogr. study, Ontario, p. 20.
Guppya sterkii La Rocque 1953, Cat. Recent Moll. Canada, p. 312.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 68.

Type locality.–New Philadelphia, Ohio.

Diagnosis.–"Shell minute, thin, yellowish translucent, brilliant, lines of growth hardly noticeable, spire depressed, four-whorled, whorls rounded, base flattened, somewhat excavated about the center, which is imperforate; aperture wide, hardly oblique, not very high, semilunate, sharp-edged, the upper part of the columella slightly reflected; upper surface of the whorls roundish, though the spire as a whole is depressed. Alt. 0.52 mm., diameter maj. 1.1 mm." (Dall). Pilsbry (1946, p. 245) noted that the original figure shows only 3½ whorls and that this is the number of whorls in other specimens.

Ecology.–Found on grassy slopes with moss and small bushes; most collections are from sifted leaves or stream drift, which gives little indication of the habitat of the species. In Ontario, Oughton (1948, p. 94 ff.) recorded this as a species of damp woodlands, especially those of deciduous trees. He also noted that it is confined to Paleozoic terranes there, which marks it as a calciphile, since the Paleozoic rocks of Ontario are mainly limestones.

Associations.–Living: OHIO - 43. Fossil: W - 28.

General distribution (fig. 467).–New Jersey, New York, Ontario, Pennsylvania, and Ohio, south to Louisiana, Alabama, and Florida, but not recorded for all states within this range.

Distribution in Ohio (inset, fig. 467).–Two records only (Sterki, 1907a, p. 375, repeated by Pilsbry, 1946) for Hudson, Summit County, and the type locality,

Tuscarawas County.

Geologic range.–F. C. Baker (1920a, p. 389) gave only "Wabash" (late Wisconsin). It is very probable that this species does not occur in the Pleistocene of Ohio. Sterki collected and identified material from a number of Pleistocene deposits in Ohio and in one case, that of the Castalia marl, he found a large and varied assemblage of land snails, including minute species. He, of all people, would have found and recognized, even in the fossil state, a snail which he had been the first to collect and which had been named after him. These facts suggest that *Guppya sterkii* originated in the southeastern United States and that it migrated northward during Pleistocene time, very possibly not reaching the glaciated areas until after the retreat of the Wisconsin ice. On the other hand, its advance must have been fairly rapid as it has been found in "postglacial deposits at Leaside, York County," Ontario, Canada, by Oughton (1948, p. 29).

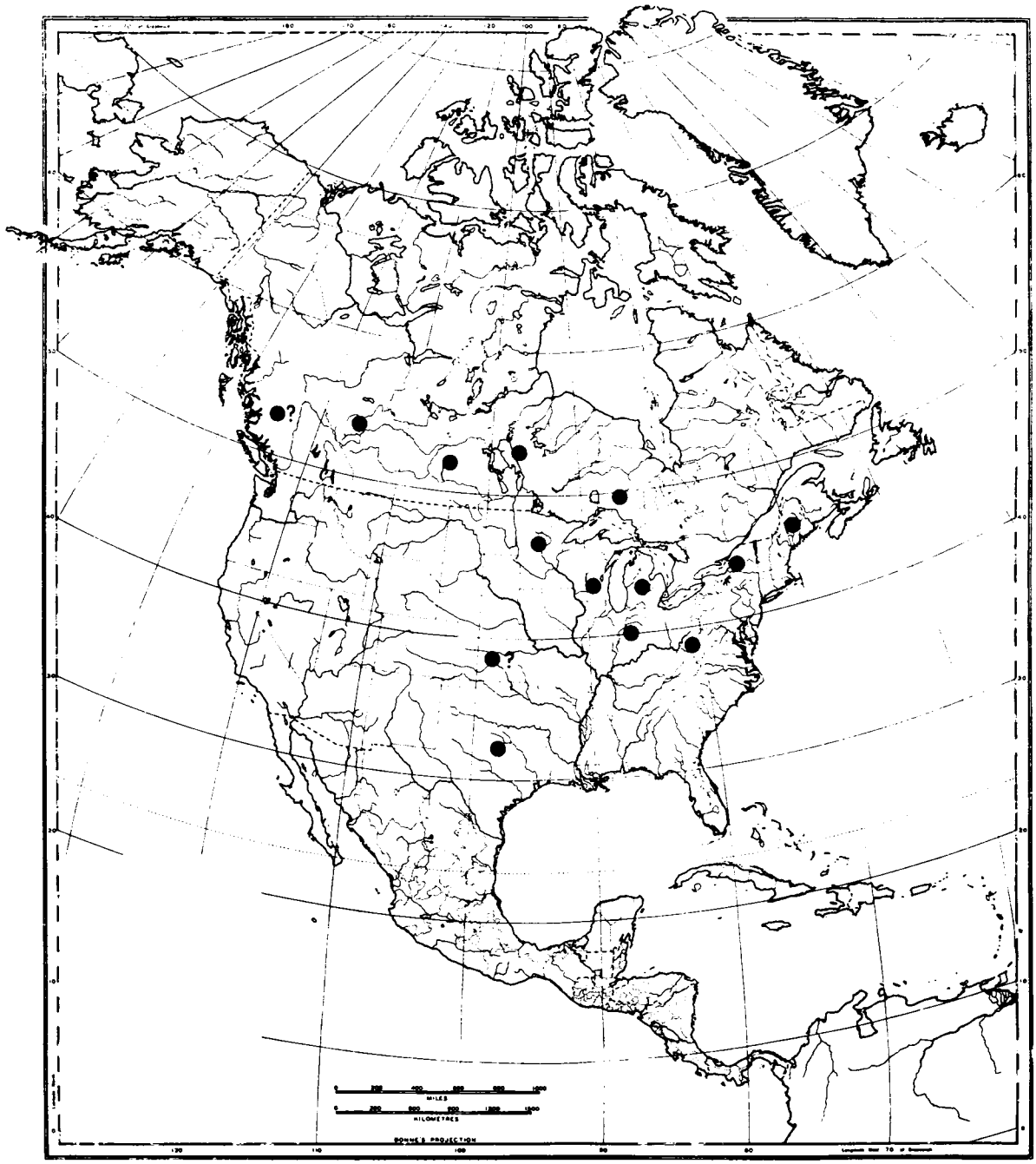

FIGURE 465.–Distribution of *Euconulus chersinus polygyratus* in North America.

FIGURE 466.–*Guppya sterkii,* magnified; after Walker (1928, p. 94, fig. 129).

Subfamily ZONITINAE

Zonitinae Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 233, 246.

Diagnosis.–Shell depressed, heliciform, in some genera toothed; caudal pit when present not overhung by a prominence or "horn"; mantle without lobes reflexed over the shell; marginal teeth of radula unicuspid; no dart apparatus, and spermathecal duct not forked anteriorly (Pilsbry, 1946).

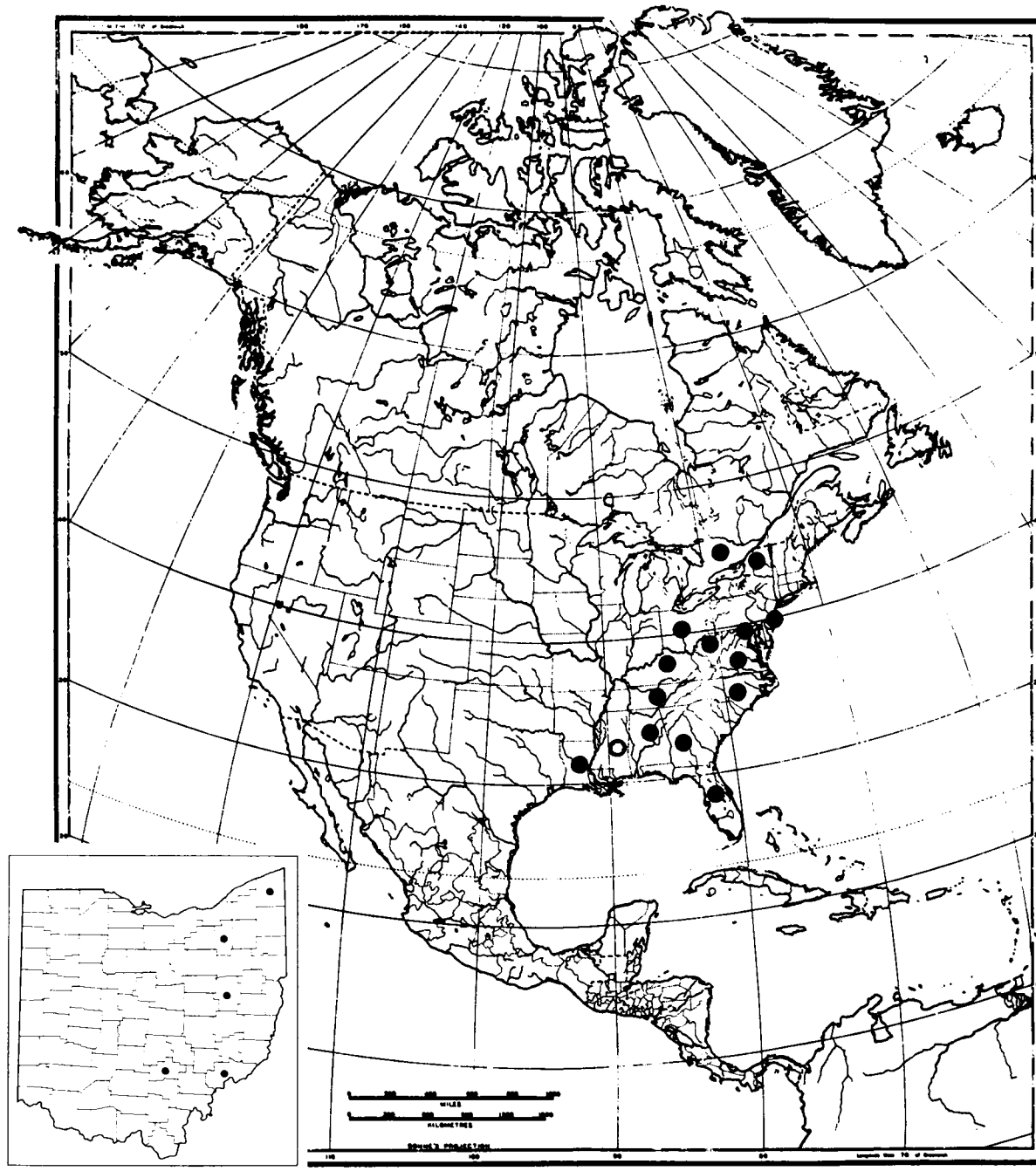

FIGURE 467.–Distribution of *Guppya sterkii* in North America; *inset,* distribution in Ohio.

Subdivisions.—The North American fauna includes eight genera of which one, *Oxychilus,* is introduced from Europe. Four of these, including *Oxychilus,* are represented in the living molluscan fauna of Ohio but only the three native genera are to be expected in the Pleistocene fauna of the State.

Genus *Oxychilus* Fitzinger 1833

Oxychilus Fitzinger 1833, Beitr. Landesk. Oesterr., v. 3, p. 100.
Polita Held 1837, Isis, v. 30, p. 916.
Hyalinia "Ag." Charpentier 1837, Neue Denkschr. Allg. Schweiz Ges., v. 1, no. 2, p. 13.
Hyalina "Féruss." Gray 1837, Zool. Soc. London Proc., p. 174; not *Hyalina* Schumacher 1817.
Helicella Gray 1847, Zool. Soc. London Proc., p. 173.
Aplostoma (Férussac) Moquin-Tandon 1855, Hist. Moll. France, v. 2, p. 72.
Lucilla Lowe 1855, Zool. Soc. London Proc., p. 177.
Euhyalina Albers 1857, Malak. Bl., v. 4, p. 91.
Omalota Megerle MS., *in* Scudder 1882, Nomencl. Zool., p. 233.
Oxychilus Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 247.

Type.—*Helix cellaria* Müller.

Diagnosis.—Shell of medium or small size (diameter 5 to 16 mm. in our species), depressed, biconvex, umbilicate, the umbilicus contained 5 or 6 times in the diameter (in our species); thin, translucent, glossy, of 4 to 6 whorls increasing moderately to the last, which is much wider.

General distribution.—Europe, Asia Minor, and North Africa. In America, from seaports and from greenhouses and their vicinity.

Geologic range.—None in North America.

Remarks.—The only reason for mentioning the three species of this genus recorded for Ohio in a report on Pleistocene Mollusca is that their shells can accidentally become incorporated into a Pleistocene deposit in two different ways. Where these snails live on the surface above a marl or peat deposit, they are likely to burrow into the soil, in the summer to avoid desiccation, in the winter to hibernate at depths sufficient to protect them from excessive variations of temperature. Many of the individuals that burrow thus into the ground die there and their shells are incorporated into a deposit accumulated centuries or even millenia earlier. They may be incorporated into a Pleistocene deposit in another way. Where such a deposit is cut into by a stream, slumping occurs frequently and on a scale sufficient to disturb the sequence of beds. snails living on the surface of the slumped area may fall into the numerous cracks produced by the slumping and as the material sifts into the cracks the snails are buried at a level totally out of sequence. So far, species of *Oxychilus* have not been reported in Pleistocene deposits in Ohio or elsewhere in North America but if they should be found, as they may well be, their presence should cause neither surprise nor the construction of elaborate hypotheses based on previous migration of these species into North America.

For the reasons just given, the treatment of these species is not as extensive as that of native species, but enough information is given to enable the reader to refer to complete discussions elsewhere.

Oxychilus cellarius (Müller) 1774
Fig. 468

Helix cellaria Müller 1774, Verm. Terr. et Fluv. Hist., v. 2, p. 28.
Hyalina cellaria Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
Vitrea cellaria Goodrich 1932, Moll. Mich., p. 27.
Oxychilus cellarium Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 272.
Oxychilus cellarius Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 249, fig. 123c.
Oxychilus cellarium Oughton 1948, Zoögeogr. study, Ontario, p. 23.
Oxychilus celarius Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 22, pl. 2, figs. 14, 15.
Oxychilus cellarius La Rocque 1953, Cat. Recent Moll. Canada, p. 312.

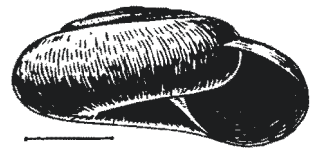

FIGURE 468.—*Oxychilus cellarius,* magnified; after F. C. Baker (1939a, p. 140, top fig.).

Type locality.—Wine cellars of Copenhagen, Denmark.

Diagnosis.—Shell strongly depressed, narrowly umbilicate, umbilicus about one-sixth of the diameter; imperfectly transparent, clear corneous with a faint amber or yellowish tint above, more or less distinctly whitish around the umbilicus; smooth, very glossy, with some weak striation, and under the microscope showing faintly to distinctly traced close spiral lines; spire slightly convex; suture conspicuous, with a narrow transparent margin; aperture rather deeply lunate; diameter about 10 mm. (modified from Pilsbry, 1946, p. 249).

Ecology.—In Nova Scotia, Dimelow (1962, Naut. 76, p. 49) found this species in a climax deciduous forest on a gentle, well-drained slope. A more typical habitat is recorded by Hubricht (1953, Naut. 67, p. 23) on a cellar wall in Danville, Virginia.

General distribution (fig. 469).—Europe, Asia Minor, and North Africa. Introduced at many places in North

America, in and around greenhouses, always in populated areas.

Oxychilus draparnaldi (Beck) 1837
Fig. 470

Helix lucida Draparnaud 1801, Tabl. Moll. France, p. 96(?); not of Pulteney, 1799 (see Pilsbry, 1946, p. 250, for status of Pulteney's species).

Helix nitida Draparnaud 1805, Hist. nat. Moll. France, p. 117; not of Müller, 1774.

Helicella draparnaldi Beck 1837, Index Moll., p. 6, substitute for *H. nitida* Drap.

Oxychilus lucidum of authors.

Hyalina (Vitrea) draparnaldi Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.

Oxychilus draparnaldi Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 250, fig. 123a.

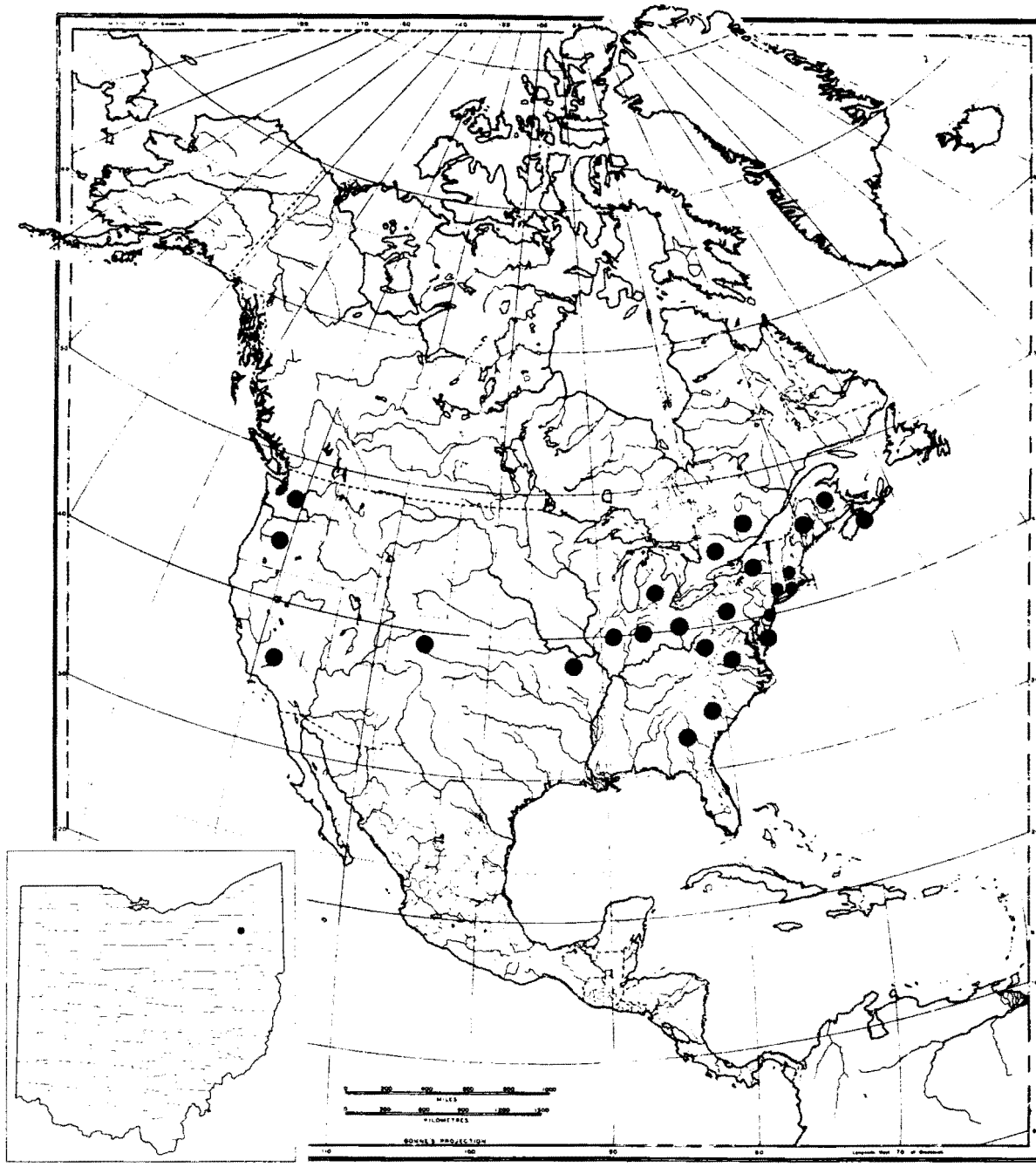

FIGURE 469.–Distribution of *Oxychilus cellarius* in North America; *inset*, distribution in Ohio.

Oxychilus lucidum Oughton 1948, Zoögeogr. study, Ontario, p. 24.
Oxychilus draparnaldi La Rocque 1953, Cat. Recent Moll. Canada, p. 312.

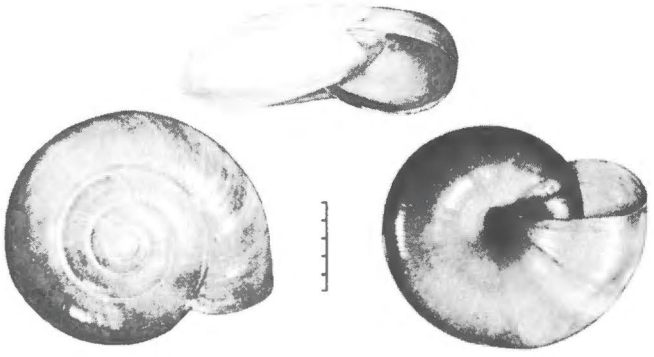

FIGURE 470.—*Oxychilus draparnaldi,* magnified; after Burch (1960, pl. II, fig. H).

Type locality.—Not specified.

Diagnosis.—Shell strongly depressed, convex above, umbilicate, the umbilicus one-sixth of the diameter; somewhat transparent, glossy, pale brown above, much paler beneath; of 5½ moderately convex whorls, the last very much wider; aperture strongly oblique, deeply lunate; lip thin; diameter 12 to 16 mm. (modified from Pilsbry, 1946, p. 250).

Ecology.—Grimm (1959, Naut. 72, p. 124) has found this species under debris near railroad tracks at a bridge in Maryland.

General distribution (fig. 471).—Europe and adjacent parts of Asia; North Africa. Introduced in North America, in greenhouses and in populated areas.

Oxychilus alliarius (Miller) 1822

Helix alliaria Miller 1822, Annals Philos. (n.s.), v. 3, p. 379.
Hyalina alliaria Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
Oxychilus alliarius Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 251, fig. 124b.
——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 312.

Type locality.—Environs of Bristol, England.

Diagnosis.—Shell depressed-convex above, whorls 4 to 4½, semitransparent, glossy, smooth, with faint but regular axial striations, most pronounced at the sutures; umbilicus small; aperture crescentic and somewhat oblique with a thin and sharp peristome; diameter about 6 mm., about half that of the other two species.

General distribution (fig. 472).—Central and western Europe. Introduced at many places in the United States and southern Canada, including Ohio. The introductions are in and around greenhouses, in vegetable gardens, and in populated areas.

Genus *Retinella* "Shuttleworth" Fischer 1877

Retinella (Shuttleworth MS.) Fischer 1877, Notit. Malac., v. 2, p. 5.
Aegopina Kobelt 1878, Rossmässler's Iconogr., v. 6, p. 15.
Glyphyalinia von Martens 1892, Biol. Centr.-Am., p. 117.
Perpolita "Pilsbry," H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 14, 15.
Glyphyalops H. B. Baker 1928, *ibid.*, p. 15, 19.
Glyphyalus H. B. Baker 1928, *ibid.*
Glyphyaloides H. B. Baker 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 194, 196.
Glyphognomon H. B. Baker 1930, *ibid.*
Retinella Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 253.

Type.—*Hyalina olivetorum* (Gmelin).

Diagnosis.—Shell (in our species) small (diameter about 3.5 to 13 mm.), depressed, thin, subtransparent, clear to amber tinted, umbilicate or imperforate; with very low spire and smooth apical whorl; aperture lunate, the lip thin.

General distribution.—Arctic to southern Mexico, but chiefly in and around the Appalachian region. Also numerous Palearctic species.

Geologic range.—Pleistocene; Aftonian to present.

Retinella indentata (Say) 1823
Fig. 473

Helix indentata Say 1823, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 372.
Vitrea indentata Dall 1905, Harriman-Alaska Exped., v. 13, p. 39.
Hyalina indentata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374, 402.
Vitrea indentata Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, 178.
——— ——— F. C. Baker 1920, Jour. Geology, v. 28, p. 455.
——— ——— F. C. Baker 1920, Life of Pleistocene, p. 389.
Glyphyalina indentata Ahlstrom 1930, Nautilus, v. 44, p. 45.
Retinella (Glyphyalinia) indentata H. B. Baker 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 209.
Vitrea indentata Goodrich 1932, Moll. Mich., p. 30.
Retinella indentata Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 271.
——— ——— Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 288, fig. 146a.

Retinella indentata Oughton 1948, Zoögeogr. study, Ontario, p. 27.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 23, pl. 2, figs. 18, 19.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 313.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 78.

Type locality.—"Harrigate and New Jersey."

Diagnosis.—Shell depressed, pellucid, highly polished; whorls four, with regular, distant, subequidistant, impressed axial striae continuous to the umbilicus; aperture rather large; lip simple; umbilicus very small, one twenty-fifth to one thirtieth the diameter (modified from Say, quoted by Pilsbry, 1946, p. 289).

Ecology.—In Ontario, Oughton (1948, p. 94 ff.)

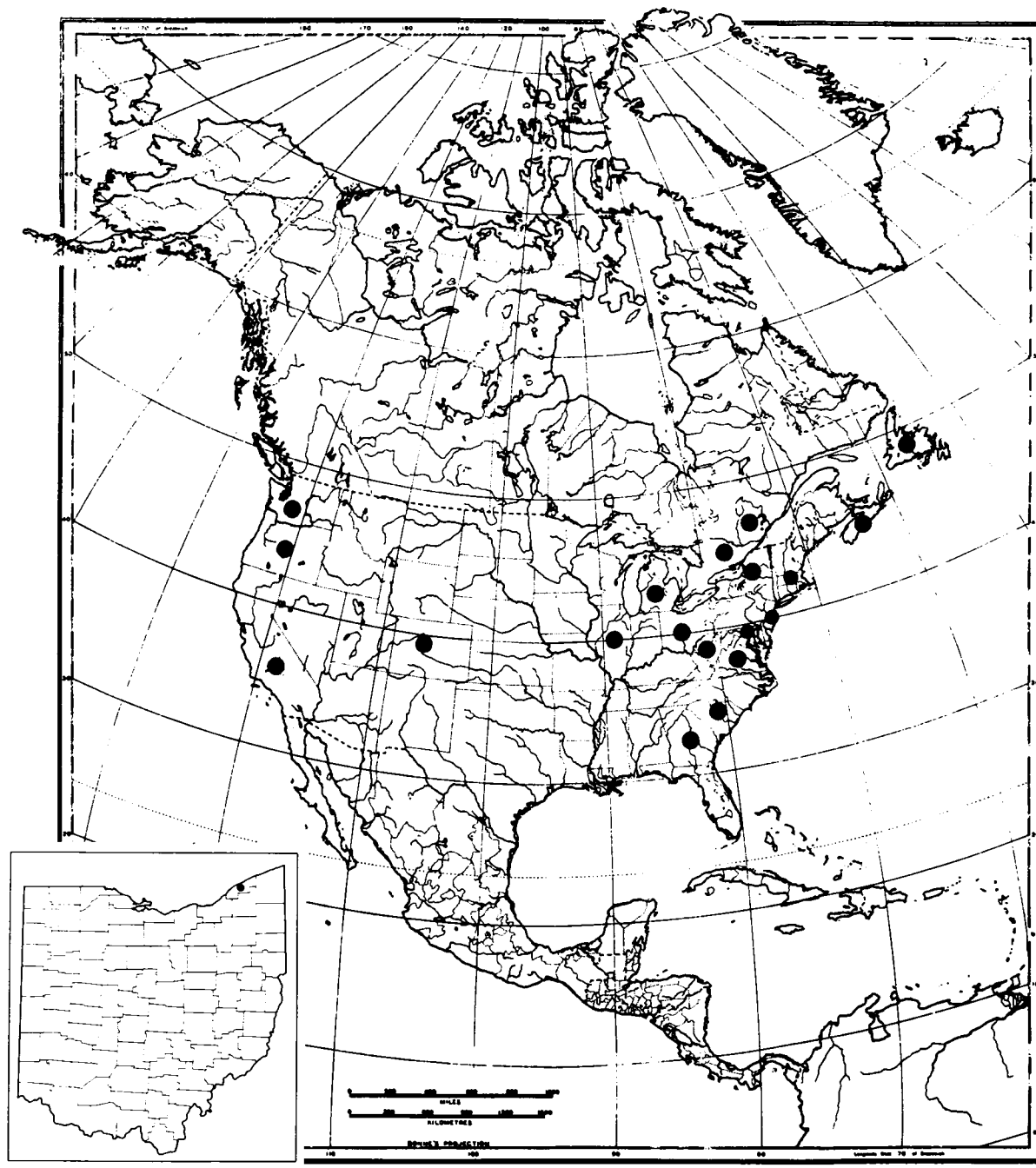

FIGURE 471.—Distribution of *Oxychilus drapamaldi* in North America; *inset,* distribution in Ohio.

found this species in damp woodlands, especially those of deciduous trees. H. B. Baker (1922b) gave the following details for localities in Dickinson County, Michigan: (37) outcrop of Sturgeon quartzite, cliffs along a creek, among scattered hardwoods and plants; (39) on sandy outwash plains, in pine and second growth; (48) in a damp hollow on the floodplain of the Menominee River, with brush of tag alders, dogwoods, hazels, and small ashes. Solem (1952, Naut. 65, p. 129) found it in virgin pine timber with some deciduous growth and undergrowth of thimbleberry in Wisconsin. Burch (1955, Naut. 69, p. 66) gave details on the relationships of this species to soil factors in eastern Virginia. Teskey (1955, Naut. 69, p. 70-71) found it in leaf mold on loose shale in the Warm Springs area of Georgia. Grimm (1959, Naut. 72, p. 124) recorded it for quarries, railroad tracks, foundations of old buildings, and under pieces of wood and wet sandstone in fields

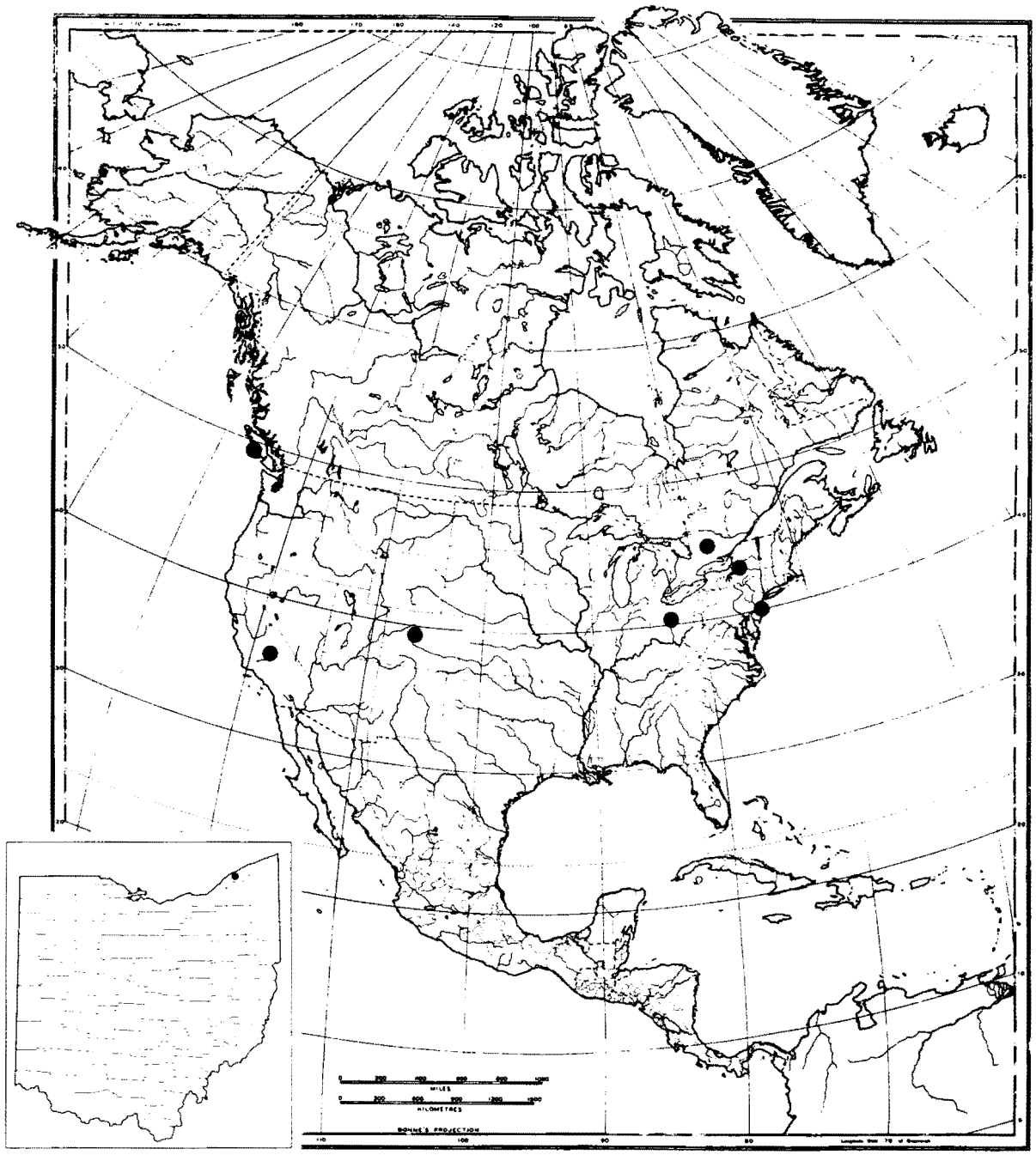

FIGURE 472.–Distribution of *Oxychilus alliarius* in North America; *inset,* distribution in Ohio.

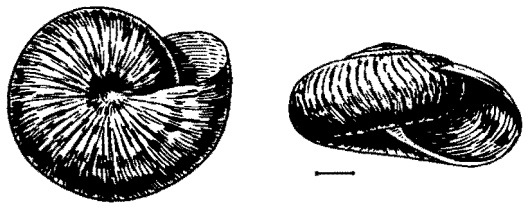

FIGURE 473.—*Retinella indentata,* magnified; after F. C. Baker (1939a, p. 71).

in Maryland.

Associations.—Living: MICHIGAN-1, 3, 4, 9, 21, 25, 26, 27, 28, 29, 32, 33; OHIO-1, 4, 43; ONTARIO-10; WISCONSIN-140. Fossil: W-26, 27, 28, 56, 57, 58, 59, 73. *R. indentata paucilirata,* living: OHIO-22.

General distribution (fig. 474).—Maine, Ontario, and Michigan, west to Kansas; south to Alabama, Tennessee, West Virginia, Virginia, and New Jersey.

Distribution in Ohio (inset, fig. 474).—"Over the state" (Sterki, 1907a, p. 374). This is probably correct,

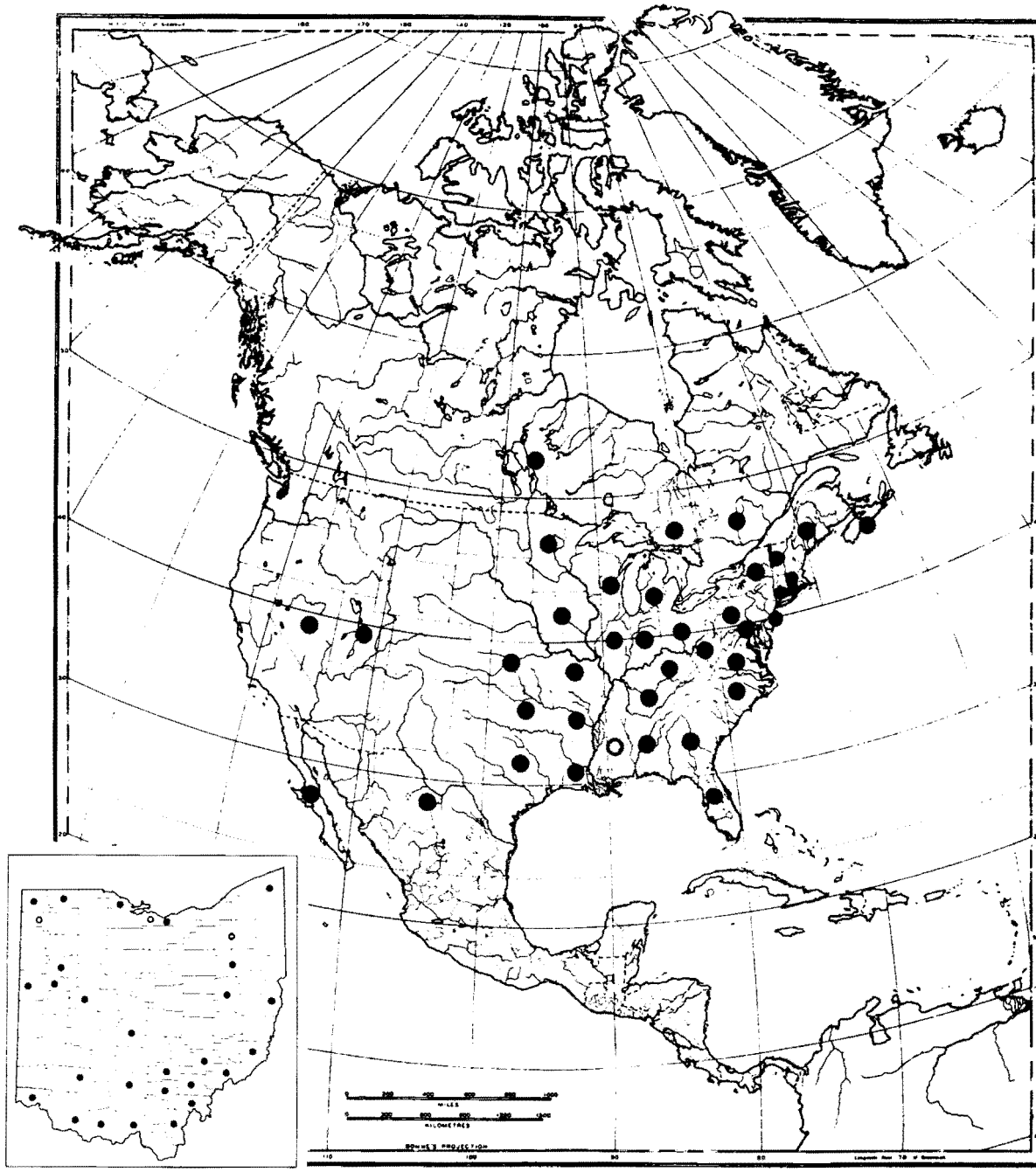

FIGURE 474.—Distribution of *Retinella indentata* in North America; *inset,* distribution in Ohio.

but records (University of Michigan, Eggleston) are concentrated in the western and southern parts of the State. The northeasternmost records are for Stark and Tuscarawas Counties.

Geologic range.—F. C. Baker (1920a, p. 389) gave Yarmouth, Sangamon, Peorian, and "Wabash." "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402); Tinkers Creek marl (Sterki, 1920, p. 174); Castalia marl (*ibid.*, p. 178); Sangamon? of Indiana (F. C. Baker, 1920b, p. 455).

Retinella wheatleyi (Bland) 1883
Fig. 475

Zonites wheatleyi Bland 1833, N. Y. Acad. Sci. Annals, v. 2, p. 368, fig. 1.
Hyalina wheatleyi Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
Vitrea wheatleyi Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Retinella (Glyphyalus) wheatleyi H. B. Baker 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 204, pl. 10, figs. 1-8.
Vitrea wheatleyi Goodrich 1932, Moll. Mich., p. 29.
Retinella wheatleyi Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 271.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 272, figs. 134; 141, nos. 1-3.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 23.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 313.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 81.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 79.

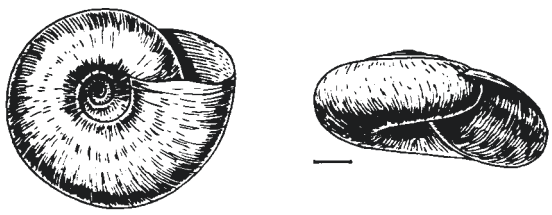

FIGURE 475.—*Retinella wheatleyi,* magnified; after F. C. Baker (1939a, p. 70, fig. B).

Type locality.—The Cliffs, Knoxville, Tennessee.

Diagnosis.—Shell umbilicate, depressed, thin, shining, pellucid, brownish, horn-colored, finely striated; spire depressed, suture slightly impressed; aperture obliquely lunate; peristome thin, acute, the margins joined by a thin callus (modified from Bland, quoted by Pilsbry, 1946, p. 272).

Ecology.—"Even in the spring, it was rare except in a shallow valley on the west-facing (more humid) slope of the ridge, where one or two individuals per square meter were obtained under the decaying leaves in the oak-chestnut woods" (H. B. Baker, quoted in Pilsbry, 1946, p. 273).

Associations.—Living: OHIO-23, 26, 43. Fossil: W-28.

General distribution (fig. 476).—Rhode Island west to Michigan and Missouri, south to Arkansas, Alabama, and North Carolina.

Distribution in Ohio (inset, fig. 476).—Probably over the State. Sterki (1907a, p. 374) gave only Tuscarawas, Cuyahoga, and Portage Counties; Pilsbry (1946, p. 272) added several counties in the southern part of the State; and Eggleston (ms. records) had the species from Wood, Logan, and Washington Counties.

Geologic range.—F. C. Baker (1920a, p. 389) gave Sangamon and "Wabash." Pleistocene: late Wisconsin, Castalia marl (Sterki, 1920, p. 178). D. W. Taylor (1960, p. 81) recorded it for the Pliocene Rexroad local fauna.

Retinella rhoadsi (Pilsbry) 1899
Fig. 477

Vitrea rhoadsi Pilsbry 1899, Nautilus, v. 12, p. 101.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Retinella (Glyphyalops) rhoadsi rhoadsi H. B. Baker 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 207.
Vitrea rhoadsi Goodrich 1932, Moll. Mich., p. 30.
Retinella rhoadsi Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 271.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 286, fig. 145.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 28.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 313.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 81.

Type locality.—White Pond, Warren County, New Jersey.

Diagnosis.—Shell similar to that of *R. indentata* but differing in having a wider umbilicus, about one-half mm. wide, showing the penultimate whorl within; axial grooves more numerous, therefore closer (modified from Pilsbry, 1946, p. 286).

Ecology.—"Uncertain; presumably similar to that of *R. wheatleyi*" (D. W. Taylor, 1960, p. 81). In Ontario, this species lives in damp woodlands, especially those of deciduous trees, but is occasionally found in *Sphagnum* bogs, according to Oughton (1948, p. 94 ff.). In Dickinson County, Michigan, H. B. Baker (1922b) found it in the following habitats: (22) near the edge

of a patch of hardwoods north of Norway, a small, swampy spring forms the head of a small brook flowing into Pine Creek; swampy banks with sedges and a few blue flags; (37) outcrop of Sturgeon quartzite: cliffs along Fern Creek, scattered hardwoods and plants; (41) higher moraines with fine hardwood cover, snails particularly in maple logs. Burch (1955, Naut. 69, p. 66) gave details of the relationships of this species to soil factors in eastern Virginia. Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. In Maryland, Grimm (1959, Naut. 72, p. 124) collected it in leaf litter along railroad tracks and in a marble quarry.

Associations.—Living: MICHIGAN-1. Fossil: S-1 (*cf.*); W-28.

General distribution (fig. 478).—Maine, Vermont, New York, Ontario, and Michigan, south to West Virginia, North Carolina, Maryland, and Delaware. A variety, *R. rhoadsi austrina* H. B. Baker, occurs in Tennessee, North Carolina, and Virginia.

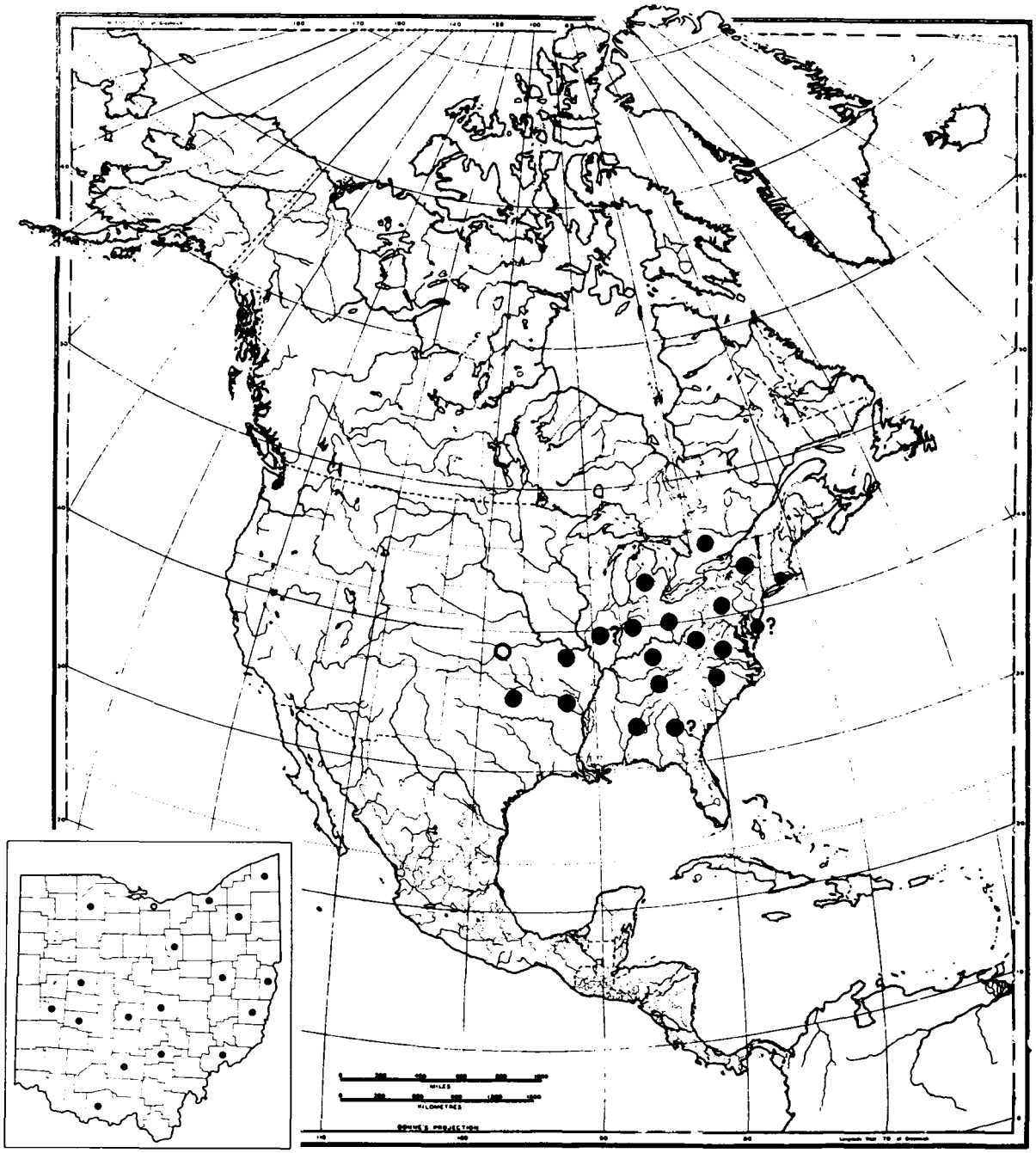

FIGURE 476.—Distribution of *Retinella wheatleyi* in North America; *inset,* distribution in Ohio.

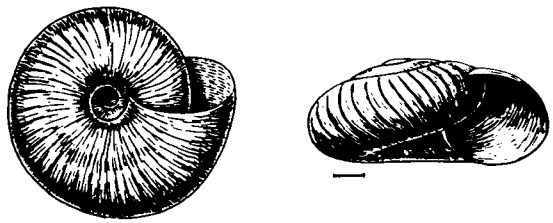

FIGURE 477.—*Retinella rhoadsi,* magnified; after F. C. Baker (1939a, p. 70, fig. C).

Distribution in Ohio (inset, fig. 478).—The presence of this species in Ohio is implied by the range given by Pilsbry but so far I have no records for the State except as a fossil.

Geologic range.—F. C. Baker (1920a, p. 389) gave only "Wabash." Sangamon of Kansas (D. W. Taylor and Hibbard 1955, p. 12); Castalia marl, late Wisconsin (Sterki, 1920, p. 178). Taylor (1960, p. 81) recorded it for the Rexroad local fauna (Pliocene).

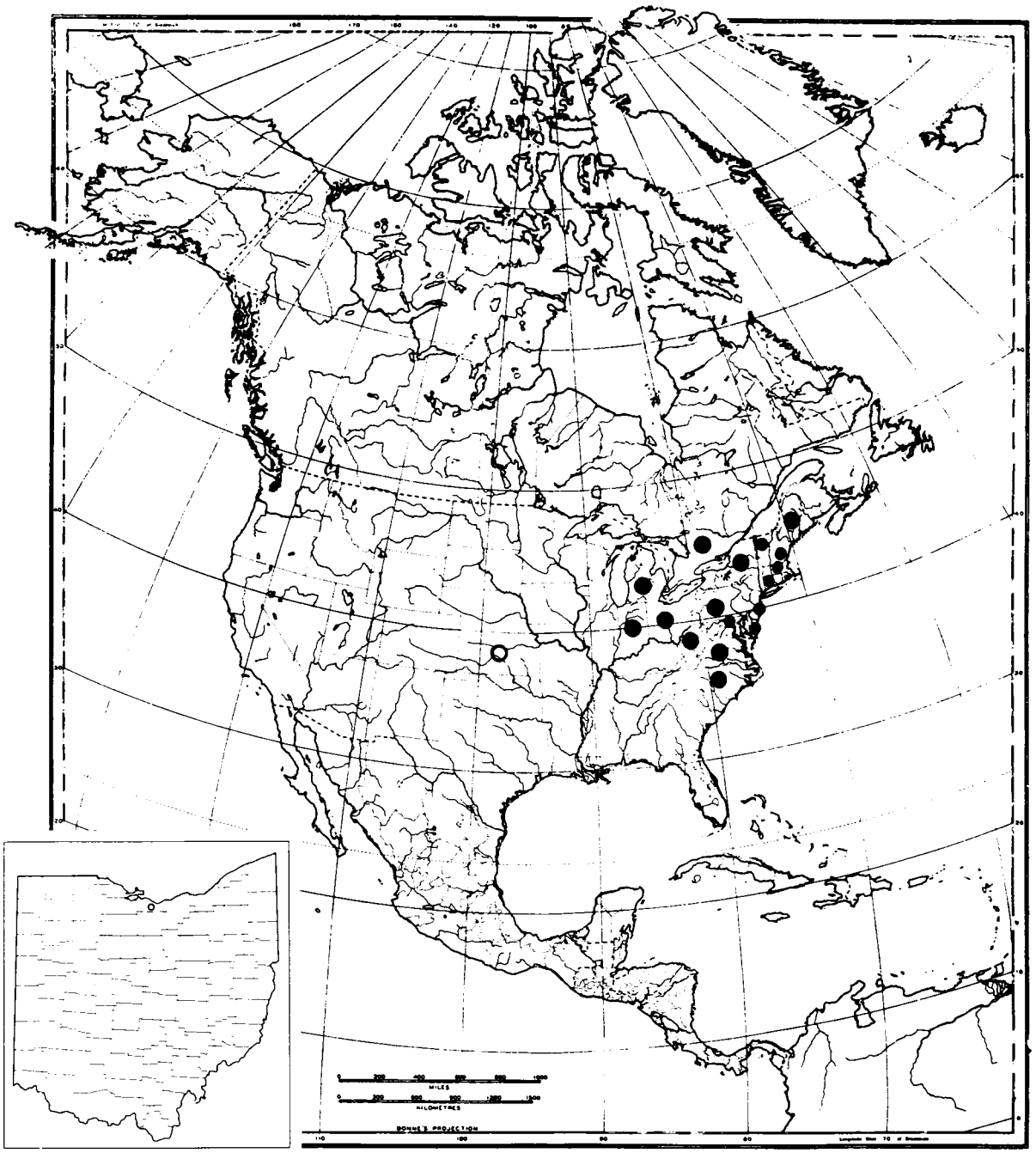

FIGURE 478.—Distribution of *Retinella rhoadsi* in North America; *inset,* distribution in Ohio.

Genus *Nesovitrea* C. M. Cooke 1921

Nesovitrea C. M. Cooke 1921, B. P. Bishop Mus., Occas. Papers, v. 7, p. 271.
Nesovitrea Forcart 1957, Archiv f. Molluskenkunde, v. 8, p. 108.
Nesovitrea Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 147.
Nesovitrea Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 80.

Type.—*Helix pauxilla* Gould 1852.

Diagnosis.—Generic characters distinguishing this from *Retinella* are in the soft parts of the animal. Fossil shells are almost identical, except for specific characteristics.

General distribution.—Holarctic and Hawaiian Islands.

Geologic range.—Late Pliocene to present.

Remarks.—As understood by Forcart (1957, p. 108-110) this genus is divided into two subgenera, *Nesovitrea s.s.* and *Perpolita.* We are concerned here only with the latter.

Subgenus *Perpolita* H. B. Baker 1928

Perpolita "Pilsbry" H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 14, 15.
Perpolita Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 256.
Perpolita Forcart 1957, Archiv f. Molluskenkunde, v. 86, p. 110.

Type.—*Helix hammonis* Ström.

Diagnosis.—"Shell sculpture of growth-wrinkles is nearly uniform, without more widely spaced deeper grooves" (Pilsbry, 1946, p. 256).

General distribution.—Holarctic.

Geologic range.—Late Pliocene to present.

Nesovitrea electrina (Gould) 1841
Pl. 16, figs. 13, 15, 18

Helix electrina Gould 1841, Invert. Mass., p. 183, fig. 111.
?*Vitrea hammonis* Billups 1902, Nautilus, v. 16, p. 51.
?*Hyalina radiatula* Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374, 402.
Vitrea hammonis Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 456.
Retinella electrina H. B. Baker 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 196.
Vitrea hammonis Goodrich 1932, Moll. Mich., p. 28.
Retinella electrina Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 271.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 256.
Retinella hammonis Oughton 1948, Zoögeogr. study, Ontario, p. 26.
Retinella electrina Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 23, pl. 3, figs. 8, 9.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 36, pl. 5, fig. H.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 22, pl. 4, figs. K, M.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 313.
--- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
Nesovitrea (Perpolita) electrina Forcart 1957, Archiv f. Molluskenkunde, v. 86, p. 110.
--- (---) --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 147.
--- (---) --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 80.
Retinella electrina Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 77.

Type locality.—Borders of Fresh Pond, Cambridge, Massachusetts.

Diagnosis.—Shell deeply umbilicate, umbilicus about one-sixth the total diameter of the shell; transparent, with a faint yellow or green tint, glossy; sculpture of crowded radial grooves, wanting on the first whorl, and not reaching the base, which is smooth except for some faint growth wrinkles; microscopic spiral striation wanting or very weak; whorls 3¾ to 4¼, the last convex below; aperture rotund-lunate (modified from Pilsbry, 1946, p. 257).

Ecology.—Taylor (1960) summarized as follows: wooded area, in leaf litter or under logs and bark in wooded spots; woodland habitat, in moist, protected spots among plant debris in wooded area, or associated with dead wood on the flood plain. Oughton (1948, p. 94 ff.) gave: wet locations, abundant in stream drift; margins of ponds, streams, marshes, seeping hillsides, and sandy flats that receive water by percolation. H. B. Baker (1922b) noted that it is most abundant in wet places and lists the following: (22) hardwood spring: near the edge of a patch of hardwoods north of Norway a small swampy spring forms the head of a small brook flowing into Pine Creek; swampy banks with sedges and a few blue flags; (40) virgin hardwoods of Menominee trough; (41) hardwoods on high moraines with fine hardwood cover, particularly in maple logs; (45) alder swamp: tag alder, dogwoods, and a few maples and ash with scanty undergrowth; (46) in and around old stumps and logs in one of the drier alluvial habitats, a clearing near Foster City; (47) stream flats, Hancock Creek, about 2 feet above July water level; (48) Menominee River flood plain, with brush of tag alders, dogwoods,

hazels, and small ashes.

"*Retinella electrina* is an inhabitant of woodlands where it lives in decaying leaves, beneath loosened bark on dead trees and under sticks and fallen logs. It is frequently associated with another woodland snail *(Zonitoides arboreus)* of similar size and superficial appearance. *R. electrina* is common in the woodlands of eastern Kansas, where the annual rainfall is generally more than 35 inches but it declines in frequency of occurrence toward the more arid Plains Border province, and is unknown in the Plains province, even where timber is locally available" (Leonard, 1950, p. 37). Taylor (1960, p. 80) quotes the above and adds: "In northern Nebraska it was found only under dead wood or among leaves on damp ground close to running water."

Associations.—Living: MICHIGAN-20, 25, 26, 27, 33, 34; OHIO-4, 26, 43; ONTARIO-7, 8, 10, 14; WIS-

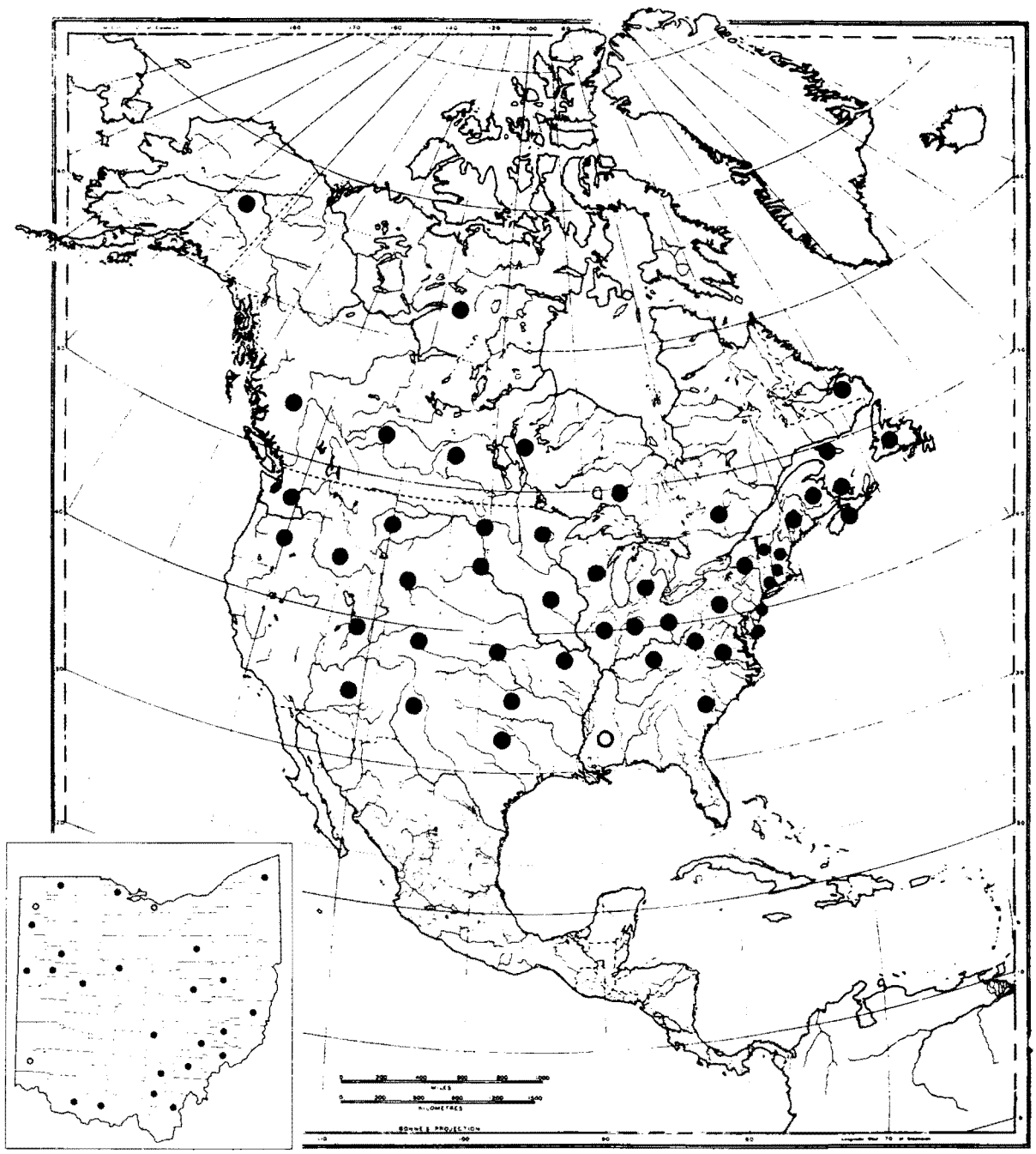

FIGURE 479.—Distribution of *Nesovitrea electrina* in North America; *inset,* distribution in Ohio.

CONSIN-139, 141, 143. Fossil: P-3; N-2; K-2, 6, 9, 13, 14, 15, 18, 19, 20, 21, 23, 24, 26, 27; Y-1; I-3, 5; S-1, 2, 3, 4; W-2, 4, 5, 6, 12, 63, 64, 65, 67, 73.

General distribution (fig. 479).—Labrador and Newfoundland west to Alaska; south to Washington, Arizona, New Mexico, Kansas, Missouri, Illinois, Indiana, Ohio, Virginia, and New Jersey.

Distribution in Ohio (inset, fig. 479).—Sterki (1907a, p. 374) gives "over the state," which is probably correct. Available records (University of Michigan collections, Eggleston, ms. records) are concentrated in the northwestern two-thirds of the State. So far, except for Ashtabula County, I have no records northeast of Lorain, Medina, Summit, Stark, Carroll, Harrison, Belmont, and Monroe Counties.

Geologic range.—F. C. Baker (1920a, p. 389) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash." Aftonian to Recent (A. B. Leonard, 1950, p. 36). Sparingly in Sappa silts, Crete-Loveland sediments, and Tazewellian zone of the Peoria Loess (Leonard, 1952, p. 22); Sangamon of Kansas and probably Illinoian of Oklahoma (D. W. Taylor and Hibbard, 1955, p. 8, 12); pro-Kansan loess of Indiana (Wayne, 1954, p. 1320); "Old Forest bed of the Ohio River" (Billups, 1920b, p. 51); Sangamon? of Indiana (F. C. Baker, 1920b, p. 456); Castalia marl (late Wisconsin) of Ohio (Sterki, 1920, p. 178); late Pliocene to Recent (Hibbard and Taylor, 1960, p. 147).

Nesovitrea binneyana (Morse) 1864
Fig. 480

Hyalina binneyana Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 13, 61, figs. 25, 26; pl. 2, fig. 9, pl. 6, fig. 27.
Vitrea binneyana Dall 1905, Harriman-Alaska Exped., v. 13, p. 39, fig. 27.
Hyalina binneyana Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
Retinella (Perpolita) binneyana H. B. Baker 1930, Acad. Nat. Sci. Philadelphia Proc., v. 82, p. 198.
Vitrea binneyana Goodrich 1932, Moll. Mich., p. 29.
Retinella binneyana Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 259, fig. 127a.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 25.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 23, pl. 3, figs. 12, 13.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 312.
Nesovitrea binneyana Forcart 1957, Archiv f. Molluskenkunde, v. 86, p. 110.
Retinella binneyana Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 76.

Type locality.—Southern Maine.

Diagnosis.—Shell thin, pellucid, nearly colorless, composed of nearly four whorls gradually enlarging; spire slightly elevated; aperture well rounded; umbilicus showing all the volutions; periostracum slightly wrinkled by axial striae, some of them stronger than the others (modified from Morse, 1864).

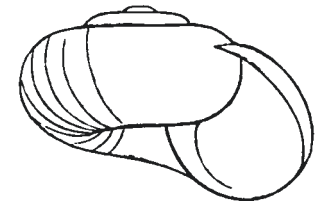

FIGURE 480.—*Nesovitrea binneyana,* magnified; after Morse (1864, p. 61, fig. 25).

Ecology.—Found in damp woodlands, especially those of deciduous trees, but also occasionally in *Sphagnum* bogs, according to Oughton (1948, p. 94 ff.). H. B. Baker (1922b) found it in and around old stumps and logs in one of the drier alluvial habitats studied by him in Dickinson County, Michigan. Lindeborg (1949, Naut. 62, p. 130) found it mainly under logs and stumps and once from moss on a tree trunk and on ferns after rain, in Ontario.

Associations.—Living: MICHIGAN-1, 40; MINNESOTA-1, 2, 3, 4, 5, 7; ONTARIO-7. Fossil: W-56, 57, 58, 59. *N. binneyana occidentalis,* fossil: W-24?

General distribution (fig. 481).—Quebec (Magdalen Islands) west to western Ontario, south to Michigan, Ohio, Pennsylvania, New York, and Maine. The distribution is peculiar in that there are no records for Vermont and New Hampshire on the east or for Wisconsin in the western part of its range. Perhaps this is due to lack of collecting but, if not, some geologic factor may be involved.

Distribution in Ohio (inset, fig. 481).—Tuscarawas County is the only locality accepted by Pilsbry (1946, p. 261); Sterki (1907a) also gave Hamilton County.

Geologic range.—Clark (1961, p. 25) has identified this species for the Castalia deposit, Ohio. Mowery (1961, p. 12) has recorded it for the Jewell Hill deposit, also in Ohio.

Genus *Mesomphix* Rafinesque 1819

Mesomphix Rafinesque 1818, Am. Monthly Mag., v. 4, p. 107, no description.
Mesomphix Rafinesque 1819, Jour. Physique, v. 88, p. 425.
Omphix Pilsbry 1911, Acad. Nat. Sci. Philadelphia Proc., p. 479.
Micromphix Pilsbry 1911, *ibid.*
Mesomphix Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 305.
Mesomphix La Rocque 1953, Cat. Recent Moll. Canada, p. 313.

Type.—*Helix laevigata* Rafinesque *non* Linnaeus =*Mesomphix vulgatus* H. B. Baker 1933.

Diagnosis.—Shell of medium to large size, perforate or umbilicate, heliciform, with flat to low-conoidal spire, of 4½ to 5 whorls, the last ample; opaque, of green, yellow, or brown color; 1½ embryonic whorls either smooth or radially striate; aperture lunate, peristome thin and simple.

General distribution.—Eastern North America from Ontario to Guatemala, in regions of moderate or high humidity, with deciduous forest.

Geologic range.—Doubtfully recorded from the Miocene and Oligocene (Henderson, 1935, p. 156).

Mesomphix inornatus (Say) 1821
Fig. 482

Helix inornata Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 371.
Zonites inornatus Call 1900, Moll. Ind., p. 375, pl. 4,

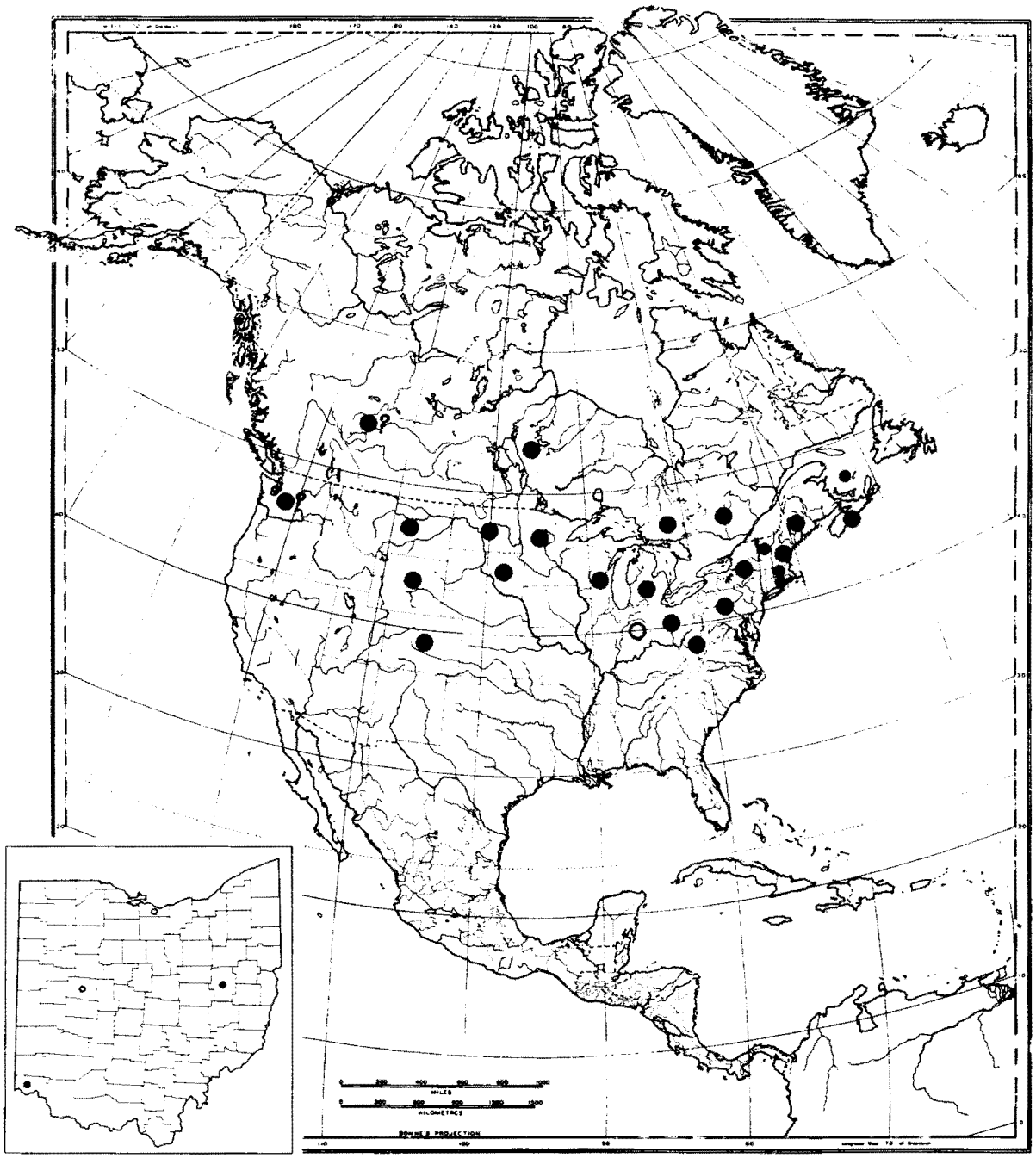

FIGURE 481.—Distribution of *Nesovitrea binneyana* in North America; *inset,* distribution in Ohio.

figs. 14, 15.

Omphalina inornata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.

Mesomphix inornata Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 270.

Mesomphix inornatus Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 307, fig. 153.

Mesomphix inornata Oughton 1948, Zoögeogr. study, Ontario, p. 23.

Mesomphix inornatus Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 26, pl. 2, figs. 8, 9.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 314.

FIGURE 482.—*Mesomphix inornatus*, magnified; after Call (1900, pl. 4, fig. 14).

Type locality.—Pennsylvania.

Diagnosis.—Shell perforate, depressed, with low, convex spire; olive to buff, glossy; weakly sculptured with low, inconspicuous axial striae and very minute papillae in close spiral series or along faint spiral striae; whorls about 5, the last double the width of the preceding, convex below, excavated around the umbilicus; aperture rotund-lunate, lined with a white callus; lip thin, the columellar termination abruptly dilated close to the umbilicus (modified from Pilsbry, 1946, p. 307).

Ecology.—This is a species of damp woodlands, especially those of deciduous trees, according to Oughton (1948, p. 94 ff.), but it is confined to Paleozoic terranes, mainly limestones, in Ontario (Oughton, 1948, p. 89). Muchmore (1959, Naut. 72, p. 85-88) has found it under stones in various woodland areas in New York State.

Ingram (1946, Naut. 59, p. 90) gives the following data: "Individuals were obvious because of their rarity. They were found on the forest floor in maple and beech-hemlock areas. Only half a dozen were collected." These observations apply to the Huyck Preserve, in New York State.

Associations.—Living: OHIO - 22; ONTARIO - 8.

General distribution (fig. 483).—Vermont, Quebec, and Ontario, south to Indiana, Kentucky, Virginia, Maryland, New Jersey, and Massachusetts. Not certainly known for Michigan, all records considered erroneous by Winslow (1926, p. 2).

Distribution in Ohio (inset, fig. 483).—"Cincinnati; Columbus; Portage Co.! (Streator); Cuyahoga Co.! (Allen); Akron (Walker); probably over most parts of the state, but e.g. not found in Tuscarawas Co." (Sterki, 1907a, p. 374). Further records available (Wurtz, 1949, Eggleston, ms. records) are concentrated in the southeastern two-thirds of the State, the limital counties Hamilton, Franklin, Cuyahoga, and Ashtabula, but the species is not recorded for many counties southeast of a line joining these counties. Its absence (subject to correction if further collecting reveals it there) in the northwestern half of the State is noteworthy and would lend support to Winslow's doubt concerning its occurrence in Michigan.

Geologic range.—Unknown.

[*Mesomphix subplanus* (Binney) 1842]

Helix sub-plana A. Binney 1842, Boston Jour. Nat. History, v. 4, pt. 1, p. 3 of cover; also v. 4, p. 241.

Omphalina subplana Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.

Mesomphix subplanus Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 312, fig. 157a-c.

Type locality.—Mountainous region of eastern Tennessee.

Diagnosis.—See Pilsbry (1946, p. 312).

General distribution.—Tennessee and North Carolina.

Distribution in Ohio.—Sterki (1907a, p. 374) is the only writer who has listed this species for Ohio. His record may have been based on an atypical specimen of *Mesomphix inornatus* (Say) with heavier striation than is usual in this species.

Geologic range.—Unknown.

Mesomphix vulgatus H. B. Baker 1933
Fig. 484

Helix laevigata Rafinesque; *Mesomphix laevigatus* Férussac 1821, Tabl. Syst. Fam. Limaçons, p. 41, no. 221, nude name; 1832, Hist. nat. Moll. terr. fluv., pl. 82, fig. 6, expl. pl., p. iv; not *Helix laevigata* Linnaeus 1766.

Omphalina laevigata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.

Mesomphix perlaevis vulgatus H. B. Baker 1933, Mich. Univ. Mus. Zoology, Occas. Papers, no. 269, p. 7; new name for *H. laevigata* Fér. and *H. lucubrata* Binney (not Say).

Mesomphix perlaevus vulgatus Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 270.

Mesomphix vulgatus Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 324, figs. 166a, b.

--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 73.

Type locality.—Kentucky.

Diagnosis.—Shell very narrowly umbilicate, depressed, with low spire; color olive brown or cinnamon brown, the upper surface indistinctly streaked; surface glossy at base and to a varying degree above; finely

and evenly striate, the striae extending over the periphery but fading out on the base, which has low growth wrinkles only; microsculpture of close, minutely papillose spiral threads over this sculpture on the last whorl, threads which on the base are weak or wanting (condensed from Pilsbry, 1946, p. 324).

Ecology.—Found in dry upland woods, under logs (condensed from Daniels, quoted by Pilsbry). In the Warm Springs area of Georgia, Teskey (1955, Naut. 69, p. 70-71) found this species on the grounds of the Foundation hospital, wooded and clogged with undergrowth, and in detritus in crannies of stone walls and rotting timbers of an old mill, Parkman Pond. In the Asheville region of North Carolina, Archer (1935, p. 80) found this species in hardwoods, usually on high banks above the road. It lives in leaf mold and occasionally under rotten logs.

Associations.—Living: OHIO - 22 *(M. perlaevis).*

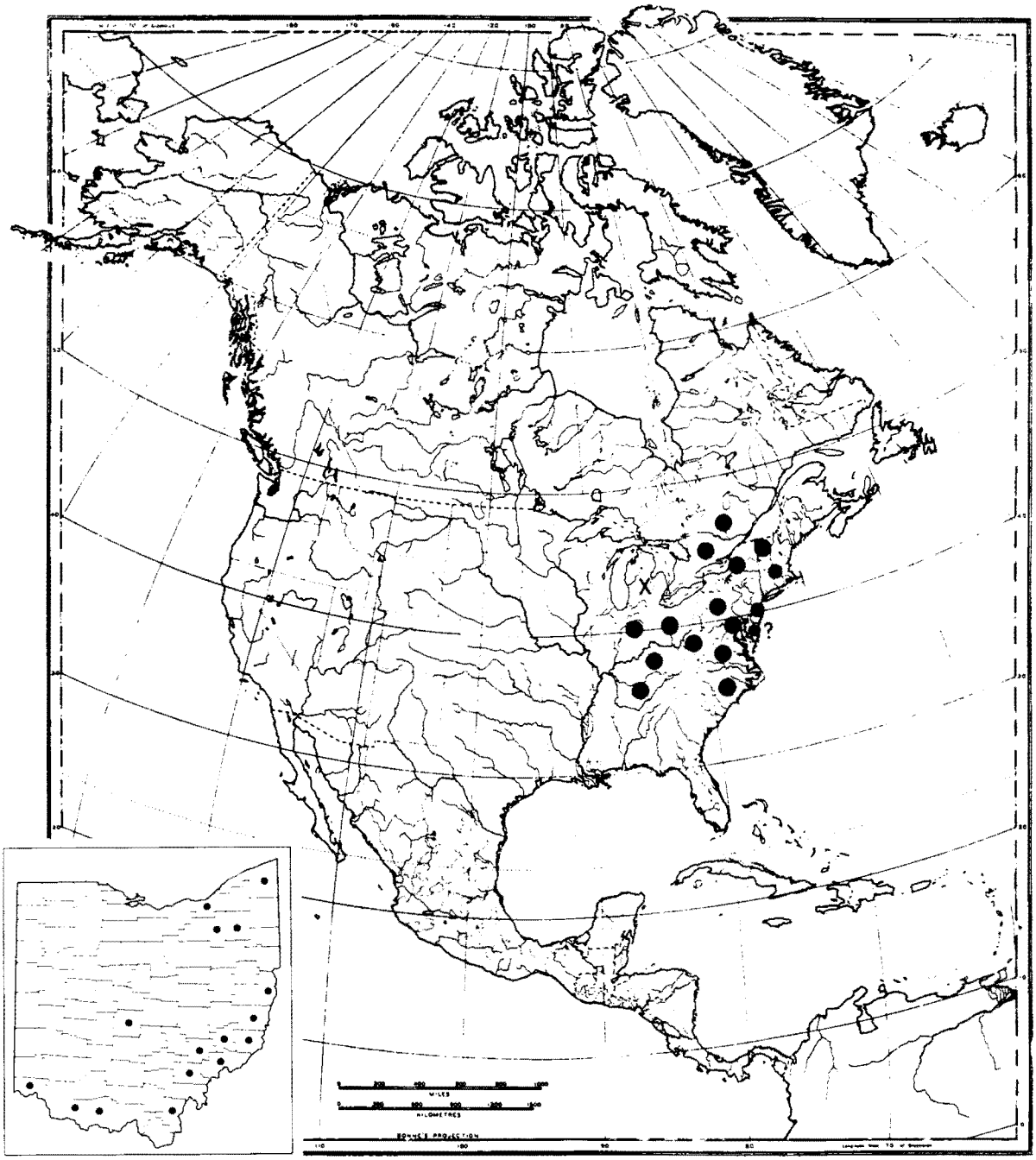

FIGURE 483.—Distribution of *Mesomphix inornatus* in North America; *inset,* distribution in Ohio.

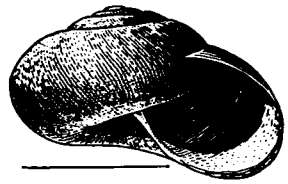

FIGURE 484.—*Mesomphix vulgatus*, magnified; after F. C. Baker (1939a, p. 68).

General distribution (fig. 485).—Pennsylvania and Maryland west to Illinois, south to Missouri, Mississippi, Alabama, Georgia, and Florida.

Distribution in Ohio (inset, fig. 485).—Pilsbry (1946, p. 324) gave Summit and Hamilton Counties. Eggleston (ms. records) confirmed the Hamilton County record and added Monroe County. The Summit County record is based on an identification by A. G. Wetherby and may be incorrect.

Geologic range.—Unknown.

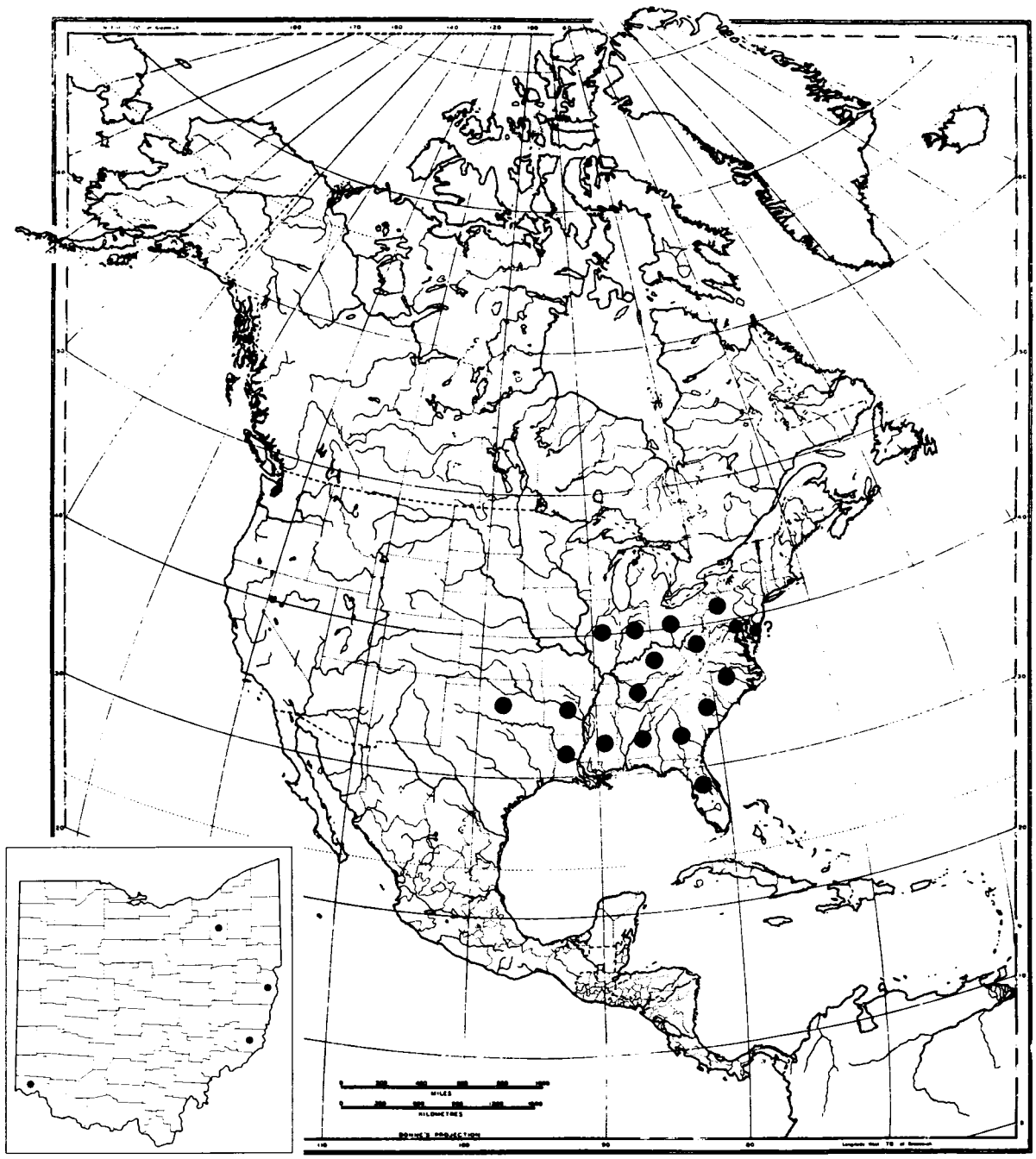

FIGURE 485.—Distribution of *Mesomphix vulgatus* in North America; *inset*, distribution in Ohio.

Subgenus *Omphalina* Rafinesque 1831

Omphalina Rafinesque 1831, Enum. and acct., p. 3.
Omphalina Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 327.

Type.—*Mesomphix (Omphalina) cupreus* (Rafinesque).

Diagnosis.—Shell large, umbilicus wider than in *Mesomphix s.s.* The fundamental differences between the two subgenera are those of the soft parts.

Remarks.—This subgenus is represented in the United States by only four species; the Mexican species, in the eastern and southern parts of that country, are more varied in form and color than those occurring farther north.

Mesomphix friabilis (W. G. Binney) 1857
Fig. 486

Helix friabilis W. G. Binney 1857, Acad. Nat. Sci. Philadelphia Proc., p. 187.
Zonites friabilis Call 1900, Moll. Ind., p. 373, pl. 4, fig. 10.
Omphalina friabilis Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
Mesomphix friabilis Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 270.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 328, fig. 169a-e.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 71.

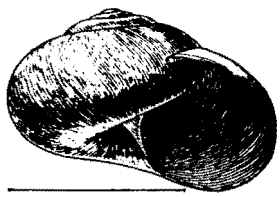

FIGURE 486.—*Mesomphix friabilis*, magnified; after F. C. Baker (1939a, p. 67).

Type locality.—Banks of the Wabash River, Indiana.

Diagnosis.—Shell very globose, transparent, brittle, thin, rarely thick, shining, reddish; spire very short, conic; whorls 5, convex, lightly wrinkled, the last very large and ventricose; apical whorls smooth, polished, whitish-corneous and unworn; aperture circular, bluish within and slightly thickened by a very thin white callus; lip simple, sharp, thin, at its junction with the body whorl violet-colored and reflected, covering part of the small and deep umbilicus, which is about one-twelfth the diameter of the shell; parietal wall of aperture covered with a light violet-colored callus.

Ecology.—Common on the bluffs along the Roanoke River in Pittsylvania County, Virginia (Hubricht, 1953, Naut. 67, p. 23).

General distribution (fig. 487).—Ohio (Hamilton County) west to Kansas, south to Texas, Louisiana, Mississippi, and Alabama.

Distribution in Ohio (inset, fig. 487).—Only one record (Wurtz, 1949), for Hamilton County.

Geologic range.—Laredo, Webb County, Texas (Pilsbry, 1946, p. 330, 331), a single fossil specimen, age unknown, probably late Pleistocene.

Mesomphix cupreus (Rafinesque) 1831
Fig. 488

Omphalina cuprea Rafinesque 1831, Enum. and acct., p. 3.
Helix fuliginosa "Griffith" A. Binney 1840, Boston Jour. Nat. History, v. 3, p. 417, pl. 24.
Zonites fuliginosus Call 1900, Moll. Ind., p. 373, pl. 4, fig. 13.
Omphalina fuliginosa Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Omphalina cuprea Goodrich 1932, Moll. Mich., p. 26.
Mesomphix cupreus Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 270.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 333, fig. 173a-d.
Mesomphix cuprea Oughton 1948, Zoögeogr. study, Ontario, p. 22.
Mesomphix cupreus Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 26, pl. 2, figs. 20, 21.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 313.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 70.

Type locality.—Kentucky.

Diagnosis.—Shell large, umbilicate, the umbilicus one-fifth or one-sixth the diameter of the shell, depressed; tawny olive to honey yellow, indistinctly streaked and generally with some brown rest lines; more or less darker, commonly blackish, near the lip; earliest whorls of adult shell worn, showing the gray or whitish calcareous layer. Surface smooth and glossy beneath, less so above; axial growth wrinkles weak, stronger toward the suture; microscopic sculpture irregular, pebbly, occasionally with ill-defined spiral lines; spire convex; whorls 4½ to 5; aperture rounded, bluish white near the sharp edge of the lip (modified from Pilsbry, 1946, p. 333).

Ecology.—"*Mesomphix cupreus* lives in densely shaded woodland on hillsides, and is usually found partly buried in the damp humus, under a layer of dead leaves. According to Mr. John Walton it feeds upon snails; fully one-third of the specimens found in July were 'devouring shell and animal, sometimes of its own species, but more frequently the young of *Mesodon albolabris, M. thyroides, M. sayii* and *Triodopsis pal-*

liata'" (Pilsbry, 1946, p. 336).

Found in Ontario (Oughton, 1948, p. 94 ff.) in damp woodlands, especially those of deciduous trees, confined to Paleozoic terranes (mainly limestones).

Ingram (1940, Naut. 54, p. 87) has described the daylight activity of *M. cupreus*. The enemies of this species certainly include shrews *(Blarina)*, as recorded at Ithaca, New York, by Ingram (1944, Naut. 57, p. 135). He (1941, Naut. 55, p. 14-15) has found it under stones, on a creek floodplain at the same locality. Muchmore (1959, Naut. 72, p. 85-88) also found it under stones in various woodland areas in New York State. In Tennessee, it occurs in red oak-black oak communities, according to Lutz (1950, Naut. 63, p. 104).

In New York State, in the Huyck Preserve, Ingram (1946, Naut. 59, p. 89-90) gathered the following data: "Individuals were very abundant in pure maple stands; their distribution in other areas was negligible. Data

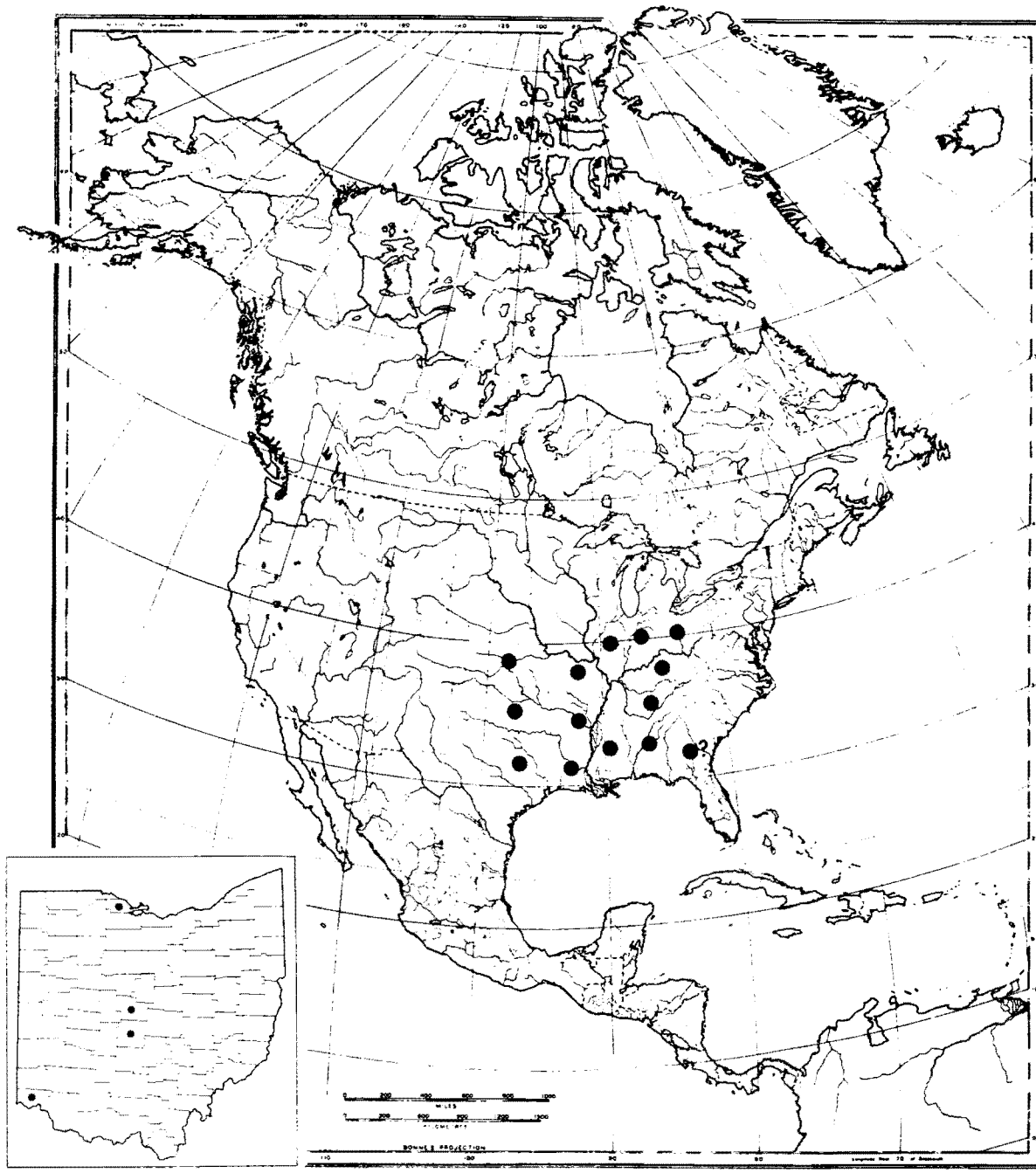

FIGURE 487.–Distribution of *Mesomphix friabilis* in North America: *inset*, distribution in Ohio.

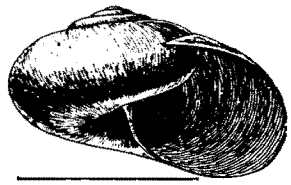

FIGURE 488.–*Mesomphix cupreus*, magnified; after F. C. Baker (1939a, p. 66).

indicates that this species prefers cool areas with a dense overhang. On the preserve the maple area in which they abounded was in a deep gorge; here a stream was present and the maple leaf humus was two to four inches thick. Their typical resting place was beneath such a humus layer in contact with the soil substratum. Specimens were rarely taken from beneath logs. Individuals were almost strictly nocturnal in their

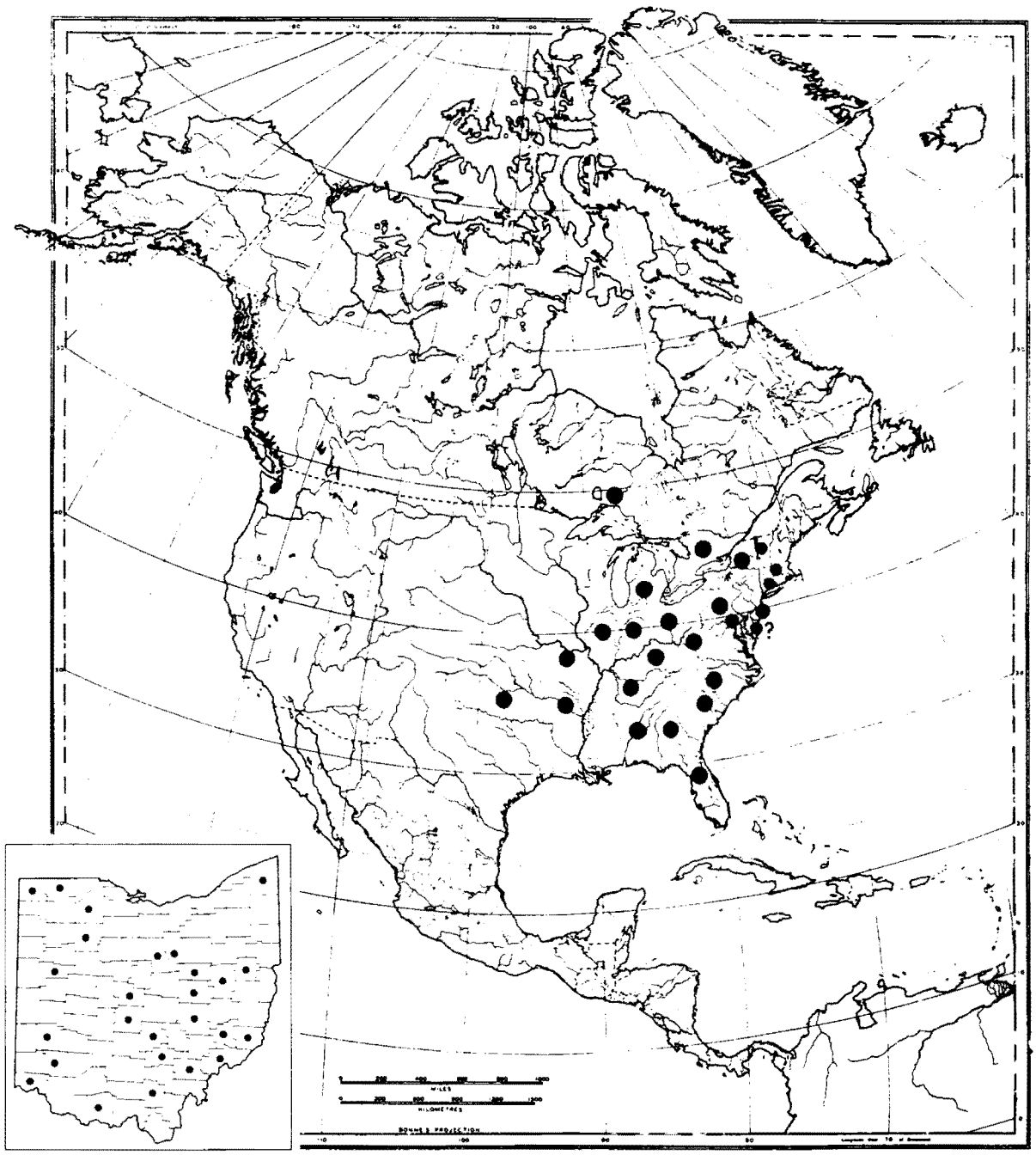

FIGURE 489.–Distribution of *Mesomphix cupreus* in North America; *inset*, distribution in Ohio.

habits, although several were collected moving about during the daylight hours. On the preserve, individuals were found in groups varying from four to six. Their tendency to aggregate was indicated when twenty-six were found in a ten foot square quadrant. In the maple areas this mollusk was the principal snail eaten by the short-tailed shrew and the white-footed deer mouse; here too it fell ready prey to the predatory snail, *Haplotrema concavum* (Say)."

Associations.—Living: OHIO-43.

General distribution (fig. 489).—Massachusetts, Vermont, New York, Ontario, Michigan, Illinois, and Missouri, south to Arkansas, Mississippi, Georgia, and North Carolina.

Distribution in Ohio (inset, fig. 489).—"Over the state" (Sterki, 1907a, p. 374); Eggleston (ms. records) has it from Ashtabula and Wood Counties in the northern part of the State and from Monroe, Washington, Adams, and Hamilton Counties in the south, as well as from other counties in the central part of the State; the University of Michigan records are for Williams, Fulton, and Auglaize Counties, confirming Sterki's statement.

Geologic range.—F. C. Baker (1920a, p. 389) gives only "Wabash."

Genus *Paravitrea* Pilsbry 1898

Paravitrea Pilsbry 1898, Nautilus, v. 11, p. 130.
Taxeodonta Pilsbry 1898, *ibid.*, p. 132.
Paravitreops H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 29.
Pectovitrea H. B. Baker 1931, Acad. Nat. Sci. Philadelphia Proc., v. 83, p. 97.
Parmavitrea H. B. Baker 1931, *ibid.*
Petrovitrea H. B. Baker 1931, *ibid.*
Paravitrea Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 349.
Paravitrea La Rocque 1953, Cat. Recent Moll. Canada, p. 314.

Type.—*Helix capsella* Gould.

Diagnosis.—Shell depressed or discoidal, umbilicate or perforate, thin, polished, with radial grooves or lines of growth; of numerous, closely coiled whorls parted by a superficial suture; internally with basopalatal radial rows of pairs of teeth or radial barriers, commonly recurring at intervals, and developed chiefly in the neanic stage, generally reduced or wanting in adults or wanting at all stages of growth; no parietal or columellar lamellae; lip thin and simple.

General distribution.—Eastern United States and Canada. This is mainly an Appalachian genus but it has spread westward across the Mississippi into the Ozark-Ouachita region.

Geologic range.—Cretaceous (Henderson, 1935, p. 156) to present. Pleistocene records rare.

Subdivisions.—H. B. Baker (1931) recognizes several subgenera and sections, mainly on the basis of anatomical characters. He gives a key, reproduced by Pilsbry (1946, p. 350), and Pilsbry in turn gives a key to the species. According to Baker's system, the Ohio species may be grouped as follows:

Subgenus *Paravitrea s.s.*
Section *Paravitrea s.s.: P. capsella*
Section *Paravitreops* H. B. Baker: *P. multidentata, P. lamellidens.*

Paravitrea multidentata (Binney) 1840
Fig. 490

Helix multidentata A. Binney 1840, Boston Soc. Nat. History Jour., v. 3, p. 425, pl. 22, fig. 5.
Hyalina multidentata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
Paravitrea multidentata lamellata H. B. Baker 1929, Nautilus, v. 42, p. 88.
Vitrea multidentata Goodrich 1932, Moll. Mich., p. 29.
Paravitrea multidentata Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 271.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 352, figs. 184, 6, 6a; 185 (part).
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 24.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 27, pl. 2, figs. 34, 35.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 314.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 75.

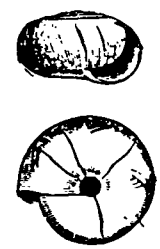

FIGURE 490.—*Paravitrea multidentata,* magnified; after Walker (1928, p. 89, fig. 121).

Type locality.—Eastern slopes of Green Mountains, Vermont (Pilsbry, 1946, p. 354).

Diagnosis.—"Shell depressed, sub-planulate above, very thin, pellucid; epidermis smooth, shining; whorls six, narrow, slightly convex, increasing but slowly in diameter, lines of growth hardly visible; suture impressed; aperture semi-lunate, narrow; lip acute; umbilicus very small, rounded, not exhibiting any of the volutions; base convex, indented around the umbilicus. Two or more rows of very minute, white teeth, radiating from the umbilicus, are seen through the shell, within the base of the last whorl. Greatest transverse diameter one-eighth of an inch" (A. Binney, quoted by Pilsbry, 1946, p. 354).

Ecology.—Oughton (1948, p. 94 ff.) listed this spe-

cies from damp woodlands, especially those of deciduous trees. Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. Archer (1934c, p. 138) noted that it was found by Goodrich on the guard rails of steps descending from the bluff at Arch Rock on the east side of Mackinac Island, Michigan.

Associations.—Living: OHIO-43.

General distribution (fig. 491).—Maine, Quebec, Ontario, and Michigan, south to Arkansas, Mississippi, and North Carolina.

Distribution in Ohio (inset, fig. 491).—Sterki (1907a, p. 374) gave Summit, Portage, Tuscarawas, and Hamilton Counties. Of these, Pilsbry (1946, p. 354) accepted only Portage County, but added Licking County. Eggleston (ms. records) had it from Adams, Washington, and Monroe Counties.

Geologic range.—Unknown.

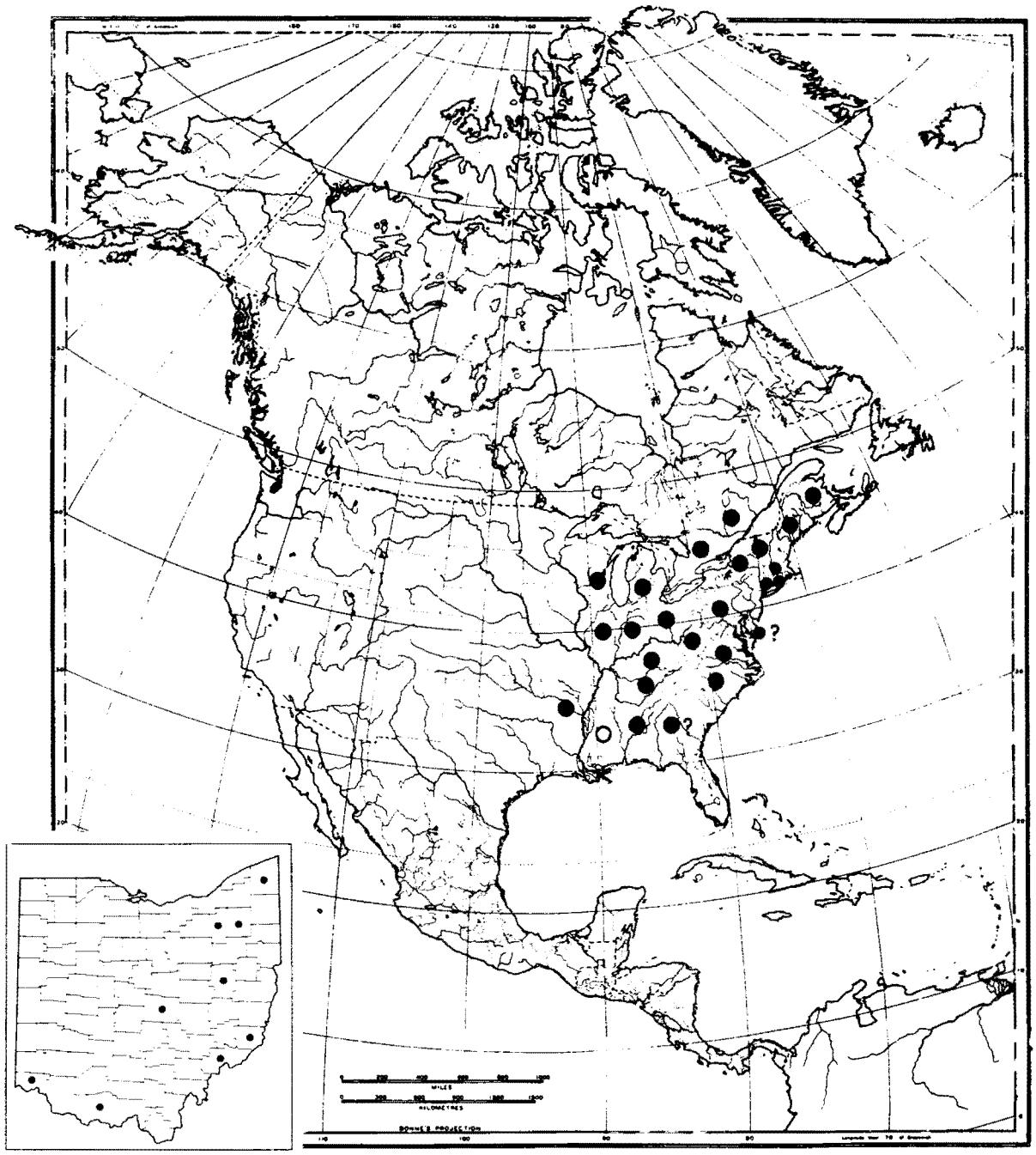

FIGURE 491.—Distribution of *Paravitrea multidentata* in North America; *inset,* distribution in Ohio.

[*Paravitrea lamellidens* (Pilsbry) 1898]

Gastrodonta lamellidens Pilsbry 1898, Nautilus, v. 11, p. 134.
Hyalina lamellidens Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
Paravitrea (Paravitreops) lamellidens H. B. Baker 1931, Acad. Nat. Sci. Philadelphia Proc., v. 83, p. 102, pl. 17, figs. 1-3.
Paravitrea lamellidens Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 358, figs. 184, nos. 2, 3, 3a, 3b; 185, nos. 1, 13, 15, 17, 18.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 25.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 314.

Type locality.—Thunderhead Mountain, Blount County, Tennessee.

Diagnosis.—Shell depressed, with low conoid spire of many closely coiled whorls, and rounded periphery; umbilicate, the umbilicus about one-eighth to one-tenth the diameter of the shell; cinnamon-buff, darker when fresh; surface glossy; the first whorl smooth; later whorls closely, regularly, and strongly striate above, weakly on the periphery and below; aperture narrowly lunate, the lip thin, dilated close to the columellar insertion; interior of last whorl with one to three white, curved, obliquely protractive radial teeth on the outer and adjacent basal walls (modified from Pilsbry, 1946, p. 358).

Ecology.—Winslow (1921, Naut. 35, p. 43) has collected this snail in the Pisgah Forest of North Carolina, under moss on a beech stump in the Pink Beds, a wide valley covered with a dense growth of rhododendron and laurel (hence the name) in Transylvania County, in the drainage basin of the French Broad River.

General distribution (fig. 492).—Tennessee and North Carolina.

Distribution in Ohio.—Recorded by Sterki (1907a, p. 374) for Portage County, probably in error. His specimens should probably be identified as *Paravitrea multidentata lamellata* H. B. Baker, which Pilsbry (1946, p. 357) regards as "a sporadic variant, not a real race or subspecies."

Geologic range.—Unknown.

Paravitrea capsella (Gould) 1851
Fig. 493

Helix rotula Gould 1848, Boston Soc. Nat. History Proc., v. 3, p. 38, not of Lowe, 1833.
Helix capsella Gould 1851, *in* A. Binney's Terr. Moll., v. II, p. 239, pl. 29a, fig. 1.
Paravitrea capsella H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 29, pl. 6, figs. 4-7.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 271.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 374, fig. 195a, b.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 74.

Type locality.—Tennessee.

Diagnosis.—"Shell quite small, planorboid, pellucid, glistening, amber-colored. Spire nearly plane, composed of about six and a half closely revolving, flattened whorls. Surface with distant, impressed, radiating striae. Suture margined. Aperture narrow, semilunar, lip simple, not thickened by callus within. Base perforated by a deep, rather small, funnel-shaped umbilicus. Diameter one-fifth of an inch; axis one-tenth of an inch" (Gould, quoted by Pilsbry, 1946, p. 374).

Ecology.—In Virginia, found on the bluffs along the Roanoke River, Pittsylvania County (Hubricht, 1953, Naut. 67, p. 23).

General distribution (fig. 494).—Virginia, West Virginia, Ohio, Indiana, and Illinois, south to Alabama and North Carolina.

Distribution in Ohio (inset, fig. 494).—Adams, Fairfield, and Warren Counties.

Geologic range.—Unknown.

Genus *Hawaiia* Gude 1911

Hawaiia Gude 1911, Malac. Soc. London Proc., v. 9, p. 272.
Pseudovitrea H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 24, 25.
Pseudohyalina Morse, in part, and of some later authors.
Hawaiia Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 418.
Hawaiia La Rocque 1953, Cat. Recent Moll. Canada, p. 315.

Type.—*Helix Kawaiensis* Pfr. (=*Helix minuscula* Binney).

Diagnosis.—Shell thin, light colored, openly umbilicate, depressed, with low convex spire of 4 to 5 whorls, the last tubular; sutures well impressed; aperture broadly rotund-lunate, the peristome thin.

General distribution.—Alaska and Maine, southward to Costa Rica and the West Indies, westward to Mexico, Arizona, and southern California. Widely introduced in the Pacific Islands, Japan, and Europe.

Geologic range.—Lower Pliocene to Recent (A. B. Leonard, 1950, p. 36).

Hawaiia minuscula (Binney) 1840
Pl. 16, figs. 4, 7, 10

Helix minuscula A. Binney 1840, Boston Jour. Nat. History, v. 3, p. 435 (1841?), pl. 22, fig. 4.
Helix minutalis Morelet 1851, Test. Noviss., v. 2, p. 7.
Helix Kawaiensis Pfeiffer 1855, Zool. Soc. London

Proc. 1854, p. 52.

Zonitoides minusculus Dall 1905, Harriman-Alaska Exped., v. 13, p. 43.

--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.

--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.

Pseudovitrea minuscula Ahlstrom 1930, Nautilus, v. 44, p. 45.

Zonitoides minusculus Goodrich 1932, Moll. Mich., p. 32.

Hawaiia minuscula Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 271.

--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 420, fig. 228a, b; 229, nos. 1-3.

--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 22.

--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 27, pl. 3, figs. 10, 11.

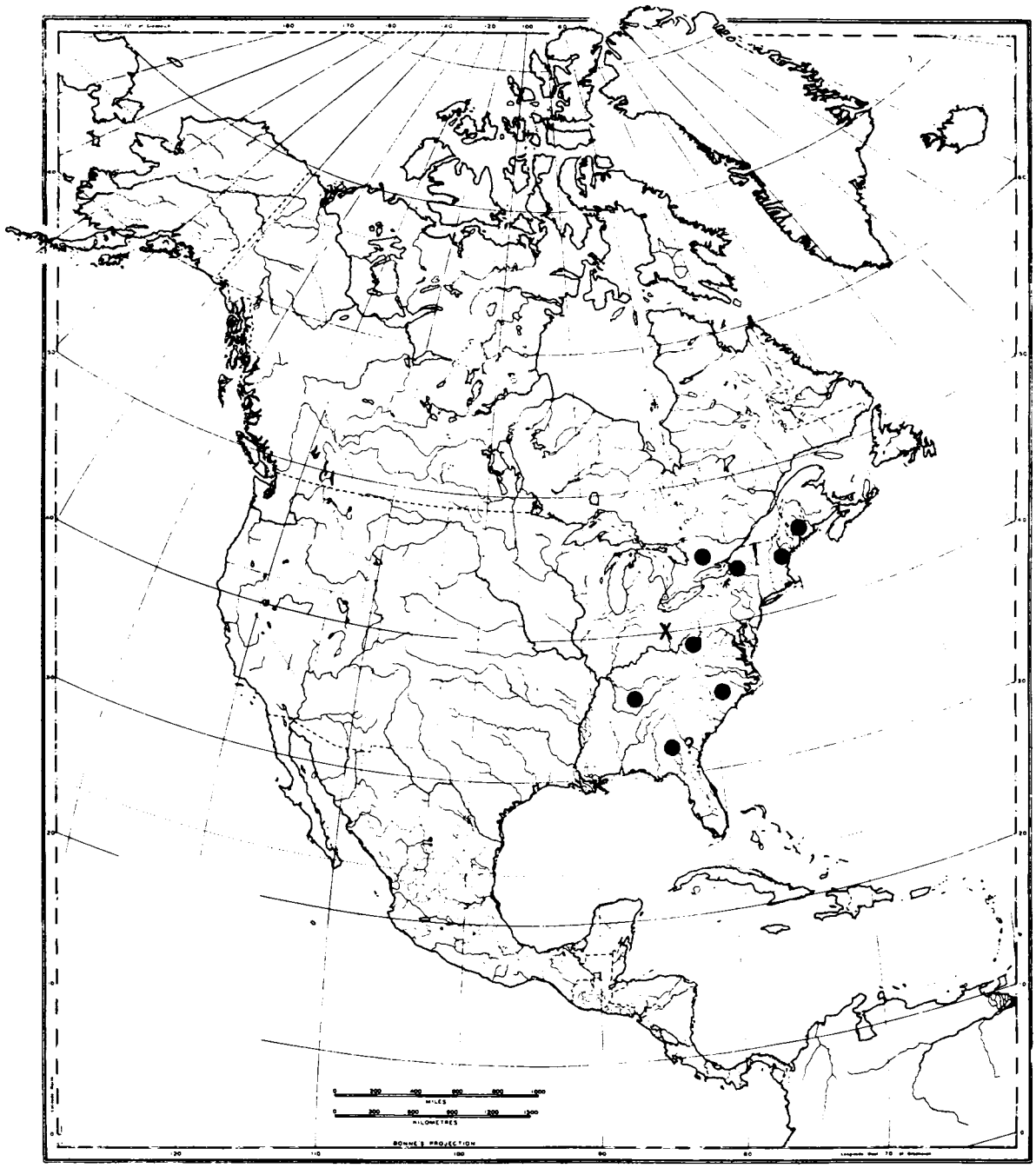

FIGURE 492.—Distribution of *Paravitrea lamellidens* in North America.

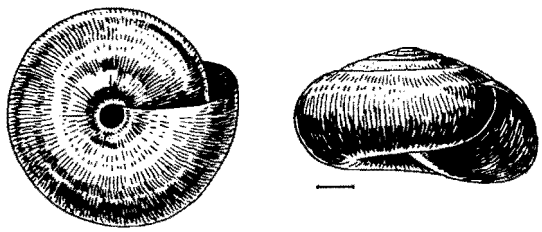

FIGURE 493.–*Paravitrea capsella*, magnified; after F. C. Baker (1939a, p. 74, upper two figs.).

Hawaiia minuscula Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 36, pl. 5, fig. A.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 20, pl. 4, figs. E-F.
--- --- La Rocque 1952, Moll. Orleton site, p. 12 ff.
--- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 315.
--- --- La Rocque and Forsyth 1957, Sidney Cut, p. 85 ff.

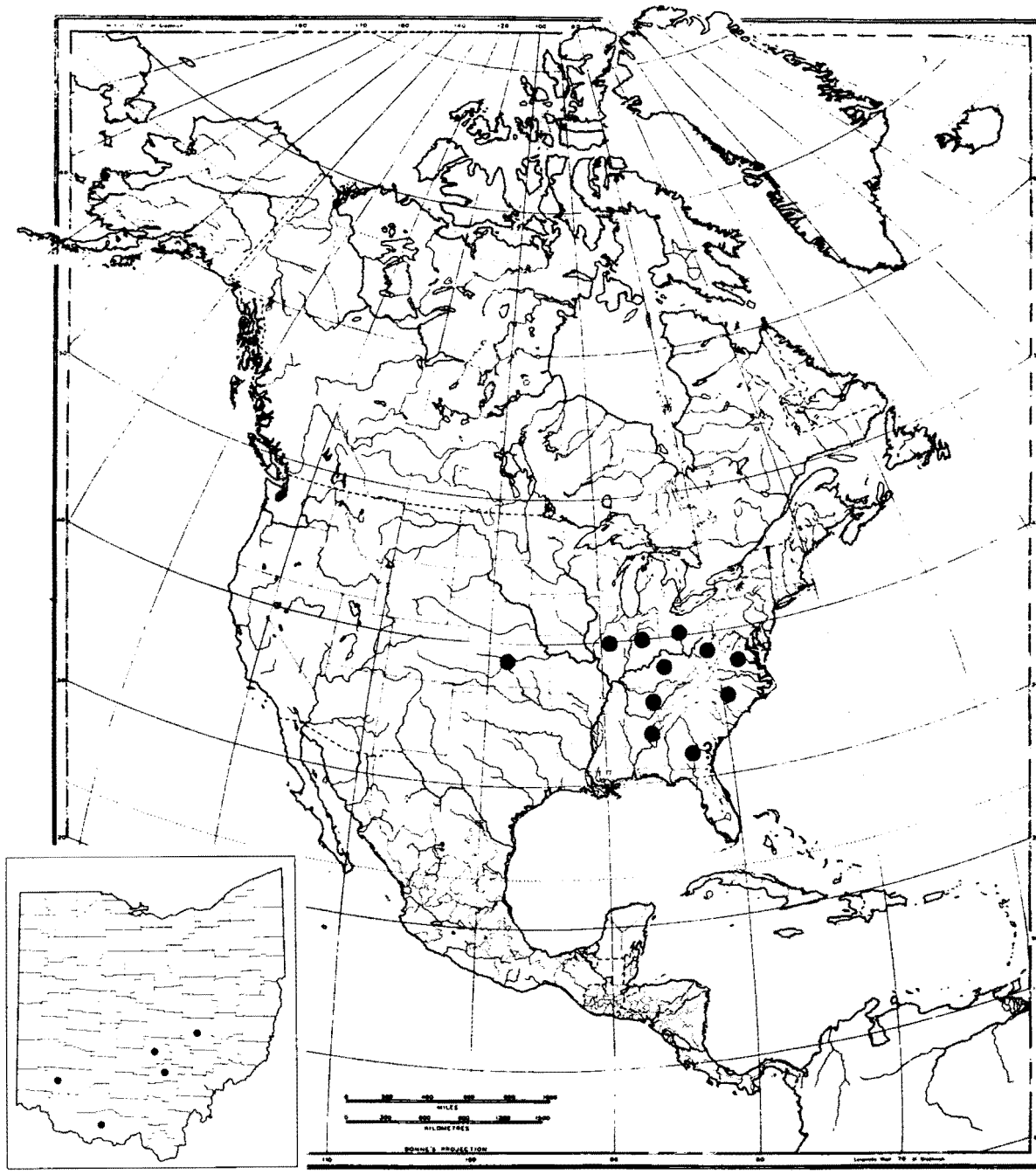

FIGURE 494.–Distribution of *Paravitrea capsella* in North America; *inset*, distribution in Ohio.

Hawaiia minuscula Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 148.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 81.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 69.

Type locality.—Ohio (Pilsbry, 1946, p. 423, footnote).

Diagnosis.—Shell minute, umbilicate, the umbilicus about one-third the diameter of the shell; depressed, the spire low, convex; thin; pale gray, commonly flesh colored above, from the contained soft parts; whorls 4, strongly convex, slowly widening, the last tubular; embryonic whorl smooth, the rest distinctly, unevenly striate above, nearly smooth beneath; spiral lines wanting or quite indistinct; aperture rounded, the height and width about equal (modified from Pilsbry, 1946, p. 421).

Ecology.—Oughton (1948, p. 94 ff.) has recorded this species in Ontario from wet locations such as floodplains of creeks and rivers, a preference which may influence its widespread occurrence. He has also pointed out that in Ontario it is confined to Paleozoic terranes (mainly limestones). In the Asheville region of North Carolina, Archer (1935, p. 79) noted that it "occurs rarely in grass and under stones ... also found in honeysuckles."

Burch (1955, Naut. 69, p. 66) has shown its relationships to soil factors in eastern Virginia. Muchmore (1959, Naut. 72, p. 85-88) collected it under stones in various woodland areas in New York State. Rehder (1949, Naut. 62, p. 125) found it common under boards and around planks near the boardwalk, Myrtle Beach, South Carolina. In Virginia, Hubricht (1953, Naut. 67, p. 24) found it on waste ground in Danville, probably introduced. In Virginia (Burch, 1954, Naut. 68, p. 32) it occurs along the James River lowlands in the eastern part of Henrico County and around the masonry of a church. Grimm (1959, Naut. 72, p. 124) found it in leaf litter along railroad tracks, around foundations of an old burned house, and under wet sandstone, in a field.

Associations.—Living: MICHIGAN-22, 25, 28, 32, 33, 34, 39; MINNESOTA-3; OHIO-1, 4, 29, 43; ONTARIO-11. Fossil: P-1, 2, 3, 4; N-1, 2; A-1; K-1, 4; Y-2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20; I-3; S-1, 2, 3, 4, 5, 6; W-2, 3, 4, 5, 8, 9, 15, 17, 20, 21, 22, 23, 28, 35, 44, 47, 56, 57, 58, 59, 60, 63.

General distribution (fig. 495).—Alaska, Northwest Territories of Canada, and Newfoundland, south to Mexico, Central America, and the West Indies. Sparsely distributed in the Rocky Mountain states. Pilsbry (1946, p. 423) thinks that the California record may be due to introduction with plants.

Distribution in Ohio (inset, fig. 495).—Tuscarawas County (Sterki, 1907a, p. 373). Other records (Eggleston, ms. records; University of Michigan collections) indicate general distribution over the State.

Geologic range.—F. C. Baker (1920a, p. 389) gave Aftonian, Yarmouth, Peorian, and "Wabash." Lower Pliocene to Recent (A. B. Leonard, 1950, p. 36); widely distributed as a Pleistocene fossil in Iowa, Nebraska, Kansas, Oklahoma, and Texas. Hibbard and Taylor (1960, p. 148) gave late Miocene to Recent. In Ohio, it is abundant in the Castalia marl (late Wisconsin) according to Sterki (1920, p. 178), confirmed by later collecting; in the Orleton deposit (late Wisconsin) (La Rocque, 1952, p. 12 ff.); in Farmdale? loess of the Cleveland region (Leonard, 1953, p. 372 ff.); and in the Sidney Cut deposits (early Wisconsin) (La Rocque and Forsyth, 1957, p. 85 ff.). Zimmerman (1960, p. 20) recorded it for the Newell Lake deposit, and Mowery 1961, p. 12) for the Jewell Hill deposit, both in Ohio.

Subfamily GASTRODONTINAE Tryon 1866

Gastrodontinae Tryon 1866, Am. Jour. Conchology, v. 2, p. 242.
Gastrodontinae Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 233, 425.

Diagnosis.—Shell as in Zonitinae, toothed in many species; a dart apparatus developed on the male side (absent in some minute forms); a duct from penial sheath to oviduct, or the spermathecal duct; outer marginal teeth of radula unicuspid.

Remarks.—The subfamilial characteristics reside in the soft parts of the animal but Pleistocene species can be identified by comparison with living forms and therefore placed in their correct position in classification.

Subdivisions.—The subfamily includes six genera of relatively small size, three of them with an armature of teeth within the body whorl, the other three without teeth. Some of these (*Clappiella,* some species of *Ventridens*) are restricted in distribution but others, *e.g., Striatura* and *Zonitoides,* are among the most widespread snails in North America.

Genus *Gastrodonta* Albers 1850

Gastrodonta Albers 1850, Die Heliceen, p. 88.
Gastrodonta Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 427.

Type.—*Helix interna* Say.

Diagnosis.—Shell perforate, conic, with convex base, of about 8 whorls, very closely coiled, the first two microscopically granulose, the rest with regular, close retractive riblets above, the base smooth; aperture narrowly lunar, obstructed by two teeth on a callous ridge of two teeth each, at intervals of a fourth of a whorl, the innermost series absorbed when a new

one is formed.

General distribution.—Southern Indiana and Ohio to Alabama.

Geologic range.—One early Tertiary and one Miocene species are referred to the genus (Henderson, 1935, p. 156, 157). Pilsbry (1946, p. 427 ff.) mentioned no Pleistocene record although *Gastrodonta interna,* a species with considerable northward extension, should be found in deposits of this age.

Gastrodonta interna (Say) 1822
Fig. 496

Helix interna Say 1822, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 155.

Zonites (Gastrodonta) internus Call 1900, Moll. Ind., p. 377, pl. 4, fig. 17.

Gastrodonta interna Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.

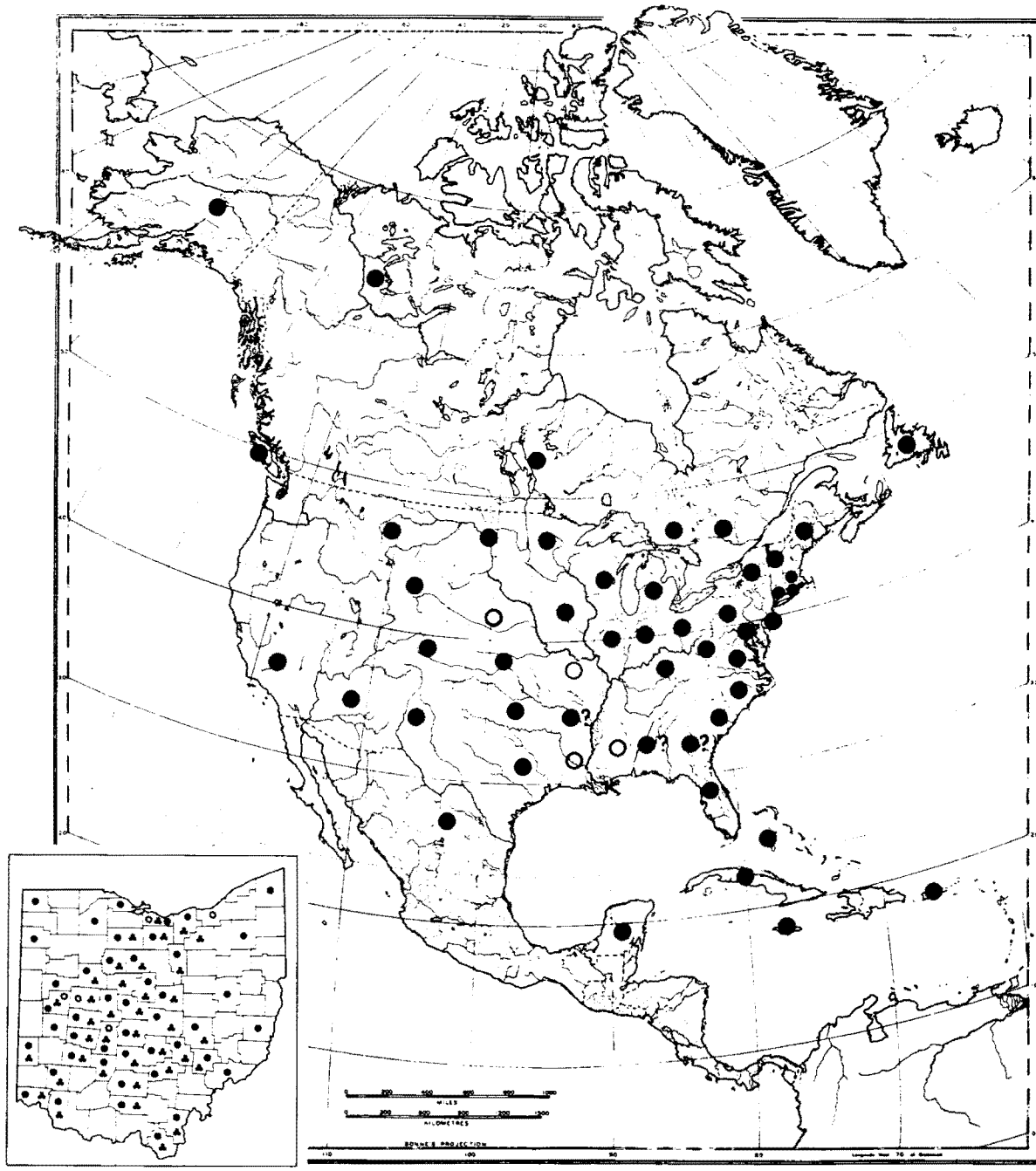

FIGURE 495.—Distribution of *Hawaiia minuscula* in North America; *inset,* distribution in Ohio.

Gastrodonta interna Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 272.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 428, fig. 230.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 67.

FIGURE 496.—*Gastrodonta interna*, magnified; after Call (1900, pl. 4, fig. 17).

Type locality.—Cincinnati, Ohio, selected by Pilsbry (1946, p. 430).

Diagnosis.—Shell minutely perforate, depressed, with convexly conic or dome-shaped spire of about 8 to 9 closely coiled whorls; central part of the base strongly impressed around the perforation; color cinnamon brown or a paler tint and with little gloss above, the base polished and some tint of buff or pale brown; first 1½ whorls smoothish, the rest with regular retractive curved riblets separated by spaces of about twice their width, extending to the periphery, the base with faint, fine growth striae only; aperture narrow, obstructed by two teeth in the basal margin, standing on a callous ridge, the inner tooth tubercular, the outer either tubercular or compressed laterally; lip either sharp or a little blunt (modified from Pilsbry, 1946, p. 429).

Ecology.—In the Asheville, North Carolina, region, Archer (1935, p. 80) found it in hardwoods, "... the most common and universally distributed zonitid in this locality. It is of great importance as an indicator of former fires, for it is favored by fires, and appears as one of the species of the fire succession group, is common under charred logs, and is as equally at home in oak-pine woods as it is in oak-logs. In pastures it may be found in considerable numbers under logs or rotten planks in company with *Zonitoides elliotti* and *Polygyra rugeli.*" Teskey (1955, Naut. 69, p. 70-71) recorded it from forest on a slope at the base of Pine Mountain fire tower, in the Warm Springs area of Georgia.

General distribution (fig. 497).—Southern Indiana, Ohio, and West Virginia, south to Alabama, Georgia, and North Carolina.

Distribution in Ohio (inset, fig. 497).—Sterki (1907a, p. 373) and Pilsbry (1946, p. 429) gave only Columbus (Franklin County) and Cincinnati (Hamilton County). It should be found at least in the southwestern part of the State.

Geologic range.—Unknown.

Genus *Ventridens* W. G. Binney 1863

Ventridens W. G. Binney 1863, Smithsonian Misc. Coll., unnumbered pamphlet, p. 9; see Pilsbry (1946, p. 434) on valid publication of this pamphlet.
Mesomphix Tryon 1866, Am. Jour. Conchology, v. 2, p. 254, not of Rafinesque.
Ventridens Pilsbry 1948, Land Moll. N. America, v. 2, pt. 1, p. 434.
Ventridens La Rocque 1953, Cat. Recent Moll. Canada, p. 315.

Type.—"*Zonites (Ventridens) suppressa* Say."

Diagnosis.—Shell subperforate or umbilicate, biconvex or with conic spire, yellow or brown, glossy or dull, obliquely striate, composed of 5 to 8 whorls; aperture lunate, the lip simple, acute; last whorl with a white callous deposit or one or more lamellar teeth near the aperture within the basal wall; the callus or laminae when present are found in the young shell, and are continuous in development; they are absorbed behind and grow in front as the shell increases in size.

General distribution.—Eastern United States and Canada (Ontario). The species is especially characteristic of the Appalachian mountain system; but a few forms occur west to the Ozark-Ouachita region, and in northeastern Texas.

Geologic range.—Several Cretaceous and Tertiary species have been referred to *Ventridens* but none of them has been shown to possess teeth or laminae. Pilsbry (1948, p. 436) lists them but does not accept them as members of the genus *Ventridens*.

Ventridens suppressus (Say) 1829
Fig. 498

Helix suppressa Say 1829, New Harmony Disseminator, v. 2, p. 229.
Zonites suppressus Sterki 1893, Nautilus, v. 7, p. 14.
Gastrodonta suppressa Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.
--- --- Goodrich 1932, Moll. Mich., p. 34.
Ventridens suppressus Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 438, fig. 235a-e.
Gastrodonta suppressa Oughton 1948, Zoögeogr. study, Ontario, p. 21.
Ventridens suppressus La Rocque 1953, Cat. Recent Moll. Canada, p. 316.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 88.

Type locality.—Germantown, Pennsylvania.

Diagnosis.—Shell subglobose, depressed, umbilicate, the umbilicus about one-eighth the diameter of the shell; pale horn color, polished, somewhat pellucid; retractive striation rather coarse below the suture, or like quite low folds, elsewhere fine and indistinct; on the base, near the umbilicus, more or less distinct but superficial spiral striae; body whorl opaque whitish near the aperture; whorls 6, spire convex; aperture sublunate, narrower beneath; within, a prominent tooth near the base, distant from the margin; in earlier stages, as many as four other, smaller teeth; lip simple (modified from Say and from Pilsbry, 1946, p. 438).

Ecology.—In Maryland, Grimm (1959, Naut. 72, p. 124) found this species in leaf litter along railroad tracks, in woods, in a marble quarry, and in ruins of a building. In Virginia, Hubricht (1953, Naut. 67, p. 24) found it in the hills in the northwestern part of Pittsylvania County. Archer (1935, p. 80-81) recorded it for hardwoods, almost entirely confined to the grassy area around sumacs, in the Asheville, North Carolina, region; it lives deep down in the grass, completely hidden from view. Its mating habits are described by Webb (1948, p. 453-461). Burch (1954, Naut. 68, p. 32) has found the form *magnidens* generally distributed over Henrico County, Virginia, but not altogether common. It has been found in a variety of habitats from under hardwood logs to around stone masonry in urbanized areas. The same author (1955, Naut. 69, p. 66) has shown the relationships of this form to soil factors in eastern Virginia.

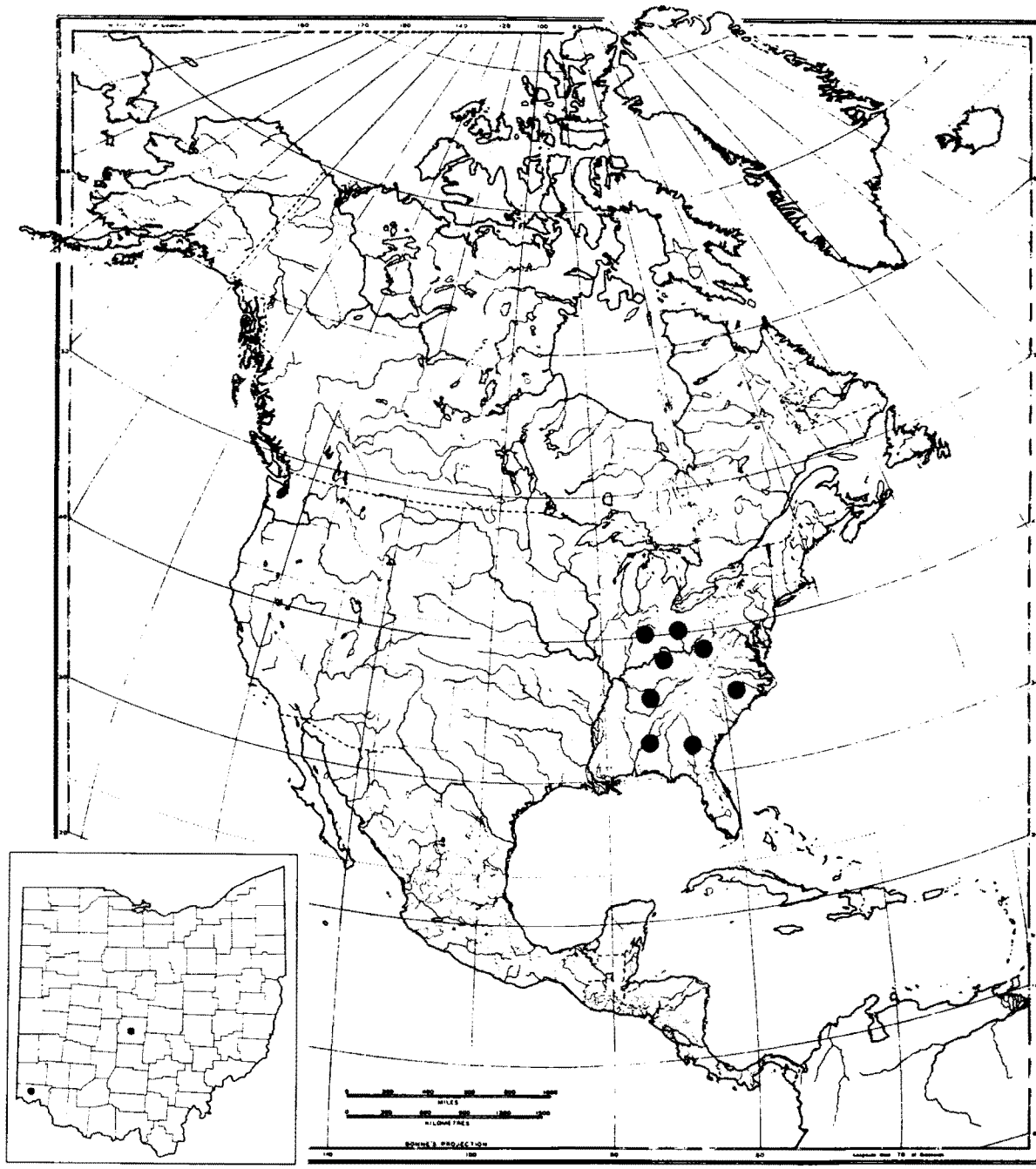

FIGURE 497.—Distribution of *Gastrodonta interna* in North America; *inset,* distribution in Ohio.

FIGURE 498.—*Ventridens suppressus*, magnified; after Walker (1928, p. 106, fig. 153).

Associations.—Living: MICHIGAN-25, 27, 28, 32, 33; OHIO-43.

General distribution (fig. 499).—New York, Ontario, and Michigan, south to Kentucky, West Virginia, and Virginia. Named forms or races (see Pilsbry, 1946, p. 440 ff.) range as far south as Alabama and North Carolina.

Distribution in Ohio (inset, fig. 499).—Portage, Tuscarawas, and Hamilton Counties, probably over most of the State, according to Sterki (1907a, p. 373). Pilsbry (1946, p. 439) adds Columbiana County. Eggleston (ms. records) has specimens from Athens and Washington Counties. These records give the impression that the species lived just to the south of the

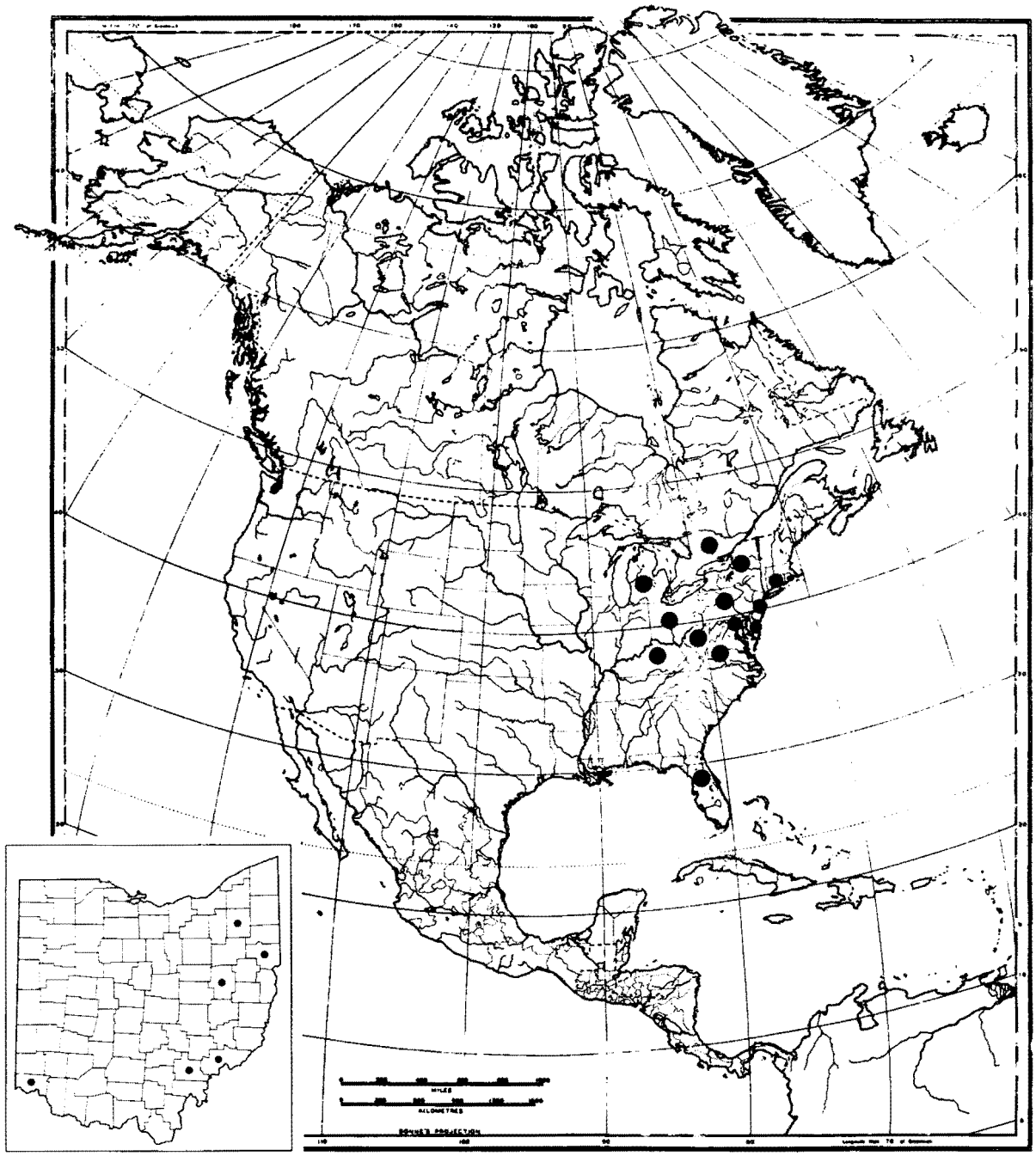

FIGURE 499.—Distribution of *Ventridens suppressus* in North America; *inset*, distribution in Ohio.

glacial boundary in Ohio and that it has extended its range just a little beyond that boundary since the retreat of the Wisconsin ice.

Geologic range.—Unknown.

[*Ventridens suppressus virginicus* (Vanatta) 1936]

Zonitoides suppressus virginicus Vanatta 1936, Nautilus, v. 49, p. 99.
Ventridens suppressus virginicus Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 440, fig. 236a-c.
--- --- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 27, pl. 3, figs. 23, 24, 25.

Type locality.—Near Endless Caverns, New Market, Shenandoah County, Virginia.

Diagnosis.—The adult stage with a long nodule within the columellar lip and a rather short, obtuse horizontal lamella within the outer lip, more remote from the columellar nodule than is the case with the outer tooth of the typical form; the neanic state with the columellar tooth conspicuously bifid (rarely trifid), and the summit of the outer-basal lamella, peripheral in position, curving toward the columella (modified from Pilsbry, 1946, p. 440).

Ecology.—In his original description, Vanatta (1936, Naut. 49, p. 99-100) noted that this snail was collected in the hills near Endless Caverns, New Market, Shenandoah County, Virginia, and that it appears to be a form belonging to a northward extension of the "Cumberland subregion" of Binney, a form that will turn out to be generally distributed in the Shenandoah Valley. Vanatta listed eleven species associated with it at the type locality. His prediction that it would be widespread was borne out by later collecting, *e.g.*, by Wurtz (1940, Naut. 53, p. 85), who found it in six counties of Pennsylvania.

General distribution.—Michigan, New York, Pennsylvania (doubtful but probable), Maryland, Kentucky, Virginia.

Distribution in Ohio.—Implied by the above range, but not as yet certainly recorded for the State.

Geologic range.—Unknown.

Ventridens gularis (Say) 1822
Fig. 500

Helix gularis Say 1822, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 156.
Gastrodonta gularis Dall 1905, Harriman-Alaska Exped., v. 13, p. 43.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.
Zonitoides (Ventridens) gularis Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 273.
Ventridens gularis Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 443, fig. 238a-g.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 315.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 85.

FIGURE 500.—*Ventridens gularis*, magnified; after Walker (1928, p. 104, fig. 151).

Type locality.—Allegheny County, Pennsylvania, locality of the neotype, selected by Pilsbry (1946, p. 446).

Diagnosis.—Shell subglobose, minutely umbilicate, pale yellowish-horn, polished, pellucid; whorls 6 or 7, with prominent somewhat regular axial striae; spire convex, a little elevated, suture moderate; lip not reflected; two lamelliform teeth just inside the aperture, one tooth oblique and placed near the middle, the other less elongate and near the base (modified from Say, quoted by Pilsbry, 1946, p. 444).

Ecology.—In the Asheville region of North Carolina, Archer (1935, p. 81) found the species in hardwoods and noted that this is another species favored by fires; it is most common in leaf mold, often in acid areas, but avoids the neighborhood of pines; it is occasionally found under logs. Hubricht (1953, Naut. 67, p. 24) found it generally distributed in Pittsylvania County, Virginia, in meadows, clearings, and along roadsides. Teskey (1955, Naut. 69, p. 70-71) has recorded the habitat of the form *theloides* in the Warm Springs, Georgia, area, as follows: forest on slope at base of Pine Mountain fire tower, and Dowdell's Knob, scenic lookout, outcrop of granite boulders on mountain top, occasional rotting log.

General distribution (fig. 501).—Indiana, Ohio, and Pennsylvania, south to Alabama, Georgia, and South Carolina.

Distribution in Ohio (inset, fig. 501).—Sterki (1907a, p. 373) had seen no specimens from Ohio but he subsequently collected the species from Tuscarawas County (Pilsbry, 1946, p. 446).

Geologic range.—Unknown.

[*Ventridens collisella* (Pilsbry) 1896]
Fig. 502

Gastrodonta collisella Pilsbry 1896, Nautilus, v. 9, p. 123.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.
--- --- Walker 1928, Terr. Moll. Ala., p. 104.
Ventridens collisella Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 450, fig. 241.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 83.

Type locality.—Knoxville, Tennessee.

Diagnosis.—Shell rather solid, minutely perforate,

above elevated and somewhat dome-shaped, below rather flattened, the periphery rounded; surface glossy, especially beneath, the base radially finely wrinkled, and with faint traces of spiral striation in the slightly excavated umbilical region; upper surface sharply sculptured with irregular, arcuate wrinkle-riblets in the direction of growth lines, and stronger toward the suture; whorls 7½, slightly convex, separated by very shallow sutures which, under the lens, seem margined below by the partial transparence of the shell in some specimens; aperture mainly basal, lunate, with a lining of white callus a short distance within, heavier and bearing a small tooth (commonly wanting) on the columellar slope, and a rather short white entering lamina toward the outer part of the base; lip edge thin and acute, suddenly expanded at the columellar insertion, half covering the umbilical perforation (modified from Pilsbry, 1946, p. 450).

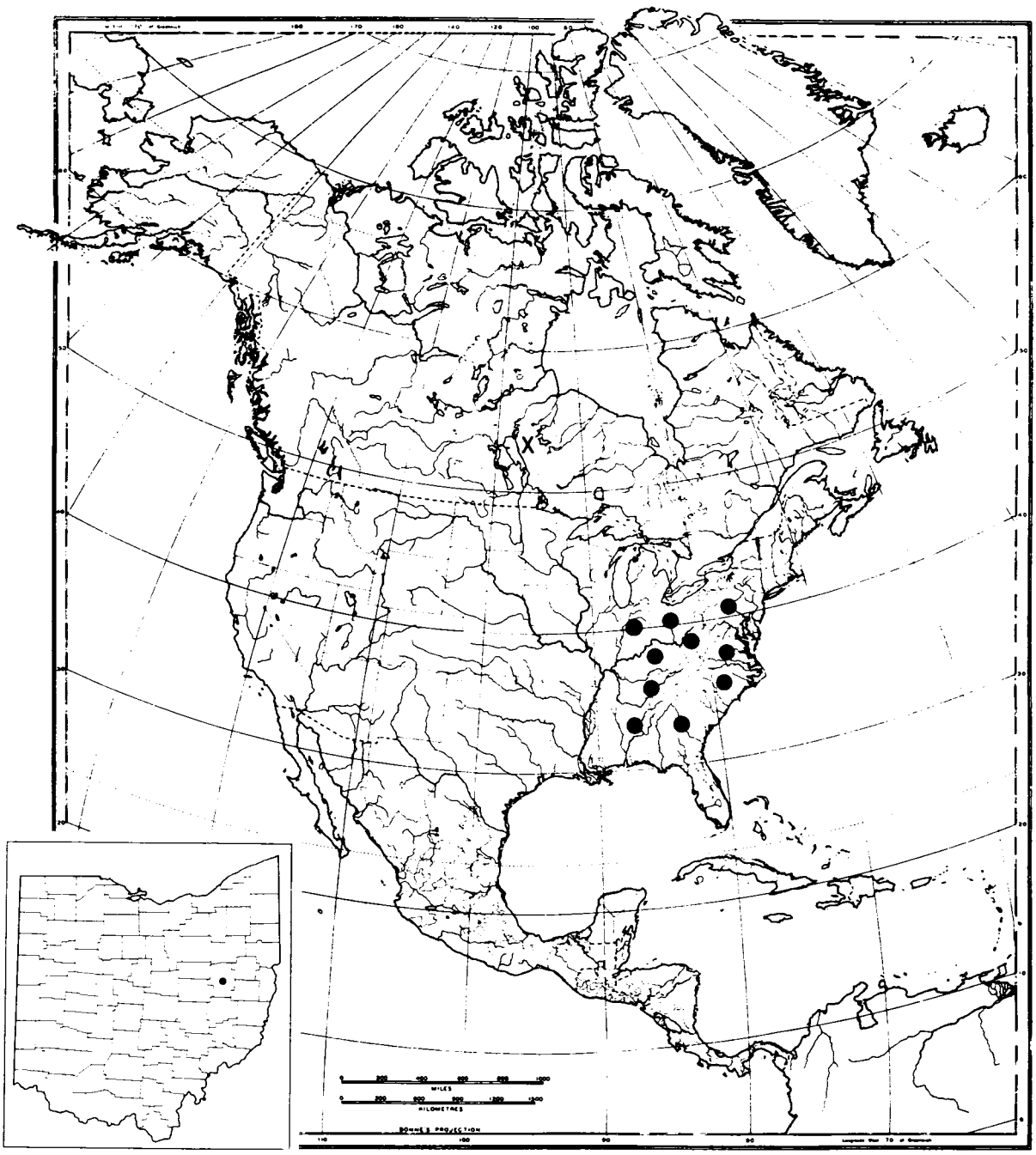

FIGURE 501.–Distribution of *Ventridens gularis* in North America; *inset,* distribution in Ohio.

FIGURE 502.–*Ventridens collisella*, magnified; after Walker (1928, p. 104, fig. 150).

Ecology.–In Tennessee, this is a species of hilly terrain in hardwoods (Lutz, 1950, Naut. 63, p. 104). Hubricht (1953, Naut. 67, p. 24) found it abundantly on the bluffs along the Roanoke River, in Pittsylvania County, Virginia.

General distribution (fig. 503).–Virginia, Tennessee, and Alabama (Pilsbry, 1946, p. 451). Pilsbry does not include any state adjacent to Ohio in the range of this species, in spite of the record noted below.

Distribution in Ohio (inset, fig. 503).–One record, possibly erroneous, for New Philadelphia, Tuscarawas County, by Sterki (1907a, p. 373). Sterki is positive in his identification and had seen specimens of undoubted *V. collisella* from eastern Tennessee when he wrote

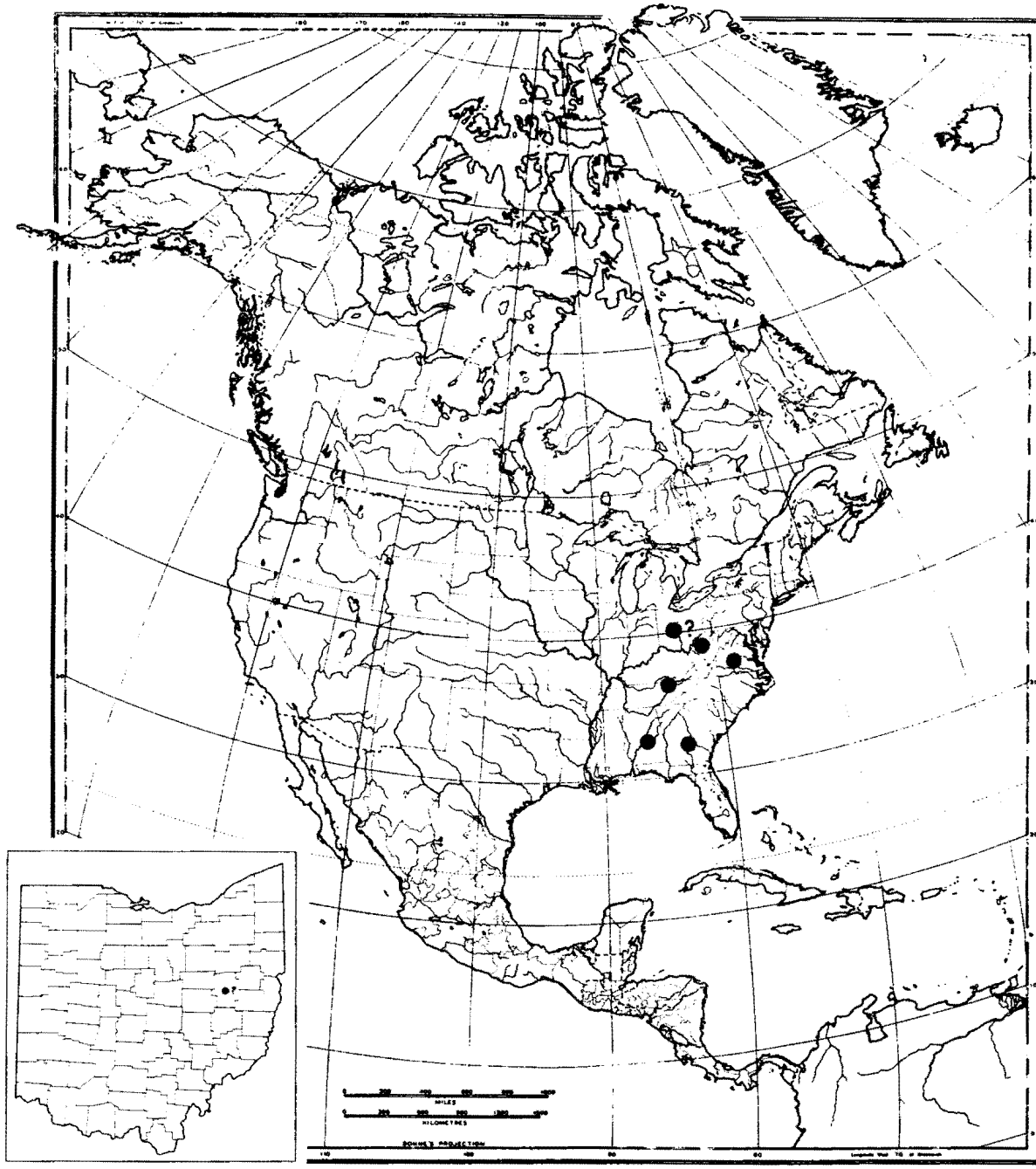

FIGURE 503.–Distribution of *Ventridens collisella* in North America; *inset*, distribution in Ohio.

his paper. Pilsbry does not mention this record nor does he mention the species for any of the neighboring states. For this reason, the species is listed as doubtful for Ohio but the record is not an impossible one.

Geologic range.—Unknown.

[*Ventridens lasmodon* (Phillips) 1841]

Helix lasmodon J. S. Phillips 1841, Acad. Nat. Sci. Philadelphia Proc., v. 1, p. 28.

Gastrodonta lasmodon Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373; later corrected to *V. suppressus.*

--- --- Sterki 1914, Ohio Naturalist, v. 14, p. 270; previous record (Sterki, 1907, above) is erroneous, based on specimens of *Ventridens suppressus.*

Ventridens lasmodon Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 457, fig. 247.

Type locality.—St. Clair County, Alabama, locality of a neotype selected by Pilsbry (1946, p. 458).

Remarks.—The only record of this species for Ohio is that of Sterki, mentioned above, which he promptly corrected. The species is restricted, according to Pilsbry (1946, p. 458) to Tennessee and Alabama. The Ohio record was therefore far out of range and this species is to be eliminated from the State list. There are no records of its occurrence as a fossil, in Ohio or anywhere else.

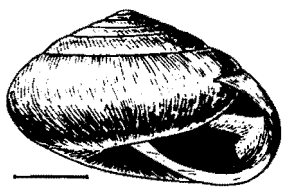

FIGURE 504.—*Ventridens demissus,* magnified; after F. C. Baker (1939a, p. 82).

Ventridens demissus (Binney) 1843
Fig. 504

Helix demissa A. Binney 1843, Boston Jour. Nat. History, v. 4, p. 361, pl. 16, fig. 1.

Gastrodonta demissa Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.

--- --- Goodrich 1932, Moll. Mich., p. 34.

Zonitoides (Ventridens) demissus Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 273.

Ventridens demissus Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 459, fig. 248.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 315.

--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 84.

Type locality.—Western Pennsylvania.

Diagnosis.—"Shell depressed-convex; epidermis yellowish horn-color, shining; whorls six, with minute lines of growth; spire obtuse; suture impressed; body-whorl expanding very little towards the aperture; aperture transverse, not large, a white, testaceous deposit within; lip thin, acute; base rather flat, smooth; umbilicus very small; umbilical region a little impressed. Greatest transverse diameter rather more than three-eights of an inch" (A. Binney, quoted by Pilsbry, 1946, p. 459).

Ecology.—Archer (1934, Naut. 47, p. 149) recorded a reversed specimen from Alabama. He noted (1937, Naut. 50, p. 120) that it is found in cultivated areas, where it lives in grass in fields. In a later paper (1937, p. 59) he described two closely related habitats in Belmont County, Ohio, as follows: "This locality is an area of pastured hills. One of the hills contains a patch of oak-hickory woods near the summit, some of the trees being white oak, yellow oak, shellbark hickory, rock maple, and beech. The soil is a yellowish clay, and the outcropping rocks are sandstone and shale. The snails are concentrated in leaf pockets, around stumps, and under logs.... In contrast with the seven species in the woods, fourteen species were found in the open fields, and some of them are abundant. They live in grass and weeds as well as among stones, and are especially common on the lower slopes." *V. demissus* is included in both lists. Archer (1939, Naut. 52, p. 97) noted that in the south this species, among others, occurs commonly in gardens within its appropriate range.

Associations.—Living: OHIO-25, 26.

General distribution (fig. 505).—Illinois, Indiana, Michigan, Ohio, and Pennsylvania, south to Mississippi, Alabama, Georgia, and Florida.

Distribution in Ohio (inset, fig. 505).—Licking, Tuscarawas, and Belmont Counties (Pilsbry, 1946, p. 460); Eggleston (ms. records) has specimens from Highland and Adams in southwestern Ohio, Holmes County, northwest of Tuscarawas County, and Athens, Washington, Morgan, Noble, Monroe, and Belmont Counties in southeastern Ohio.

Geologic range.—Pleistocene: late Wisconsin. It should be noted that, in Ohio at least, this species is recorded most abundantly south and east of the glacial boundary which it transgresses only in Highland, Licking, and Holmes Counties. Its presence in Michigan is interesting in this respect as there is only one record. Clark (1961, p. 26) has identified it from the Castalia deposit, late Wisconsin, of Ohio.

Ventridens ligera (Say) 1821
Fig. 506

Helix ligera Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 157.

Helix wardiana Lea 1836, Am. Philos. Soc. Trans.,

v. 6, p. 67, pl. 23, fig. 82.

Zonites ligerus Call 1900, Moll. Ind., p. 374, pl. 4, fig. 11.

Zonites (Gastrodonta) ligerus var. *sagdinoides* Gratacap 1901, Am. Mus. Nat. History Bull., v. 13, p. 344.

Gastrodonta ligera Billups 1902, Nautilus, v. 16, p. 51.

--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373, 402.

--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.

--- --- Goodrich 1932, Moll. Mich., p. 33.

Zonitoides (Ventridens) ligerus Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 273.

Ventridens ligera Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 465, fig. 253.

Gastrodonta ligera Oughton 1948, Zoögeogr. study,

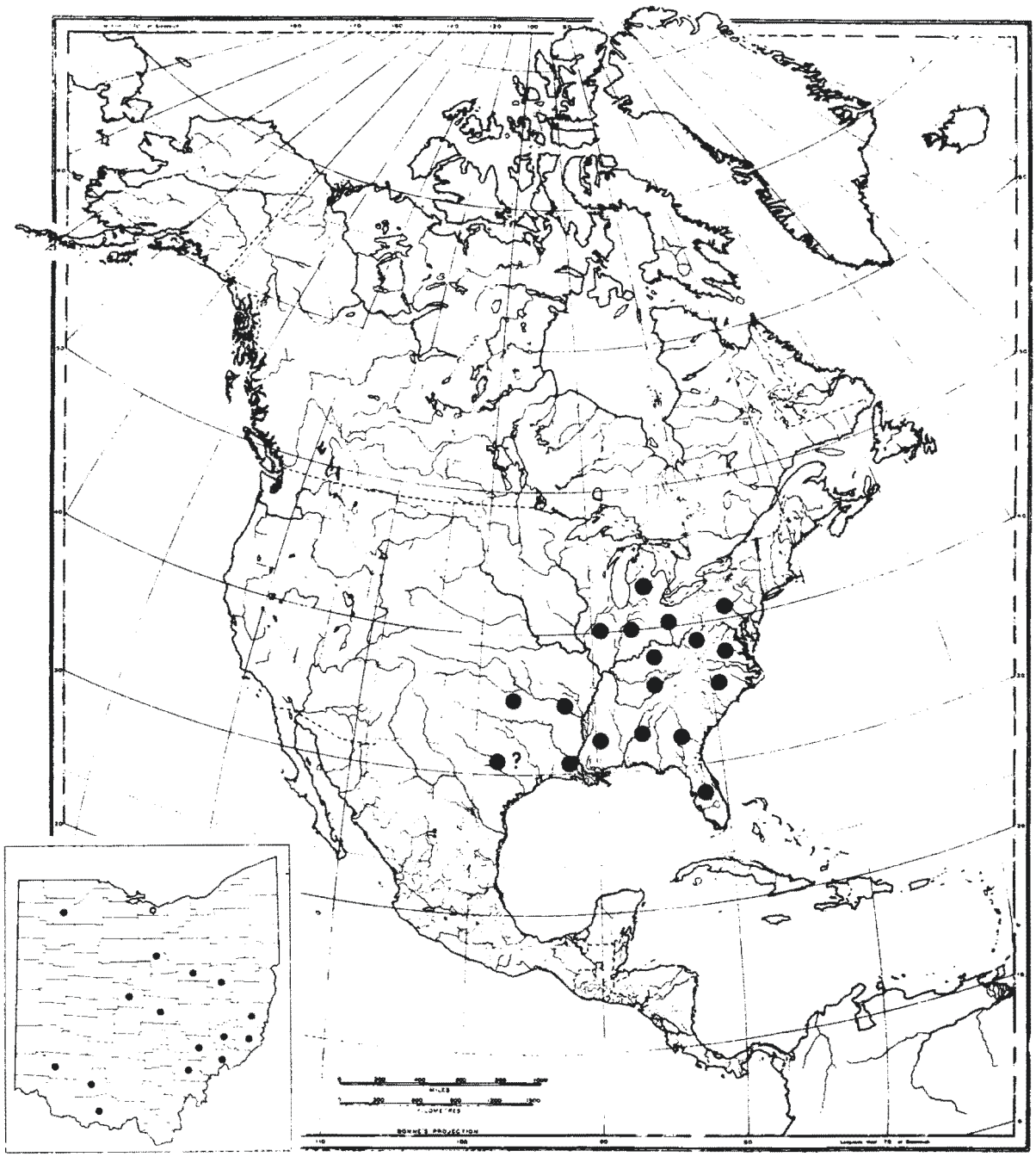

FIGURE 505.–Distribution of *Ventridens demissus* in North America; *inset*, distribution in Ohio.

Ontario, p. 21.

Ventridens ligera Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 28, pl. 3, figs. 1, 2.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 316.

--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 87.

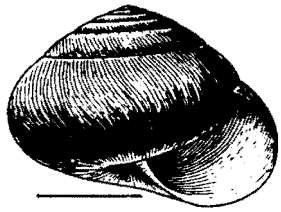

FIGURE 506.–*Ventridens ligera*, magnified; after F. C. Baker (1939a, p. 81).

Type locality.–Missouri.

Diagnosis.–Shell convexly conic, pale yellow horn color, polished; body whorl pellucid, yellowish-white, opaque beneath near the aperture; the whorls 6 to 7, irregularly but strongly wrinkle-striate and somewhat glossy above; base much more glossy, with weaker striation and microscopic spiral striae; umbilicus very small, about one-twelfth the diameter of the shell; lip simple, lined within with a white callous thickening which is commonly very thin or almost wanting.

Ecology.–Burch (1955, Naut. 69, p. 66) has shown the relationships of this species to soil factors in eastern Virginia. Muchmore (1959, Naut. 72, p. 85-88) has collected it under stones in various woodland areas in New York State. Wurtz (1941, Naut. 54, p. 142-143) has described a winter agglomeration of snails, including this species, in the soil of a northward sloping hillside in Allegheny County, Pennsylvania. In South Carolina, Rehder (1949, Naut. 62, p. 125-126) found it around fallen logs, near a creek; in Virginia, he (*ibid.*, p. 122) recorded it as common, under boards, bricks, and debris, not far from a beach. In Virginia also, Hubricht (1953, Naut. 67, p. 24) found it common in the floodplains of the Dan and Roanoke Rivers, Pittsylvania County. In Maryland, Grimm (1959, Naut. 72, p. 124) listed it from a quarry; under wet sandstone, in a field; around foundations of an old burned house; and near railroad tracks. In Tennessee, it occurs in hardwood forests on sloping terrain (Lutz, 1950, Naut. 63, p. 104). Its mating habits have been described by Webb (1948, p. 453-461).

Associations.–Living: OHIO-22, 23, 24, 27, 43. Fossil: W-24, 26, 28.

General distribution (fig. 507).–Michigan, Ontario, and New York, southwest to Illinois, Missouri, and Oklahoma, south to Arkansas, Alabama, and Florida, east to New Jersey and Delaware.

Distribution in Ohio (inset, fig. 507).–Practically over the State. Pilsbry recorded it from Hamilton and Brown Counties north to Huron, and east to Tuscarawas and Jefferson Counties. Eggleston (ms. records) has specimens from many of the southern and central counties, and the University of Michigan collections from Fulton, Erie, Hancock, Allen, and Hamilton Counties.

Geologic range.–F. C. Baker (1920a, p. 389) gave Yarmouth, Sangamon, Peorian, and "Wabash." Pleistocene of Ohio and Indiana: "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); Sangamon? of Indiana (Baker, 1920b, p. 455); "Defiance sandy deposit (loess?)" of Ohio (Sterki, 1907a, p. 402); Castalia marl (late Wisconsin) of Ohio (Sterki, 1920, p. 178).

Ventridens intertextus (Binney) 1841
Fig. 508

Helix intertexta A. Binney 1841, Boston Jour. Nat. History, v. 3, p. 414.

Zonites intertextus Call 1900, Moll. Ind., p. 374, pl. 4, fig. 12.

Gastrodonta intertexta Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.

--- --- Goodrich 1932, Moll. Mich., p. 33.

Zonitoides (Ventridens) intertextus Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 273.

Ventridens intertextus Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 468, fig. 254.

Gastrodonta intertexta Oughton 1948, Zoögeogr. study, Ontario, p. 21.

Ventridens intertextus Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 28, pl. 2, figs. 22, 23.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 316.

--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 86.

Type locality.–Cabarrus County, North Carolina.

Diagnosis.–Shell globose-pyramidal, yellowish-horn color; whorls 6 to 7, with numerous fine axial striae and very minute spiral striae, intersecting each other; last whorl with a narrow light-colored band, and an ill-defined brownish band below it; aperture rounded, a little transverse; lip thin, lightly thickened, slightly reflected at its junction with the base of the shell; umbilicus small, in some specimens nearly obsolete; base whiter than upper surface (modified from A. Binney).

Ecology.–At the northern limit of its range in Ontario, Oughton (1948, p. 94 ff.) found this species in damp woodlands, especially those of deciduous trees. Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. Ingram (1940, Naut. 54, p. 87) has described its daylight activities; he (1944, Naut. 57, p. 135-137) has listed shrews among its enemies and noted (1950, Naut. 63, p. 142) that it is attacked and eaten by carabid beetles of the genus *Calosoma*. He (1941, Naut. 55,

p. 14-15) has collected it under stones on the flood-plain of a creek in the Ithaca region of New York. Teskey (1955, Naut. 69, p. 70-71) has found it in a forest on the slope at the base of Pine Mountain fire tower, in Georgia. In Pittsylvania County, Virginia, it is generally distributed, but not common, in clearings and along roadsides (Hubricht, 1953, Naut. 67, p. 24). Its mating habits have been described by Webb (1948, p. 453-461) and the eggs have been studied by Ingram (1944, p. 95).

Ingram (1946, Naut. 59, p. 90) reported the following from the Huyck Preserve in New York State: "Individuals were erratic in their distribution, being found in all areas but fields and orchards. Specimens were most abundantly taken from flood-plain forests. On flood-plains individuals sought shelter beneath water carried debris piles; less commonly it was collected from beneath water carried logs. On the flood plain its com-

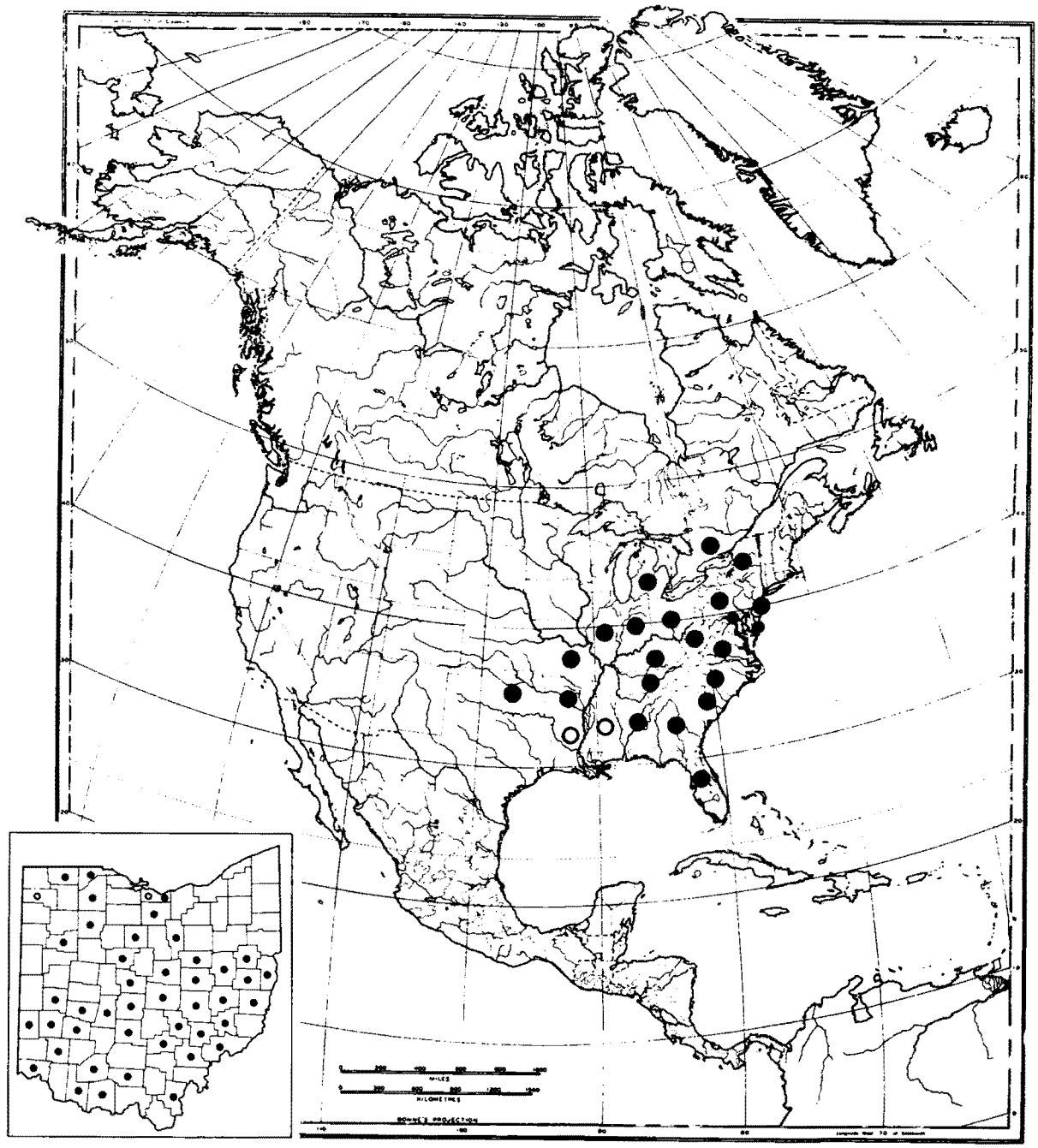

FIGURE 507.—Distribution of *Ventridens ligera* in North America; *inset,* distribution in Ohio.

FIGURE 508.—*Ventridens intertextus*, magnified; after Call (1900, pl. 4, fig. 12).

panion was *Anguispira alternata* (Say); these two species were the dominant snails of the flood-plain area. Both were preyed upon by *H. concavum* and the short-tailed shrew. *V. intertextus* seemed generally to avoid wooded areas where thick humus abounded."

Associations.—Living: OHIO-22, 23, 24, 43.

General distribution (fig. 509).—Illinois, Michigan, Ontario, and New York, south to Texas, Louisiana, Mississippi, Florida, and South Carolina.

Distribution in Ohio (inset, fig. 509).—Pilsbry gave Adams, Licking, and Jefferson Counties; Eggleston (ms. records) added Wayne, Washington, and Perry Counties; Wurtz (1949) gave Vinton and Highland

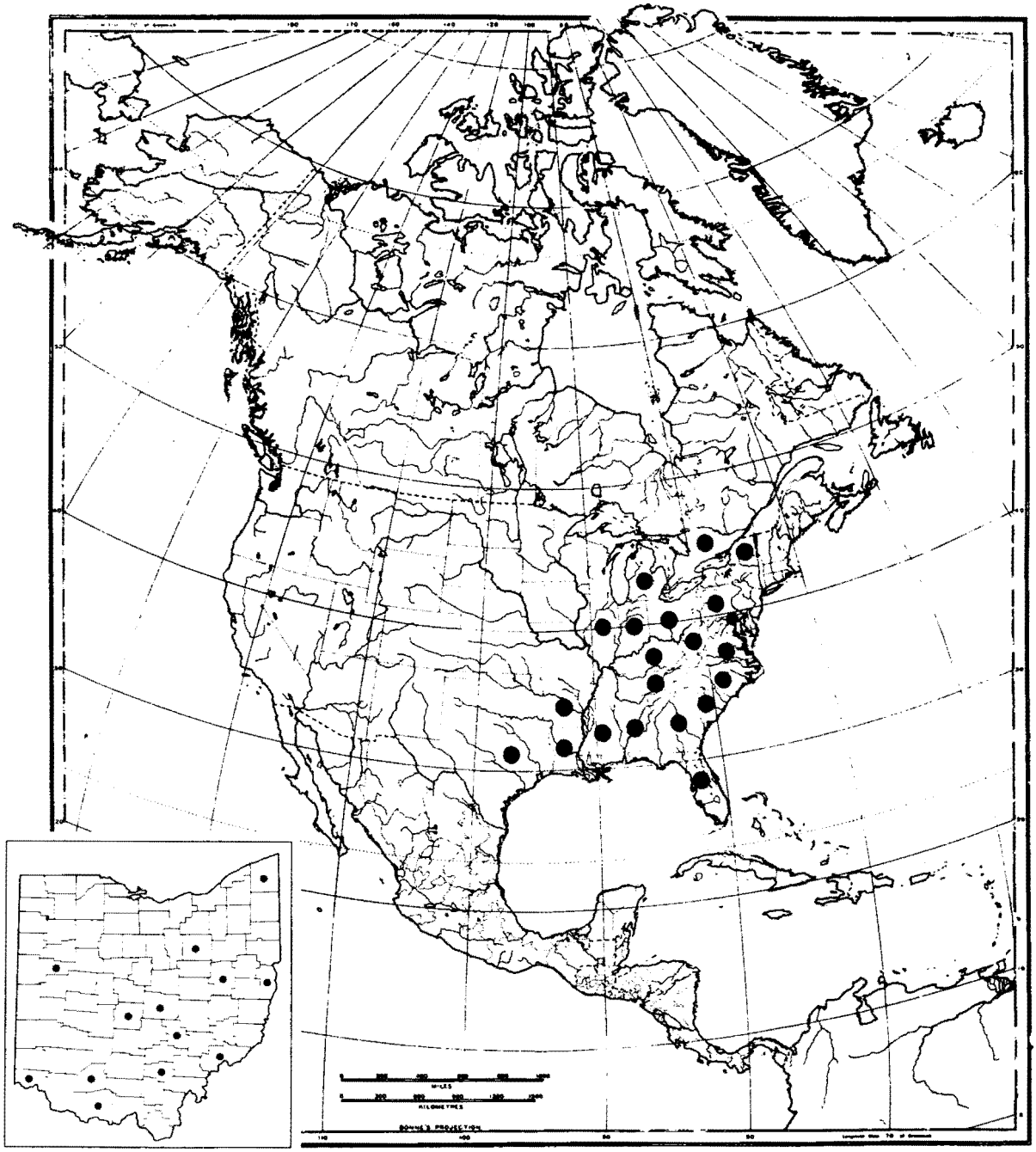

FIGURE 509.—Distribution of *Ventridens intertextus* in North America; *inset*, distribution in Ohio.

Counties; and the University of Michigan collections contain specimens from Auglaize County.

Geologic range.—Unknown.

Genus *Zonitoides* Lehmann 1862

Zonitoides Lehmann 1862, Malak. Bl., v. 9, p. 111.
Zonitoides H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 33, 37.
Zonitellus H. B. Baker 1928, *ibid.*, p. 37.
Zonitoides H. B. Baker 1929, *ibid.*, v. 81, p. 254.
Zonitoides Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 474.
Zonitoides La Rocque 1953, Cat. Recent Moll. Canada, p. 316.

Type.—*Helix nitida* Müller.

Diagnosis.—Shell small (diameter 4 to 8 mm.), thin, depressed, umbilicate, lightly or distinctly striate above, rarely ribbed, of 3½ to 4½ convex, regularly increasing whorls, the last rounded; aperture rounded, lunate, lip thin; no internal callus or teeth.

General distribution.—Practically Holarctic, occurring over most temperate parts of the northern continents. Introduced on parts of all continents except possibly South America.

Geologic range.—Tertiary of Europe; Pleistocene of North America.

Remarks.—The diagnostic generic characters are those of the soft parts; the shell may be confused at first with that of *Retinella* or *Oxychilus* but the species of all three genera can be recognized from shell characteristics.

Zonitoides arboreus (Say) 1816
Pl. 16, figs. 12, 14, 17

Helix arboreus Say 1816, Nicholson's Encycl., v. 2, art. Conchology, species no. 2, pl. 4, fig. 4.
Zonites (Hyalina) arboreus Call 1900, Moll. Ind., p. 375, pl. 4, fig. 1.
Zonitoides arboreus Dall 1905, Harriman-Alaska Exped., v. 13, p. 42 (no illus.).
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373, 402.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 45.
--- --- Goodrich 1932, Moll. Mich., p. 32.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 273.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 480, figs. 261, 262.
Zonitoides arborea Oughton 1948, Zoögeogr. study, Ontario, p. 31.
Zonitoides arboreus Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 29, pl. 2, figs. 16, 17.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 37, pl. 4, fig. B.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 26, pl. 3, figs. A, B.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 316.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 149.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 81.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 89.

Type locality.—Probably Philadelphia, Pennsylvania.

Diagnosis.—Shell nearly twice as wide as high, thin, shining, yellow to dark brown; whorls 5, finely striate and with faint revolving lines barely showing under low-power magnification; convex, with a sharp-edged outer lip; umbilicus open; aperture nearly circular.

Ecology.—This species is able to occupy almost any kind of environment; it is equally at home in dense woods and open plains, in cultivated fields and gardens and in city yards, even where there is a minimum of cover and moisture. Ingram (1940, Naut. 54, p. 87) has described the daylight activities of this species. He (1944, Naut. 58, p. 25-27) has collected it in beech–yellow-birch and sycamore woodlands at Ithaca, New York, and described its winter habits there. Oughton (1948, p. 94 ff.) found it in both damp and drier, more open deciduous woodlands in Ontario, occasionally in *Sphagnum* bogs. Lindeborg (1949, Naut. 62, p. 130) found it to be probably the most abundant snail in the Quetico area of Ontario, under decaying logs and stumps, but also on damp moss, including *Sphagnum*, in a bog at the south end of a lake. Ants and these snails were seldom found under the same logs. H. B. Baker (1922b) noted it in nine habitats, by far the most abundant mollusk in the hardwoods and other upland habitats of Dickinson County, Michigan. Muchmore (1959, Naut. 72, p. 85-88) collected it under stones in various woodland areas in New York State. Solem (1952, Naut. 65, p. 129) listed it for a large tract of virgin pine with some deciduous growth and undergrowth of thimbleberry, and from beach drift of Lake Michigan in the Door Peninsula of Wisconsin. Dimelow (1962, Naut. 76, p. 49) collected it in Nova Scotia, in a climax deciduous forest on a gentle, well-drained slope. Burch (1955, Naut. 69, p. 66) noted its relationships to soil factors in eastern Virginia. It may be quite numerous in a small area; Goodrich (1931, p. 5) collected about 200 specimens from a decaying log in Keweenaw County, Michigan, and Archer (1934c, p. 139) found it common in the limestone talus near Fort Mackinac on the island of the same name in Michigan. Archer (1935, p. 81) took it in leaf mold and under logs in both pine and hardwood forests in the Asheville,

North Carolina, region. Grimm (1959, Naut. 72, p. 124-125) found it in Maryland in leaf litter along railroad tracks, in the ruins of a building, in quarries, and in woods. Burch (1954, Naut. 68, p. 32) stated that it is probably the most common land snail in Henrico County, Virginia, both in number of specimens and in distribution; it is not restricted to woodlands and it apparently has no preference for any particular hardwood. Rehder (1949, Naut. 62, p. 125) found it under fallen leaves and near fallen logs in South Carolina, under boards in a backyard in North Carolina, and in Virginia (*ibid.*, p. 123) under bark of fallen logs in a small clearing. Teskey (1955, Naut. 69, p. 70-71) collected it from detritus in crannies of stone walls and from rotting timbers of an old mill in the Warm Springs, Georgia, area. The eggs have been described by Ingram (1944, p. 95). Its ecology in greenhouses has been described by Karlin (1956, p. 121-125).

Ingram (1946, Naut. 59, p. 90) gives the following data from the Huyck Preserve in New York State: "This

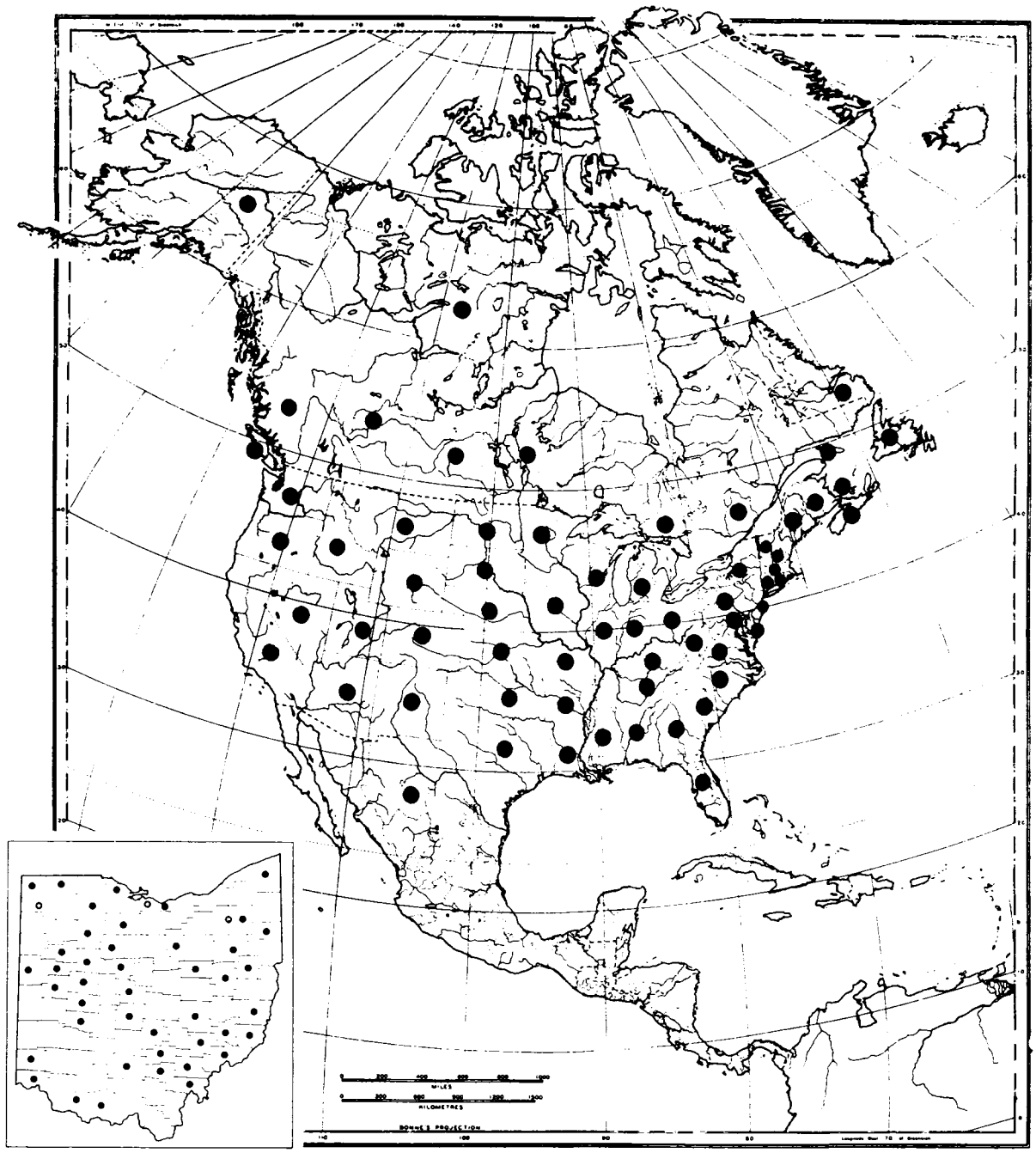

FIGURE 510.—Distribution of *Zonitoides arboreus* in North America; *inset*, distribution in Ohio.

was the most common small snail of the preserve. It was found in all of the available areas with the exception of grass covered fields. It was one species that did not noticeably avoid hemlock areas. The only area that it avoided was the flood plain forest where humus and logs were not abundant."

Associations.—Living: MICHIGAN-1, 3, 4, 7, 8, 9, 17, 20, 23, 25, 26, 27, 28, 31, 32, 33, 34, 36, 38, 39, 40; MINNESOTA-1, 2, 3, 4, 5, 6, 7, 8, 22b; OHIO-1, 3, 4, 7, 26, 43; ONTARIO-7, 8, 10, 11, 14. WISCONSIN-138, 144. Fossil: N-2; K-2; Y-7, 8, 10, 11, 12, 16; S-1, 2, 3, 4, 5, 6; W-6, 7, 9, 17, 26, 27, 28, 56, 57, 58, 59, 73.

General distribution (fig. 510).—In North America, from Great Slave Lake and Newfoundland south to Central America and the West Indies. It is recorded for every state in the continental United States except Alaska and for every province of Canada.

Distribution in Ohio (inset, fig. 510).—Specimens have been seen for about half the counties of Ohio but the records are so widespread that the species should eventually be found in every county of the State.

Geologic range.—F. C. Baker (1920a, p. 389) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash." Yarmouth to Recent, Kansas and Oklahoma (A. B. Leonard, 1950, p. 37); probably Illinoian, Oklahoma (D. W. Taylor and Hibbard, 1955, p. 8); Wisconsin of Ohio: Castalia marl, Tinkers Creek marl (Sterki, 1920, p. 174, 178); "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402). Early Pliocene to Recent (Hibbard and Taylor, 1960, p. 149). Clark (1961, p. 26) has confirmed Sterki's earlier record for the Castalia deposit.

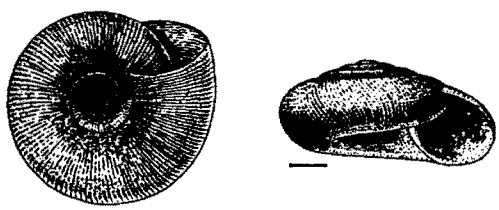

FIGURE 511.—*Zonitoides limatulus,* magnified; after F. C. Baker (1939a, p. 80, lower two figs.).

Zonitoides limatulus (Binney) 1840
Fig. 511

Helix limatula "Ward, ined.," A. Binney 1840, Boston Jour. Nat. History, v. 3, p. 434, pl. 21, fig. 2.
Zonites (Hyalina) limatulus Call 1900, Moll. Ind., p. 376, pl. 4, fig. 16.
Zonitoides limatulus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.
Zonitoides limatulus Goodrich 1932, Moll. Mich., p. 32.
——— ——— Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 273.
——— ——— Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 484, fig. 263.

Type locality.—"Ohio," according to A. Binney, but no more exact locality can be ascertained. The specimens came from Dr. Ward, who lived at Chillicothe and later at Roscoe, Coshocton County. Chillicothe appears to be a more likely locality as there are no records of the species for eastern Ohio north of Morgan and Washington Counties.

Diagnosis.—Shell small, convex-depressed; epidermis white; suture distinctly impressed; whorls more than four, convex, with very fine, oblique, parallel striae, which become obsolete on the base; aperture subcircular; lip thin, acute; umbilicus large and deep, one-third or one-fourth the diameter of the shell.

Ecology.—This species has been recorded from two Wisconsin localities by Morrison (1929, p. 43-44): Station III. That portion of the floodplain of Trout Creek that is above the reach of ordinary high waters. This station includes the very mesophytic slopes of the sides of the creek valley that are rather heavily overgrown with brush and small trees. The snails were found under small logs (not drift logs) and in the leaf mold. Station V. Slopes of northern exposure in the valley of the Kickapoo. These were studied on Asper Heims Hill, which is an outlier, just to the west of the town. The slope here is very steep, and heavily wooded, with a good many fallen logs. Snails were collected from the leaf mold and from under the logs, which were mostly in stage three of decay, with the heartwood still solid. Both localities are in Crawford County and in each case the associated snails, including *Hendersonia occulta,* are listed. Cahn and Kemp (1929, p. 67) found only one specimen of *Z. limatulus* from rotten wood in Turkey Run State Park, Indiana. In Lincoln County, Maine, Archer (1931, Naut. 45, p. 34) listed it as present in a bush-covered stretch of land between two lakes.

Associations.—Living: WISCONSIN-140, 142.

General distribution (fig. 512).—Missouri, Indiana, Ohio, New York, and, doubtfully, Michigan.

Distribution in Ohio (inset, fig. 512).—In the State, the records are concentrated in the southern half; northernmost records are for Clark, Franklin, and Morgan Counties, but not all the counties to the south of these have produced records.

Geologic range.—Unknown.

Zonitoides nitidus (Müller) 1774
Fig. 513

Helix nitida Müller 1774, Verm. Terr. et Fluv. Hist., v. 2, p. 32.
Zonitoides nitidus Dall 1905, Harriman-Alaska Exped., v. 13, p. 42 (no illus.).
——— ——— Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.
Zonitoides nitida F. C. Baker 1920, Life of Pleistocene, p. 389.
Zonitoides nitidus Ahlstrom 1930, Nautilus, v. 44, p. 45.

Zonitoides nitidus Goodrich 1932, Moll. Mich., p. 32.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 273.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 476, fig. 259.
Zonitoides nitida Oughton 1948, Zoögeogr. study, Ontario, p. 32.
Zonitoides nitidus Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 28, pl. 3, figs. 3, 4.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 316.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 91.

Type locality.—Fridrichsberg, Denmark.

Diagnosis.—Shell umbilicate, the umbilicus one-fifth the diameter of the shell; olivaceous yellow, very glossy, somewhat transparent, composed of about 4½

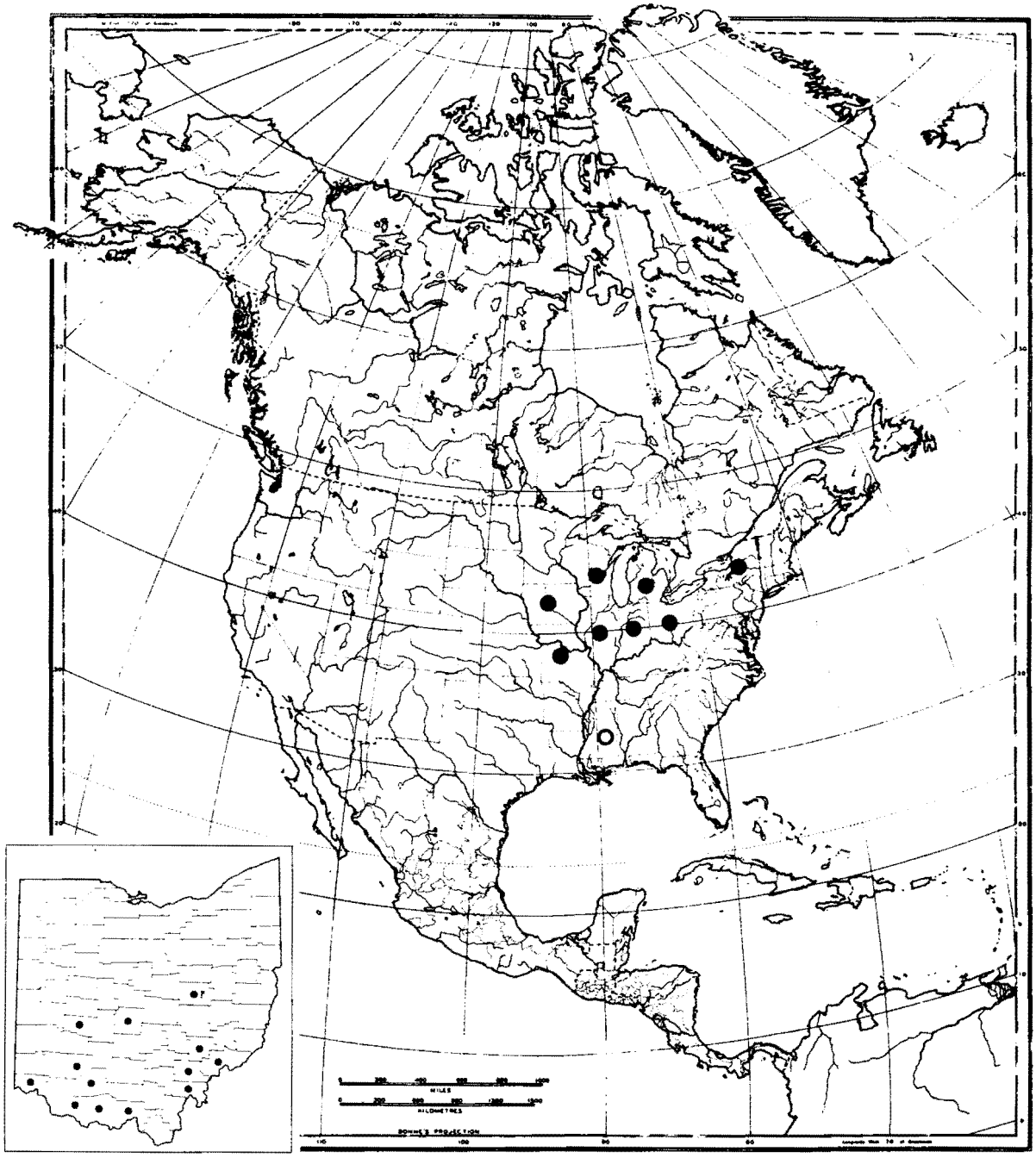

FIGURE 512.—Distribution of *Zonitoides limatulus* in North America; *inset*, distribution in Ohio.

convex, gradually widening whorls joined by a well impressed suture; embryonic 1½ whorls smooth, the rest finely, weakly marked by growth lines, the base smoother and more transparent; aperture lunate, the peristome thin; the columellar margin narrowly dilated.

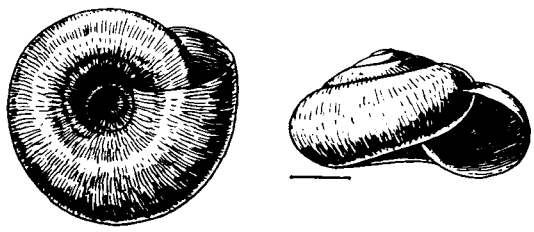

FIGURE 513.–*Zonitoides nitidus*, magnified; after F. C. Baker (1939a, p. 80, upper two figs.).

Ecology.–Generally found near water or in marshy places, never in upland woods where *Z. arboreus* lives. In the late autumn the species often congregates in large numbers under dead wood in wet places and hibernates thus in groups. Oughton (1948, p. 94 ff.) found this species in wet locations, such as stream flood plains, margins of ponds and streams, and marshes; he noted (1948, p. 89) that in Ontario it is confined to Paleozoic terranes, mainly limestones. Solem (1952, Naut. 65, p. 129) has recorded it for a large tract of virgin pine timber, with some deciduous growth and undergrowth of thimbleberry in Door County, Wisconsin. It is less common than *Z. arboreus*, in Minnesota and elsewhere, in wet places (Dawley, 1955, Naut. 69, p. 58).

Associations.–Living: MICHIGAN-24, 30; OHIO-43; ONTARIO-3, 7.

General distribution (fig. 514).–Alaska south to California, Utah, South Dakota, Arkansas, Tennessee, and Maryland.

Distribution in Ohio (inset, fig. 514).–"Over the state" according to Sterki (1907a, p. 373). Records available are not numerous: Williams, Fulton, and Auglaize Counties (University of Michigan); Miami, Clark, and Washington Counties (Eggleston, ms. records).

Geologic range.–F. C. Baker (1920a, p. 389, quoted by Pilsbry, 1946, p. 477) has recorded the species for the Sangamon in Indiana and Illinois, but A. B. Leonard (1950, 1952) did not mention the species. There are no fossil records for Ohio.

Remarks.–Compared with *Z. arboreus*, this species is larger, less depressed, and a little more narrowly umbilicate; it also lacks the faint spiral lines of *Z. arboreus;* the base is more convex, and the aperture rounder.

Genus *Striatura* Morse 1864

Striatura Morse 1864, Syn. Fluv. Terr. Moll. Me., p. 1 (undated, but prior to next reference); Portland Soc. Nat. History Jour., v. 1, p. 17.

Pseudohyalina Morse 1864, Syn. Fluv. Terr. Moll. Me., p. 1.

Striaturops H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 33.

Striatura Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 487.

Striatura La Rocque 1953, Cat. Recent Moll. Canada, p. 317.

Type.–*Striatura milium* (Morse).

Diagnosis.–Shell minute, depressed, umbilicate, thin, of few (3 to 3½) whorls, with sculpture of fine spiral striae and more or less obliquely axial riblets, which may be high and well spaced or fine and close, or in *S. ferrea*, subobsolete.

General distribution.–Nearctic; one subgenus, *Pseudohyalina*, also in Hawaii, probably introduced.

Geologic range.–Unknown.

Striatura exigua (Stimpson) 1850
Fig. 515

Helix annulata Case 1847, Am. Jour. Sci. and Arts, 2d ser., v. 3, p. 101, figs. 1-3; *non* Gmelin 1790, Syst. Nat., 13th ed., v. 1, p. 3622.

Helix exigua Stimpson 1850, Boston Soc. Nat. History Proc., v. 3, p. 175.

Zonitoides exiguus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.

Striatura exigua H. B. Baker 1928, Acad. Nat. Sci. Philadelphia Proc., v. 80, p. 33, pl. 7, figs. 1-5.

Zonitoides exiguus Goodrich 1932, Moll. Mich., p. 32.

Striatura exigua Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 272.

--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 490, fig. 268.

--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 29, pl. 3, fig. 14.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 317.

--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 80.

Type locality.–"Near Lake Superior" (Case, *H. annulata*); vicinity of Boston, Massachusetts (Stimpson, *H. exigua*).

Diagnosis.–Shell minute, discoidal, pellucid, corneous greenish, a little convex above, convex below; whorls 3½, convex, spirally striate and (except at apex) having distant longitudinal ribs which are obliquely crossed by growth striae; last whorl rounded; suture impressed; umbilicus wide; aperture rounded, lip simple (modified from Stimpson, 1850).

Ecology.–Prefers low, wet ground (Morse, 1864). In Ontario, Oughton (1948, p. 94 ff.) found this species in damp woodlands, especially those of deciduous

trees, and occasionally in *Sphagnum* bogs. In the Ottawa region, I have found it sparingly in moss growing on stumps and logs in shady woods. H. B. Baker (1922b) collected only two specimens in a damp hollow of the Menominee River flood plain, with brush of tag alders, dogwoods, hazels, and small ashes, Dickinson County, Michigan. Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. Dawley (1955, Naut. 69, p. 59) found it in damp woods or bogs in Minnesota.

General distribution (fig. 516).—Newfoundland, Magdalen Islands, Nova Scotia, west to western Ontario, north of Lake Superior; south to Minnesota, Michigan, Ohio, Pennsylvania, and New Jersey.

Distribution in Ohio (inset, fig. 516).—Recorded for Portage County but it is probable that it has been overlooked in other northern counties.

Geologic range.—None recorded. The species should be found in glaciated portions of North America, especially in Canada, but, so far as I know, it

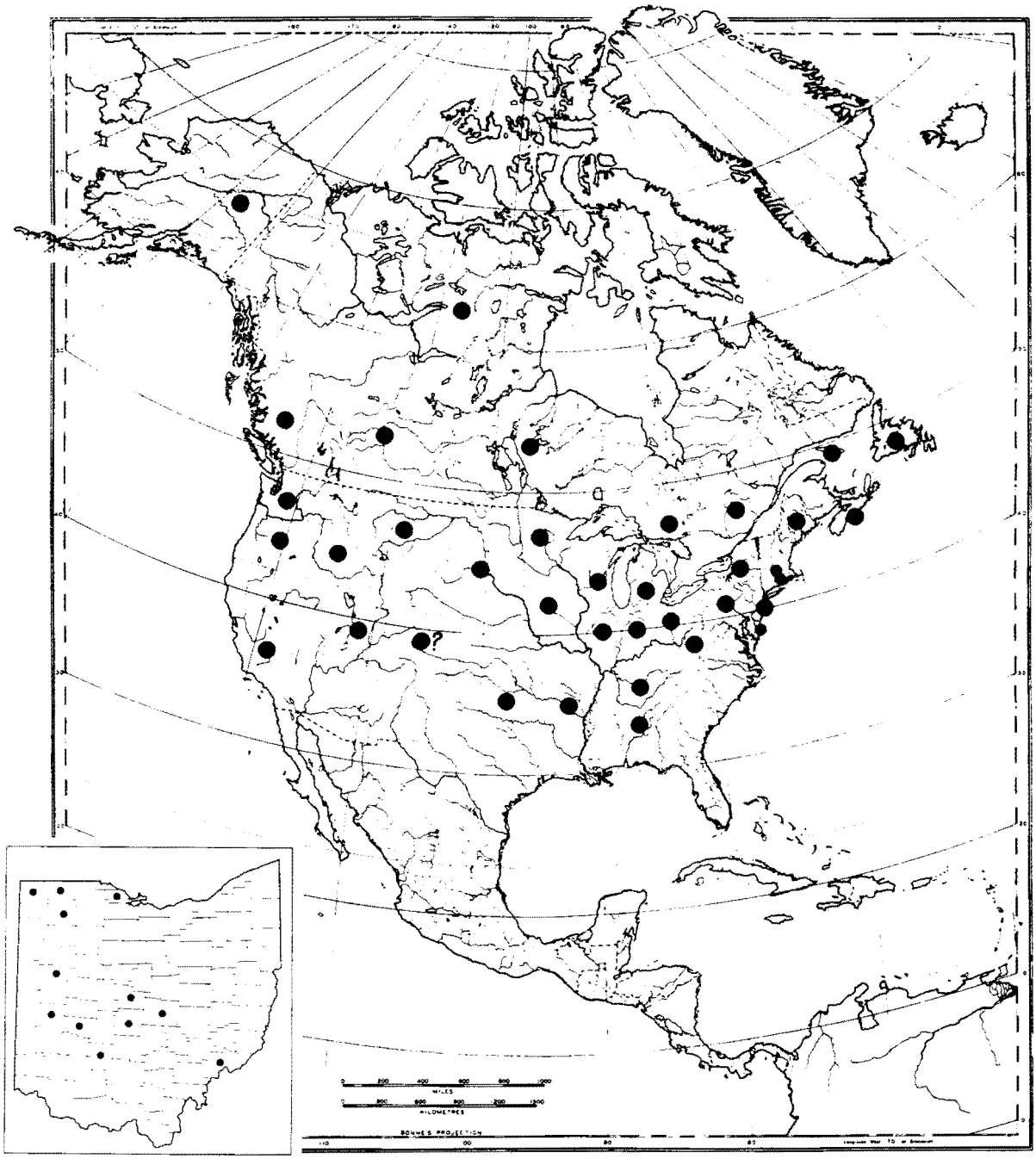

FIGURE 514.—Distribution of *Zonitoides nitidus* in North America; *inset,* distribution in Ohio.

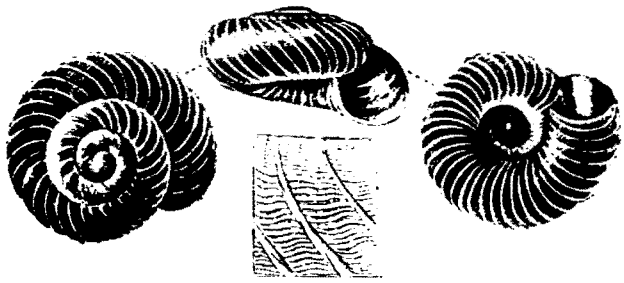

FIGURE 515.—*Striatura exigua*, magnified; after Pilsbry (1946, p. 490, fig. 268).

has not. Can it be that the species is a late arrival to the northeastern United States and Canada?

Striatura ferrea Morse 1864
Fig. 517

Striatura ferrea Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 17, figs. 36-39, pl. 2, fig. 10, pl. 7, fig. 40.
Hyalina ferrea Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 374.
Vitrea ferrea Goodrich 1932, Moll. Mich., p. 30.

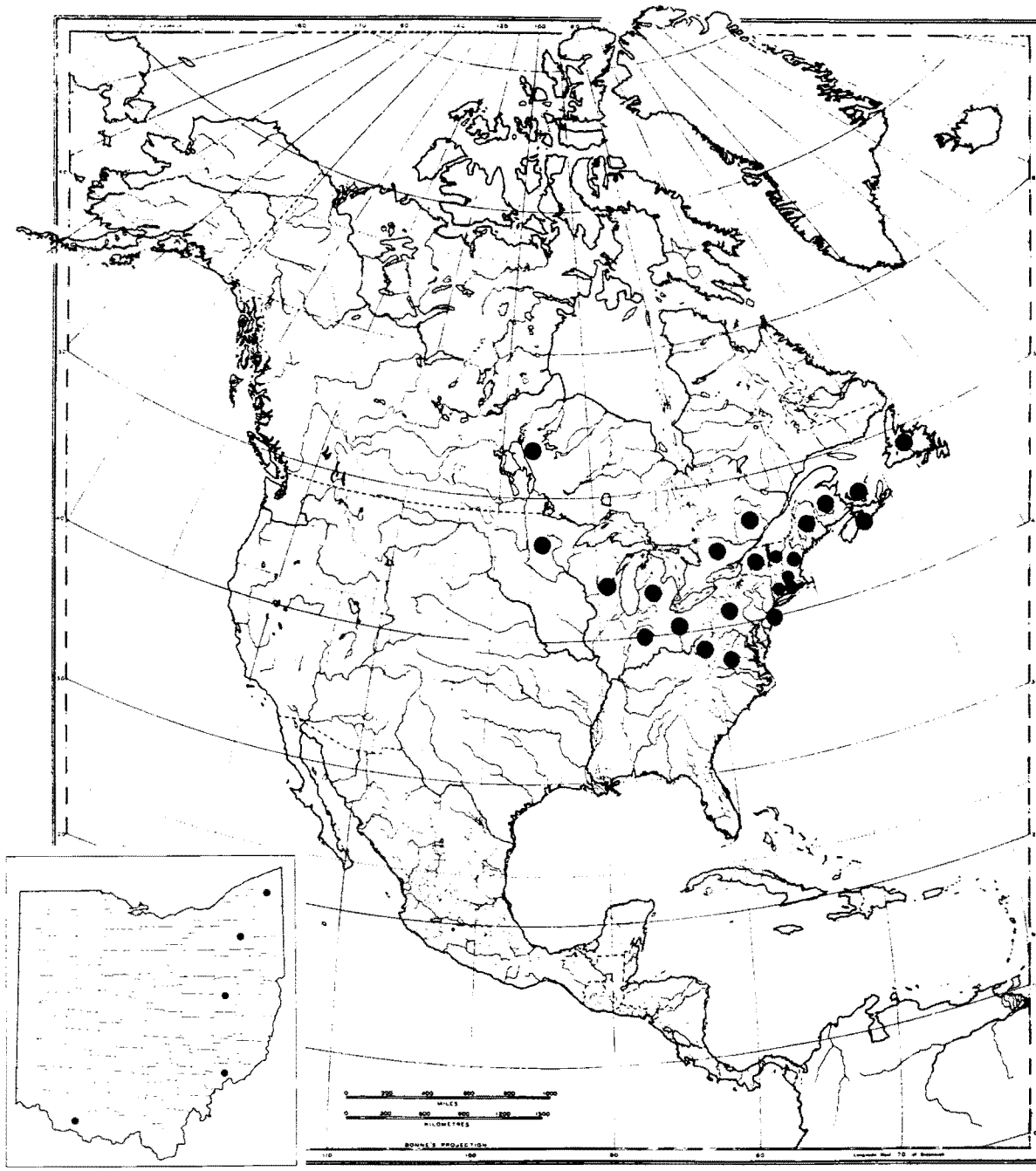

FIGURE 516.—Distribution of *Striatura exigua* in North America; *inset*, distribution in Ohio.

Striatura ferrea Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 497, fig. 273.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 29.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 30, pl. 3, fig. 16.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 317.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 81.

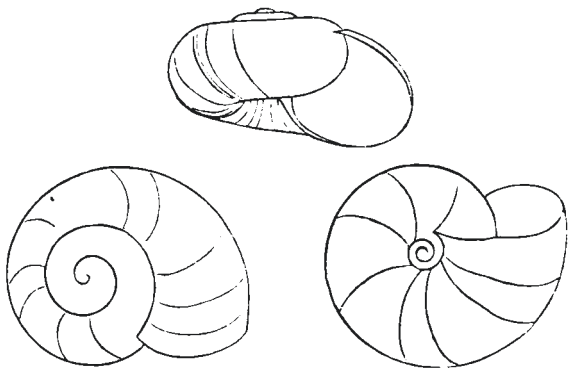

FIGURE 517.—*Striatura ferrea,* magnified; after Morse (1864, p. 17, figs. 36-38).

Type locality.—Maine.

Diagnosis.—Shell small, translucent, with a steel-gray tint, not shining; of three whorls, the outer one rapidly enlarging; aperture well rounded, very large, spire slightly elevated; suture distinct, deeply channelled near the apex; umbilicus small, exhibiting all the whorls; spiral striae minute, crossed by fine axial striae.

Ecology.—"Found in damp localities" (Morse, 1864). The species occurs in damp woodlands, especially those of deciduous trees in Ontario (Oughton, 1948, p. 94 ff.). H. B. Baker (1922b) found it in a swampy thicket near the mouth of a small creek, with arborvitae and deciduous trees, in Dickinson County, Michigan. In the Ottawa region, I have found it most commonly in moss from well-shaded stumps and logs in woods, especially along margins of swamps.

Associations.—Living: OHIO-43; QUEBEC-6.

General distribution (fig. 518).—Nova Scotia west to Ontario; south to North Carolina and Tennessee.

Distribution in Ohio (inset, fig. 518).—Summit, Portage, and Tuscarawas Counties (Sterki, 1907a, p. 374).

Geologic range.—Unknown.

Striatura milium (Morse) 1859
Fig. 519

Helix milium Morse 1859, Boston Soc. Nat. History Proc., v. 7, p. 28.
Striatura milium Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 18, figs. 41, 42; pl. 7, fig. 43.
Zonitoides milium Dall 1905, Harriman-Alaska Exped., v. 13, p. 43, fig. 30.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Goodrich 1932, Moll. Mich., p. 33.
Striatura milium Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 272.
--- --- Pilsbry 1946, Land Moll. N. America, v. 2, pt. 1, p. 495, fig. 272.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 29.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 29, pl. 3, figs. 26, 27.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 23, pl. 4, fig. A; fig. 11.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 317.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 82.

Type locality.—Maine.

Diagnosis.—Shell very minute, broadly umbilicate (umbilicus nearly one-third the diameter of the shell), with low conic-convex spire; yellowish corneous or gray; composed of slightly over 3 convex whorls; embryonic shell of 1½ whorls, the first one smooth, the next half whorl usually more or less distinctly striate spirally; postembryonic whorls regularly, finely costulate, the riblets retractive, more oblique than growth lines, and decussated by closer spirals; this sculpture almost obsolete on the base, and the surface more glossy; last whorl tubular, aperture subcircular (modified from Pilsbry, 1946, p. 495).

Ecology.—The animal lives among dead leaves in woods, and may be collected by sifting. Pilsbry (1946) has found it most frequently on northern slopes with chestnut, beech, or even oak, but Morse (in Pilsbry, 1946, p. 496) stated that in Maine it lives also where the growth is almost exclusively pine, spruce, and hemlock.

Found in damp woodlands, especially those of deciduous trees, in Ontario (Oughton, 1948, p. 94 ff.). H. B. Baker (1922b) recorded a single specimen from higher moraines with fine hardwood cover in Dickinson County, Michigan, where snails were found particularly in maple logs. Burch (1955, Naut. 69, p. 66) recorded the relationships of this species to soil factors in eastern Virginia. Lindeborg (1949, Naut. 62, p. 130) found it under decaying logs in Ontario. The most frequent occurrences in the Ottawa region were in moss from well-shaded stumps and logs in swamps and along the wet margins of woods ponds. The snails are not evident in the field but are collected from siftings of the dry moss.

Associations.—Living: MICHIGAN-17, 18, 23, 25; MINNESOTA-3, 7; OHIO-43; ONTARIO-2, 3; QUEBEC-6. Fossil: W-5, 6, 9, 12, 16, 17, 19.

General distribution (fig. 520).—Manitoba, Ontario, Quebec, Newfoundland, and Prince Edward Island,

south to New Jersey, Pennsylvania, West Virginia, Kentucky, Indiana, and Illinois.

Distribution in Ohio (inset, fig. 520).—Portage County (Pilsbry, 1946). The species does not seem to have been collected in any other county up to the present but it should almost certainly be found in the northeastern counties adjoining Portage County.

Geologic range.—F. C. Baker (1920a, p. 389) gave only Peorian for this species. Tazewellian zone of the Peoria Loess (A. B. Leonard, 1952, p. 23). These are the only fossil records of the species known to me.

Family LIMACIDAE

Limacidae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 521.

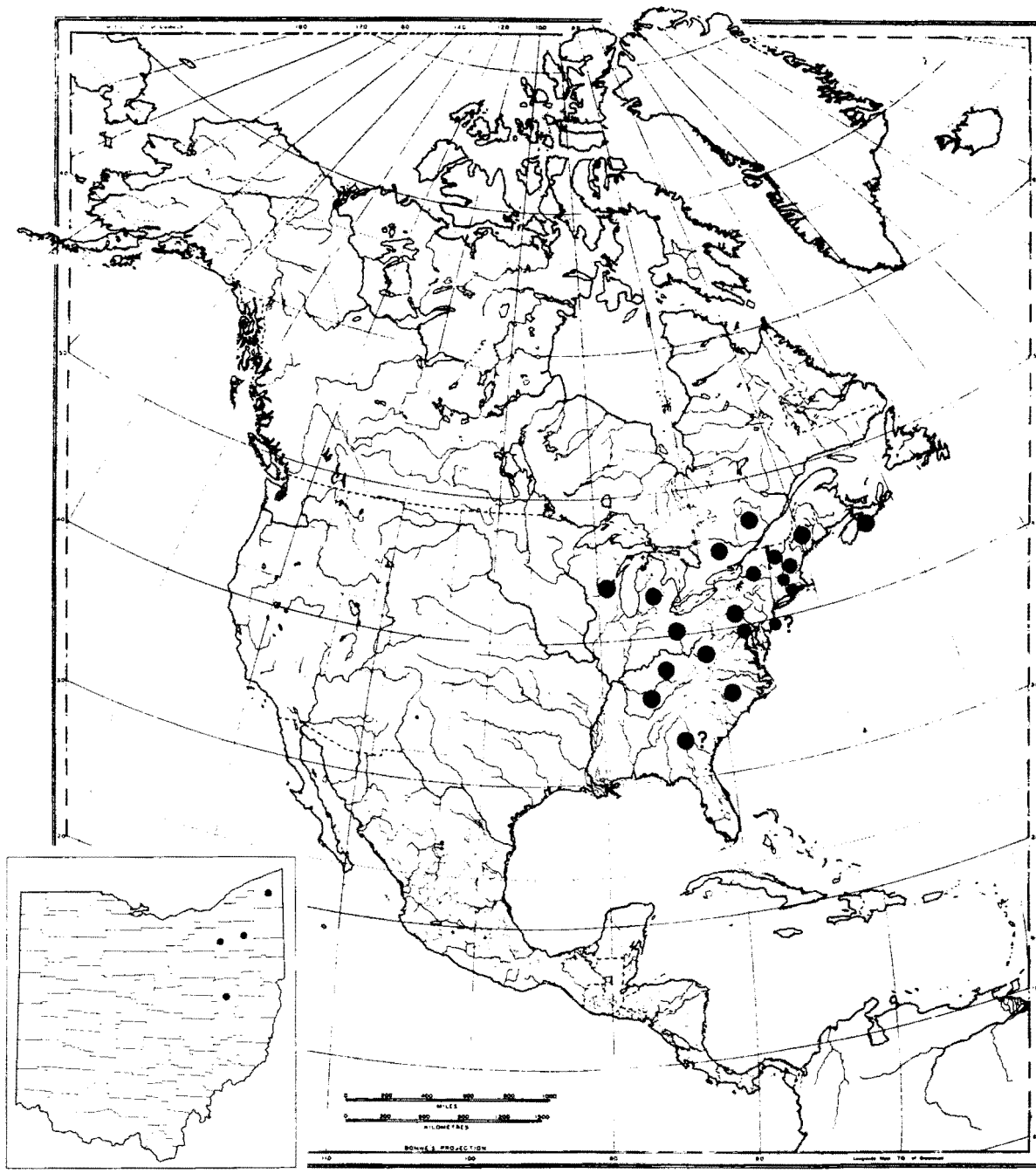

FIGURE 518.—Distribution of *Striatura ferrea* in North America; *inset,* distribution in Ohio.

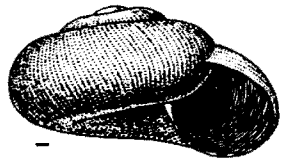

FIGURE 519.—*Striatura milium*, magnified; after F. C. Baker (1939a, p. 77).

Diagnosis.—Aulacopod slugs with an oval mantle on the forward part of the back which extends forward in a free lobe under which the head may be withdrawn; shell small, reduced to a flat plate which is wholly covered in Ohio genera (partially exposed in others); breathing pore in right margin of mantle, behind a short slit to the edge; jaw smooth; marginal teeth of radula simply thorn shaped or bifid, with narrow, oblong basal plates.

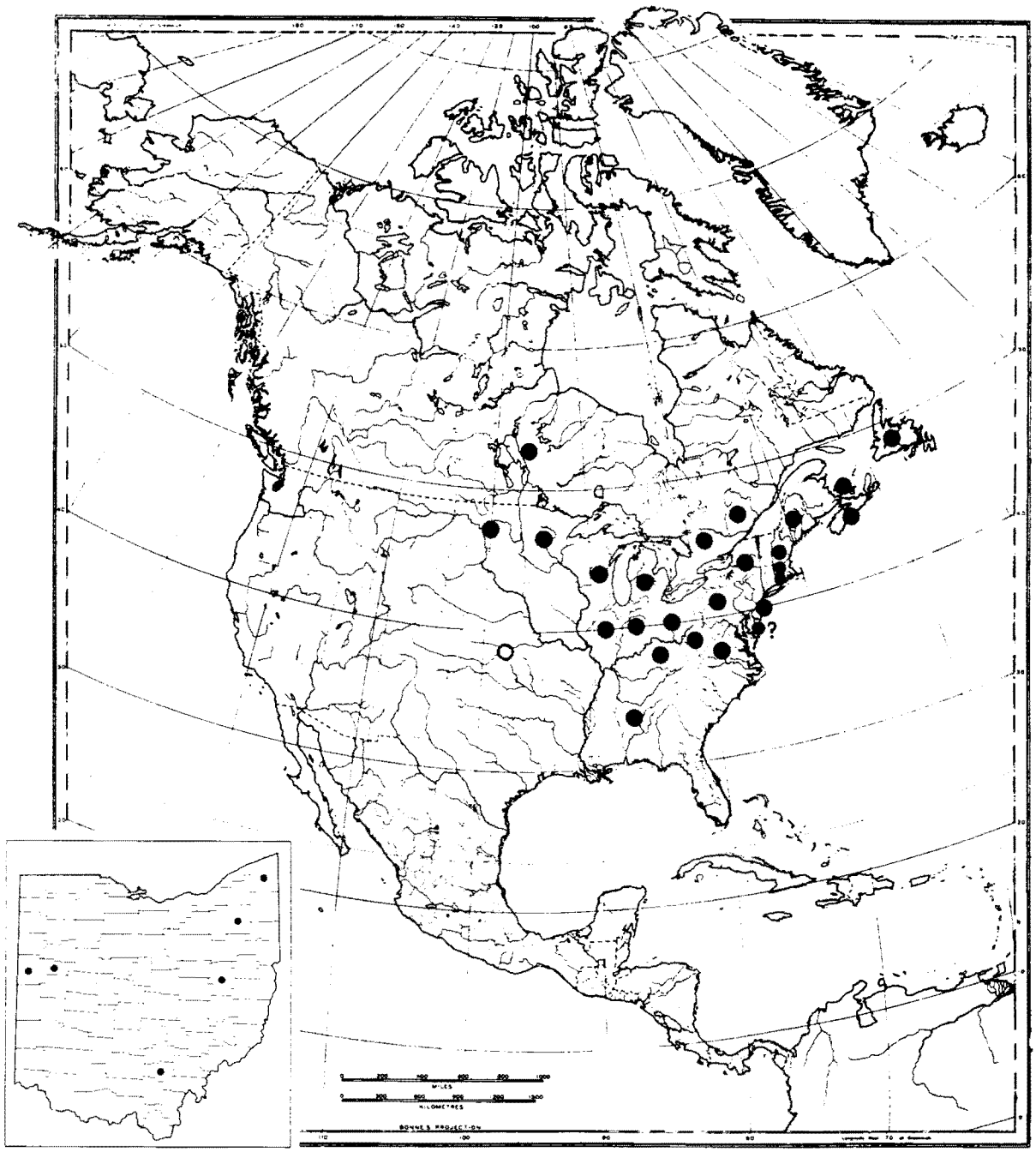

FIGURE 520.—Distribution of *Striatura milium* in North America; *inset*, distribution in Ohio.

Subdivisions.—Numerous genera which it is unnecessary to enumerate here belong in this large family of slugs. The genera of immediate concern to the Pleistocene of Ohio are *Limax* and *Deroceras,* both represented in the living fauna of Ohio by native and introduced species. In the Pleistocene deposits of the State, only *Deroceras* is represented.

Remarks.—Slug shells are fairly common in Pleistocene nonmarine deposits but are often overlooked because of their unusual shape. They should be looked for in all such deposits and their presence recorded, even though specific identification is commonly impossible.

Genus *Limax* Linnaeus 1758

Limax Linnaeus 1758, Syst. Nat., 10th ed., p. 562; 1767, 12th ed., p. 1081.
Limax Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 523.
Limax La Rocque 1953, Cat. Recent Moll. Canada, p. 318.

Type.—*Limax maximus* Linnaeus.

Diagnosis.—Large, commonly spotted or striped slugs native to Europe, with the shell completely enclosed in the mantle; shell large, oval, flat, thin, practically indistinguishable from that of *Deroceras* except for size in the adult of living species.

General distribution.—Europe, Asia Minor, Algeria; introduced in North and South America, South Africa, Australia, Hawaii, and elsewhere. In North America: Newfoundland, Ontario, Massachusetts, Rhode Island, New York, New Jersey, Pennsylvania, Maryland, Ohio, Michigan, Illinois, Missouri, Texas, Colorado, Utah, California, and Oregon.

Geologic range.—Undetermined. Species have been recorded from the Pleistocene of North America but it seems more suitable to refer these to *Deroceras,* a genus certainly present on this continent since the late Pleistocene, rather than to *Limax,* whose living species have been introduced into North America in historic times.

Limax maximus Linnaeus 1758
Fig. 521

Limax maximus Linnaeus 1758, Syst. Nat., 10th ed., v. 1, p. 652.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 375.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 45.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 41, pl. 5, fig. 7.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 318.

Type locality.—Sweden.

Diagnosis.—Animal large, yellowish gray, generally spotted with black; spots on the shield scattered, or concrescent into irregular blotches or marbling; spots behind the shield commonly arranged in three bands of black spots lengthwise on each side, or with one or two bands continuous; rarely uniformly pale, without markings, or in some specimens suffused with blackish throughout; neck, sole, and foot fringe pale; internal shell oblong, thin, nearly flat, covered with a thin yellowish epidermis above and projecting at the edges, the lower face white (modified from Pilsbry, 1948, p. 524).

Ecology.—A common slug of gardens, cellars, springhouses, litter in shady places, habitats which afford shelter by day. It is not found in woods or anywhere far from habitations. It is known to have lived in the United States at least since 1867, when it was collected in Philadelphia. It has become abundant in many places where it has been introduced but, like the following species, it has not spread quickly and has lost ground in some places.

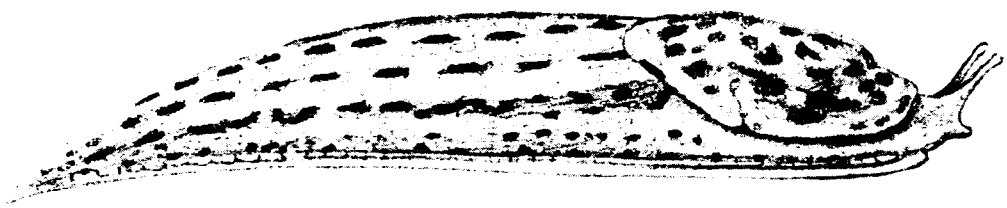

FIGURE 521.—*Limax maximus,* approximately X1; after Burch (1960, pl. III, fig. H).

Archer (1934c, p. 139) found this species under oak leaves in the cemetery on Mackinac Island, Michigan. It is, of course, commonly found in the neighborhood of greenhouses, in city gardens, and in vacant lots, as well as around refuse dumps. It is quite resistant to cold; colonies have been known to survive in the Ottawa region for several years in spite of the severe climate of that area. In Tennessee (Lutz, 1950, Naut. 63, p. 105) it is found in gardens, around damp places, introduced.

General distribution (fig. 522).—Europe, Asia Minor, Algeria; introduced in North and South America, South Africa, Australia, Hawaii, and elsewhere. In North America: Newfoundland, Quebec, Ontario, and British Columbia, south to New Jersey, Maryland, Ohio, Illinois, Missouri, Texas, Colorado, Utah, and California.

Distribution in Ohio (inset, fig. 522).—Recorded only for Hamilton and Wayne Counties (Sterki, 1907a,

p. 375) but likely to occur in populated places anywhere in the State.

Geologic range.—Unknown in North America.

Limax flavus Linnaeus 1758
Fig. 523

Limax flavus Linnaeus 1758, Syst. Nat., 10th ed., p. 652.
--- --- Call 1900, Moll. Ind., p. 372, pl. 7, fig. 5.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 375.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 278.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 528.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 41, pl. 5, fig. 5.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 318.

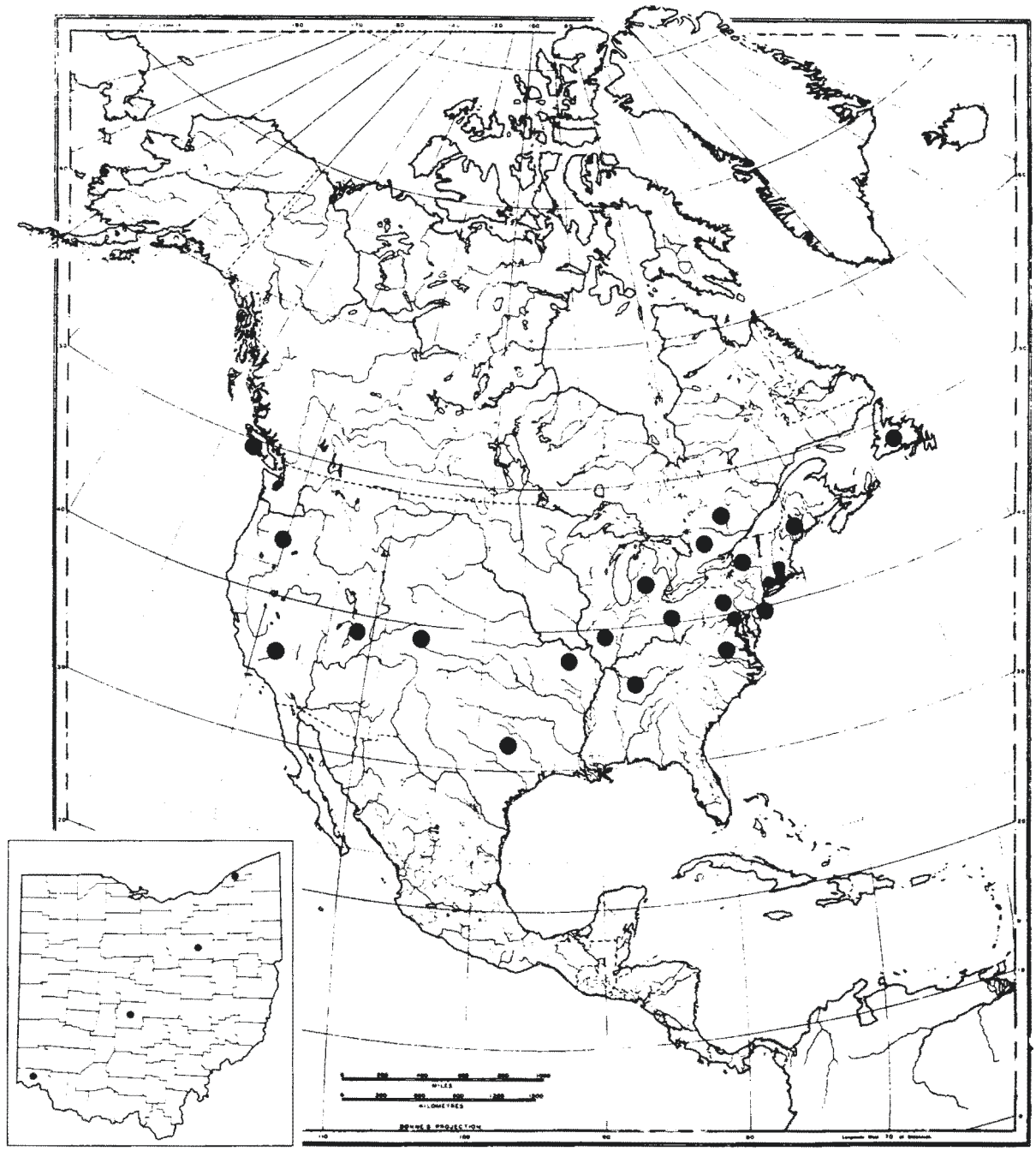

FIGURE 522.—Distribution of *Limax maximus* in North America; *inset*, distribution in Ohio.

Type locality.—Europe.

Diagnosis.—Animal large, yellowish gray above, with many irregular spots of clear yellow on the shield, and oval yellow wrinkles on the body; the gray disappearing on the sides, which are entirely pale yellow toward the front; tentacles bluish; shell large, oval, practically indistinguishable from that of other species of the family.

Ecology.—The animal always lives in or near cultivated places, never far from gardens or farms. It feeds on cultivated plants, both green leaves and tubers (carrot, potato, turnip), but is said to prefer fungi to leafy plants. It is well known in Europe as a garden pest; in this country it has caused damage in greenhouses and intensively cultivated gardens. Although it is known to have lived in North America before 1825, when Thomas Say recorded it for Philadelphia, it has not noticeably extended its range in the many places in which it has been introduced; in fact, in several places where no particular effort is known to have been made to eradicate it, it seems to have lost ground instead.

General distribution (fig. 524).—Europe, throughout the temperate part of the continent; imported in many European colonies on other continents. Quebec (doubtfully) and sporadically from Maine to Missouri, south to Texas, Alabama, Georgia, and South Carolina.

Distribution in Ohio.—Not definitely recorded but noted as probable by Sterki (1907a, p. 375).

Geologic range.—Unknown in North America.

FIGURE 523.—*Limax flavus,* approximately X1; after Burch (1960, pl. III, fig. G).

Genus *Deroceras* Rafinesque 1820

Deroceras Rafinesque 1820, Annals of Nature, v. 1, p. 10.
Krynickia Kaleniczenko 1839, Bull. Soc. Imp. Nat. Moscou, p. 30.
Krynickillus Kaleniczenko 1851, Bull. Soc. Imp. Nat. Moscou, v. 24, p. 220.
Malino Gray 1855, Cat. Pulm. Coll. Brit. Mus., pt. I, p. 178.
Agriolimax Mörch 1865, Jour. Conchyl., v. 13, p. 378.
Hydrolimax Malm 1868, Göteborgs Kongl. Vetensk. Handl., v. 10, p. 79.
Chorolimax Westerlund 1894, Nachrbl. d. malak. Ges., v. 26, p. 163.
Arctolimax Westerlund 1894, *ibid.*
Deroceras Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 532.

Type.—*Limax gracilis* Rafinesque (=*Limax laevis* Müller).

Diagnosis.—Shell internal in the living animal, oval, concentrically striate, the nucleus a little to the left of the middle of the posterior margin; fossil shells indistinguishable except by relative size from those of *Limax* and other genera of the Limacidae.

General distribution.—Entire Palearctic region and both Americas; two species, *D. reticulatum* (Müller) and *D. laeve* (Müller), probably have been introduced in America by commerce, but Pilsbry (1948, p. 552-557, 560-563) described three species which appear to be native to this continent. The finding of *D. aenigma* Leonard in the Upper Pliocene or Lower Pleistocene of Kansas and possibly of Ohio confirms the endemic nature of the genus in the United States from at least early Pleistocene time.

Geologic range.—Upper Pliocene or Pleistocene to present. The geologic history of this genus may be considerably more extensive as the shell is easily overlooked and its true nature is not evident to anyone not familiar with land snail assemblages.

Speciation.—Pilsbry (1948, p. 533) noted that over sixty species of this genus have been named but that fewer than half of these are recognizably described. Of the North American species recognized by him, two are described in this report since they are definitely known for Ohio. In addition, a fossil species, *D. aenigma,* subsequently described by Leonard, has been doubtfully identified from Ohio deposits.

The other species known to occur in North America are one introduced species, *D. caruanae* (Pollonera), discussed by Pilsbry (1948, p. 557), and three native species not likely to be found in Ohio, all described as new by Pilsbry: *D. monentolophus* (1948, p. 552), *D. heterura* (1948, p. 560), and *D. hesperium* (1948, p. 554).

Deroceras aenigma Leonard 1950
Pl. 14, figs. 10, 11

Deroceras aenigma Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 38, pl. 5, fig. E.
--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 12.
Deroceras cf. *D. aenigma* La Rocque and Conley 1956, Hunter's Run, p. 326 ff.
Deroceras aenigma Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1,

p. 146.

Deroceras aenigma Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 80.

Type locality.—SW¼ sec. 22, T. 33 S., R. 29 W.; 9 miles south and 7 miles west of Meade, Meade County, Kansas; Rexroad Ranch deposits, Aftonian (*fide* Leonard).

Diagnosis.—"The species is known only from the internal shell, which is elongate, roundly oblong, heavy, bearing concentric growth striae which emanate from a subterminal nucleus displaced toward the left. . . . Shell elongate, roundly oblong, relatively thick and heavy; left border convex, right border slightly concave, anterior and posterior borders convex; dorsal surface arched, nucleus subterminal displaced toward the left; growth striae fine, crowded; growth rests making distinct ridges, parallel with striae, 3 in number; ventral surface of shell slightly concave, marked by irregular shallow grooves and rounded ridges, which are roughly

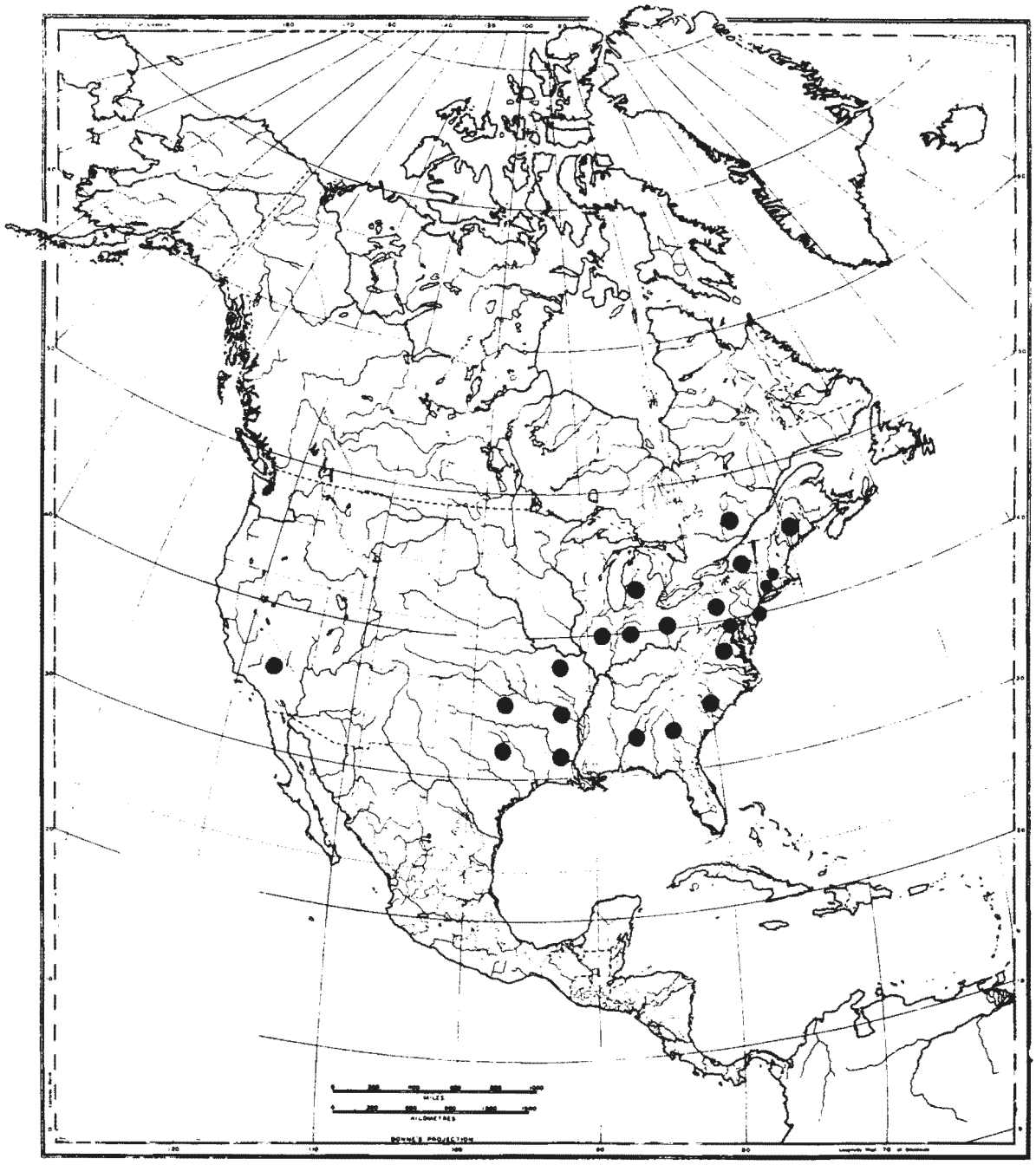

FIGURE 524.—Distribution of *Limax flavus* in North America.

parallel to long axis. Total length, 4.0 mm.; greatest width, 2.5 mm.; thickness, 1.1 mm." (Leonard, original description).

Ecology.—Leonard (1950, p. 38) stated that "It may reasonably be inferred that the ecological requirements of *D. aenigma* were generally like those of *D. laeve*. . . . The latter lives in humid situations, on floodplains and low terraces of streams, and in or near marshes, under logs, twigs, leaves, grasses, or among mosses and other vegetation." D. W. Taylor (1960) listed this species as an inhabitant of moist leaf mold and plant debris: under logs and bark, or among leaves, moss, or grass in moist situations not far from water.

Associations.—Fossil: P-1, 2, 3, 4; N-1, 2; A-1; K-1, 2, 9, 10, 12, 13, 14, 18, 19, 20, 23, 24, 25, 26, 27; S-1(*cf.*), 2, 3, 4, 5; W-28(?).

General distribution (fig. 525).—Aftonian and Yarmouthian of Iowa, Nebraska, Kansas, Oklahoma, and Texas (Leonard); possibly late Pleistocene of Ohio (La Rocque and Conley).

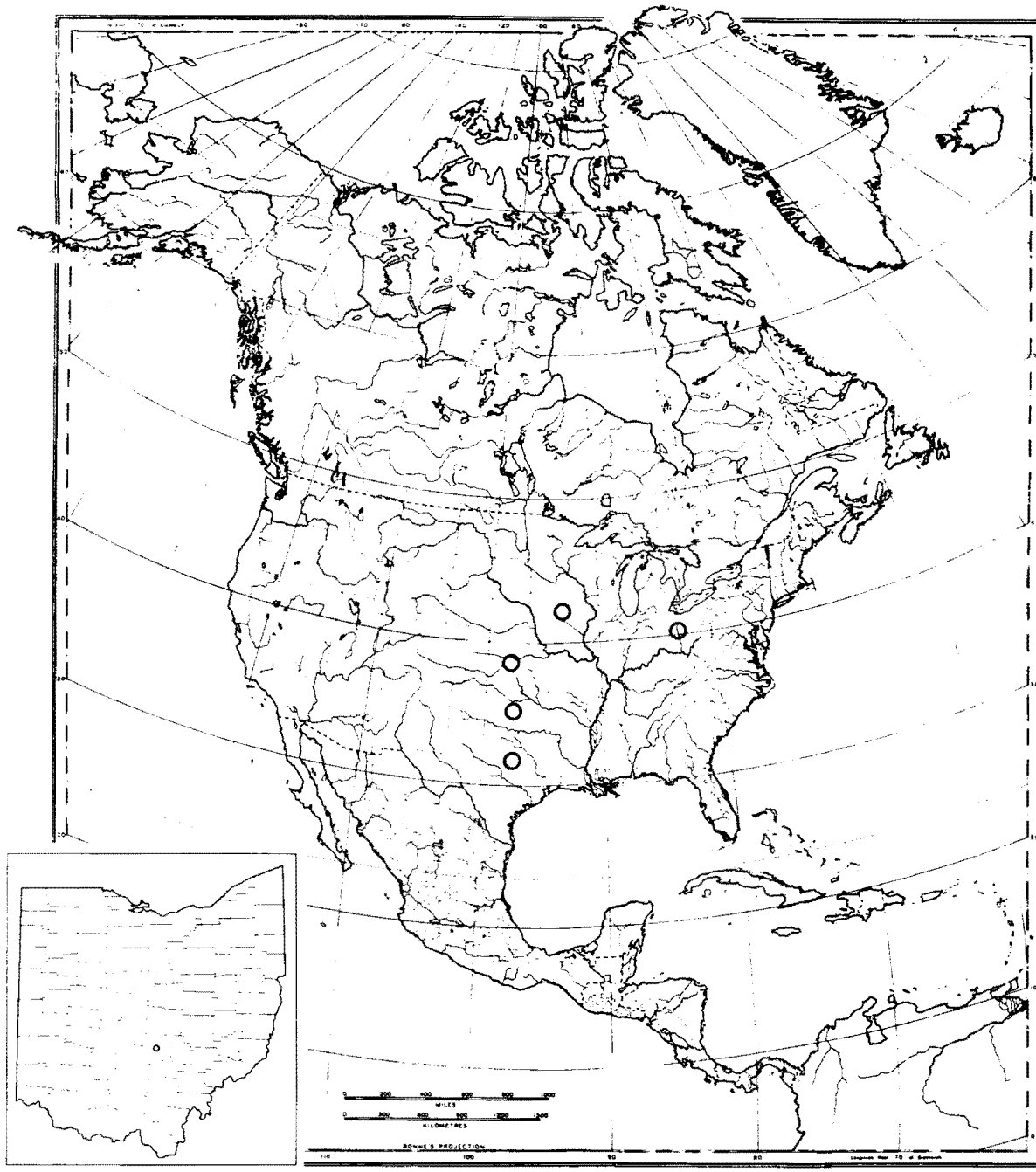

FIGURE 525.—Distribution of *Deroceras aenigma* in North America; *inset*, distribution in Ohio.

Distribution in Ohio (inset, fig. 525).—Doubtfully, late Pleistocene, Hunter's Run deposit, Fairfield County; Castalia marl, "one shell plate, 5 mm. long, 3.5 broad and rather thick" (Sterki, 1920, p. 178). If these records are correctly assigned to *D. aenigma*, the species may turn out to be quite common in the Pleistocene of Ohio.

Geologic range.—Leonard (1950, p. 38) gave the geologic range of his species as Aftonian and Yarmouthian. The types are from the Rexroad Formation which Hibbard and Taylor (1960, p. 20) have dated as Upper Pliocene on the basis of fossil mammals.

Deroceras laeve (Müller) 1774
Fig. 526

Limax laevis Müller 1774, Verm. Terr. et Fluv. Hist., v. 2, p. 1.
Limax campestris Binney 1842, Boston Soc. Nat. History Proc., v. 1, p. 52.
Limax campestris Call 1900, Moll. Ind., p. 371, pl. 4, fig. 18.
Agriolimax campestris Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 375.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Goodrich 1932, Moll. Mich., p. 41.
Deroceras gracile Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 278.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 44.
Deroceras laeve Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 42, pl. 5, fig. 2.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 539, figs. 289-291.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 19, pl. 4, fig. J.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 319.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 145.

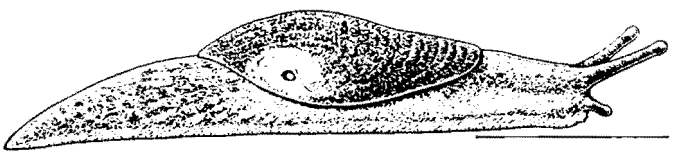

FIGURE 526.—*Deroceras laeve*, magnified; after F. C. Baker (1939a, p. 129).

Type locality.—Denmark.

Diagnosis.—A small slug, of various shades of amber, without spots or markings, to blackish; head and tentacles smoky; body cylindrical, elongated, terminating in a very short carina at its posterior extremity; mantle oval, fleshy, not prominent, with fine concentric lines; back covered with prominent elongated tubercles and furrows; foot narrow, whitish; breathing pore on posterior right margin of the mantle; body covered with a thin, watery mucus; shell oblong, left margin more convex than the right, nucleus not quite terminal on the left side of the posterior end; length about 4 mm.

Ecology.—This slug prefers humid areas and is particularly partial to floodplains and low terraces of streams; it is also found in or near marshes, in wet weather crawling quite far up the vegetation; in dry weather, it hides under logs, twigs, leaves, grass roots, and moss. It is much hardier than might be inferred from the above data and will live also in apparently dry situations with good cover and protection from desiccation. In rainy weather, it emerges from cracks between sidewalks or buildings and lawns and its slime trails attest to its abundance in apparently unlikely situations that are usually dry but afford sufficient moist cover to suit this species.

Oughton (1948, p. 94 ff.) listed this species for damp woodlands, especially those of deciduous trees. H. B. Baker (1922b) noted the following habitats, all in Dickinson County, Michigan: (16) swamp in floating marsh: a partially flooded area in the floating marsh surrounding Tamarack Lake; (38) sandy outwash plains, pine and second growth; (44) ash-cedar swamp, snails in humus around bases of trees; (46) clearing in hardwoods: snails in and around old stumps and logs; one of the drier alluvial habitats; (47) floodplain of Hancock Creek, about 2 feet above July water level; (48) floodplain of Menominee River, in a damp hollow with brush of tag alders, dogwoods, hazels, and small ashes; (49) floodplain of Sturgeon River, flooded even in slight overflows, rather unfavorable to mollusks. Archer (1934c, p. 139) found it under logs and leaves in the hardwoods on Mackinac Island, Michigan.

Grimm (1959, Naut. 72, p. 125) found it along and near railroad tracks in Maryland. Lutz (1950, Naut. 63, p. 105) recorded it for red-oak–black-oak communities in Tennessee. Lindeborg (1949, Naut. 62, p. 129) found it on damp moss at the base of a cliff and under half-decayed poplar logs in Ontario. Wayne (1959b, p. 92) recorded it for the following habitats in the northern part of its range: undersides of rocks and pieces of wood and cardboard, from water level at the edge of a tundra pond to about 3 meters above pond level on a slope, most numerous near water level, at Churchill, Manitoba; on the lower sides of flat rocks on Southampton Island; and beneath pieces of crating lumber and cardboard just above water level in muskeg at Coral Harbour, Northwest Territories, Canada.

Ingram (1946, Naut. 59, p. 92) gave the following notes for the Huyck Preserve in New York State: "This small, introduced slug was rarely taken. It was most often observed crossing roads before the sun was high. It seemed to prefer forested land to overgrown berry and grass covered fields. Collections were made from beneath logs and humus in maple and beech-hemlock areas."

Associations.—Living: MANITOBA - 39; MICHIGAN - 1, 22, 28, 31, 32, 33, 34, 35, 36, 40; OHIO - 4, 34, 39, 43; ONTARIO - 7, 14; WISCONSIN - 138, 139, 140, 144. Fossil: K - 7; I - 5; W - 2, 3, 4, 12, 28(?), 62, 64, 65, 67, 69, 71.

General distribution (fig. 527).—Alaska, Baffin Land, Hudson and James Bays, and Newfoundland, southward to Florida and Central America.

Distribution in Ohio (inset, fig. 527).—Sterki (1907a, p. 375) gave "over the state" and mentioned Harrison County specifically. This widely distributed species is probably to be found in every county of the State, as Sterki stated. For the fossil record, see below.

Geologic range.—F. C. Baker (1920a, p. 389) gave only "Wabash." A. B. Leonard (1952, p. 19) gave "Crete-Loveland, Peoria, to Recent." D. W. Taylor and Hibbard (1955, p. 12) recorded it with some doubt from the (probably) Illinoian and Sangamon of Kansas.

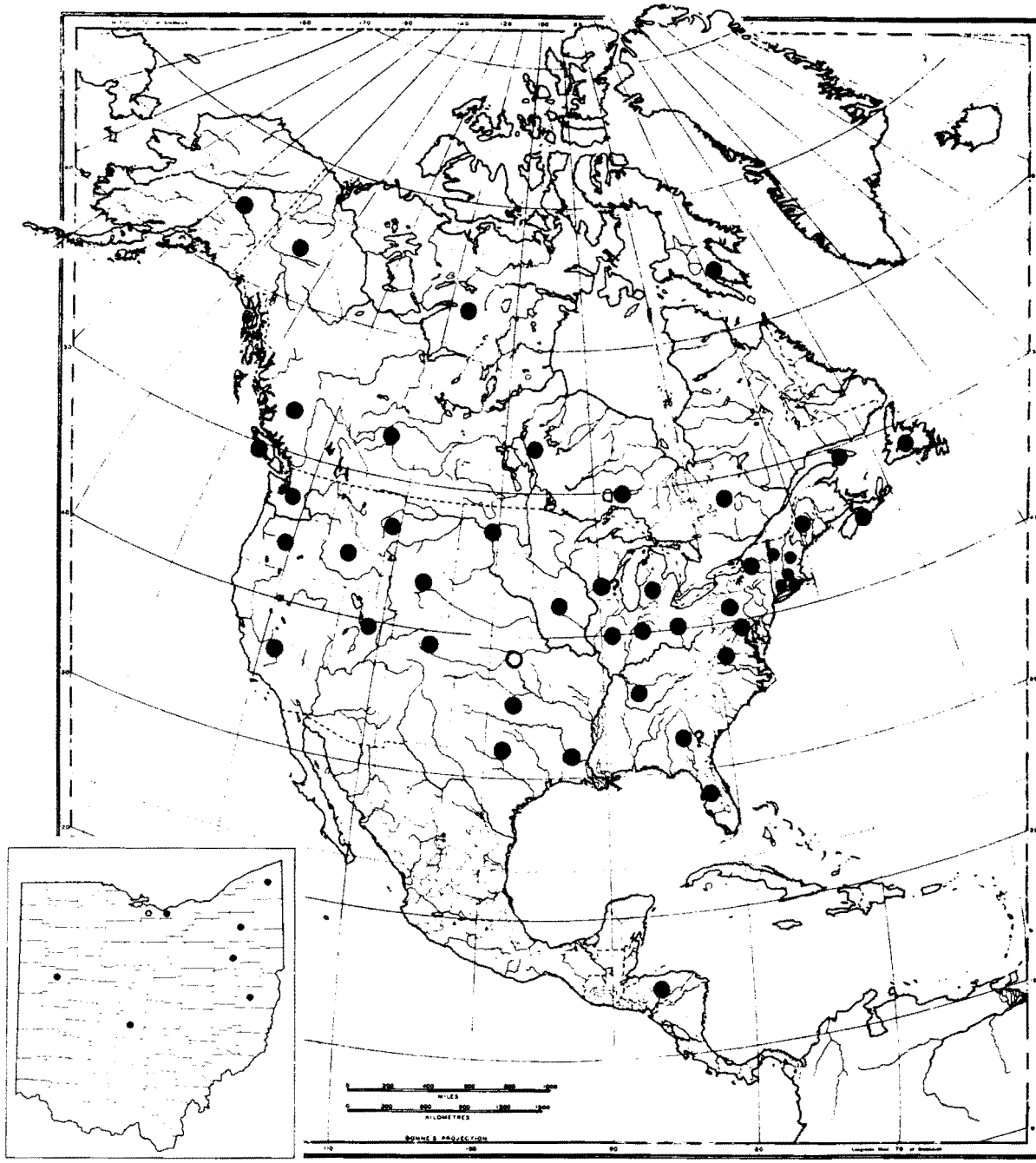

FIGURE 527.—Distribution of *Deroceras laeve* in North America; *inset*, distribution in Ohio.

Sterki (1920, p. 178) recorded it for the Castalia marl, late Pleistocene. Hibbard and Taylor (1960, p. 145) gave Illinoian to Recent.

Deroceras reticulatum (Müller) 1774
Fig. 528

Limax reticulatus Müller 1774, Verm. Terr. et Fluv. Hist., v. 2, p. 10.
Agriolimax agrestis Dall 1905, Harriman-Alaska Exped., v. 13, p. 45, fig. 31.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 375.
Agriolimax reticulatus Luther 1915, Acta Fauna et Flora Fennica, v. 40, no. 2.
Agriolimax agrestis Goodrich 1932, Moll. Mich., p. 41.
Deroceras agreste Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 278.
Deroceras reticulatum Oughton 1948, Zoögeogr. study, Ontario, p. 43.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 534, figs. 287, 288.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 42, pl. 5, fig. 4.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 319.

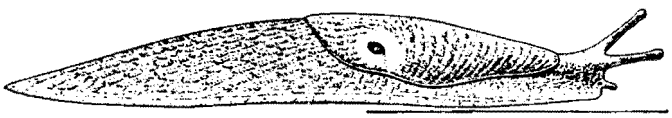

FIGURE 528.—*Deroceras reticulatum*, magnified; after F. C. Baker (1939a, p. 130).

Type locality.—Gardens of Rosenborg and Fridrichsdal, Denmark.

Diagnosis.—A rather large and stout slug, somewhat keeled near the tail; mantle concentrically striate, the back and sides with long, low tubercles; upper surface whitish, buff, in rare specimens entirely black; some specimens with gray or blackish markings of varying size and abundance; mantle more than one-third the total length of the shell, breathing pore at its posterior fourth, surrounded by a raised, pale border; mucus abundant and sticky, milky white when the slug is irritated; length of animal about 35 mm., up to 50 mm.; shell slightly convex, rather thin, with faint lines of growth; nucleus a little to the left of the middle of the posterior margin.

Ecology.—This slug is one of the hardiest of the North American species, although it is almost certainly introduced on this continent. It seems to prefer gardens and fields, where it has become a pest, seriously injurious to cauliflower, cabbage, potato, and other vegetable crops, but it also causes trouble in gardens where it destroys young plants of almost any kind. It is widespread and has been taken in open woods far from any human dwelling where it feeds on mushrooms, small dead animals of almost any kind, and decaying fruits and leaves.

Archer (1935, p. 78) described its habitat in the Asheville, North Carolina, region as follows: common throughout the city; inhabits the edges of sidewalks, and during wet weather crawls on the lawns. It also lives in large numbers in honeysuckles both in exposed and shaded areas. I have found it abundant around gardens under any kind of debris which can afford it some protection against dryness, such as pieces of wood, baskets, barrels, bases of birdbaths, even thick corrugated cardboard and litter of sticks and dead leaves. Grimm (1959, Naut. 72, p. 125) found it on and near railroad tracks in Maryland.

The species can become a pest in gardens if the surroundings provide enough cover for it. It has been known to attack potatoes underground and to eat every green vegetable above ground.

Associations.—Living: MICHIGAN-30, 31; OHIO-32, 34, 37, 38, 39, 42.

General distribution (fig. 529).—British Columbia to northern Quebec and Newfoundland, south to California, Utah, Colorado, and Georgia. Probably to be found in all states of the Union and every province of Canada.

Distribution in Ohio (inset, fig. 529).—The species is probably to be found all over the State; actual records (Sterki, 1907a, p. 375) are for Cuyahoga, Defiance, Seneca, Portage, Stark, and Hamilton Counties. To these may be added Franklin County and Ottawa County (Put-in-Bay), where the writer has collected this species.

Geologic range.—Unknown for North America, although some of the slug shells in our Pleistocene deposits could just as easily be referred to this species as to others.

Family ENDODONTIDAE

Endodontidae Pilsbry 1894, Man. Conchology, v. 9, p. xxviii.
Endodontidae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 565.

Diagnosis.—Planispiral or depressed heliciform, commonly carinate, not glossy; periostracum opaque, with axial striations and in some genera spiral ornamentation as well; aperture rounded-lunate, lip sharp and little if at all thickened.

Subdivisions.—The Ohio members of this family are placed in three different subfamilies, Endodontinae (genera *Anguispira* and *Discus*), Helicodiscinae (genus *Helicodiscus*), and Punctinae (genus *Punctum*).

Remarks.—The family is nearly universal in distribution and a large proportion of the genera and species are insular according to Pilsbry (1948, p. 566). The species include some of the hardiest snails in

the North American fauna and the family is represented far to the north on this continent.

Subfamily ENDODONTINAE

Endodontinae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 567.

Genus *Anguispira* Morse 1864

Anguispira Morse 1864, Terr. Pulm. Maine, Portland Soc. Nat. History Jour., v. 1, p. 11.

Helix, *Patula*, and *Pyramidula* (in part) of earlier authors, Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 567.

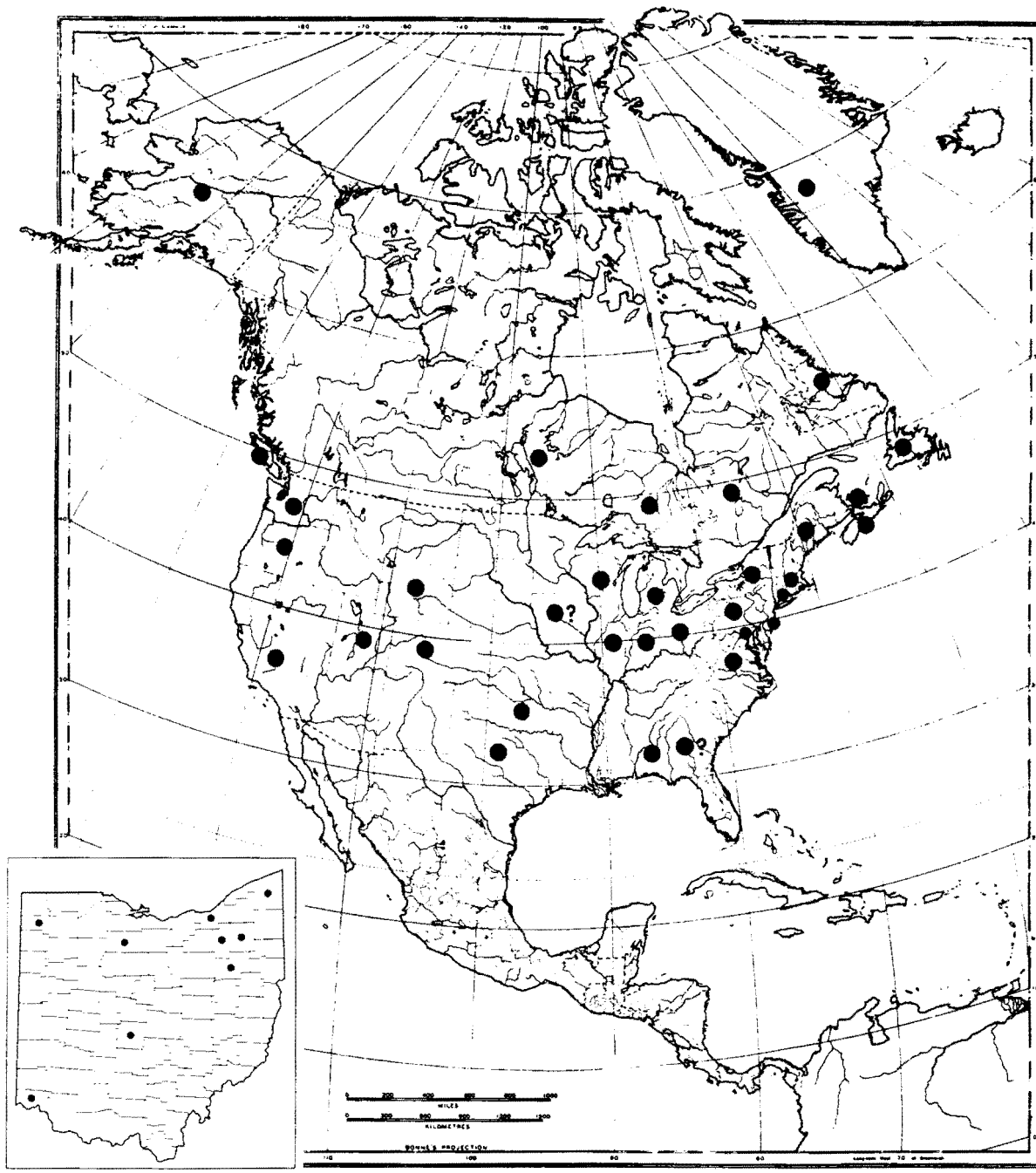

FIGURE 529.—Distribution of *Deroceras reticulatum* in North America; *inset*, distribution in Ohio.

Anguispira Pilsbry 1948, *ibid.*
Anguispira La Rocque 1953, Cat. Recent Moll. Canada, p. 320.

Type.—*Helix alternata* Say.

Diagnosis.—Shell helicoid or depressed helicoid, of medium to large size, openly umbilicate, of about 4½ to 6 tubular or flattened whorls, the latter angulate or even carinate in youth; the carination persists into maturity in some species; aperture wider than the umbilicus, without internal teeth or lamellae; lip thin and simple, expanded at the columellar margin.

General distribution.—United States and Canada (Ontario to Nova Scotia), mainly east of the plains region, and species in the Columbia River drainage.

Geologic range.—Pleistocene (Aftonian) to present.

Anguispira alternata (Say) 1816
Fig. 530

Helix alternata Say 1816, Nicholson's Encycl., v. 2, art. conchology, species 4, pl. 1, fig. 2.
Patula alternata Call 1900, Moll. Ind., p. 380, pl. 5, figs. 2, 3.
Pyramidula alternata Billups 1902, Nautilus, v. 16, p. 51.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 49, figs. 33-35.
Patula alternata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 377, 401, 402.
Pyramidula alternata F. C. Baker 1920, Jour. Geology, v. 28, p. 455.
Pyramidula alternata alba F. C. Baker 1920, *ibid.*
Pyramidula alternata Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Anguispira alternata Ahlstrom 1930, Nautilus, v. 44, p. 45.
--- --- Goodrich 1932, Moll. Mich., p. 34.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 274.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 33.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 568, fig. 305.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 30, pl. 2, figs. 1-3.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 17, pl. 2, fig. L.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 320.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 5, 6.
Anguispira alternata alba Taft 1961, *ibid.*

Type locality.—"Middle States" (Say).

Diagnosis.—Shell depressed helicoid, widely umbilicate, pale yellow or horn color, blotched with reddish brown; the blotches on the upper surface irregularly flamelike, on the lower surface spots and streaks; surface sculpture of curved riblike striae separated by minute axial wrinkles and weakly impressed spiral lines; aperture rounded, lip sharp.

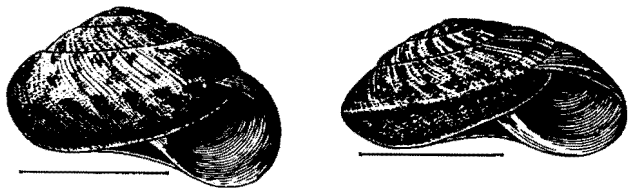

FIGURE 530.—*Anguispira alternata*, magnified; after F. C. Baker (1939a, p. 84).

Ecology.—A hardy species, able to live in rocky highlands or humid lowlands from Florida and Texas into Ontario and Quebec. It is capable of existing in areas with a minimum of cover and moisture.

A prolific, ubiquitous, and hardy snail favoring woodlands, especially of deciduous trees, but able to live in drier, more open woods or fields (Oughton, 1948, p. 94 ff.). H. B. Baker (1922b) found it in several habitats in Dickinson County, Michigan: (36) outcrop of Quinnesec schist, in dead leaves and humus, collected in hollows in the rocks, thickly overgrown with bearberries and scattered hardwoods and conifers; (38) sandy outwash plains, in pine and second growth; (39) in young hardwoods, in a small hollow between two granitic ridges; partially burned, some low-growing plants; (40) in virgin hardwoods; (41) in maple logs in hardwoods on higher moraines; (43) in a swampy thicket near the mouth of a small creek, with arborvitae and deciduous trees; (46) around old stumps and logs in a clearing in virgin hardwoods.

Archer (1934c, p. 139) noted that on Mackinac Island, Michigan, it "occurs in all habitats, but is especially common in open fields around burdocks, or at the bases of bluffs where there is little forest cover. However, it is one of the few species noticeable in the arborvitae. Near the fort it was found in a nasturtium garden."

The daylight activity of the species has been noted by Ingram (1940, Naut. 54, p. 87). The same author (1941, Naut. 55, p. 14-15) recorded it for floodplain of a creek, under stones, in beech–yellow-birch and sycamore woodlands (1944, Naut. 58, p. 25-27) in New York State. Muchmore (1959, Naut. 72, p. 85-88) also found it under stones in various woodlands areas in the same state. Wurtz (1941, Naut. 54, p. 142-143) has described a winter agglomeration of various species of land snails, including this one, in the soil of a northward-sloping hillside in Allegheny County, Pennsylvania.

Solem (1952, Naut. 65, p. 129) has found it in a large tract of virgin pine with some deciduous growth

and undergrowth of thimbleberry; and near a small freshwater lake on Washington Island, northern end of Door Peninsula, Wisconsin. Dimelow (1962, Naut. 76, p. 49) recorded it for a climax deciduous forest on a gentle well-drained slope in Nova Scotia. Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. In Ontario, Lindeborg (1949, Naut. 62, p. 129) found it under a rotten log. At the other end of its range, various forms or subspecies are recorded in much the same kinds of habitats. Its enemies include shrews, as recorded by Ingram (1944, Naut. 57, p. 135).

In the Huyck Preserve, in New York State, Ingram (1946, Naut. 59, p. 90-91) gathered the following data: "Individuals preferred floodplain areas; water-carried debris piles resting over moist soil formed their typical habitat. Collections were also commonly made from beneath debris piles and logs along the waterways of the preserve. Although they were found in all of the forest areas, it was the exception rather than the rule to take them from deep in forest areas. Fields and bogs were avoided. Several apparent strays were found beneath the rocks and in hedge rows. In hedge rows they made their abodes beneath fallen branches. In two instances specimens were found aestivating in hollow beech trees resting upon the ground. In one such instance six specimens were co-inhabitants of a hollowed tree with a raccoon. The latter apparently did not relish this mollusk or was well fed on the customary crayfish diet, for the snails remained in the hollow tree for 60 days before they were removed. Fresh scats of the raccoon indicated that the tree was used continually by this mammal as a daylight retreat throughout the summer. On the flood plains this snail was eaten by the short-tailed shrew."

Associations.—Living: MINNESOTA - 4; MICHIGAN - 1, 2, 3, 4, 6, 7, 8, 23, 25, 26, 27, 28, 29, 31, 32, 33, 36, 39, 40; OHIO - 3, 6, 26, 27, 28, 29, 43; ONTARIO - 7, 8, 11, 14; WISCONSIN - 138, 139, 140, 141, 142, 143. Fossil: W - 24, 25, 26, 28, 62, 73.

General distribution (fig. 531).—Ontario to Nova Scotia, southward to Texas, Louisiana, Mississippi, Alabama, and Florida. Westward, it has spread to Minnesota, South Dakota, Kansas, Oklahoma, and Texas.

Distribution in Ohio (inset, fig. 531).—Probably to be found in all counties of the State; records are abundant from Hamilton to Williams, Ashtabula, and Monroe Counties; its apparent absence in some counties is probably due to lack of collecting.

Geologic range.—F. C. Baker (1920a, p. 389) listed the species for Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash" beds. According to A. B. Leonard (1952, p. 17) found "in Kansas, only in Bignell loess near the Missouri River; occurs in Peoria loess in type section of Loveland loess at Loveland, Pottawattamie Co., Iowa." It has been found in postglacial deposits as far north as Simcoe and York Counties in Ontario. In Ohio it is known for the "Old Forest bed" (Billups, 1902b, p. 51); the Middletown "pre-glacial deposits" (Sterki, 1907a, p. 401) and the "Defiance sandy deposit" (Sterki, 1907a, p. 402); the Castalia marl (Sterki, 1920, p. 178); and other deposits of similar character. It does not occur in all Pleistocene deposits in the State that contain land snails but no special significance can be attached, at present, to its pattern of distribution.

Variation.—A number of varieties recorded in the southern and western part of the range of this species have been revised by Pilsbry (1948, p. 571 ff.). Some of these are mere forms of little taxonomic value but others are considered good subspecies. Only one form, described from Middle Sister Island in Lake Erie, in Ontario, need be recognized here.

Anguispira alternata eriensis Clapp 1916
Pl. 15, figs. 10-12

Pyramidula alternata eriensis Clapp 1916, Carnegie Mus. Annals, v. 10, p. 535, pl. 32, figs. 9-12.
Anguispira alternata eriensis Ahlstrom 1930, Nautilus, v. 44, p. 45.
--- --- --- Oughton 1948, Zoögeogr. study, Ontario, p. 34.
Anguispira alternata form *eriensis* Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 572, fig. 305b, c.
Anguispira alternata eriensis La Rocque 1953, Cat. Recent Moll. Canada, p. 320.
--- --- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 6.

Type locality.—Middle Sister Island, Lake Erie, Ontario.

Diagnosis.—Shell very dark, flame markings dark chocolate brown and coalescing into two almost solid bands at the periphery, commonly hardly separated; body whorl subcarinate, upper lip considerably flattened; lip thickened in old shells, parietal callus very heavy, commonly forming a strong ridge.

Ecology.—Similar to that of the typical subspecies.

Associations.—Living: OHIO - 1, 2; ONTARIO - 12, 13.

General distribution.—Islands in Lake Erie; along the Great Lakes and Niagara River and in some localities in Quebec, Maine, and Pennsylvania, west to Wisconsin, Illinois, and Kansas.

Distribution in Ohio.—Green Island, Lake Erie; isolated occurrences of the form may be expected along the shores of Lake Erie also.

Geologic range.—None recorded, but the form occurs in aboriginal deposits on Frontenac Island, Cayuga Lake, New York (Blakeslee, 1945, Naut. 58, p. 110 ff.).

Remarks.—Specimens of this form appear strikingly different from the type form in isolated colonies, such as those on Green Island and at the type locality. Goodrich thought that this form was developed where the snails were not forced to take cover in narrow quarters during the day, particularly in areas where the air

is constantly moist. He cited as examples the marshy sections of Monroe County, Michigan, and Clapp noticed that the specimens living on the islands of Lake Erie were abroad by day, as well as by night.

Anguispira kochi (Pfeiffer) 1845
Fig. 532

Helix solitaria Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 157; not *H. solitaria* Poiret 1800.

Helix kochi Pfeiffer 1845, Zool. Soc. London Proc., p. 127.

Patula solitaria Call 1900, Moll. Ind., p. 379, pl. 4, fig. 20; pl. 5, fig. 1.

Pyramidula solitaria Billups 1902, Nautilus, v. 16, p. 51.

--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 49.

Patula (Pyramidula) solitaria Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 377, 401, 402.

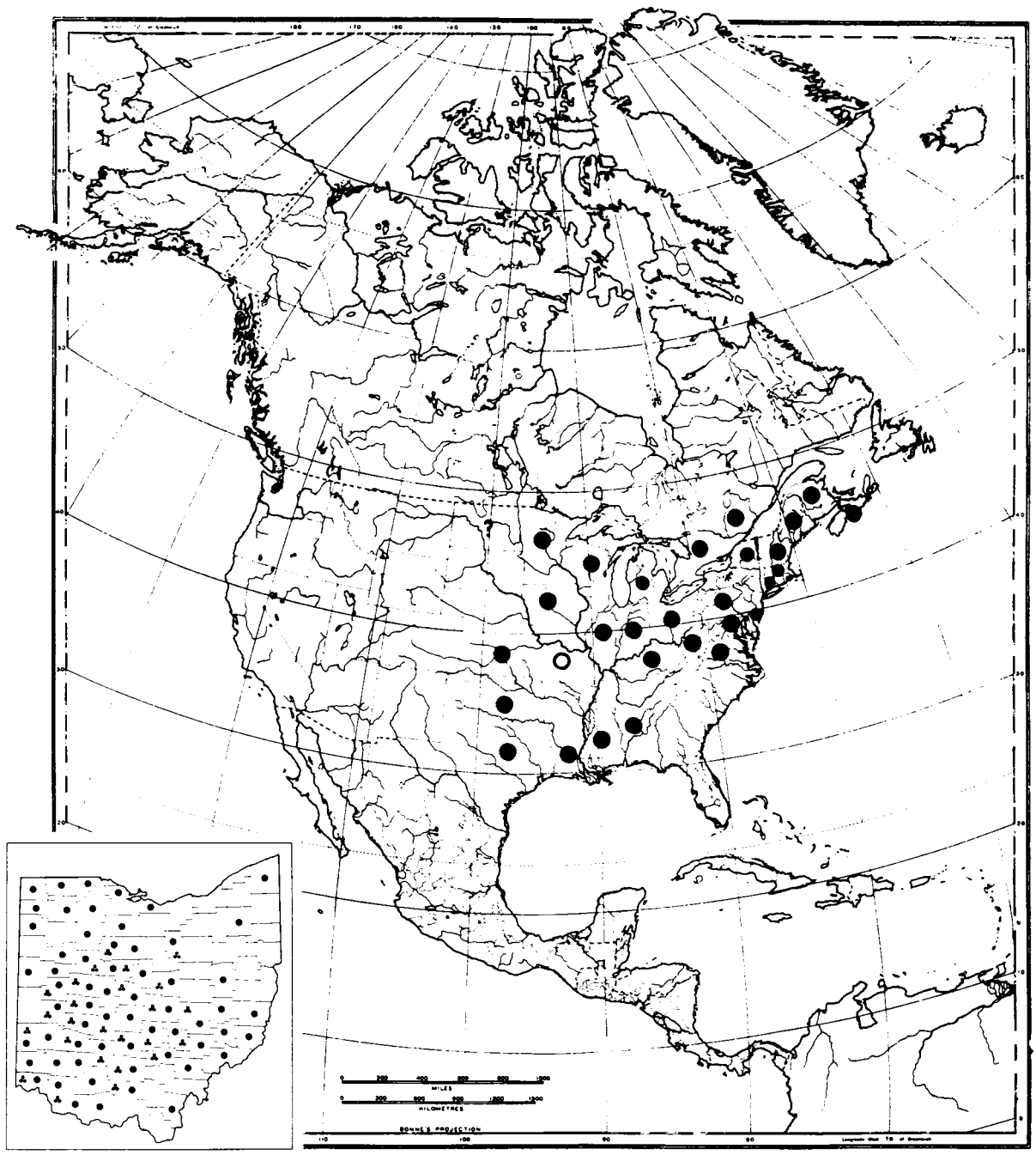

FIGURE 531.—Distribution of *Anguispira alternata* in North America; *inset,* distribution in Ohio.

Pyramidula solitaria F. C. Baker 1920, Jour. Geology, v. 28, p. 455.
Pyramidula solitaria var. *albina* F. C. Baker 1920, *ibid.*
Pyramidula solitaria Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Anguispira solitaria Ahlstrom 1930, Nautilus, v. 44, p. 45.
Anguispira kochi Goodrich 1932, Moll. Mich., p. 35.
Anguispira kochi form *albina* Goodrich 1932, *ibid.*
Anguispira kochi Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 274.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 35.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 591, fig. 325.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 320.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 6.
Anguispira kochi albina Taft 1961, *ibid.*, p. 7.

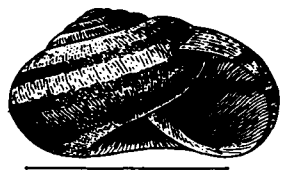

FIGURE 532.—*Anguispira kochi,* magnified; after F. C. Baker (1939a, p. 85).

Type locality.—Cincinnati, Ohio (Pilsbry, 1948, p. 592).

Diagnosis.—Shell depressed-globose, with conic spire, widely umbilicate; surface some shade of yellow, with two bands of brown, one on the periphery, the other above it; one or both bands may be absent; aperture rounded, lip simple.

Ecology.—Goodrich (1932, p. 35) states that this is "one of the typical mollusks of the old forests, and seldom found even in thick second-growth timber. It hides during the hours of bright days under rotting leaves or decaying logs. Because of its thick shell, protecting it against fast disintegration, the species is a common one among the subfossil shells of the forest loam and the gravel and sand banks of streams that have changed their courses." The species is neither as adaptable nor as hardy as *Anguispira alternata* and it is quite evident from the abundance of dead shells in localities where it can no longer be found alive that its range is becoming more and more restricted with time.

This is not as abundant or widespread a species as *A. alternata* but I have found it in numbers on Kelleys Island, Ohio, in dead leaves over very thin soil on top of glacial grooves in limestone, along the margin of sparse woods. In Michigan, it is plentiful in places in well-drained areas in sparse woods, over limestone. Conkin (1957, Naut. 71, p. 11) recorded it in Kentucky for bushy and forested slopes and creek bottoms with highly calcareous soil.

Associations.—Living: OHIO-1, 5, 7, 43; ONTARIO-11. Fossil: W-24, 25, 26, 28.

General distribution (fig. 533).—Southwestern Ontario and Michigan, south to Illinois, Missouri, and Arkansas; east to Pennsylvania and Kentucky. A western subspecies *(A. kochi occidentalis)* occurs in British Columbia, Washington, Oregon, Idaho, and Montana.

Distribution in Ohio (inset, fig. 533).—Generally, but sporadically, distributed in the entire State. Two more or less distinct forms occur on the islands of Lake Erie in Ohio and still another *(A. kochi roseoapicata)* on islands in Ontario.

Geologic range.—F. C. Baker (1920a, p. 389) gives Yarmouth, Sangamon, Peorian, and "Wabash." "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); Middletown "pre-glacial deposits" and "Defiance sandy deposit" (Sterki, 1907a, p. 401, 402); Castalia marl (Sterki, 1920, p. 178); Sangamon(?), Bartholomew County, Indiana (Baker, 1920b, p. 456); subfossil (Goodrich, 1932, p. 35).

Anguispira kochi mynesites (Clapp) 1916
Pl. 15, figs. 7, 8

Pyramidula solitaria mynesites Clapp 1916, Carnegie Mus. Annals, v. 10, p. 535, pl. 32, figs. 7, 8.
Anguispira kochi mynesites Oughton 1948, Zoögeogr. study, Ontario, p. 35.
Anguispira kochi form *mynesites* Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 593, fig. 325f.
Anguispira kochi mynesites La Rocque 1953, Cat. Recent Moll. Canada, p. 320.
--- --- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 7.

Type locality.—Mouse Island, Lake Erie, Ohio.

Diagnosis.—"Shell small, solid, straw-colored, with two brown bands, the lower wider and darker than the upper one which is sometimes almost obsolete. Apex pink like var. *roseo-apicata.* Whorls 5½. Compared with vars. *strontiana* and *roseo-apicata* it is constantly much smaller and intermediate in color, but with the banding of the latter" (Clapp, 1916).

Ecology.—An isolated population, favored by more or less constant moist air but for some reason dwarfed in size.

Associations.—Living: OHIO-3.

General distribution.—Mouse Island, Lake Erie, Ohio. Pilsbry (1948, p. 594) has seen wholly similar shells from as far west as Missouri.

Distribution in Ohio.—Mouse Island, Lake Erie.

Geologic range.—None recorded.

Remarks.—Pilsbry (1948, p. 594) noted that wholly

similar shells are found elsewhere, even as far west as Missouri, and added that this is an "ecologic or other form, occurring sporadically rather than a geographic race or subspecies." It seems best to consider the Mouse Island population as representatives of the typical form, isolated geographically by chance from the main population and showing characteristics due solely to the genetic pattern of the original individuals brought to the island. As such, no taxonomic significance is attached to the name.

Anguispira kochi roseoapicata (Clapp) 1916
Pl. 15, figs. 4-6

Pyramidula solitaria roseo-apicata Clapp 1916, Carnegie Mus. Annals, v. 10, p. 534, pl. 32, figs. 4-6.
Anguispira kochi roseo-apicata Oughton 1948, Zoögeogr. study, Ontario, p. 594.
--- --- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 594.
--- --- --- La Rocque 1953, Cat. Recent Moll.

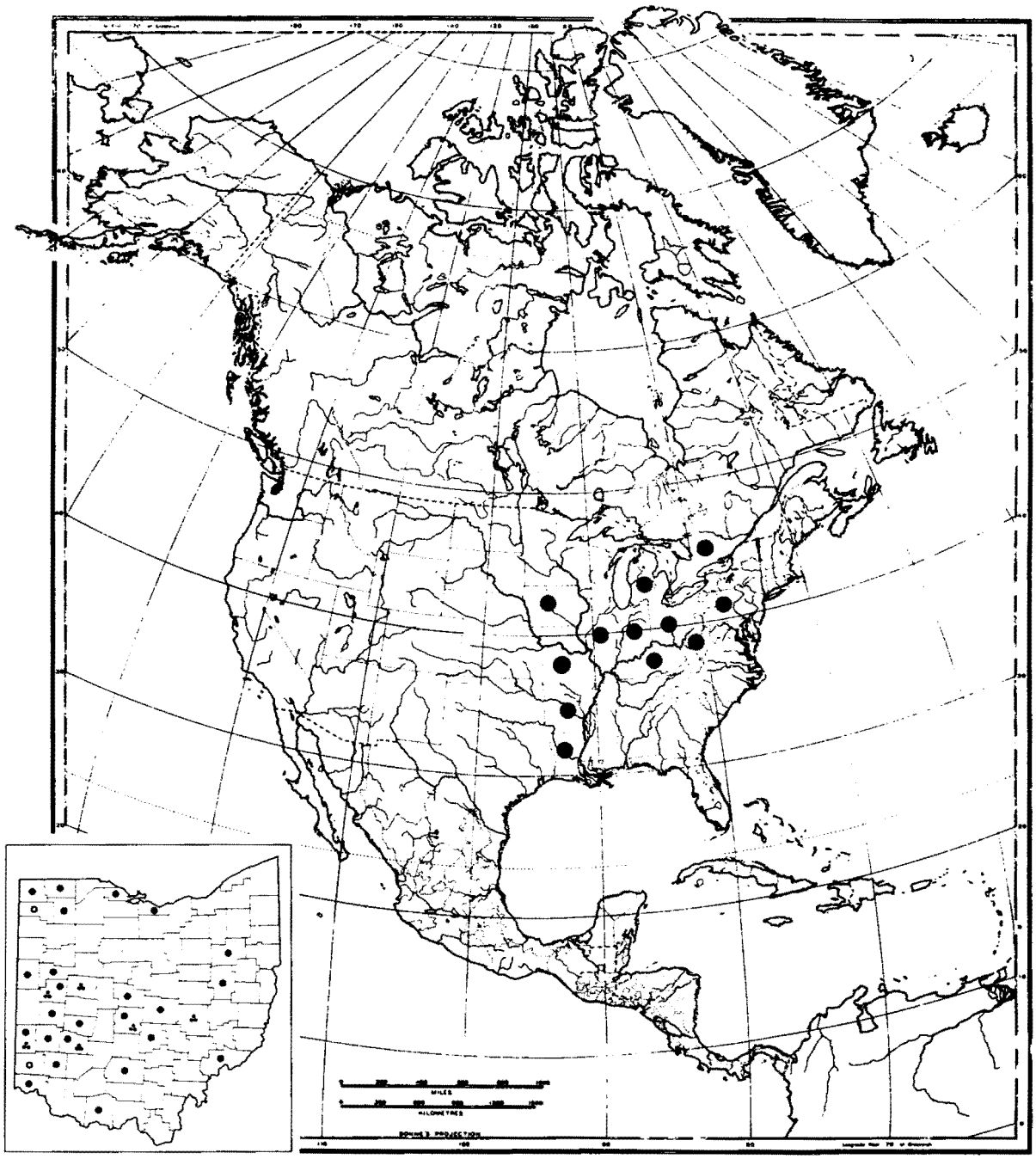

FIGURE 533.—Distribution of *Anguispira kochi* (eastern subspecies only) in North America; *inset*, distribution in Ohio.

Canada, p. 321.
Anguispira kochi roseo-apicata Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 7.

Type locality.—North Harbour Island, Lake Erie, Ontario, Canada.

Diagnosis.—"Shell small, elevated, very heavy, with apical whorls pink .... Mature shells are mostly largely denuded, the epidermis which remains being in ragged patches. The pink apex is a very marked character in this variety" (Clapp, 1916). Most shells of this subspecies bandless, only a small proportion retaining one or two bands, which are commonly weak.

Ecology.—An island form, living in an environment with abundant moisture, but one that is unfavorable in its effect on the epidermis.

Associations.—Living: ONTARIO-11, 13, 14.

General distribution.—Islands in Lake Erie, in Ontario only.

Distribution in Ohio.—None recorded.

Geologic range.—None recorded.

Remarks.—Included here because of the close proximity of the known distribution to islands in Ohio.

Anguispira kochi strontiana (Clapp) 1916
Pl. 15, figs. 1-3

Pyramidula solitaria strontiana Clapp 1916, Carnegie Mus. Annals, v. 10, p. 532, pl. 32, figs. 1-3.
Anguispira kochi strontiana Ahlstrom 1930, Nautilus, v. 44, p. 45.
--- --- --- Oughton 1948, Zoögeogr. study, Ontario, p. 35.
--- --- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 594, fig. 325e.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 321.
--- --- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 7.

Type locality.—Green (formerly Strontian) Island, Lake Erie, Ohio.

Diagnosis.—"Shell very heavy, coarsely striate, uniform straw-color without a trace of bands. Most specimens show traces of impressed spiral lines. This variety is much more elevated, heavier, and smaller than the typical banded form from the mainland" (Clapp, 1916).

Ecology.—A form favored by more or less constantly moist air on islands of Lake Erie where calcium carbonate is plentifully available in many outcrops of Silurian limestones and dolomites.

Associations.—Living: OHIO-2; ONTARIO-12.

General distribution.—Islands in Lake Erie, Ohio and Ontario.

Distribution in Ohio.—Green, Starve, Put-in-Bay (South Bass?) Islands.

Geologic range.—None recorded.

Genus *Discus* Fitzinger 1833

Discus Fitzinger 1833, Beitr. Landesk. Oesterr., v. 3, p. 99.
Gonyodiscus Fitzinger 1833, *ibid.*, v. 3, p. 98.
Patula Held 1837, Isis, p. 918.
Eyryomphala Beck 1837, Index Moll., p. 8.
Delomphalus "Agassiz" Charpentier 1837, Cat. Moll. Suisse, p. 12.
Euromphala "Beck" Lowe 1852, Annals and Mag. Nat. History (2), v. 9, p. 115.
Patularia Clessin 1877, Deutsch. Exc.-Moll.-Fauna, p. 86 (*non* Swainson, 1840).
Goniodiscus "Beck," Kobelt 1880, p. 111; Conchylienb., p. 231.
Cratera "Megerle" Scudder 1882, Nomenclator Zoologicus, p. 81.
Allerya Bourguignat 1898, Atti Acad. Sci. Palermo (n.s. 8), no. 1, p. 1, *non* Mörch, 1877.
Discus MacMillan 1940, Carnegie Mus. Annals, v. 27, p. 397.
Discus Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 598.

Type.—*Helix ruderata* Stud.

Diagnosis.—Shell opaque, of some shade of brown, with flammulate markings or plain; openly umbilicate; rib-striate, at least above the periphery; whorls increasing very gradually; aperture simple or with a columellar tubercle; peristome simple and thin.

General distribution.—Holarctic realm, generally spread; in North America, south to Mexico and perhaps beyond.

Geologic range.—Upper Cretaceous to present. Widespread in the entire Pleistocene.

Discus cronkhitei (Newcomb) 1865
Pl. 14, figs. 1-3

Helix cronkhitei Newcomb 1865, Calif. Acad. Sci. Proc., v. 3, p. 180.
Patula striatella Call 1900, Moll. Ind., p. 381, pl. 4, fig. 3.
Pyramidula striatella Billups 1902, Nautilus, v. 16, p. 51.
Pyramidula cronkhitei Dall 1905, Harriman-Alaska Exped., v. 13, p. 50.
Pyramidula striatella Dall 1905, *ibid.*
Pyramidula cronkhitei anthonyi Pilsbry 1906, Acad. Nat. Sci. Philadelphia Proc., p. 153.
Patula striatella Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 377, 402.
Pyramidula cronkhitei anthonyi Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, 178.
--- --- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Gonyodiscus cronkhitei anthonyi Ahlstrom 1930, Nautilus, v. 44, p. 45.

Gonyodiscus cronkhitei anthonyi Goodrich 1932, Moll. Mich., p. 37.
Discus cronkhitei cronkhitei MacMillan 1940, Carnegie Mus. Annals, v. 27, p. 405, pl. 39, figs. 15, 16.
Discus cronkhitei anthonyi MacMillan 1940, *ibid.*, p. 406, pl. 40, figs. 10, 11.
--- --- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 31, pl. 2, figs. 6, 7.
Discus cronkhitei Oughton 1948, Zoögeogr. study, Ontario, p. 36.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 600.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 35, pl. 4, fig. C.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 19, pl. 4, figs. N-O; fig. 8.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 321.
Discus cronkhitei anthonyi La Rocque 1953, *ibid.*
Discus cronkhitei Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 8.
--- --- La Rocque and Forsyth 1957, Sidney Cut, p. 85 ff.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 143.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 79.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 8.

Type locality.—Klamath Valley, Oregon.

Diagnosis.—Shell depressed, buff to brown, with low spire and widely open umbilicus; whorls convex, with widely separated axial riblets; aperture rounded, peristome thin, simple, dilated towards the columellar insertion.

Ecology.—"In the east it lives in humid forest, under dead wood, and among rotting leaves or grass in rather wet situations" (Pilsbry, 1948, p. 604). This is a species of wooded areas that lives in leaf litter or under logs and bark in wooded spots. Oughton (1948, 94 ff.) listed it for damp woodlands, especially those of deciduous trees and noted it occasionally in *Sphagnum* bogs.

Dimelow (1962, Naut. 76, p. 49) found it in Nova Scotia in a climax deciduous forest, on a gentle well-drained slope. Grimm (1959, Naut. 72, p. 125) collected it in Maryland under debris near railroad tracks, in the ruins of buildings, under deadwood near marble quarries, in leaf litter near railroad tracks, and under wet sandstone and pieces of wood in a field. Lindeborg (1949, Naut. 62, p. 129) listed it in Ontario from moss banks, under logs, and from moss on a tree trunk after rain.

Associations.—Living: MICHIGAN-30; MINNESOTA-1, 2, 3, 4, 5, 7, 8; OHIO-1, 6, 43; ONTARIO-7, 8, 10; QUEBEC-6; WISCONSIN-138, 139, 140, 141. Fossil: K-1, 2, 5, 6; I-3, 5; Y-2, 4, 5, 6, 7, 8, 12, 13, 14, 16, 17, 21; S-6; W-2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 17, 18, 22, 24, 26, 27, 28, 44, 64, 65, 66, 69, 73.

General distribution (fig. 534).—Newfoundland and Alaska, south to California, Arizona, New Mexico, and Texas.

Distribution in Ohio (inset, fig. 534).—Over the State; counties from which it is apparently missing are those from which little collecting has been done.

Geologic range.—Hibbard and Taylor (1960, p. 143) gave its range as Middle Pliocene to Recent, and added: "The single known Tertiary occurrence is in the Teewinot formation, Jackson Hole, Teton County, Wyoming. . . . In the southern High Plains it is known from Kansan, Illinoian, and Wisconsin deposits." Yarmouth to Recent (A. B. Leonard, 1950, p. 35); Sappa, Crete-Loveland, Peoria to Recent. In the Peoria Loess (Tazewellian zone), *D. cronkhitei* is largely replaced by *D. shimeki* (Leonard, 1952, p. 19). Oklahoma, probably Illinoian (D. W. Taylor and Hibbard, 1955, p. 8). In Ohio, Billups (1902b, p. 51) collected it from the "Old Forest bed of the Ohio River"; Sterki (1907a, p. 402) obtained it from the "Defiance sandy deposit (loess?)"; La Rocque and Forsyth (1957, p. 85) from the Sidney Cut faunule (Early Wisconsin). As *D. cronkhitei anthonyi*, it has been recorded from the Illinoian and Wisconsinan of Kansas (Leonard and Frye, 1943, p. 457), and from the following late Wisconsin deposits in Ohio: Tinkers Creek marl (Sterki, 1920, p. 174),, Castalia marl (Sterki, 1920, p. 178).

Variation.—For a long time, the eastern and western forms of this species were considered as subspecifically distinct and the eastern form was called *D. cronkhitei anthonyi* (Pilsbry). The distinction was abandoned as impractical by Pilsbry (1948, p. 604), who recognized a single subspecies, *D. cronkhitei catskillensis* (Pilsbry), characteristic of eastern North America east of the Mississippi.

Discus cronkhitei catskillensis (Pilsbry) 1898

Pyramidula striatella catskillensis Pilsbry 1898, Nautilus, v. 12, p. 86.
Pyramidula cronkhitei catskillensis Walker 1906, Moll. Mich., pt. 1, p. 493.
Gonyodiscus cronkhitei catskillensis Goodrich 1932, Moll. Mich., p. 37.
Discus cronkhitei catskillensis MacMillan 1940, Carnegie Mus. Annals, v. 27, p. 407, pl. 39, figs. 17, 18.
--- --- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 605, fig. 328e, f.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 321.
--- --- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.

Type locality.—Catskill Mountains in Tannersville Valley, Greene County, New York.

Diagnosis.—"The shell is pale brown, obtusely but distinctly angular at the periphery, flattened below the angle; sculpture a little sharper and umbilicus somewhat wider than usual in *D. cronkhitei*. Height 2.5 mm., diameter 5 mm.; 4 whorls" (Pilsbry, 1948, p. 605).

Ecology.—"Found on rotten logs and among dead leaves in dryer situations than eastern *D. cronkhitei* generally, often at higher elevations and in hilly or mountainous country" (Pilsbry, 1948, p. 606). H. B. Baker (1922b) listed it from several habitats in Dickinson County, Michigan, as follows: (27) beaver pond damming a creek, with floating vegetation and logs, even forming sedge-covered islands; (38) sandy outwash plains, with pine and second growth; (39) young hardwoods, in small hollow between granitic ridges; partially burned, some low-growing plants; (40) virgin hardwoods of the Menominee trough; (41) hardwoods on morainal ridges of the Calumet Trough, particularly in

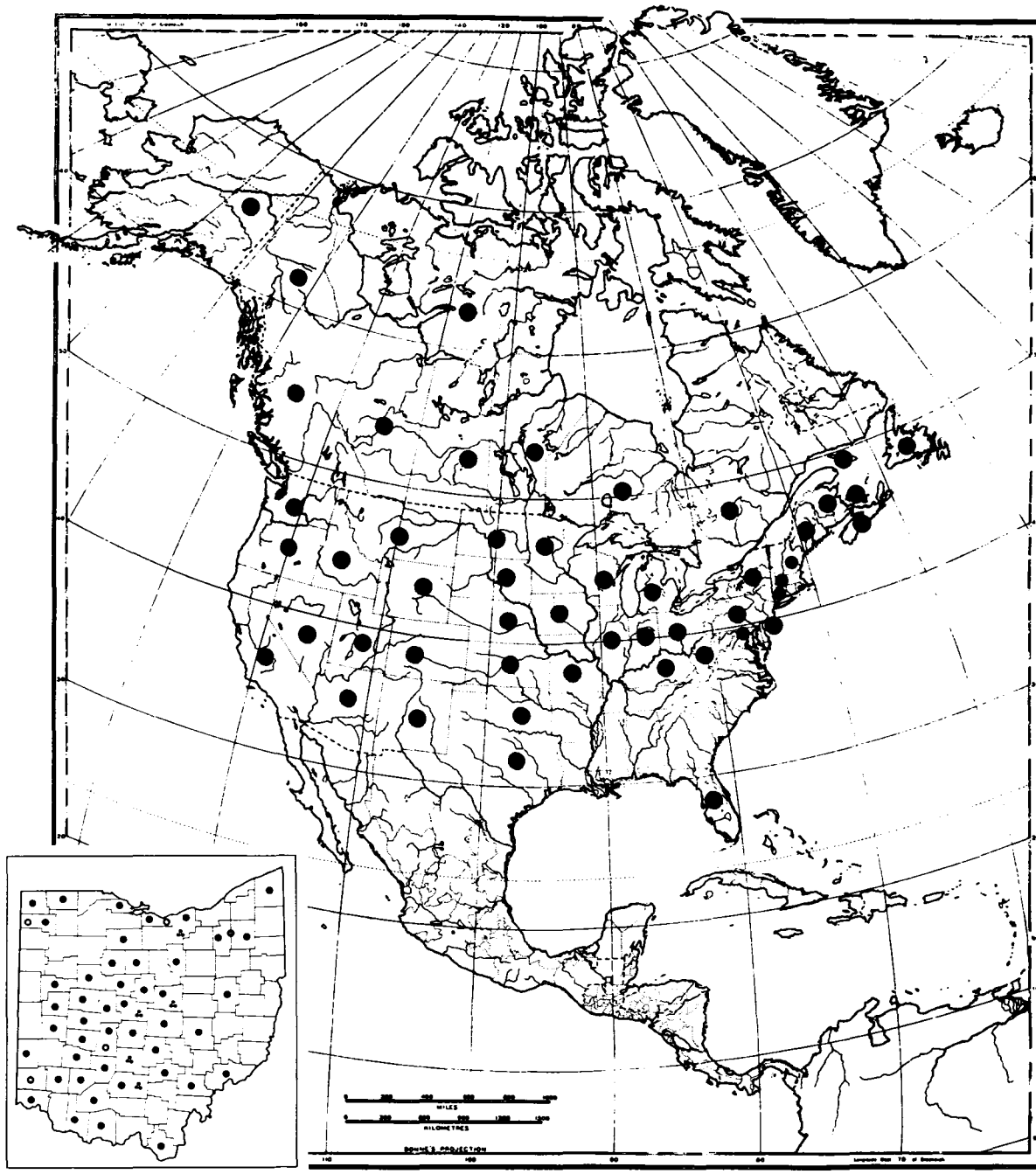

FIGURE 534.—Distribution of *Discus cronkhitei* in North America; *inset,* distribution in Ohio.

maple logs. Archer (1934c, p. 139) listed it from limestone talus and in the hardwoods of Mackinac Island, Michigan.

Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State.

Ingram (1946, Naut. 59, p. 91) found this species in all of the wooded areas of the Huyck Preserve in New York State, "adhering to the undersurfaces of logs. It was also a common lake margin snail where it was found beneath prostrate decaying fence posts resting on blackberry bushes. Individuals were also taken from beneath maple leaf humus and fallen bark in young maple stands and maple hedge-rows."

Associations.—Living: MICHIGAN - 1, 4, 7, 8, 9, 40.

General distribution (fig. 535).—New England, New York, Ontario, and New Jersey, west to Michigan, Minnesota, and South Dakota.

Distribution in Ohio (inset, fig. 535).—Not as yet

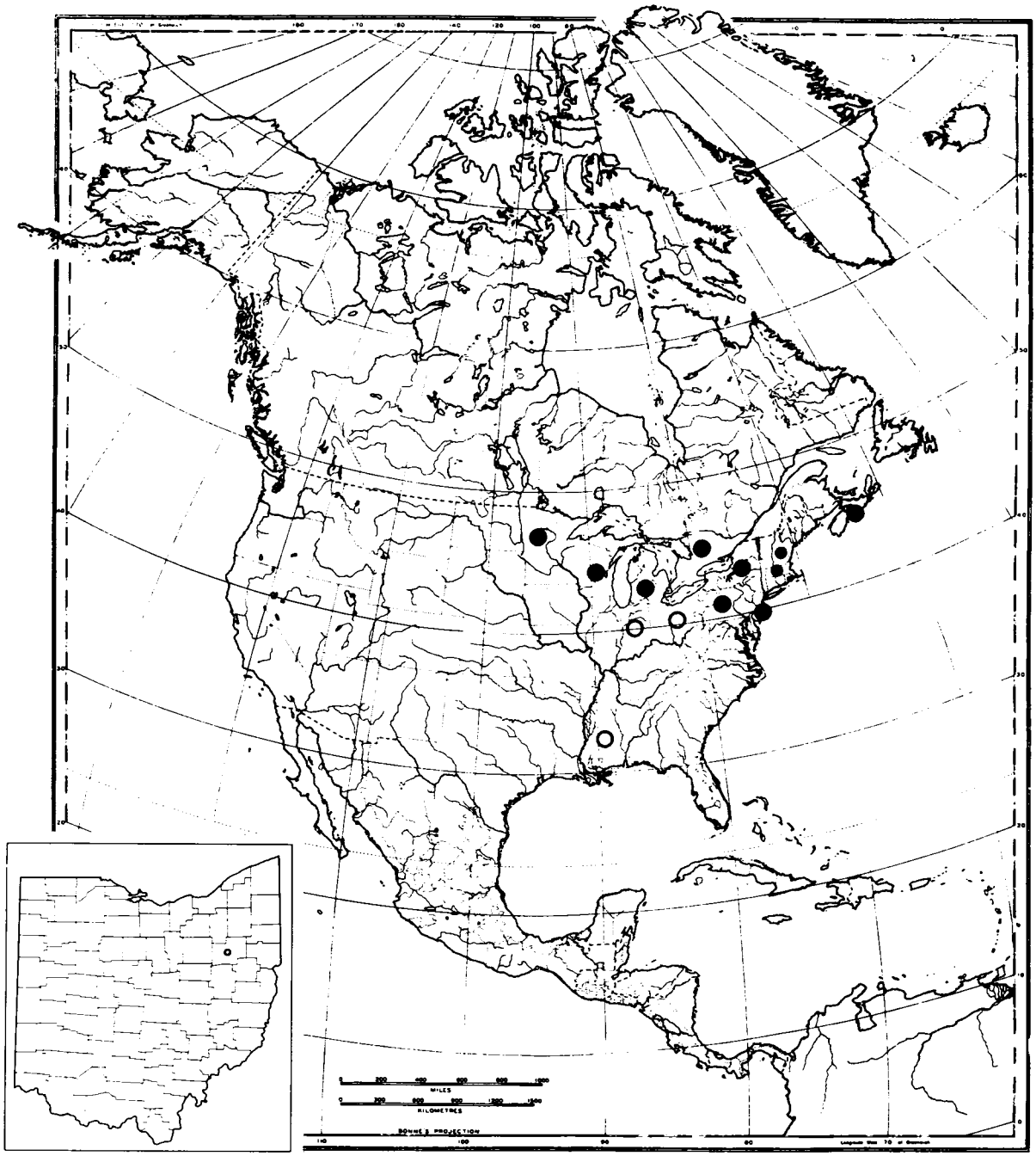

FIGURE 535.—Distribution of *Discus cronkhitei catskillensis* in North America; *inset,* distribution in Ohio.

definitely recorded for the State but it is likely that angulated specimens of *D. cronkhitei,* formerly placed under *D. cronkhitei anthonyi,* may belong under this subspecies. It may be expected in the northern and eastern portions of the State and even perhaps, as a fossil, in the western counties, as Wayne (1954, p. 1320) collected it from pro-Kansas loess in Indiana.

Geologic range.—The only records appear to be the following: Wayne (1954, p. 1320), pro-Kansan loess in Putnam County, Indiana; Sheatsley (1960, p. 103), Aultman deposit, Stark County, Ohio. On the other hand, its fossil occurrence may be confused by identifications with subspecies *anthonyi* in the past.

Discus macclintocki (F. C. Baker) 1928
Fig. 536

Gonyodiscus macclintocki F. C. Baker 1928, Nautilus, v. 41, p. 133.
--- --- F. C. Baker 1931, Jour. Paleontology, v. 5, p. 281, pl. 32, figs. 3a, b.
Discus macclintocki Morrison 1940, Nautilus, v. 53, p. 123.
Discus macclintocki macclintocki MacMillan 1940, Carnegie Mus. Annals, v. 27, p. 410, pl. 42, figs. 10, 11.
Discus macclintocki Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 606, fig. 329a.
Discus mc clintocki Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.

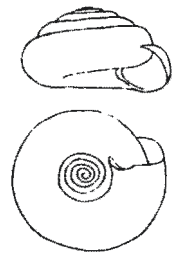

FIGURE 536.—*Discus macclintocki,* magnified; after F. C. Baker (1931c, pl. 32, figs. 3A, B).

Type locality.—Peorian loess, 3½ miles east and 1¾ miles south of Lewistown, Liverpool Township, Fulton County, Illinois.

Diagnosis.—"Shell orbicular, with convex, dome-shaped spire; whorls six, slowly and regularly increasing in size, tightly wound, slightly convex, the body whorl typically flatly rounded; sutures well impressed; base flatly rounded, excavated near the widely open umbilicus, which exhibits all of the whorls including the nucleus; sculpture of many close-set, distinct ribs, which become finer on the base, there being usually an almost smooth space in the center of lower part of the body whorl; aperture widely or roundly lunate, arched above where the outer lip joins the body whorl; peristome simple, acute, without parietal callus, the terminations of the outer and columellar lip being widely separated" (F. C. Baker, 1928, Naut. 41).

Ecology.—Live specimens collected by Shimek were taken from under a decaying white birch log in Iowa. It appears, therefore, that the ecology of the species is closely similar to that of *D. cronkhitei.* Hubricht (1955, Naut. 69, p. 34) found this species living in Bixby State Park, Iowa, in pockets of leaves and moss in crevices exposed to the cold air (about 50°F.) blowing from a cave.

Associations.—Fossil: W-60.

General distribution (fig. 537).—Illinois, Iowa, Missouri as a fossil (Peorian in Illinois) and living in Iowa. Farmdale? Loess in Cuyahoga County, Ohio. The species is to be expected in Indiana and other localities in Ohio although its distribution may be restricted to fossil deposits of early Wisconsin age.

Distribution in Ohio (inset, fig. 537).—Farmdale? Loess, near Cleveland, Cuyahoga County (A. B. Leonard, 1953, p. 372 ff.).

Geologic range.—Peorian (Illinois); Pleistocene, unspecified, Missouri and Iowa; Wisconsin (Farmdale?) Ohio. The discovery of living specimens in Iowa makes it likely that this species will be found in Pleistocene deposits of Peorian and younger age elsewhere.

Variation.—The subspecies *D. macclintocki angulatus* F. C. Baker (1928, Naut. 41, p. 134) has been described from loess of Yarmouth age in Illinois. As late as 1948 (Pilsbry, 1948, p. 607) it was unknown from any other locality.

Discus patulus (Deshayes) 1830
Fig. 538

Helix perspectiva Say 1817, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 18 (not *H. perspectiva* Megerle von Mühlfeld, 1816).
Helix patula Deshayes 1830, Encycl. Méth., v. 2, p. 217.
Patula perspectiva Call 1900, Moll. Ind., p. 381, pl. 5, fig. 4.
Pyramidula perspectiva Billups 1902, Nautilus, v. 16, p. 51.
Patula perspectiva Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 377.
Pyramidula perspectiva Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Gonyodiscus perspectivus Goodrich 1932, Moll. Mich., p. 36.
Discus patulus angulatus Kutchka 1938, Nautilus, v. 52, p. 13, pl. 2, fig. 4.
Discus patulus carinatus MacMillan 1940, Nautilus, v. 53, p. 143, new name for *D. patulus angulatus* Kutchka (preoccupied by *D. macclintocki angulatus* F. C. Baker 1928); not *Helix (Patula) perspectiva carinata* Gratacap 1901.
Discus patulus MacMillan 1940, Carnegie Mus. Annals, v. 27, p. 399, pl. 41, figs. 16, 17.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 274.
--- --- Oughton 1948, Zoögeogr. study, Ontario,

p. 38.

Discus patulus Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 608, fig. 330a, b.

--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 31, pl. 2, figs. 4, 5.

--- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 321.

--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 9.

Type locality.—"Environs of New York" (Deshayes); "near Lake Erie" (Say).

Diagnosis.—Shell depressed, convex above, broadly umbilicate and deeply concave below, cinnamon-brown, the base generally lighter; whorls regularly arcuately rib-striate, the riblets rounded, slightly nar-

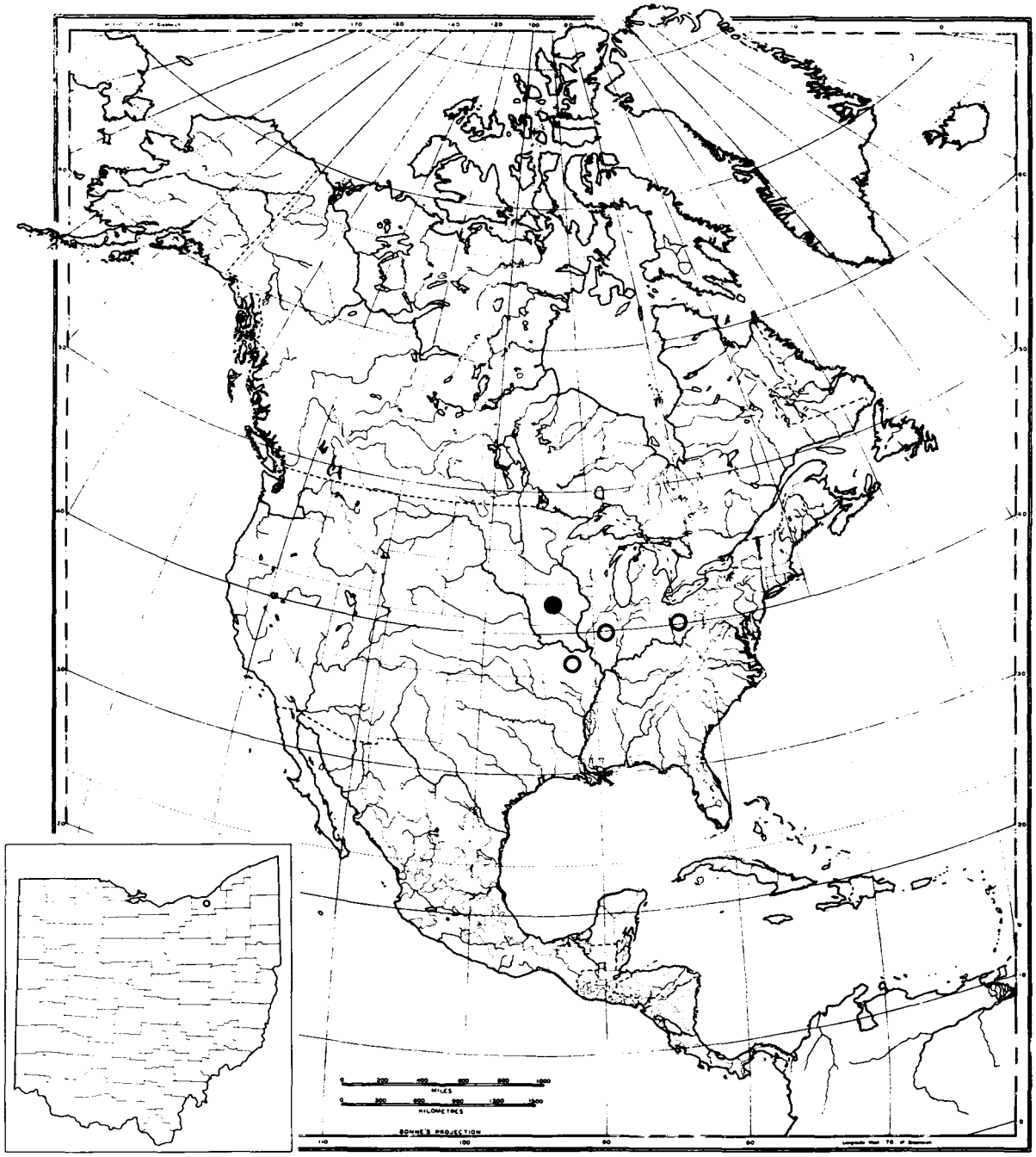

FIGURE 537.—Distribution of *Discus macclintocki* in North America; *inset,* distribution in Ohio.

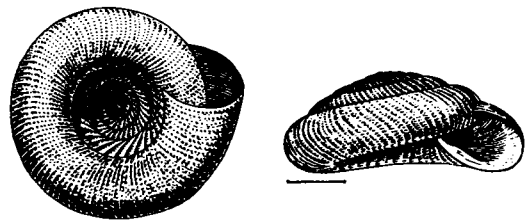

FIGURE 538.—*Discus patulus*, magnified; after F. C. Baker (1931c, pl. 32, figs. 3A, B).

rower than the intervals, nearly 4 in 1 mm. on the front of the last whorl; below the periphery riblets weakened and others interpolated; within the umbilicus riblets strong again; whorls 5½, strongly convex, slowly widening, the last rounded peripherally, very convex below; aperture simple, but with a rounded tubercle or callous tooth a short distance within on the callus which lines the columellar wall (modified from Pilsbry, 1948, p. 608).

Ecology.—In the rich mold around rotting logs, and

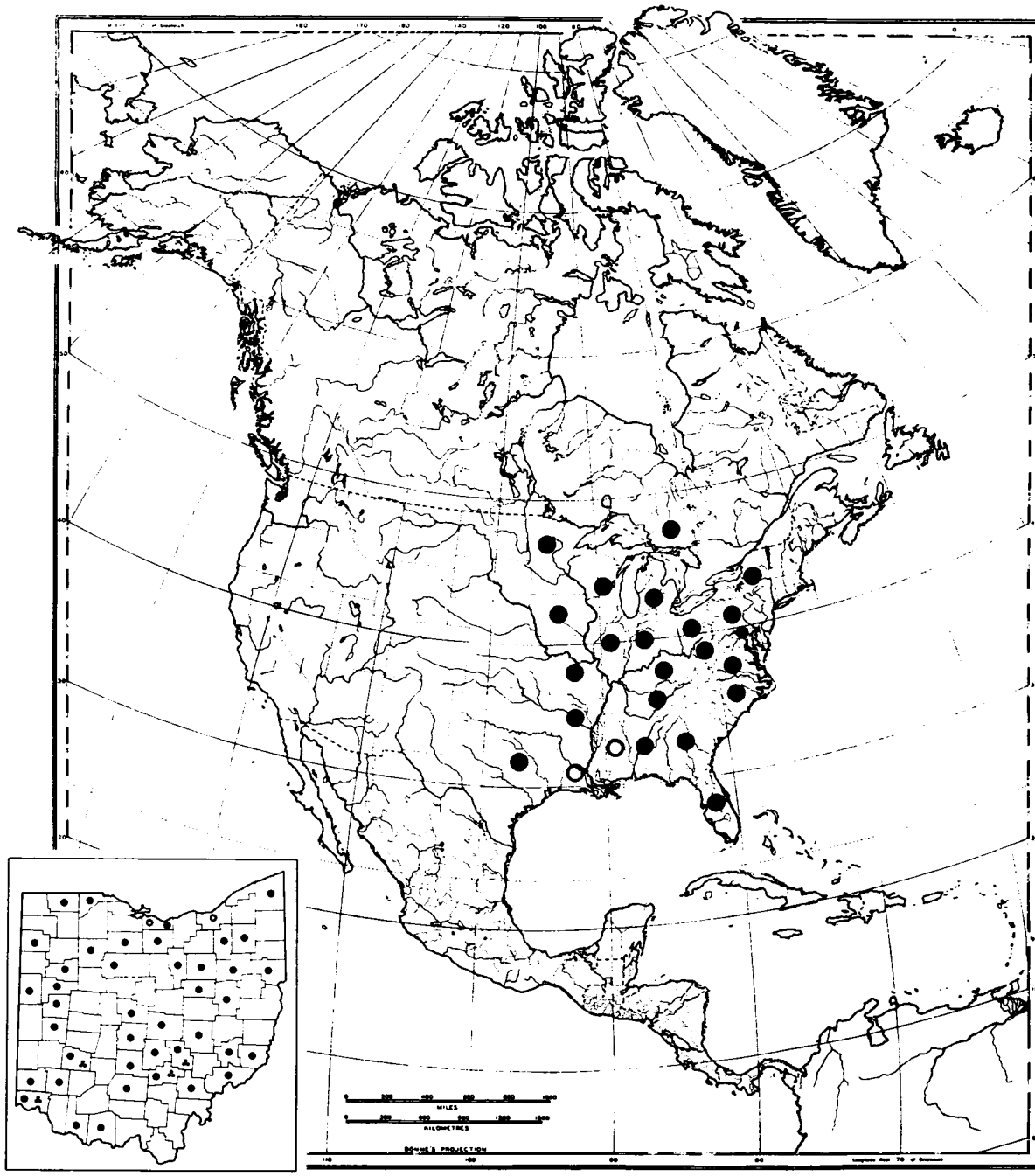

FIGURE 539.—Distribution of *Discus patulus* in North America; *inset*, distribution in Ohio.

under their loose bark, or burrowing in the soft, rotten wood. Oughton (1948, p. 94 ff.) listed this as a species of damp woodlands, especially those of deciduous trees. Archer (1935, p. 81) found it almost abundant under logs and in heavy leaf mold and around the bases of rocks in the Asheville region of North Carolina. The winter habits of this species, at Ithaca, New York, in beech–yellow-birch and sycamore woodlands, have been described by Ingram (1944, Naut. 58, p. 25-27).

Associations.–Living: OHIO-29, 43. Fossil: W-24, 61.

General distribution (fig. 539).–West of the Alleghenies between the Potomac and Mohawk valleys, westward to Iowa, Missouri, and Arkansas, south to Georgia, Alabama, and Florida. Its northward limit is in Ontario, in Brant, Elgin, Halton, and Hastings Counties.

Distribution in Ohio (inset, fig. 539).–Over the State, although records are not available for all counties.

Geologic range.–F. C. Baker (1920a, p. 389) gave Yarmouth, Sangamon, Peorian, and "Wabash." Lower and upper pro-Tazewell loess, Cleveland, Cuyahoga County, Ohio (A. B. Leonard, 1953, p. 372 ff.); Castalia marl (Sterki, 1920, p. 178); "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51).

Subfamily HELICODISCINAE

Helicodiscinae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 622.

Genus *Helicodiscus* Morse 1864

Helicodiscus Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 25.
Helicodiscus Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 622.
Helicodiscus La Rocque 1953, Cat. Recent Moll. Canada, p. 322.

Type.–*Helix lineata* Say (=*H. parallelus*).

Diagnosis.–Shell small, disk- or coin-shaped, with nearly flat spire and broadly open umbilicus; pale, unicolored, typically spirally striated or lirate, the embryonic 1¾ whorls often smoother; whorls narrowly coiled, of small caliber; at all stages of growth, the last whorl usually with one to three pairs of small conical teeth at irregular intervals within the outer and basal walls of its cavity (spiral threads and teeth wanting in subgenus *Hebetodiscus*); aperture lunate, lip unexpanded, sharp.

General distribution.–Southern Canada southward to Mexico; one species in the Columbia River drainage, but otherwise wanting on the Pacific slope and in the northern mountain states.

Geologic range.–Yarmouth to present (A. B. Leonard, 1950, p. 34).

Helicodiscus parallelus (Say) 1821
Pl. 16, figs. 1-3

Helix lineata Say 1817, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 18; v. 2, p. 373; not *Helix lineata* Olivi 1792.
Planorbis arellellus Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 164; corrected to *parallellus* in the index, p. 407.
Helicodiscus lineatus Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 25, figs. 61, 62; pl. 2, fig. 3; pl. 7, fig. 63.
--- --- Call 1900, Moll. Ind., p. 382, pl. 4, figs. 5, 6.
--- --- Billups 1902, Nautilus, v. 16, p. 51.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 52, fig. 36.
Helicodiscus parallelus Pilsbry 1906, Acad. Nat. Sci. Philadelphia Proc., p. 156.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.
Helicodiscus lineatus Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
Helicodiscus parallelus F. C. Baker 1920, Jour. Geology, v. 28, p. 455.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 45.
--- --- Goodrich 1932, Moll. Mich., p. 30.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 274.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 39.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 625, fig. 339.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 34, pl. 2, figs. 10, 11.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 34, pl. 4, fig. A.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 21, pl. 5, figs. P, Q.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 322.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 144.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 79.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 10.

Type locality.–Council Bluffs, Iowa (Pilsbry, 1948, p. 627).

Diagnosis.–Shell small, disk-shaped, the upper surface flat or very slightly convex; broadly umbilicate; thin, pale yellow, with a greenish tint, nearly lusterless; whorls 4 to 4½, convex, very narrow and slowly increasing, the last rounded at periphery and base; sculpture of numerous spiral threads; interior of

last whorl with small conical teeth in pairs, within outer and basal walls, commonly two pairs, rarely only one or three or none.

Ecology.—Found on decaying wood and damp leaves, in shady, humid places; commonly collected in leaf siftings and stream debris. H. B. Baker (1922b) found this species common in moist places in Dickinson County, Michigan. He listed the following habitats: (36) outcrop of Quinnesec schist, in dead leaves and humus, collected in hollows of the rocks, overgrown with bearberries and scattered hardwoods and conifers; (38) sandy outwash plains, pine and second growth; (41) hardwood-covered moraine ridges, particularly in maple logs; (42) cedar-tamarack bog, under bark of freshly cut cedar stumps; (43) arborvitae swamp: swampy thicket near mouth of a small creek, with arborvitae and deciduous trees; (46) clearing in hardwoods; snails in and around old stumps and logs; one of the drier alluvial habitats; (47) floodplain of creek, about 2 feet above July water level; (48) damp hollow in floodplain of Menominee River, with brush of tagalders, dogwoods, hazels, and small ashes. Archer (1934c, p. 139) recorded it for hardwoods under leaves and in the limestone talus near the fort on Mackinac Island, Michigan. Oughton (1948, p. 94 ff.) found it in damp woodlands, especially those of deciduous trees in Ontario.

Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. Burch (1955, Naut. 69, p. 66) tabulated its relationships to soil factors in eastern Virginia. Ingram (1941, Naut. 55, p. 14-15) collected it under stones, on a creek floodplain. He (1944, Naut. 58, p. 25-27) described its winter habits at Ithaca, New York, in beech–yellow-birch and sycamore woodlands. Solem (1952, Naut. 65, p. 129) collected it from virgin pine forest with undergrowth of thimbleberry, in beach drift of Lake Michigan, and near a small freshwater lake on the Door Peninsula of Wisconsin. Teskey (1955, Naut. 69, p. 70-71) found it in leaf mold on loose shale in the Warm Springs area of Georgia. In the coastal area of South Carolina, Rehder (1949, Naut. 62, p. 125) found it under fallen leaves and near fallen logs. In Virginia, Burch (1954, Naut. 68, p. 32) listed it as very common throughout the woodland areas; most common in hardwood forests, exceeded in abundance only by *Zonitoides arboreus.* In Maryland, Grimm (1959, Naut. 72, p. 125) found it in quarries, in woods, in leaf litter and under debris near railroad tracks, and in the ruins of an old building.

"This small mollusk was the dominant bog species where it was found in abundance on hummocks at the base of bog ferns. None were found in forest stands" (Ingram, 1946, Naut. 59, p. 91, observations on the Huyck Preserve, New York State).

Associations.—Living: MICHIGAN-1, 7, 8, 25, 26, 32, 33, 34, 39, 40; MINNESOTA-2, 4, 5, 7, 22b; OHIO-1, 6, 7, 25, 43; ONTARIO-3, 8, 12; QUEBEC-6; WISCONSIN-138, 139, 140, 141, 142, 144. Fossil: N-2; K-2, 3, 14, 15, 17, 18, 23, 24, 25; I-3; S-1, 2, 3, 4, 5; W-8, 9, 14, 15, 21, 22, 24, 28, 56, 57, 58, 59.

General distribution (fig. 540).—Manitoba east to Newfoundland, Prince Edward Island, New Brunswick, and Maine, south to Oklahoma, Arkansas, Alabama, and Georgia.

Distribution in Ohio (inset, fig. 540).—"Over the state, common" (Sterki, 1907a). This statement is borne out by records which cover every portion of Ohio but the county records are not as numerous as might be desired.

Geologic range.—F. C. Baker (1920a, p. 389) gave Aftonian, Yarmouth, Sangamon, and "Wabash." Yarmouth to Recent (A. B. Leonard, 1950, p. 34); Oklahoma, probably Illinoian (D. W. Taylor and Hibbard, 1955, p. 8); "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); Castalia marl (Sterki, 1920, p. 178); Sangamon, Bartholomew County, Indiana (F. C. Baker, 1920b, p. 455). Hibbard and Taylor (1960, p. 144) gave the range as Nebraskan or Aftonian to Recent. Clark (1961, p. 26) identified the species from the Castalia deposit, in Ohio.

Helicodiscus singleyanus (Pilsbry) 1890
Pl. 16, figs. 5, 8, 11

Zonites singleyanus Pilsbry 1890, Acad. Nat. Sci. Philadelphia Proc. 1889, p. 84; *ibid.*, 1888, pl. 17, fig. M.

Hyalinia laeviuscula Sterki 1892, Nautilus, v. 6, p. 53.

Hyalinia texana Sterki 1892, Nautilus, v. 6, p. 54; apparently an error for *H. laeviuscula.*

Zonitoides laeviusculus Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 373, 402.

Zonitoides laeviuscula F. C. Baker 1920, Life of Pleistocene, p. 389.

Helicodiscus (Hebetodiscus) singleyanus singleyanus H. B. Baker 1929, Acad. Nat. Sci. Philadelphia Proc., v. 81, p. 264, pl. 10, figs. 13-15.

Zonitoides laeviusculus Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 273.

Helicodiscus singleyanus Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 636, fig. 346.

——— ——— Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 21, pl. 4, fig. H; fig. 10.

——— ——— Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 8.

Helicodiscus (Hebetodiscus) singleyanus Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 144.

——— *(———)* ——— Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 79.

Type locality.—New Braunfels, Comal County, Texas.

Diagnosis.—Shell minute, depressed, thin, corneous, translucent; spire low but convex; surface glossy,

weakly marked by ripples of growth and a few somewhat deeper though inconspicuous grooves; spiral striae very faint, numerous, visible only in good specimens.

Ecology.—"It seems to be a burrowing snail" (Pilsbry, 1948, p. 636). D. W. Taylor summarized the habitat of this species as follows: damp to dry habitat, damp, protected places or relatively dry, exposed habitats. This species is more tolerant of drouth than others and requires little cover. In Maryland, Grimm (1959, Naut. 72, p. 125) found it around the foundation of an old burned house, in ruins of another building, and in a quarry.

Associations.—Living: OHIO-43. Fossil: P-1, 3, 4; N-1, 2; A-1; K-3; S-2, 4, 5, 6; W-3, 9, 17, 21, 26.

General distribution.—New Jersey, Maryland, and Pennsylvania, west to South Dakota, south to Arizona, New Mexico, Texas, Louisiana, Alabama, and Florida.

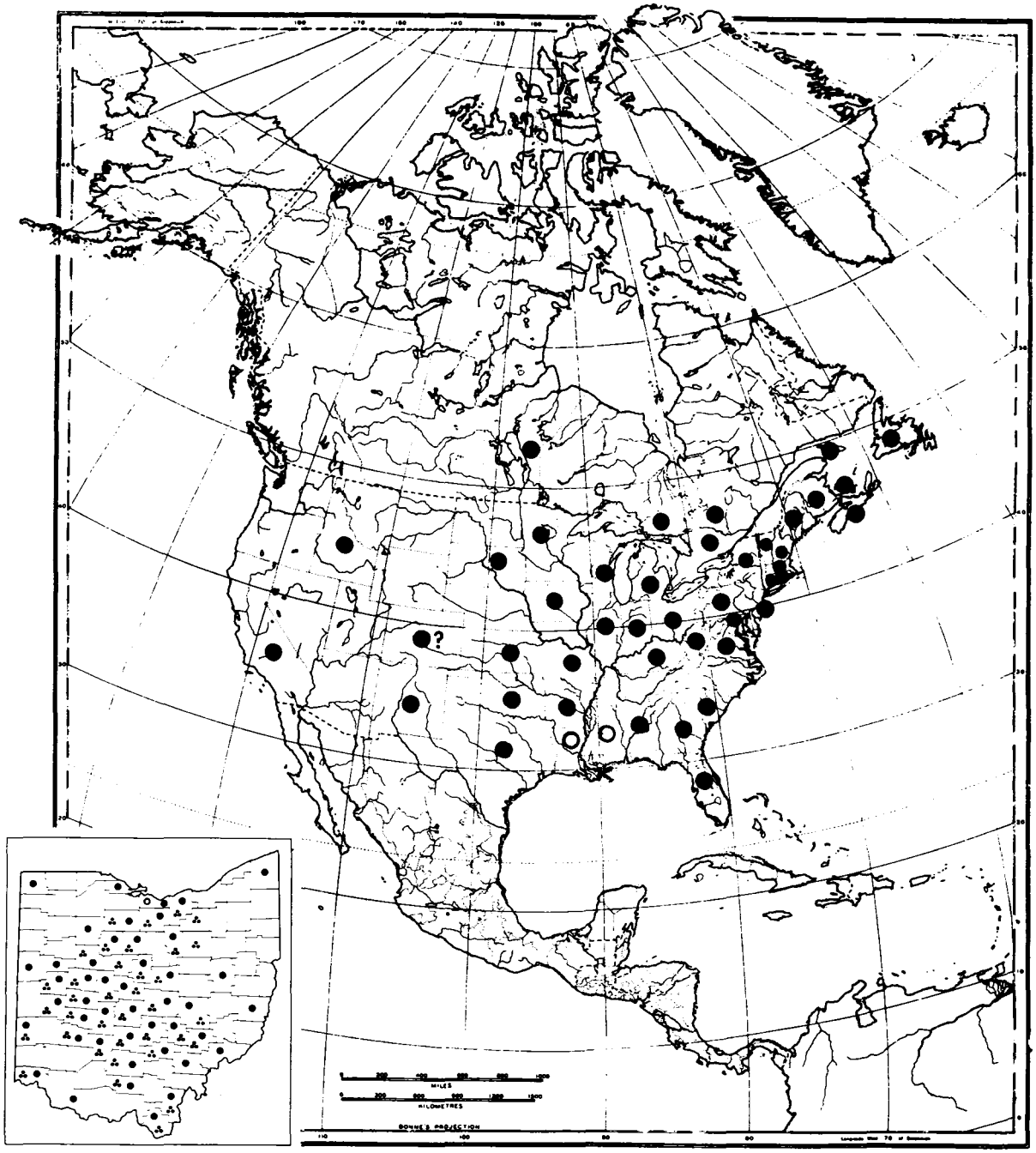

FIGURE 540.—Distribution of *Helicodiscus parallelus* in North America; *inset,* distribution in Ohio.

Distribution in Ohio.—Tuscarawas County; Troy, Miami County (Sterki, 1907a, p. 373).

Geologic range.—F. C. Baker (1920a, p. 389) gave only "Wabash" for the species. Crete-Loveland sands and silts, Peoria Loess (Tazewellian zone) to Recent (A. B. Leonard, 1952, p. 21); Oklahoma, probably Illinoian (D. W. Taylor and Hibbard, 1955, p. 8); "Defiance sandy deposit (loess?)," probably Wisconsin, recorded as *Zonitoides laeviusculus* by Sterki (1907a, p. 402). Hibbard and Taylor (1960, p. 144) gave late Pliocene to Recent.

Remarks.—The Ohio records probably belong under *H. singleyanus inermis* and are so treated in this report.

Helicodiscus singleyanus inermis H. B. Baker 1929
Fig. 541

Helicodiscus singleyanus inermis H. B. Baker 1929, Nautilus, v. 42, p. 86, pl. 3, figs. 1-3; Acad. Nat. Sci. Philadelphia Proc., v. 81, p. 263, pl. 9, figs. 2, 3.

--- --- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 637, fig. 347.

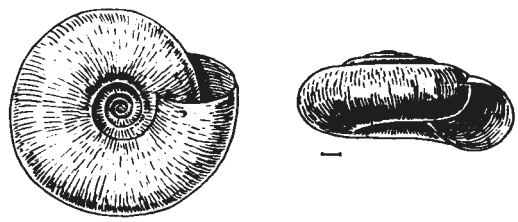

FIGURE 541.—*Helicodiscus singleyanus inermis*, magnified; after F. C. Baker (1939a, p. 89).

Type locality.—Dove (Martin Spring), Marion County, Tennessee.

Diagnosis.—Shell yellowish corneous, with darker varicoid lines; whorls 4½; sculpture of growth lines weak except for a few varicoid ones on the last whorl; surface weakly punctate under high magnification but without trace of spiral ornamentation of any sort.

Ecology.—The type locality, Dove, Marion County, Tennessee, yielded a single specimen from leaf humus near the base of limestone ledges (H. B. Baker, 1929, Naut. 42, p. 87). F. C. Baker (1935, Naut. 48, p. 106) recorded "a number of this recently described race" from Turkey Run State Park, Indiana, and noted that it is common in Indiana and Illinois, but without further ecological details. Morrison (1939, Naut. 53, p. 47) listed this as one of the species of snails from a roof deposit in a cave in Virginia. He did not find it living nearby but it probably occurs there.

General distribution (fig. 542).—Similar to that of *H. singleyanus s.s.*, but not as extensive; New Jersey west to Indiana, south to Louisiana, Mississippi, Alabama, and Florida.

Distribution in Ohio (inset, fig. 542).—Paulding County, one lot in Museum of Zoology, University of Michigan.

Geologic range.—Not recorded.

Remarks.—The status of the subspecies is in some doubt. It was recognized by H. B. Baker (1929, Naut. 42) and by Pilsbry (1948) but both recognized that the absence of spiral sculpture, categorically stated in the description of the subspecies, is a variable character and one which cannot be discerned on worn specimens. The subspecies is included here because of the Ohio record previously mentioned, but it is quite likely that the subspecies will eventually be considered as identical with the typical form.

Subfamily PUNCTINAE Morse 1864

Punctinae Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 27.

Punctinae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 640.

Genus *Punctum* Morse 1864

Punctum Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 27.

Patulastra Pfeiffer 1878, Nomencl. Hel. Viv., p. 87.

"*Pullastra* Pfr." Westerlund 1889, Fauna Paläarct. Reg. Binnenconch., v. I, Helix, p. 6 (misspelling of *Patulastra* Pfr., in synonymy of *Punctum*).

Punctum H. B. Baker 1930, Mich. Univ. Mus. Zoology Occas. Papers, no. 220, p. 5.

Punctum Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 641.

Punctum La Rocque 1953, Cat. Recent Moll. Canada, p. 322.

Type.—*Helix minutissima* Lea.

Diagnosis.—Shell very minute, umbilicate, subdiscoidal with convex spire; unicolored; sculpture of oblique delicate striae with or without spaced riblets, and excessively minute spiral striae; whorls about 4, convex, the first 1½ smooth or lightly striate spirally, rather indistinctly demarked from those following, the last whorl cylindric; aperture lunate-rounded, the lip simple and thin.

General distribution.—Throughout the Holarctic realm, also South Africa and Mexico. One species, *P. bristoli* (Gul.), in Bermuda.

Geologic range.—Upper Oligocene to present in Europe. Pleistocene to present in North America.

Punctum minutissimum (Lea) 1841
Fig. 543

Helix minutissima Lea 1841, Am. Philos. Soc. Trans., v. 9, p. 17.

Punctum pygmaeum of American authors, not of Draparnaud.

Punctum pygmaeum Dall 1905, Harriman-Alaska Exped., v. 13, p. 53.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 389.
Punctum minutissimum H. B. Baker 1930, Mich. Univ. Mus. Zoology Occas. Papers, no. 220, p. 5.
Punctum pygmaeum Goodrich 1932, Moll. Mich., p. 36.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 275.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 39.
Punctum minutissimum Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 34, pl. 2, fig. 27.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 322.
--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 12.

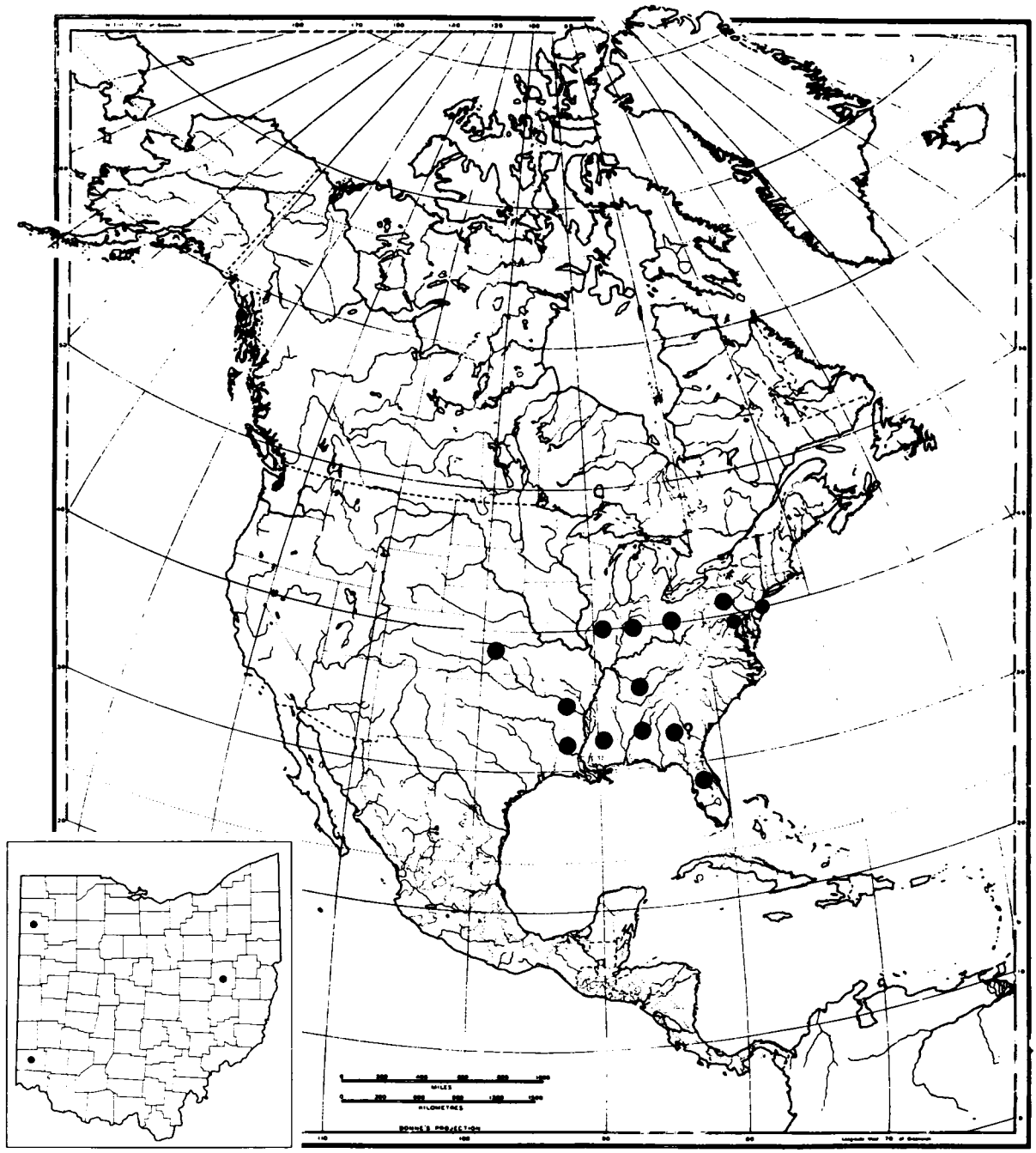

FIGURE 542.–Distribution of *Helicodiscus singleyanus inermis* in North America; *inset,* distribution in Ohio.

Punctum minutissimum Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 79.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 11.

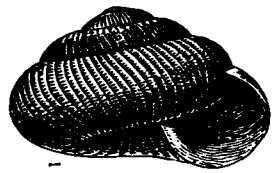

FIGURE 543.—*Punctum minutissimum,* magnified; after F. C. Baker (1939a, p. 90).

Type locality.—Vicinity of Cincinnati, Ohio.

Diagnosis.—Shell very minute, depressed conoid, umbilicate; thin, corneous or light brown, somewhat translucent, shining; postnuclear whorls with close, somewhat unequal, very delicate axial striae and very fine and faint spiral lines, especially on the base of the last whorl; whorls 3¾, convex, the last well rounded; aperture lunate, the lip simple and acute.

Ecology.—Found on damp leaves, around decaying logs, chiefly in dense hardwood growths. This species prefers the rotten bark of beech trees and woody fungi such as *Polyporus* and *Boletus*.

Oughton (1948, p. 94 ff.) listed it from both damp and drier, more open woodlands, especially those of deciduous trees in Ontario. Burch (1955, Naut. 69, p. 66) gave details of its relationships to soil factors in eastern Virginia. Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. In Maryland, Grimm (1959, Naut. 72, p. 125) recorded it for woods beside a road, in leaf mold.

Associations.—Living: MICHIGAN-18, 25, 26, 32, 33; OHIO-1, 43; ONTARIO-3; QUEBEC-6. Fossil: K-6; Y-1; I-5, 7; S-1; W-28, 56, 57, 58, 62, 63, 64, 65, 70.

General distribution (fig. 544).—Newfoundland west to Ontario, Michigan, South Dakota, Idaho, and Oregon, south to New Mexico, Mexico, Georgia, and Florida.

Distribution in Ohio (inset, fig. 544).—"Over the state" (Sterki, 1907a, p. 378). Records are sparse but this is probably due to lack of collecting. Pilsbry (1948, p. 645) mentioned only the type locality; Eggleston (ms. records) collected it in Licking and Washington Counties; and there are specimens from Auglaize and Fulton Counties in the University of Michigan collections.

Geologic range.—F. C. Baker (1920a, p. 389) gave Sangamon and "Wabash." Sterki (1920, p. 178) cited it for the Castalia marl, Ohio. D. W. Taylor and Hibbard (1955, p. 12) confirmed the Sangamon record (Jinglebob local fauna, Kansas). Clark (1961, p. 26) found it in the Castalia deposit, Erie County, Ohio.

Family ARIONIDAE
Genus *Arion* Férussac 1821

This is a genus of slugs in which the shell is reduced to rare calcareous granules under the mantle. The probability of a fossil record for these slugs is practically nil. On the other hand, they are important in the living molluscan fauna, especially in urban areas. To illustrate the pattern of distribution of these slugs, a map showing that of *A. hortensis* is given here (fig. 545) and the following notes on ecology of *A. circumscriptus* may be of interest. Both are widely introduced in North America and presumably originated in Europe where they are also widespread.

Ecology of Arion circumscriptus *Johnston.*—Ingram (1946, Naut. 59, p. 92) reported on the Huyck Preserve in New York State: "Individuals avoided forest areas. They were abundant in fields at the bases of berry roots, and on flood plains beneath logs and debris piles. Turning boards around human habitations revealed good collecting grounds. In oak hedge-rows specimens were taken curled up in down-turned acorn cups."

In the Ottawa region, I have collected it mainly in the vicinity of houses and farm yards. It took refuge under the bottom layer of logs in wood piles but also under boards, pieces of cardboard, and the bases of birdbaths. I have also collected it under flower pots and broken pieces of discarded flower pots. It is partial to the vicinity of compost heaps but it seems to thrive equally well under flat flagstones, in this case Ordovician limestone. In Michigan, it was abundant around trash heaps by the side of a country road, under debris of all sorts under sparse tree cover.

Family PHILOMYCIDAE Keferstein 1866

This is a large family of Asiatic and American slugs which have very little chance of preservation as fossils since the shell is completely absent. They are represented in the living molluscan fauna of Ohio by two genera, *Philomycus* and *Pallifera,* and several species which are listed below for the sake of completeness. Their present distribution (see figs. 546-550) is of interest from the standpoint of Pleistocene history as it does not follow the pattern common in land snail genera found on both sides of the Pacific. In this case, the family is represented in Japan and China and south to Java and the Celebes on the Asian side but on the American side it is absent from the mountain and Pacific states and from the West Indies. It is eastern in distribution but not confined east of the Mississippi, as representatives of *Philomycus* are known as far west as Oklahoma, Texas, Louisiana, Arkansas, Missouri, and Iowa, and of *Pallifera* as far west as Illinois and Missouri. It has penetrated into

Mexico and Central and South America as far south as Columbia. This distribution is not one that would be expected on the basis of the migration routes open during Pleistocene time, for the whole Pacific slope was then open to molluscan invasion. Possibly this group of slugs penetrated to America in Tertiary time and their range has been progressively restricted since then.

The Ohio species, together with references to Pilsbry's monograph, are the following:

Philomycus carolinianus (Bosc) 1802; Pilsbry, 1948, p. 753, fig. 404 (see also fig. 551, this bulletin).

Philomycus carolinianus flexuolaris Rafinesque 1820; Pilsbry, 1948, p. 756, fig. 405.

Pallifera dorsalis (Binney) 1842; Pilsbry, 1948,

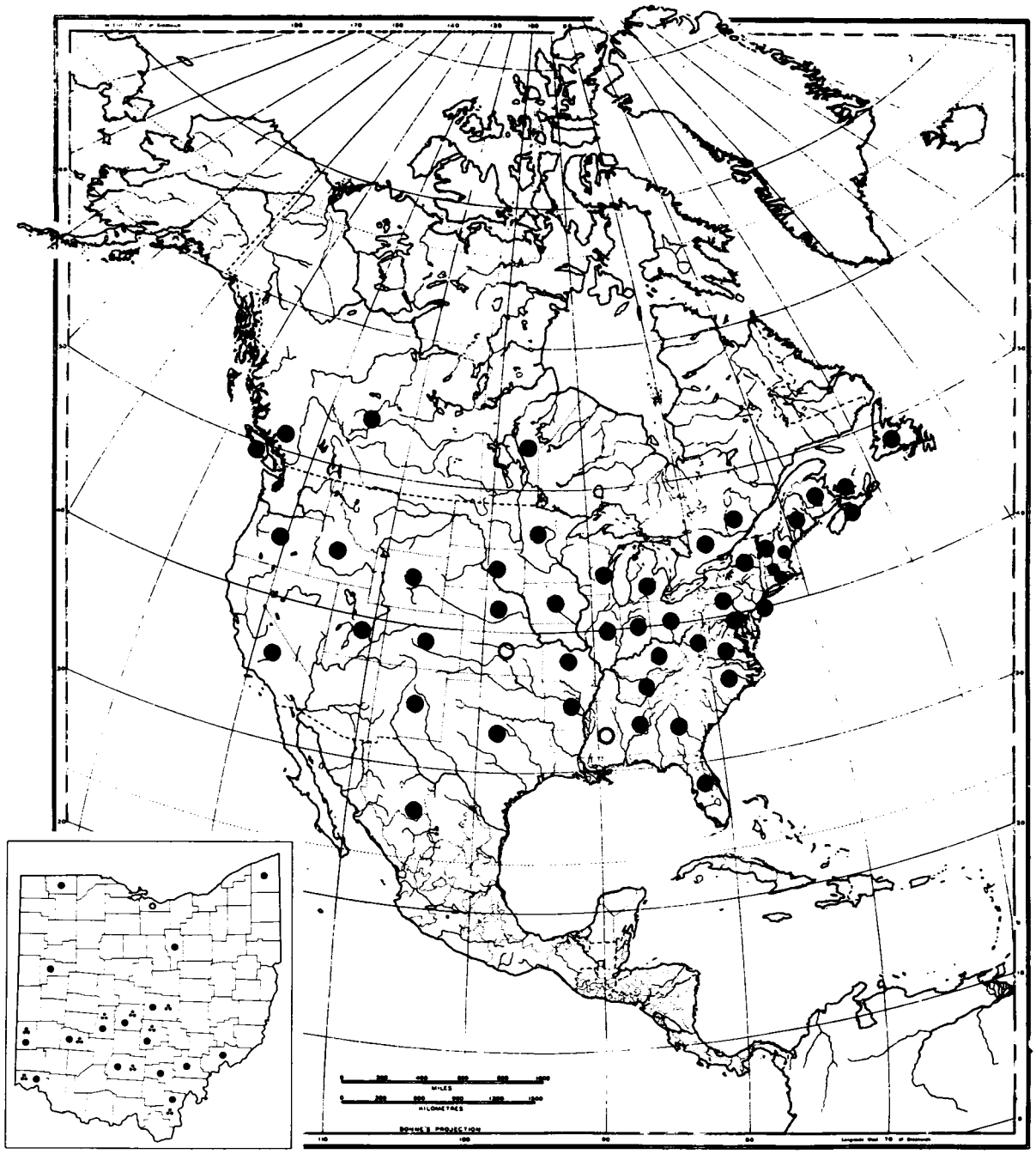

FIGURE 544.–Distribution of *Punctum minutissimum* in North America; *inset,* distribution in Ohio.

p. 760, figs. 407a-f; 408, 409.
Pallifera obioensis (Sterki) 1916; Pilsbry, 1948, p. 763, fig. 410a, b.
Pallifera hemphilli (W. G. Binney) 1885; Pilsbry 1948, p. 765, figs. 407g, 411d (North Carolina and Georgia to Michigan).
Pallifera fosteri F. C. Baker 1939; Fieldbook Ill. land snails, p. 133, fig.

Ecological notes on two species are given here as illustrations.

Ecology of Philomycus carolinianus.–Ingram (1940, Naut. 54, p. 87) has described the daylight activity of this species. Dimelow (1962, Naut. 76, p. 49) has recorded it from climax deciduous forest on a gentle well-drained slope in Nova Scotia (var. *flexuolaris*). Oughton (1948, p. 94 ff.) listed it for damp woodlands,

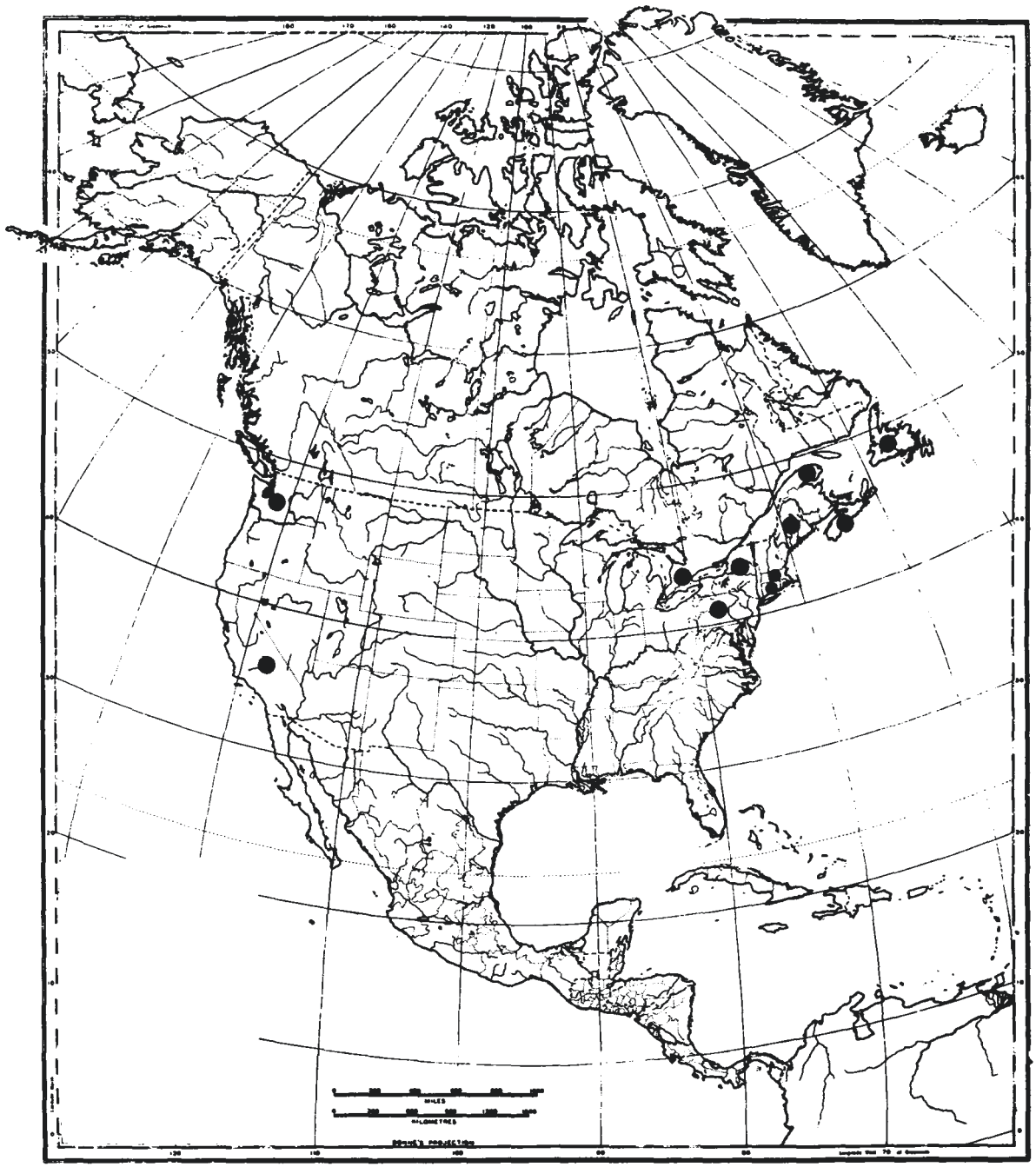

FIGURE 545.–Distribution of *Arion hortensis* in North America.

especially those of deciduous trees. Archer (1934c, p. 140) found it under leaves and logs in the hardwoods on Mackinac Island, Michigan, but only immature specimens were found. Ingram (1949, Naut. 62, p. 86-93) summarized his observations on this species in New York State as follows: of arboreal tendencies, in beech-hemlock stands especially, favoring beech over hemlock; active throughout all hours of the day, in sun or shadow; rains bring it out, crawling up beech trees up to 60 feet; in summer, two to six individuals under sprung bark of a beech or yellow birch log; it is not solitary in habit, is often taken on gills and stalks of mushrooms in bright daylight; slime tracks are tenacious and conspicuous; its food is fungi, but not shelf fungi; it also feeds on algae growing on beech bark; mushrooms eaten are mainly soft but may range to *Polyporus sulphureus*, which is medium hard in consistency.

FIGURE 546.—Distribution of *Philomycus carolinianus* in North America; the records on this map may include a few that should be referred to *P. carolinianus flexuolaris; inset*, distribution in Ohio.

Ingram (1946, Naut. 59, p. 92) gave the following for the Huyck Preserve in New York State: "This was the most common on the forest slugs. It was one of the dominant animals in the beech-hemlock forest areas. Its local range did not extend into fields or orchards. On the flood plains it was an outer marginal form. In forest areas during summer dry periods they were found concealed beneath humus, logs, fallen bark, and in decaying log crevices. Occasionally they were taken from beneath large mushrooms."

Ecology of Pallifera dorsalis.—Found in damp woodlands, especially those of deciduous trees (Oughton, 1948, p. 94 ff.). H. B. Baker (1922b) found it in only one locality, a particularly rich piece of hardwoods near Foster City, Michigan. Dimelow (1962, Naut. 76, p. 49) has collected it in Nova Scotia in

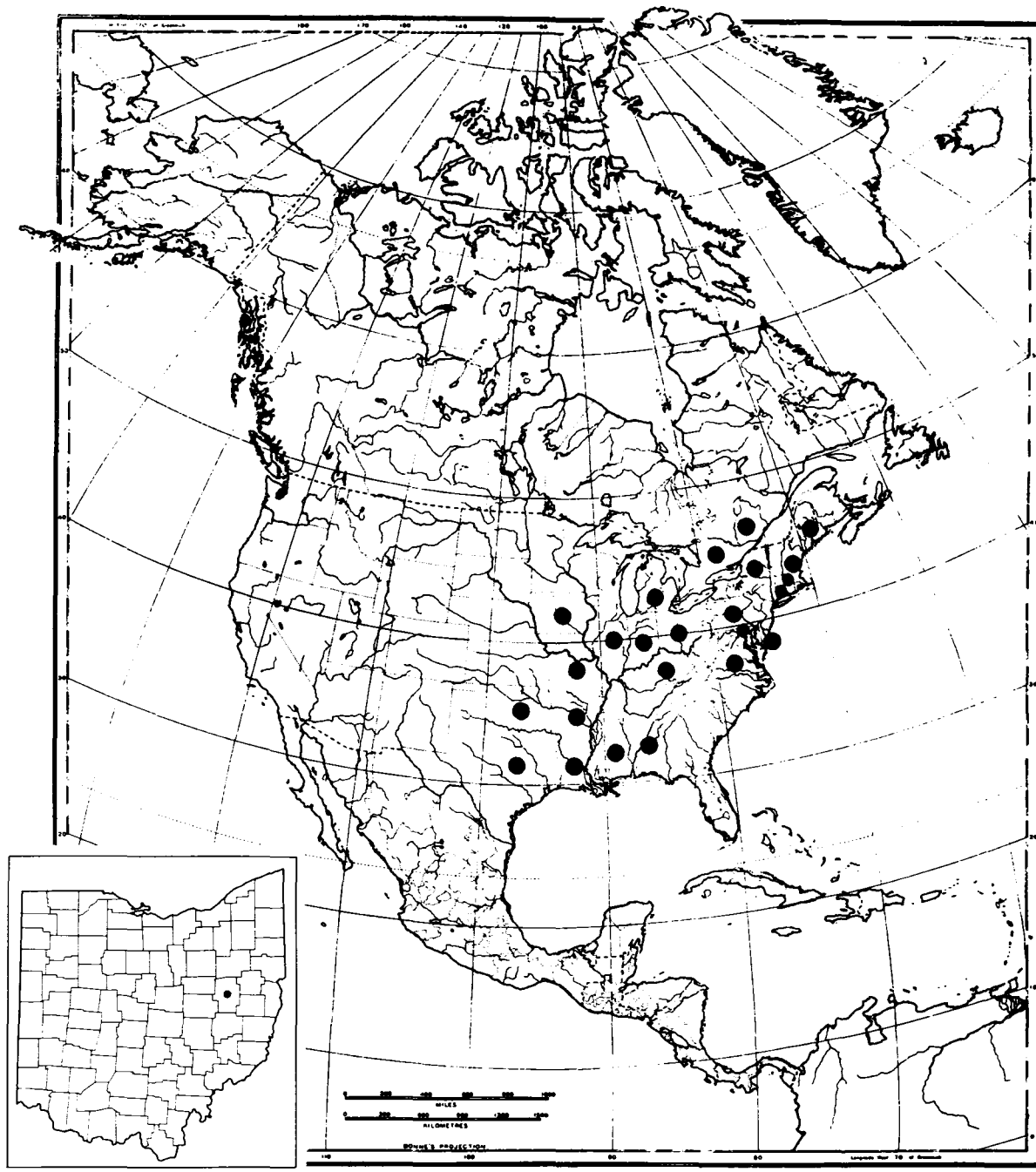

FIGURE 547.—Distribution of *Philomycus carolinianus flexuolaris* in North America; some of these records may refer to other subspecies; *inset*, distribution in Ohio.

climax deciduous forest on gentle well-drained slopes. Lindeborg (1949, Naut. 62, p. 129) found a single specimen, in moss on a tree trunk after rain.

Family SUCCINEIDAE

Succineidae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 771.

Diagnosis.—Shell thin, usually external, ovate, imperforate, of few (up to 4) whorls, the spire usually short, sometimes wanting; aperture large, ovate, with thin, simple peristome (or in *Hyalimax* the shell is reduced to a convex plate concealed in the mantle).

General distribution.—Practically worldwide, on all of the continents and on many oceanic islands.

Geologic range.—Eocene to present. The oldest representative of the genus, according to Henderson

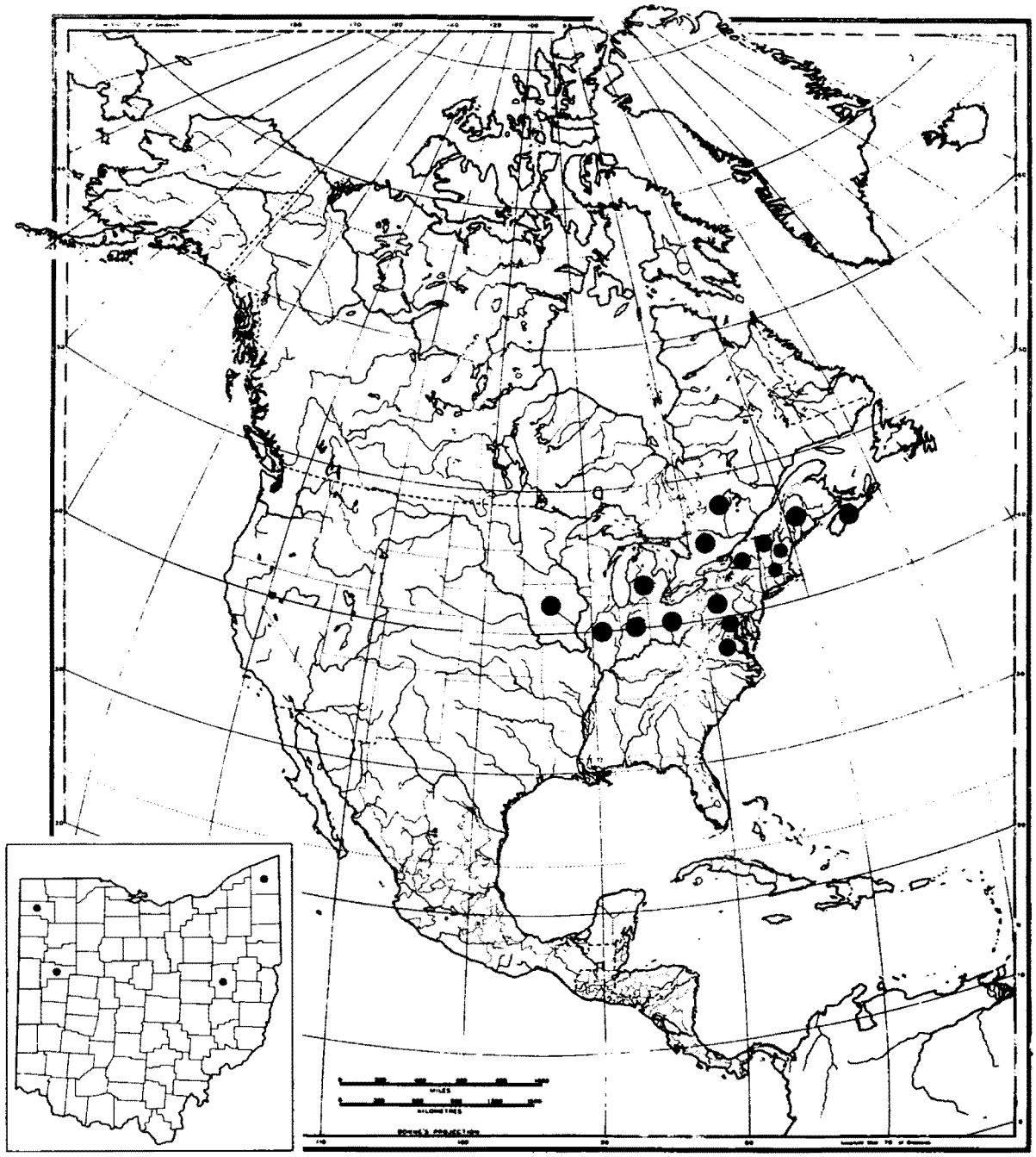

FIGURE 548.—Distribution of *Pallifera dorsalis* in North America; *inset,* distribution in Ohio.

(1935, p. 158), seems to be *S. papillispira* White of the Green River Eocene.

Remarks.—Until recently, all the Ohio species were placed in the genus *Succinea.* In this report four genera, *Succinea, Oxyloma, Quickella,* and *Catinella,* are recognized.

Genus *Oxyloma* Westerlund 1885

Oxyloma Westerlund 1885, Fauna Paläarct. Reg. Binnenconch., v. 5, p. 1.

Hydrotropa Lindholm 1927, Archiv. f. Molluskenkunde, v. 59, p. 328, 331.

Succinea section 4, Quick 1933, Malac. Soc. London Proc., v. 20, p. 311.

Succinea of American authors, in part.

Oxyloma Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 775.

Oxyloma La Rocque 1953, Cat. Recent Moll. Canada, p. 326.

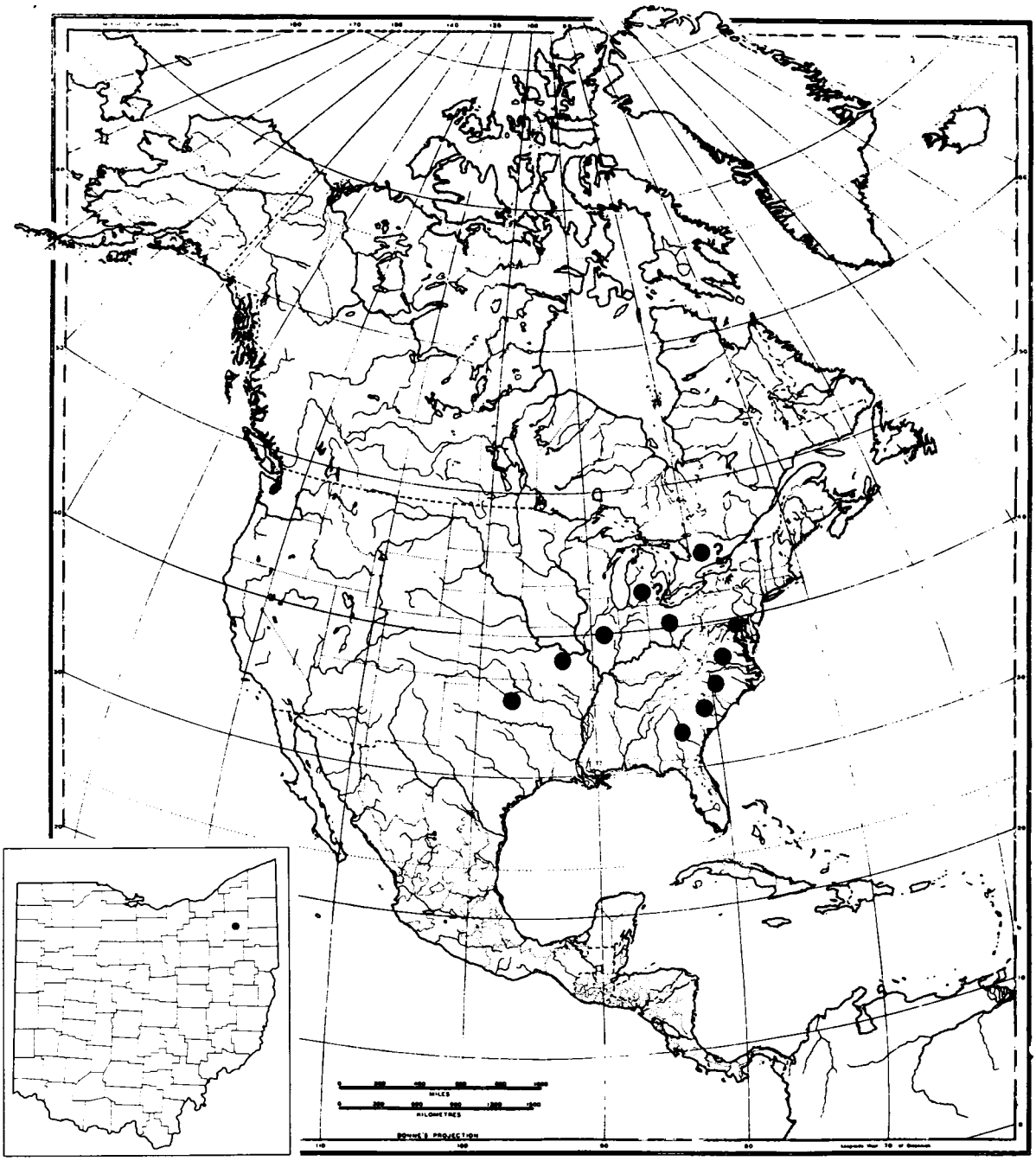

FIGURE 549.—Distribution of *Pallifera fosteri* in North America; *inset,* distribution in Ohio.

Type.—*Succinea dunkeri* Pfeiffer.

Diagnosis.—Shell very thin, with the whorls somewhat flattened above the periphery and the spire generally short; the shells almost indistinguishable from those of *Succinea* but can generally, from the anatomy of the living mollusks, be assigned to species which are known to belong to one of the two genera.

General distribution.—Northern continents and South Africa; southern and insular limits elsewhere not known.

Geologic range.—Pleistocene, at least from Yarmouth, to present.

Remarks.—Pilsbry (1948, p. 775 ff.) has divided the genus into two sections; the North American mainland species belong in section *Neoxyloma* Pilsbry.

Oxyloma decampii gouldi Pilsbry 1948

Succinea ovalis Gould 1841, Invert. Mass., p. 194, fig. 125; not *S. ovalis* Say.

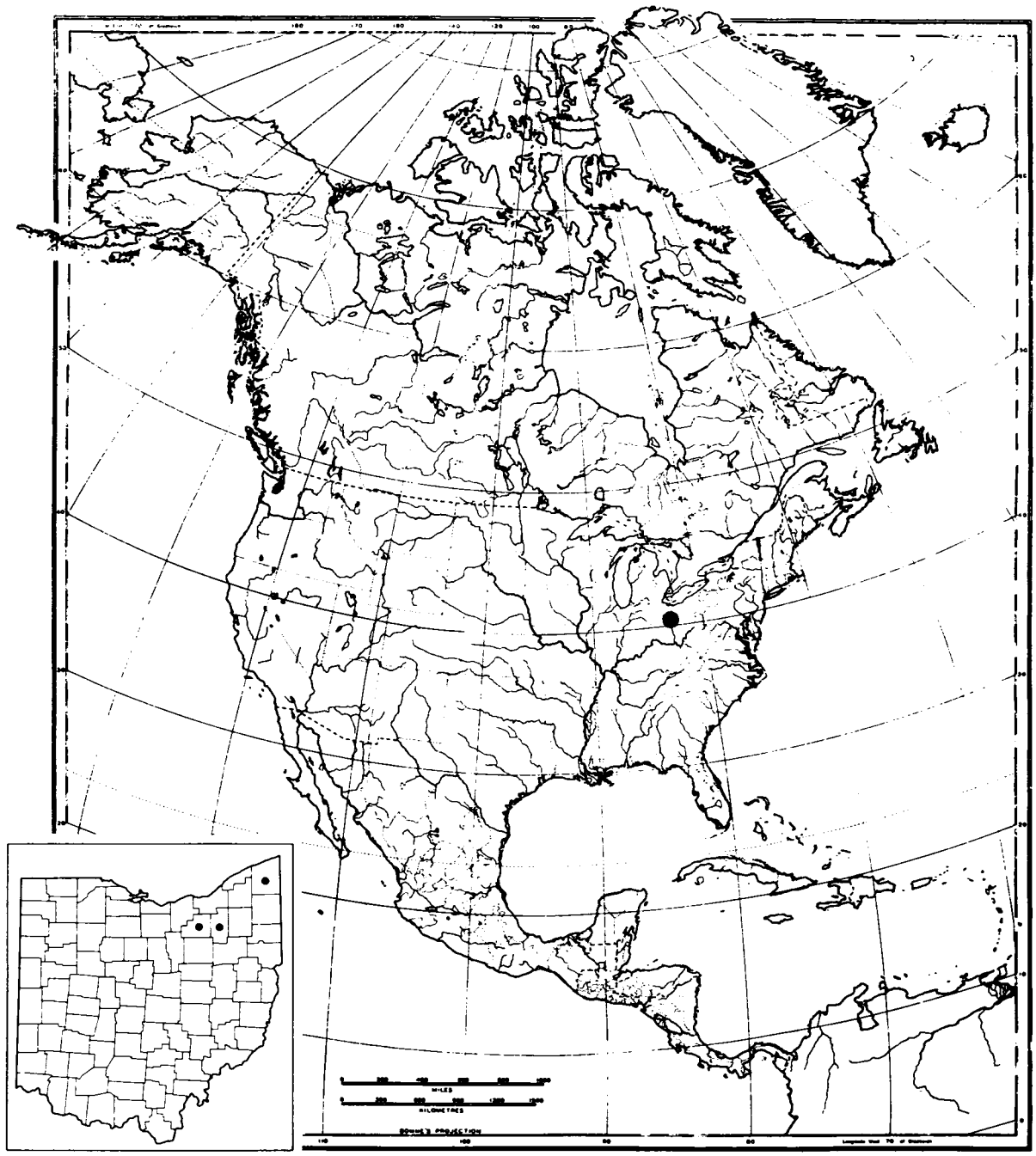

FIGURE 550.—Distribution of *Pallifera ohioensis* in North America; *inset,* distribution in Ohio.

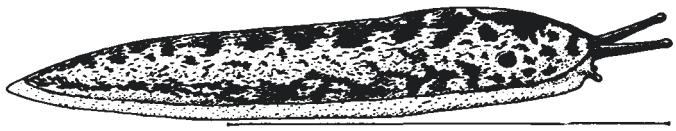

FIGURE 551.—*Philomycus carolinianus,* magnified; after F. C. Baker (1939a, p. 131).

Succinea retusa Lea, in part, of many recent authors, *fide* Pilsbry.

?*Succinea* sp. "very large" Billups 1902, Nautilus, v. 16, p. 51.

Oxyloma decampi gouldi Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 782, figs. 418c, d, h-t, v, y.

Oxyloma decampii gouldi La Rocque 1953, Cat. Recent Moll. Canada, p. 326.

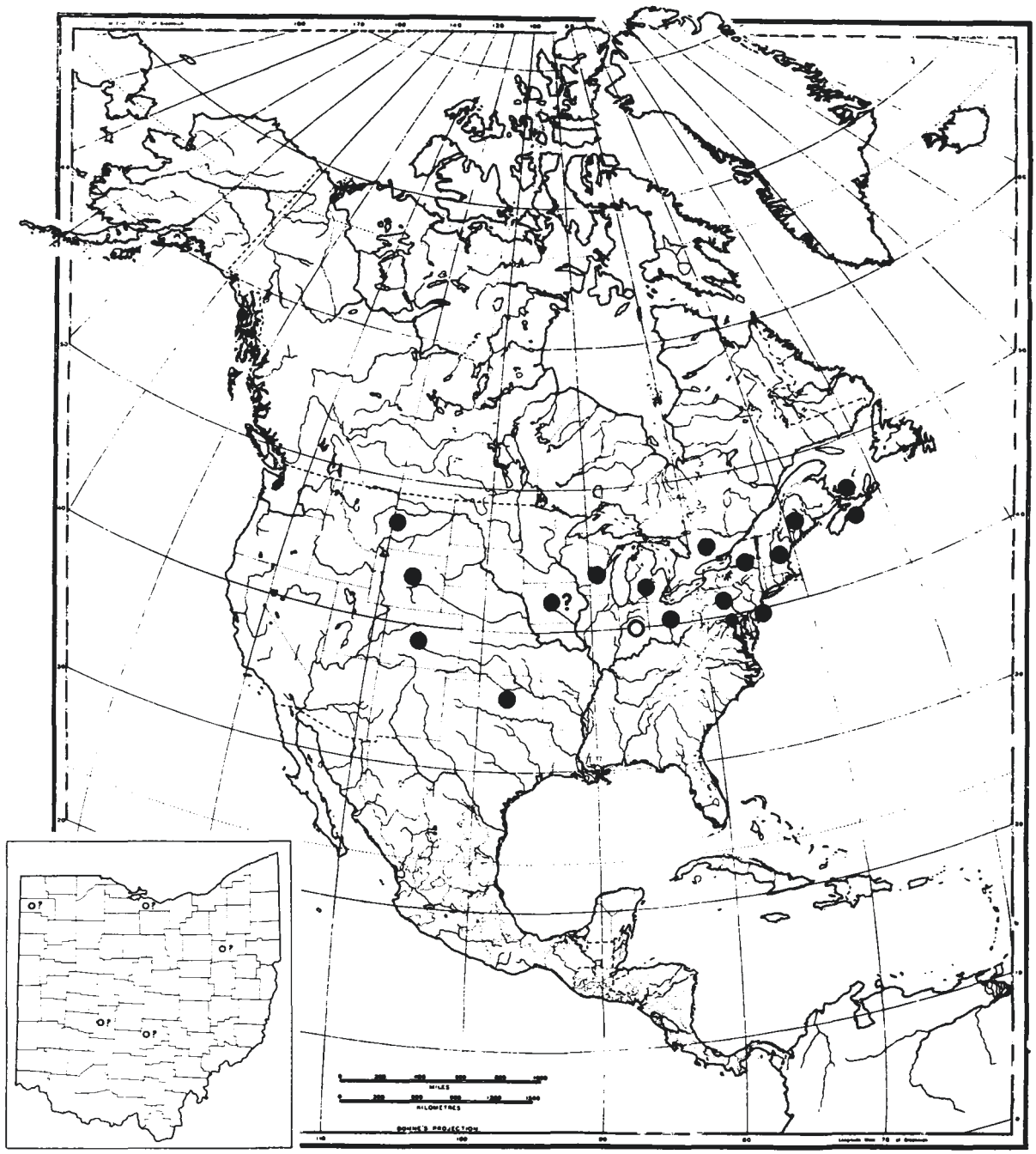

FIGURE 552.—Distribution of *Oxyloma decampii gouldi* in North America; *inset,* distribution in Ohio.

Type locality.—None given.

Diagnosis.—Small, very thin, pale yellow; less slender than typical *O. decampii,* with a longer and narrower aperture than *O. peoriensis;* aperture less wide and less effuse basally than *O. retusa* and *O. effusa subeffusa;* the last whorl is more convex than in *O. retusa,* especially in profile view (modified from Pilsbry, 1948, p. 782).

Ecology.—A species of marshy places, common on and around the aquatic vegetation of muddy pond and river margins and ditches.

Associations.—Fossil: K-6; Y-1; I-5; W-64.

General distribution (fig. 552).—Prince Edward Island and Nova Scotia west to Ontario, south to Maryland, west to Montana and Colorado.

Distribution in Ohio (inset, fig. 552).—The range given by Pilsbry implies that this species is present in Ohio but its synonymy is much too involved to permit definite identifications of previous records except from specimens. Billups' record of a "very large" *Succinea* from the Old Forest bed may belong here as well as some of the records of *S. retusa* by other authors.

Geologic range.—"?Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); Hunters Run deposit(?) (La Rocque and Conley, 1956, p. 326); Orleton site(?) (La Rocque, 1952, p. 12 ff.); "Defiance sandy deposit(?)" (Sterki, 1907a, p. 402); Tinkers Creek marl(?) (Sterki, 1920, p. 174); Castalia marl(?) (Sterki, 1920, p. 181).

Remarks.—As indicated by Pilsbry (1948, p. 782), it is probable that most records of *Succinea retusa* for Ohio belong under this subspecies of *O. decampii.* Nevertheless, *O. retusa* does occur in Ohio and the distribution of the two forms needs clearing up. Until this is done, both forms are mentioned here.

Oxyloma retusa (Lea) 1834
Fig. 553

Succinea retusa Lea 1834, Am. Philos. Soc. Trans., v. 5, p. 117, pl. 19, fig. 86.
Succinea higginsi "Bland, nov. spec." Tryon, 1866, Am. Jour. Conchology, v. 2, p. 237, pl. 17(2), fig. 24; Bland, 1866, Am. Jour. Conchology, p. 373, pl. 17, fig. 24.
Succinea calumetensis Calkins 1878, Valley Naturalist, v. 1, no. 11, p. 57, text fig.
Succinea retusa magister Pilsbry 1899, Nautilus, v. 12, p. 103.
Succinea ovalis Gould, Call 1900, Moll. Ind., p. 401, pl. 7, fig. 4.
Succinea retusa Dall 1905, Harriman-Alaska Exped., v. 13, p. 56, fig. 38.
——— ——— Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380, 402.
Succinea retusa higginsi Sterki 1907, *ibid.*
Succinea retusa Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, 181.
——— ——— F. C. Baker 1920, Life of Pleistocene, p. 389.
Succinea higginsia Dennis 1928, Aquatic Gastr. Bass Is. region, p. 3.
Succinea retusa Ahlstrom 1930, Nautilus, v. 44, p. 45.
——— ——— Goodrich 1932, Moll. Mich., p. 38.
——— ——— Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 281.
——— ——— Oughton 1948, Zoögeogr. study, Ontario, p. 76.
——— ——— Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 48, pl. 2, figs. 25, 26.
Oxyloma retusa Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 785, fig. 421.
——— ——— La Rocque 1952, Moll. Orleton site, p. 12 ff.
——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 327.
?Oxyloma cf. *O. retusa* La Rocque and Conley 1956, Hunter's Run, p. 326.
Oxyloma retusa Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 141.
——— ——— Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 78.
——— ——— Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 58.

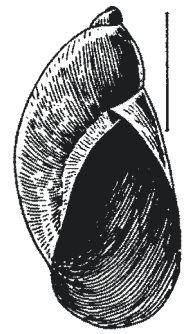

FIGURE 553.—*Oxyloma retusa,* magnified; after F. C. Baker (1939a, p. 125, fig. A).

Type locality.—Near Cincinnati, Ohio.

Diagnosis.—"Typically this species differs from *O. d. gouldi* by the larger size and the broader, more retracted and less deeply curved basal margin of the aperture. However, these are variable qualities; in some of the forms temporarily placed here as races of *retusa,* the basal arc of the peristome is rather deeply arched. The color is colonial buff" (Pilsbry, 1948, p. 786).

Ecology.—Taylor described the habitat of this species as semiaquatic, riparian: among sedges, watercress, and other plants at the water's edge, or in debris and vegetation in marshy places. Oughton (1948, p. 94 ff.) listed it for wet locations and noted that it may be collected in large numbers in stream drift; it lives on margins of ponds, streams, and other wet places. H. B. Baker (1922b) listed the following specific habitats: (3) swampy shore of a lake; large bog with floating marsh at its edge; (14) permanent pond:

bayou off the East Branch formed by old river channel; pool choked by vegetation; (17) beaver meadow: site of a former beaver pond, not as yet grown over by surrounding thickets; covered with grass, except in a few lower spots where ponds formed after rains; (27) beaver pond damming a creek, with floating vegetation and logs, even forming sedge-covered islands; (28) swampy cutoff of Hancock Creek, filled with water only when the creek was in flood; ditch about 6 feet wide and 2 feet deep, partially choked by logs; (44) ash-cedar swamp, snails in humus around bases of trees; (49) floodplain of Sturgeon River, flooded even in slight overflows, rather unfavorable to land mollusks. Muchmore (1959, Naut. 72, p. 88) recorded this as one of the few species not occurring under stones, even on floodplains, in New York State. Ingram (1940, Naut. 54, p. 87) has described its daylight activity and (1941, Naut. 55, p. 14-15) recorded it from the floodplain of Six

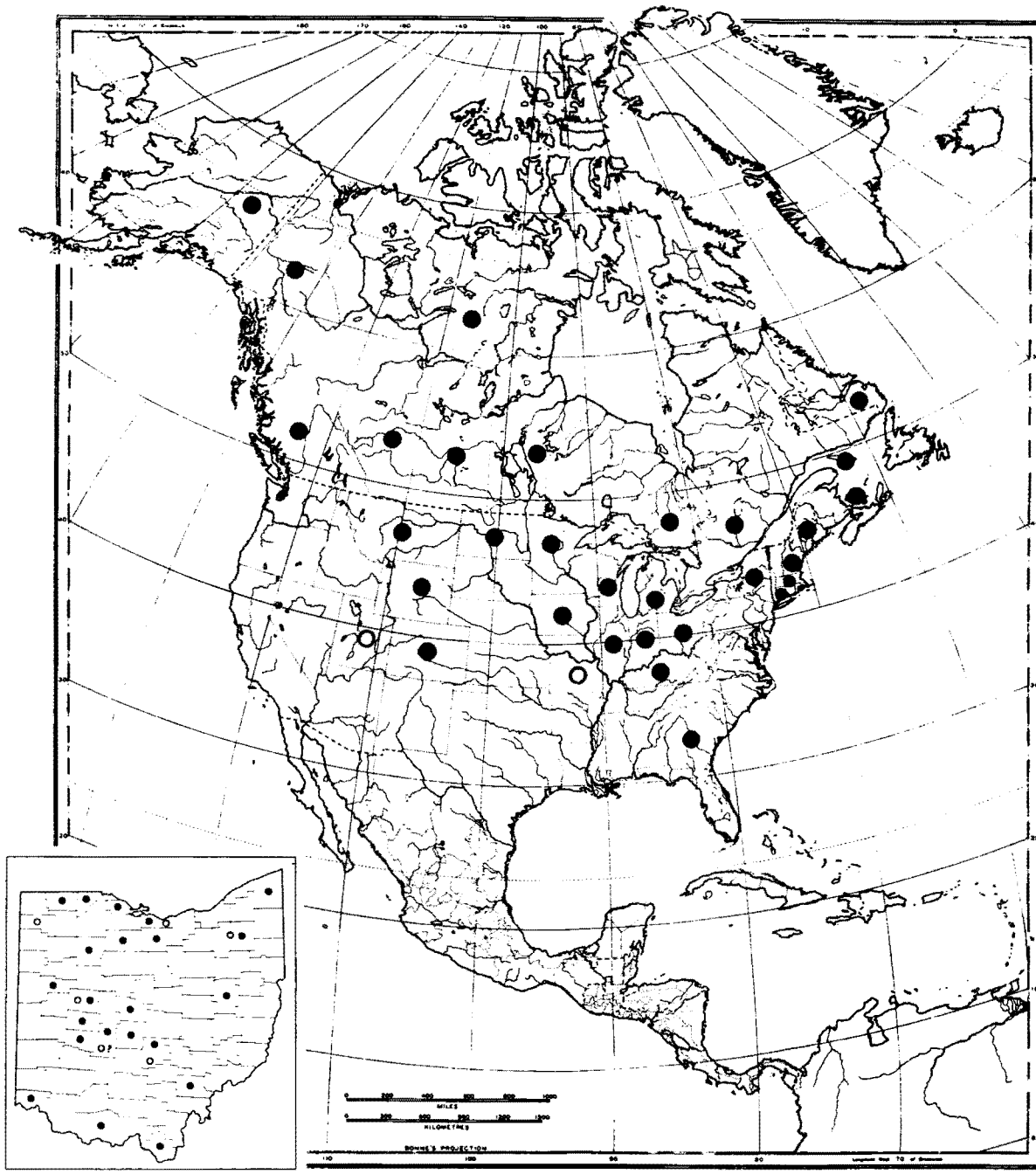

FIGURE 554.–Distribution of *Oxyloma retusa* in North America; *inset*, distribution in Ohio.

Mile Creek, under stones, at Ithaca, New York. Solem (1952, Naut. 65, p. 129) recorded it for an exceedingly damp area along the shore of Lake Michigan, on the Door Peninsula in Wisconsin. Ingram (1946, Naut. 59, p. 92) gave the following: "Individuals were confined to lake and pond margins. Collections were made from partially submerged logs in *Myosotis* lake and in Lincoln pond. Individuals were rarely collected from small stagnant ponds."

Associations.—Living: MICHIGAN-5, 15, 16, 17, 19, 24, 25, 36, 40; MINNESOTA-6, 13b, 16; NEW YORK-34; OHIO-7, 29, 31, 39, 43; ONTARIO-7, 8, 10; WISCONSIN-138. Fossil: N-2; S-6; W-26?, 27, 28, 35, 56, 57, 58, 59, 73. *Oxyloma retusa higginsi,* living: OHIO-4, 19.

General distribution (fig. 554).—"Yukon? and British Columbia? east to Labrador and Maine" (La Rocque, 1953, p. 327). The range as given by Pilsbry (1948, p. 786) is much more restricted: Ohio, Illinois, Iowa, Minnesota, North Dakota, Montana.

Distribution in Ohio (inset, fig. 554).—"Over the state" (Sterki, 1907a, p. 380). Manuscript records by Eggleston and others cover most of the State. In some cases, these records should perhaps be placed under *O. decampii gouldi.*

Geologic range.—F. C. Baker (1920a, p. 389) gave Aftonian, Yarmouth, Sangamon, and "Wabash." The species is not mentioned by A. B. Leonard (1950,1952), who placed midwestern records under other species. Hibbard and Taylor (1960, p. 141) gave "Early Pleistocene to Recent." In Ohio, the species has been recorded for deposits of Wisconsin age but the identifications are subject to revision: "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402); Tinkers Creek marl (Sterki, 1920, p. 174); Castalia marl (Sterki, 1920, p. 181); Orleton mastodon site (La Rocque, 1952, p. 12 ff.); Hunter's Run (La Rocque and Conley, 1956, p. 326 ff.); Newell Lake deposit (Zimmerman, 1960, p. 20); and Castalia deposit (Clark, 1961, p. 26).

Genus *Quickella* C. R. Boettger 1939

Succinea, section 1, Quick 1933, Malac. Soc. London Proc., v. 20, p. 310.
Quickella C. R. Boettger 1939, Zool. Anz., v. 127, p. 150.
Quickella Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 842.

Type.—*Succinea arenaria* Bouchard-Chantereaux.

Diagnosis.—"The penis is without a sheath, and has an appendix in the form of a very short, blunt protuberance, lateral at the apex (or, in the subgenus *Mediappendix,* a sac arising at and below the middle). There is no distinctly differentiated epiphallus. The vagina is very short. Jaw of the usual arcuate form with rather strong median projection. 'Marginal teeth of radula few, about equal in number to the laterals, and with very short, broad basal plates.' The shell is succineiform, with strongly rounded whorls and produced spire" (Pilsbry, 1948, p. 842-843).

General distribution.—Europe, Atlantic and Channel coast zone of France, Holland, and southern England. America (subgenus *Mediappendix*): coastal New Jersey and south to North Carolina; Midwest (Indiana and surrounding states); Pacific states.

Geologic range.—Pleistocene: Wisconsin, perhaps older.

Remarks.—Until 1958, When Hubricht (1958, Naut. 72, p. 61) pointed out that *Succinea avara* and *S. vermeta* differed specifically, this genus was thought to be restricted to the coastal areas of North America. His placing of *S. vermeta* in genus *Quickella,* which appears to be correct, extends the range as given by Pilsbry (1948, p. 843). This development illustrates the unsettled and confusing state of classification of the Succineidae of North America and indicates that the final revision of the group may be quite different from the current one.

Quickella vermeta (Say) 1829
Fig. 555

Succinea vermeta Say 1829, New Harmony Disseminator, v. 2, p. 230.
Succinea avara vermeta Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380.
——— ——— ——— F. C. Baker 1920, Jour. Geology, v. 28, p. 455.
——— ——— ——— Goodrich 1932, Moll. Mich., p. 40.
——— ——— ——— Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 281.
——— ——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 328.
Quickella vermeta Hubricht 1958, Nautilus, v. 72, p. 60.
Succinea avara vermeta Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 56.

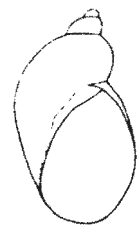

FIGURE 555.—*Quickella vermeta,* magnified; after F. C. Baker (1931c, pl. 32, fig. 20B).

Type locality.—Near New Harmony, Indiana.

Diagnosis.—Sutures very deeply indented, giving the whorls of the spire the appearance of being almost separated; color corneous to bright golden yellow.

Ecology.—Margins of ponds (Say, 1829). Mozley (1926, Naut. 40, p. 55) listed this species from near a lake in the Jasper Park region of Alberta. He gave no details on the habitat, but this record is an indication of this snail's ability to withstand cold and a short summer season.

General distribution (fig. 556).—Indiana and neighboring states. It has been recorded from Alberta, Manitoba, Ontario, Quebec, and southward, but the identifications require confirmation.

Distribution in Ohio (inset, fig. 556).—Tuscarawas County (Sterki, 1907a, p. 380); it probably occurs elsewhere in the State but has been included under *Succinea avara.*

Geologic range.—Pleistocene (Sangamon?), Bartholomew County, Indiana (F. C. Baker, 1920b, p. 456).

Remarks.—Hubricht (1958, Naut. 72, p. 61) stated that *Q. vermeta* is not a synonym of *Succinea avara* but differs specifically from that species. He has dissected specimens from New Harmony, Indiana, the type locality, which indicate that *Q. vermeta* is related to *Q. vagans* and therefore a member of the genus *Quickella.* Although Hubricht appears to be the first to place this species in a genus other than *Succinea,* he is not

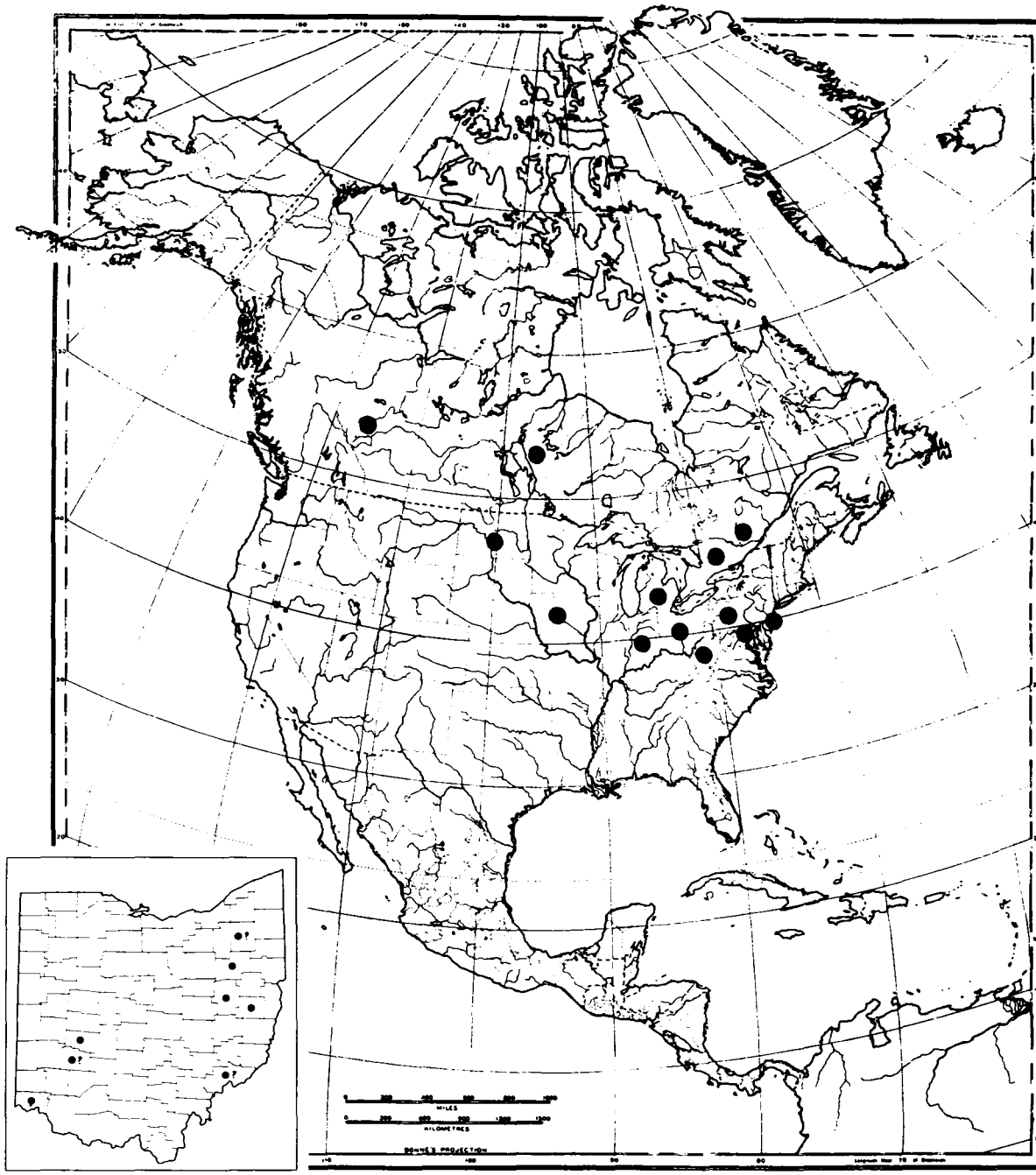

FIGURE 556.—Distribution of *Quickella vermeta* in North America; *inset,* distribution in Ohio.

the first to note its distinctness from *S. avara*. Sterki (1907a, p. 380) insisted on the validity of *S. vermeta* as a variety. Bryant Walker, quoted by Pilsbry (1948, p. 839), believed the two forms to be identical and Pilsbry agreed with that opinion, stating that *S. avara vermeta* was probably the "full development of the species in humid places," but qualifying his opinion by noting that "the variations observed in the genitalia may indicate the existence of several species or races." The shell characters suggest a close relationship between the two forms and it may well be that the genitalia of *S. avara* will indicate that it should also be transferred to *Quickella*. Until these points have been elucidated, *S. avara* and *Q. vermeta* are considered separately in this report and placed in separate genera, following Hubricht.

Genus *Succinea* Draparnaud 1801

Succinea Draparnaud 1801, Tabl. Moll. France, p. 55.
Lucena Oken 1815, Lehrbuch der Naturgeschichte, Zool., v. 3, p. 311-312.
Tapada Studer 1820, Naturwiss. Anz. Allg. Schweiz Gesell. Naturwiss., 3te Jahrg., p. 86.
Cochlohydra Férussac 1821, Tabl. Syst. Fam. Limaçons, p. 30 (26), in part.
Amphibina Hartmann 1821, *in* Steinmüller's Neue Alpina, v. 1, p. 208-247.
Amphibulina Hartmann 1821, Syst. Erd- u. Süssw. Gasterop. Europas, *in* Sturm, Fauna Deutschlands, 6 Abth., p. 42, 55 (error for *Amphibulima* Lamarck; see p. 27).
Neritostoma "Klein" Mörch 1864, Synopsis Moll. Daniae, p. 32, *non* H. and A. Adams, 1855.
Hydrophyga Lindholm 1927, Archiv. f. Molluskenkunde, v. 59, p. 330.
Austrosuccinea Iredale 1937, Australian Zoologist, v. 8, p. 307.
Succinea Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 799.
Succinea La Rocque 1953, Cat. Recent Moll. Canada, p. 328.

Type.—*Succinea putris* (Linnaeus).

Diagnosis.—Shell thin, ovate, of about 2½ to 3 whorls; variable in degree of elongation but usually with shorter whorls than *Oxyloma, q. v.*; diagnostic characters of the genus especially those of the soft parts of the animal.

General distribution.—Europe, Asia, North and South America, Australia, New Zealand.

Geologic range.—Eocene of Wyoming and Pliocene of Florida to present.

Remarks.—From shell characters alone, it is difficult to distinguish this genus from *Oxyloma*. According to recent work (Quick, 1933; Pilsbry, 1948) the soft parts are sufficiently distinct to warrant recognition of both genera and others as well. At first glance, shells of *Succinea* and *Oxyloma* may be confused with those of *Pseudosuccinea* (family Lymnaeidae) but the character of the ornamentation is sufficient to distinguish them. In the Succineidae, the spiral ornamentation is not normally present; it may be developed sporadically on some specimens but never to such an extent as to cause confusion with *Pseudosuccinea*, which has the fine regular spiral ornamentation of the Lymnaeidae.

Succinea aurea Lea 1846
Fig. 557

Succinea aurea Lea 1846, Am. Philos. Soc. Trans., v. 9, p. 4.
Succinea indiana Pilsbry 1905, Nautilus, v. 19, p. 28.
Succinea aurea Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380.
Succinea indiana Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 382.
Succinea aurea Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 48, pl. 2, fig. 24.
——— ——— Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 815.
——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 328.
——— ——— Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 55.

FIGURE 557.—*Succinea aurea*, magnified; after Walker (1928, p. 171, fig. 269).

Type locality.—Springfield, Clark County, Ohio.

Diagnosis.—Shell small, ovate, inflated; yellow, the spire or the apex typically red-gold or salmon tinted, but in many specimens the shell is pale yellow; surface glossy, with microscopic wrinkles of growth; whorls 3, very convex, parted by a deep suture; aperture oblique, about two-thirds the total length of the shell (modified from Pilsbry, 1948, p. 815).

Ecology.—"Dryish wooded slope bordering maple swamp; on plants in a cat-tail marsh . . .; brackish tidal marshes . . .; on hillside facing the west" (Pilsbry, 1948, p. 815, 817). Burch (1954, Naut. 68, p. 31) found it along the James River in Virginia; generally picked up from rocks near the water's edge, not common.

General distribution (fig. 558).—Ontario east to Maine, south to South Carolina, Indiana, and Ohio.

Distribution in Ohio (inset, fig. 558).—Clark, Greene, and Hamilton Counties (Pilsbry, 1948); Pike, Washington, and Portage Counties (Eggleston, ms. records). The species appears to be sporadically distributed in the State but it may be more abundant than the records indicate because of confusion with other species.

Geologic range.—None recorded.

Succinea avara Say 1824
Fig. 559

Succinea avara Say 1824, Long's Exped., App., v. 2, p. 260, pl. 15, fig. 6.
Succinea wardiana Lea 1841, Am. Philos. Soc. Proc., v. 2, p. 31.
Succinea avara Call 1900, Moll. Ind., p. 402, pl. 7, fig. 3.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 57, fig. 39.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380, 402.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, 181.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 45.

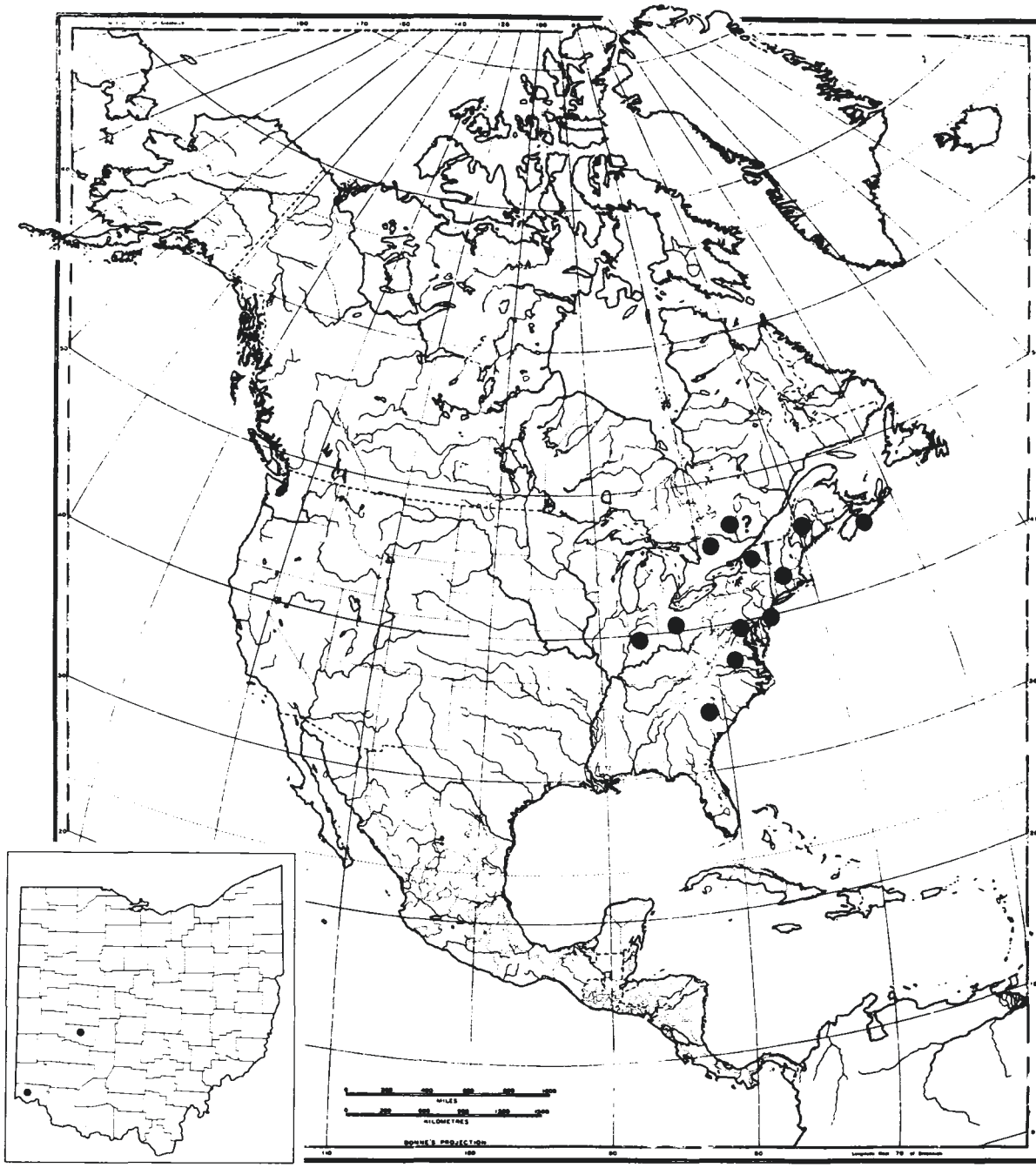

FIGURE 558.—Distribution of *Succinea aurea* in North America; *inset,* distribution in Ohio.

Succinea avara Goodrich 1932, Moll. Mich., p. 39.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 281.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 74.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 837, fig. 455a-k.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 47, pl. 2, fig. 30.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 23, pl. 4, fig. G.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 23, pl. 2, fig. G.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 328.
--- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 11.
--- --- La Rocque and Forsyth 1957, Sidney Cut, p. 85 ff.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 56.

FIGURE 559.—*Succinea avara*, magnified; after Call (1900, pl. 7, fig. 3).

Type locality.—Northwest Territories.

Diagnosis.—Shell slender, fragile; pale yellowish (varying from a greenish to an ochraceous or a pinkish tint); surface irregularly wrinkled, more coarsely so on the latter part of the last whorl; usually daubed or coated with earth; shell of a little more than 3 very strongly convex whorls, sutures deep; aperture ovate, two-thirds the length of the shell or less (modified from Pilsbry, 1948, p. 837).

Ecology.—Usually found on vegetable debris thrown up on muddy shores, or crawling on the muddy banks of ditches, often exposed to the sun; also in swampy places in pastures. It is an upland species as well, to be seen under stones with Pupillidae, or occasionally after rains crawling up the trunks of trees (Pilsbry, 1948, p. 839).

H. B. Baker (1922b) found this species in damp places in Dickinson County, Michigan; specifically, (44) ash-cedar swamp: snails in humus around bases of trees; (48) in a damp hollow of the Menominee River floodplain, with brush of tag alders, dogwoods, hazels, and small ashes. Solem (1952, Naut. 65, p. 129) found it in an exceedingly damp area covered with piles of reeds tossed up during storms in an open spot on the shore line, Door County, Wisconsin; and near a small freshwater lake at the northern end of the Door Peninsula. Teskey (1955, Naut. 69, p. 70-71) collected it from detritus in crannies of stone walls and rotting timbers of an old mill in the Warm Springs area of Georgia. At the other extreme of its range, Wayne (1959, p. 93) recorded it from sedges and mud at the margins of ponds in the muskeg around Churchill, Manitoba. Branson (1959, Naut. 72, p. 145-146) gave the following notes for Oklahoma: small pond, surrounded by a gently dipping well-vegetated watershed; soil thoroughly saturated by unusually heavy rains; east slope of pond's watershed supported a luxuriant growth of *Nostoc* sp. from the water's edge to about 30 feet into the Bermuda grass around the pond; *S. avara* was associated with *Nostoc*, 31 specimens per square foot; observations were made in April; in July the soil was dry, *Nostoc* and the snails were absent on the slopes but abundant on mud banks of the pond; in Oklahoma, this species is somewhat amphibious, found on aquatic vegetation or pieces of dead vegetation in the water as well as in truly terrestrial habitats; it is nearly always found in moist situations with algae and molds. Grimm (1959, Naut. 72, p. 125) listed it from leaf litter in a low area near railroad tracks and around the foundation of an old burned house in Maryland.

Associations.—Living: MANITOBA-39; MICHIGAN-1, 5, 22, 32, 33, 34, 36, 40; NEW YORK-42; OHIO-7, 43; ONTARIO-11, 12, 14; WISCONSIN-138, 140, 144. Fossil: K-19, 22; Y-1 (var.); S-1 (*cf.*); W-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 43, 44, 48, 51, 52, 53, 54, 55, 56, 58, 59, 73.

General distribution (fig. 560).—Mackenzie District south to British Columbia, California, and Mexico; east to Quebec, New Brunswick, and Newfoundland, south to Florida.

Distribution in Ohio (inset, fig. 560).—"Over the state" (Sterki, 1907a, p. 380). Unpublished records in the University of Michigan Museum of Zoology collections and Eggleston's records substantiate Sterki's statement; I have no records for the counties of northeastern Ohio but this may be due more to lack of collecting than to actual absence of the species.

Geologic range.—F. C. Baker (1920a, p. 388) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash" for this species. Yarmouth to Recent (A. B. Leonard, 1950, p. 23); Indiana, pro-Kansan loess (Wayne, 1954, p. 1320); "Defiance sandy deposit (loess?)," Ohio (Sterki, 1907a, p. 402); Tinkers Creek marl (Sterki, 1920, p. 174); Castalia marl (Sterki, 1920, p. 181), the type form and a "peculiar form" which Sterki describes as "possibly distinct; larger, 8-10 mm. long, with 4-4½ rather flat whorls; the spire is long and very slender"; Sidney Cut, early Wisconsin (La Rocque and Forsyth, 1957, p. 85 ff.). More recently, the species has been identified from the following Pleistocene deposits in Ohio: Aultman (Sheatsley, 1960, p. 106), Jewell Hill Mowery, 1961, p. 12), and Castalia (Clark, 1961, p. 26).

Remarks.—The relationships of this species with *Quickella vermeta* have been described under that species. It may be that the distribution as given here is much too extensive and that later work, especially that of Rehder, who has a monograph of the family in prep-

aration, may show that several species are included under this one name.

Succinea grosvenori Lea 1864
Fig. 561

Succinea lineata W. G. Binney 1857, Acad. Nat. Sci. Philadelphia Proc., p. 19; not *S. ovalis* var. A, *lineata* DeKay, 1844.

Succinea grosvenori Lea 1864, Acad. Nat. Sci. Philadelphia Proc., p. 109.

Succinea mooresiana Lea 1864, *ibid.*

Succinea greerii Tryon 1866, Am. Jour. Conchology, v. 2, p. 232, pl. 2(17), fig. 8.

Succinea lineata forma *elongata* Cockerell 1892, Jour. Conchology, v. 7, p. 39.

Succinea grosvenori Dall 1905, Harriman-Alaska Exped., v. 13, p. 57, fig. 40.

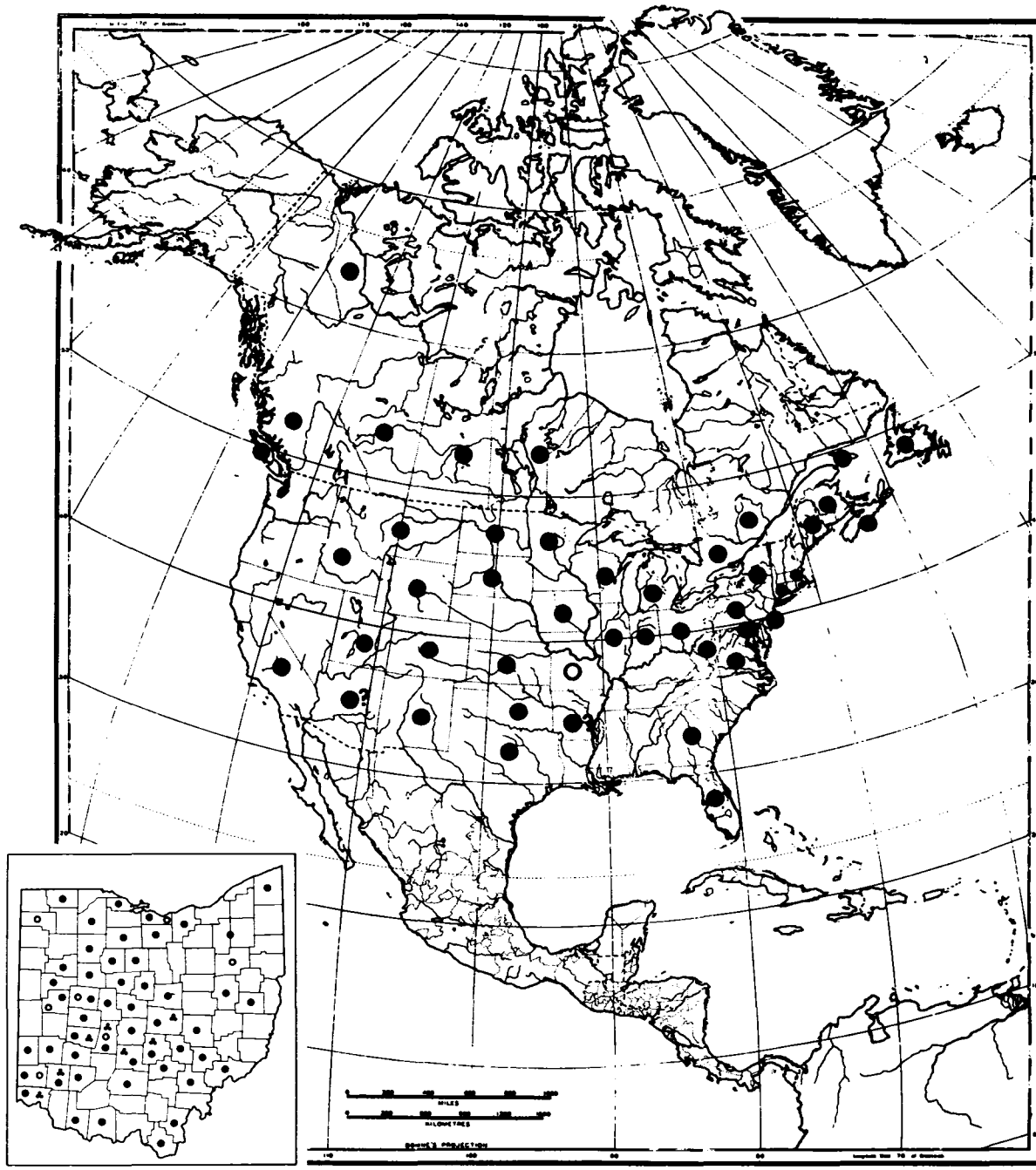

FIGURE 560.–Distribution of *Succinea avara* in North America; *inset,* distribution in Ohio.

Succinea grosvenori F. C. Baker 1920, Life of Pleistocene, p. 389.
--- --- Leonard and Frye 1943, Am. Jour. Sci., v. 241, p. 457.
--- --- Oughton 1948, Zoogeogr. study, Ontario, p. 75.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 819, figs. 444, 452i, j.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 24, pl. 4, fig. I.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 24, pl. 2, fig. J.
--- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 329.
--- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
Succinea cf. *grosvenori* Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 11.
Succinea grosvenori La Rocque and Forsyth 1957, Sidney Cut, p. 85 ff.

FIGURE 561.—*Succinea grosvenori*, magnified; after Walker (1928, p. 169, fig. 267).

Type locality.—"Santa Rita Valley, Kansas?" (Pilsbry, 1948, p. 821).

Diagnosis.—Shell thin, rather short, inflated, with strongly convex whorls, very deep suture, and generally somewhat coarse sculpture in places, rarely showing some irregular and interrupted spiral impressions in the peripheral region; color pale yellow, never transparent (modified from Pilsbry, 1948, p. 821).

Ecology.—This species, "as now understood, tolerates an astonishingly wide range in practically all external conditions. It occurs from the warm humid Gulf coast to semi-arid areas in the great plains and mountain states, and in British America it extends north within the border of Northwest Territory" (Pilsbry, 1948, p. 821).

Mozley (1928, Naut. 42, p. 16) recorded this species from Baldur, near Cobbs Lake, Manitoba, without details of habitat, but this record at least indicates that the species is a hardy one, able to withstand severe cold and a relatively short summer season. Colton (1929, p. 94) has listed it from Arizona, probably washed from upper layers on the bank of a deep limestone canyon upstream. Again, there are no further details on habitat but this could be taken as fair evidence of ability to withstand heat and prolonged desiccation. Chamberlin and Berry (1929, Naut. 42, p. 125) listed it from localities in Utah which would indicate the same sort of conditions. Mozley (1930, Naut. 43, p. 82) gave a locality in Saskatchewan, again near a lake, which would give the same indications as the Manitoba record. Shimek (1935, Naut. 49, p. 7, 10) noted that in all its range it is usually subject to xeric conditions, and this is true even of the lower Mississippi region. With one exception, he found the species living only on loess banks or bluffs in Iowa, Nebraska, Missouri, Arkansas, Kentucky, Tennessee, Mississippi, and Louisiana. He stated that the "specimens were usually few and scattered, and this was true even in the two localities in which the species was obtained in greatest number.... In drier weather the scattered individuals were found clinging to the bare faces of the loess bluffs, or on the equally bare upper parts of the talus at their base, and always on the more sheltered sides, either facing north, or protected by turns and crevices in the bluffs. ... They creep about in moister weather, or during the early morning hours in drier periods, but close up promptly as soon as dry conditions return." In winter, they form thick, opaque white epiphragms, in sheltered crevices. He continued: "It is evident that this species selects two quite different major habitats, namely, that noted above, and another on the plains which may be quite moist or wet, but more or less alkaline or saline .... Both types, however, are distinctly xeric. The plains alkaline ponds and moist spots are very dry during much of the average summer, and even when wet, they are strongly xeric, as shown by the character of their scant vegetation.... It is evident, therefore, that this species is far removed in habit from the co-generic 'amphibious' and mesophilous forms, and is a distinct xerophile."

In contrast, Eyerdam (1939, Naut. 53, p. 64) recorded this species in wet moss on Kodiak Island, Alaska. On the other hand, MacMillan (1944, Naut. 57, p. 131) recorded it from a habitat similar to the first described by Shimek in Nebraska. Sand Creek has cut a wide canyon through the badlands, exposing steep banks of white sands and fine clays; MacMillan's specimens of *S. grosvenori* came from the face of the outcrop but were dead and devoid of epidermis. He speculated that they came from the outcrop as "there were no lakes or other types of water from which it was possible for these snails to have originated" but it seems a perfectly normal habitat in light of Shimek's observations.

Associations.—Fossil: K-1, 2, 4, 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27; I-1, 2, 3(?), 4; S-1, 7; W-2, 4, 5, 6, 7, 9, 12, 13, 15, 16, 17, 18, 19, 20, 21, 18(?), 43, 44, 60, 61, 64.

General distribution (fig. 562).—Northwest Territories (Great Slave Lake), Alberta, Saskatchewan, Manitoba, Ontario, southward to Florida and Arizona.

Distribution in Ohio (inset, fig. 562).—The species has not, as yet, been recorded living from the State but it occurs here as a Pleistocene fossil.

Geologic range.—F. C. Baker (1920a, p. 389) gave Yarmouth, Sangamon, and Peorian. Blanco to Recent (Leonard, 1952, p. 24) in Iowa, Nebraska, Kansas, Oklahoma, and Texas; Pleistocene, around Las Vegas,

New Mexico (Pilsbry, 1948, p. 821); pro-Kansan loess, Putnam County, Indiana (Wayne, 1954, p. 1320); Sangamon, Farmdale? loess, lower and upper pro-Tazewell loess, Cleveland, Ohio (Leonard, 1953, p. 372); Sidney Cut, Shelby County, Ohio (La Rocque and Forsyth, 1957, p. 85 ff.).

Succinea grosvenori gelida F. C. Baker 1927

Succinea grosvenorii gelida F. C. Baker 1927, Nautilus, v. 40, p. 118.

Succinea avara gelida Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 48, pl. 2, figs. 32, 33.

Succinea grosvenori gelida Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 823, fig. 444g, h.

Succinea avara gelida Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.

Type locality.—Boone County, Illinois, one-half mile northwest of depot at Irene, in Peorian Loess.

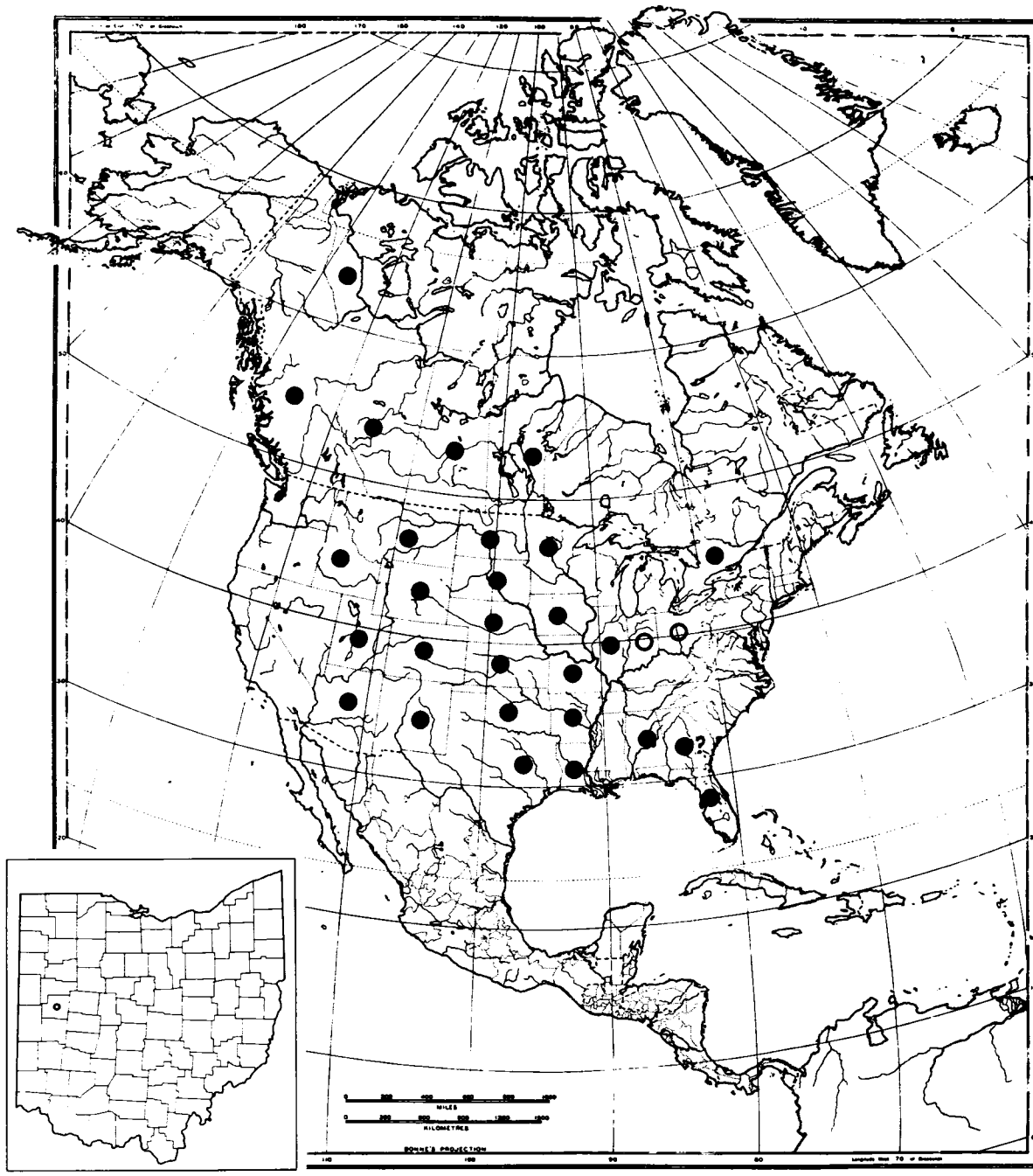

FIGURE 562.—Distribution of *Succinea grosvenori* in North America; *inset,* distribution in Ohio.

Diagnosis.—"Shell small, elongated, rather narrow; whorls 3½, convex, separated by deep sutures, last whorl comparatively small, flat-sided, or but slightly convex; spire long, acute; aperture rounded, about half as long as shell; columella straight curving into the parietal wall in a gentle curve, not forming a distinct angle; there is a slight callus which is spread over the parietal wall; sculpture of rather fine, vertical striae" (F. C. Baker, 1927, Naut. 40, p. 118).

Ecology.—Probably the same as the typical form.

Associations.—Fossil: I-7; W-61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71. "*Catinella gelida* var.," fossil: K-6, 7; I-5.

General distribution (fig. 563).—Pleistocene, extinct; Yarmouth to late Wisconsin. Not recorded as living.

Distribution in Ohio (inset, fig. 563).—Lower and upper pro-Tazewell loess, Cleveland, Ohio (A. B.

FIGURE 563.—Distribution of *Succinea grosvenori gelida* in North America; *inset,* distribution in Ohio.

Leonard, 1953, p. 372 ff.).

Geologic range.—Yarmouth, Sangamon, and Wisconsin deposits in Illinois; pro-Tazewell loess in Ohio; Wisconsin(?) marl, Livingston County, New York (Robertson and Blakeslee, 1948, p. 48).

Remarks.—The writer follows Pilsbry (1948) in referring this subspecies to *S. grosvenori* rather than *S. avara,* as has been done by Leonard (1953) and by Robertson and Blakeslee (1948), mainly because of Baker's (1927, Naut. 40) insistence on its relationships to the former and not to the latter. The distribution of this form may be greater than is indicated by the records as it may be confused with other species of *Succinea,* as pointed out by Baker (1927, Naut. 40, p. 119).

Succinea ovalis Say 1817
Fig. 564

Succinea ovalis Say 1817, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 15.
Helix (Cochlohydra) ovalis Férussac 1822, Tabl. Syst. Fam. Limaçons, p. 26.
Succinea obliqua Say 1824, Long's Exped., App., v. 2, p. 260, pl. 15, fig. 7.
Succinea campestris Gould 1841, Invert. Mass., p. 195, fig. 126.
Succinea totteniana Lea 1841, Am. Philos. Soc. Trans., v. 2, p. 32.
Succinea obliqua Call 1900, Moll. Ind., p. 402, pl. 7, fig. 2.
?*Succinea* sp. "very large" Billups 1902, Nautilus, v. 16, p. 51.
Succinea obliqua Dall 1905, Harriman-Alaska Exped., v. 13, p. 58, fig. 41.
Succinea ovalis Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 174, 181.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Goodrich 1932, Moll. Mich., p. 39.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 281.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 75.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 801, figs. 430-433.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 49, pl. 2, fig. 28.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 24, pl. 4, fig. J.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 24, pl. 2, fig. K; fig. 14.
--- --- La Rocque 1952, Moll. Orleton site, p. 12 ff.
Succinea ovalis ovalis La Rocque 1953, Cat. Recent Moll. Canada, p. 329.
Succinea ovalis Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 78.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 57.

Type locality.—Philadelphia, Pennsylvania.

Diagnosis.—Shell oval, inflated, thin, translucent, of a greenish-yellow tint, the summit paler or reddish; glossy; lightly marked with wrinkles of growth; whorls 2½, strongly convex, the last inflated, convex throughout; aperture ovate, about three-fourths the length of shell; this *Succinea* larger and more inflated than any other of the region it inhabits (modified from Pilsbry, 1948, p. 802, 803).

FIGURE 564.—*Succinea ovalis,* magnified; after Call (1900, pl. 7, fig. 2).

Ecology.—Found on low ground near streams, in summer often upon the weedy herbage of such places, a foot or two from the ground. It has been collected on the undersides of horizontal limbs and on the trunks of apple trees as much as eight feet from the ground. It is also found in rather dry woods, under stones and leaves, but not commonly.

In the Ithaca region of New York, Ingram (1944, Naut. 57, p. 135-137) noted that this is one of the snails hoarded by shrews *(Blarina).* The same author (1941, Naut. 55, p. 14-15) recorded it for the floodplain of a creek, under stones; and (1944, Naut. 58, p. 25-27) from beech–yellow-birch and sycamore woodlands in the same region, where he studied its winter habits. Oughton (1948, p. 94 ff.) found it in deciduous woodlands in Ontario, in both damp and drier more open woods. He also found it in forest litter, dried but still alive after more than a week. Muchmore (1959, Naut. 72, p. 85-88) collected it under stones in various woodland areas in New York State. Archer (1934c, p. 140) found it below the bluffs near the East End Cottages on Mackinac Island, Michigan; these were very large, elongated, and of a pinkish hue. Lindeborg (1949, Naut. 62, p. 130) found it under decomposing logs in Ontario.

Ingram (1946, Naut. 59, p. 92) reported as follows from the Huyck Preserve, New York State: "This snail was typically a flood plain inhabitant where it was taken from beneath stick debris piles; specimens were also taken from beneath logs bordering the lake. Sixteen individuals were collected beneath humus and logs deep in the beech-hemlock forest strips. In bogs individuals were found at the bases of bog ferns on hummocks. On the preserve this species apparently adapts itself well to civilization for it was not uncommon to make collections in hedge-rows bordering roads. The short-tailed shrew fed on this species."

Associations.—Living: MICHIGAN-1, 7, 8, 17, 20, 25, 28, 29, 32, 33; MINNESOTA-3, 7; OHIO-5(?), 43;

ONTARIO-7, 8, 10; WISCONSIN-138, 139, 140. Fossil: K-18, 23; I-6; S-1; W-2, 24, 27, 28, 35, 48, 49, 50, 51, 62, 63.

General distribution (fig. 565).—Newfoundland and James Bay to North Dakota and Nebraska, south to Alabama and North Carolina.

Distribution in Ohio (inset, fig. 565).—Probably all over the State. Oddly enough, Sterki (1907a, p. 380) considered it rare and gave only Cincinnati and Medina and Tuscarawas Counties. I have seen specimens from four counties in northwestern Ohio and Eggleston (ms. records) has it for many of the southern counties along the Ohio River and as far north as Stark and Portage Counties.

Geologic range.—F. C. Baker (1920a, p. 388) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash" for this species. Yarmouth to Recent (A. B. Leonard, 1950, p. 24); "Old Forest bed of the Ohio River"

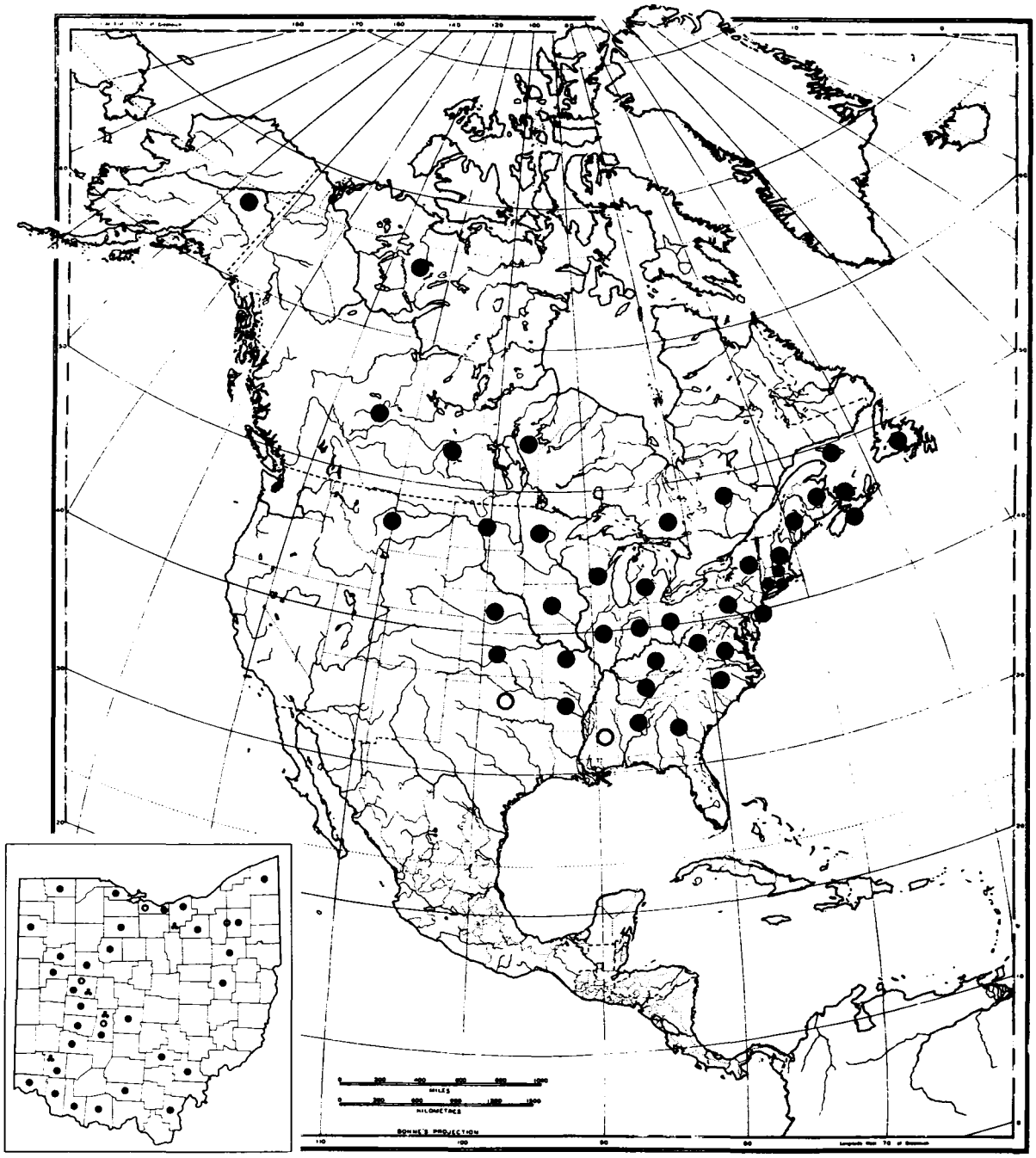

FIGURE 565.—Distribution of *Succinea ovalis* in North America; *inset,* distribution in Ohio.

(Billups, 1902b, p. 51); Tinkers Creek marl (Sterki, 1920, p. 174); Castalia marl, "frequent, with a short spire, form *totteniana* or near" (Sterki, 1920, p. 181); Orleton site (La Rocque, 1952, p. 12 ff.). Recently, the species has been recorded for the following Ohio Pleistocene deposits: Newell Lake (Zimmerman, 1960, p. 20) and Jewell Hill (Mowery, 1961, p. 12).

Remarks.—Three subspecies, *S. ovalis optima* Pilsbry, *chittenangoensis* Pilsbry, and *pleistocenica* F. C. Baker, are recognized by Pilsbry (1948, p. 805 ff.). Only the first of these has been recorded, by implication, for Ohio.

Succinea ovalis optima Pilsbry 1908
Fig. 566

Succinea ovalis optima Pilsbry 1908, Acad. Nat. Sci. Philadelphia Proc., p. 48, fig. 4.
--- --- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 805, figs. 430f, 434.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 329.

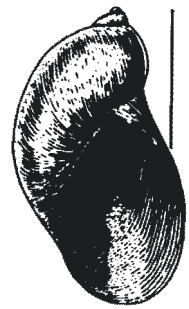

FIGURE 566.—*Succinea ovalis optima,* magnified; after F. C. Baker (1939a, p. 122, fig. B).

Type locality.—Cruger's Valley, near Upper Red Hook, Dutchess County, New York.

Diagnosis.—Shell much more robust than *S. ovalis,* with coarser wrinkle sculpture, and yellow predominating over green; the contour about that of the larger examples of *S. ovalis* but varying to nearly or quite as broad as typical *ovalis;* suture deep and, at the last whorl, oblique (modified from Pilsbry, 1948, p. 805).

Ecology.—In a report on a sinistral specimen, Ingram (1941, Naut. 55, p. 67) mentioned this species as collected from beside a small stream at Ithaca, New York.

General distribution (fig. 567).—Ontario (Niagara Glen), New York to Minnesota, south to Kentucky.

Distribution in Ohio.—None recorded, except as implied by the above general distribution.

Geologic range.—None recorded.

Remarks.—Pilsbry (1948, p. 807) himself said that this is a rather dubious subspecies, more likely only a large form, reflecting optimum conditions. It is retained here for completeness of the record.

Suborder ORTHURETHRA
Family STROBILOPSIDAE

Strobilopsidae Hanna 1922, Nautilus, v. 35, p. 91.
Strobilopsidae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 849.

Diagnosis.—Orthurethra with globose or subdiscoidal shells with internal lamellae and folds which appear very early and develop continuously into those of the adult shell.

Subdivisions.—The family contains a single genus, *Strobilops,* of eastern North America, South America, and eastern Asia, and the Tertiary of central and western Europe.

Remarks.—Since a single genus is involved, details of geographic and geologic distribution are given under the genus *Strobilops.* Reasons for recognizing a separate family for this single genus are given by Pilsbry (1948, p. 848 ff.).

Genus *Strobilops* Pilsbry 1893

Strobila Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 24, 26; not of Sars 1829, nor of Sodovsky 1837.
Strobilus Sandberger 1872; not of Anton, 1839.
Strobilops Pilsbry 1893, Acad. Nat. Sci. Philadelphia Proc. 1892, p. 403.
Strobilops Pilsbry 1927, Man. Conchology, v. 28, p. 12 ff.
Strobilops Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 849.
Strobilops La Rocque 1953, Cat. Recent Moll. Canada, p. 330.

Type.—Helix labyrinthica Say.

Diagnosis.—Shell small, perforate or umbilicate, trochiform to subdiscoidal, with rounded, angular, or carinate periphery, of 4½ to 6 closely coiled whorls; cavity of the last whorl obstructed by two or three long parietal lamellae, the upper one emerging to the edge of the parietal callus, the lower one weaker, emerging or immersed, the intermediate one, when present, smallest and remote from the aperture; a series of two or more short folds on the basal wall of the cavity deep within the last whorl; these lamellae and folds appearing very early in life, growing at the forward end and being absorbed behind; peristome expanded, usually thickened, the insertions of the lip remote (modified from Pilsbry, 1948, p. 849).

General distribution.—Humid eastern half of North America from Quebec, Ontario, and Manitoba, lat 52° N., to Guatemala; Cuba and Jamaica; South America from Venezuela to Para in eastern Brazil, the Galapagos Islands; Japan, Korea, China, and the Philippines.

Geologic range.—Eocene to Pliocene of central

and western Europe; Pliocene and Pleistocene (Aftonian to present) of North America.

Strobilops labyrinthica (Say) 1817
Fig. 568

Helix labyrinthica Say 1817, Acad. Nat. Sci. Philadelphia Jour., v. 1, p. 124.
Strobila labyrinthica Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 26, figs. 64-67, pl. 8, fig. 68.
Strobila labyrinthica virgo Pilsbry 1892, Nautilus, v. 6, p. 94.
Strobila labyrinthica Call 1900, Moll. Ind., p. 382, pl. 5, figs. 5, 5a.
Strobilops labyrinthica Dall 1905, Harriman-Alaska Exped., v. 13, p. 27, figs. 7-9.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4,

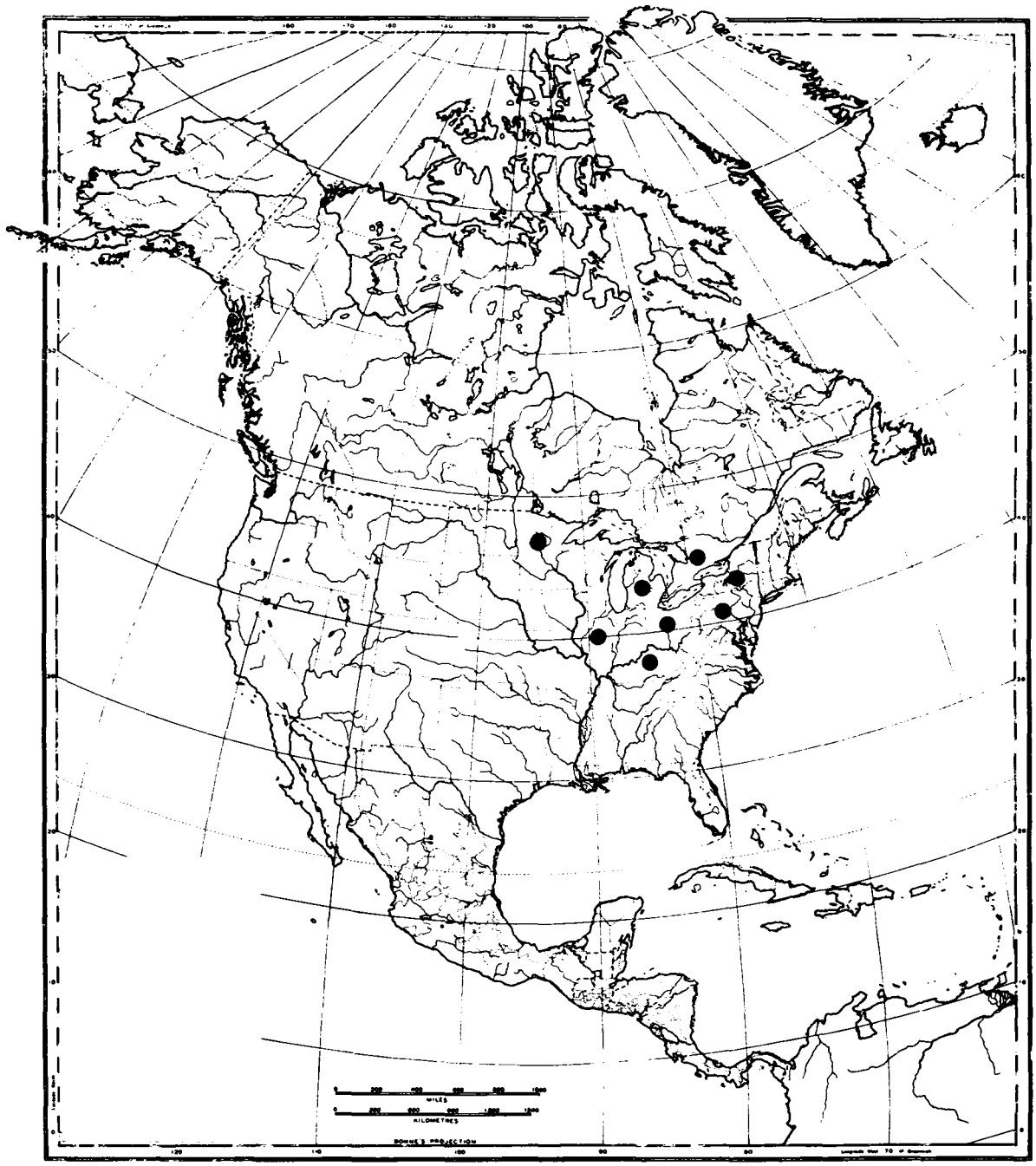

FIGURE 567.–Distribution of *Succinea ovalis optima* in North America.

p. 378.
Strobilops labyrinthica virgo Sterki 1907, *ibid.*
Strobilops labyrinthica F. C. Baker 1920, Life of Pleistocene, p. 388.
Strobilops virgo F. C. Baker 1920, *ibid.*
Strobilops labyrinthicus Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
Strobilops labyrinthica Pilsbry 1927, Man. Conchology, v. 28, p. 20, pl. 1, figs. 1-11.
--- --- Goodrich 1932, Moll. Mich., p. 20.
Strobilops labyrinthica virgo Goodrich 1932, *ibid.*
Strobilops labyrinthica Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 279.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 66.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 854, fig. 463.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 43, pl. 3, figs. 20-22.
--- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 330.
--- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
Strobilops (s.s.) labyrinthica Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 121.
Strobilops (s.s.) labyrinthica Taylor 1960, U.S. Geol. Prof. Paper 337, p. 65.
Strobilops labyrinthica Taft 1961, Ohio Biol. Survey Bull., n.s., no. 3, p. 54.
Strobilops labyrinthica virgo Taft 1961, *ibid.*

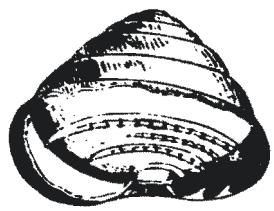

FIGURE 568.—*Strobilops labyrinthica,* magnified; after Call (1900, pl. 5, fig. 5).

Type locality.—Philadelphia, Pennsylvania.

Diagnosis.—Shell narrowly umbilicate, dome-shaped, the periphery obtusely subangular; whorls 5½, convex, very slowly widening, the first 1½ smooth, pale, the rest chestnut brown, sculptured with narrow obliquely radial ribs, narrower than their intervals, passing over the periphery but weakening at the base, the first half of which is typically nearly smooth; aperture semilunar; peristome brown, expanded, thick; the parietal lamella emerging to the edge of the parietal callus and penetrating inward a little more than half a whorl; the infraparietal lamella much smaller, only shortly emerging, the end visible in a basal view; inside penetrating as far as the parietal lamella; a low and slender interparietal lamella between these lamellae deep within; all three strongly nodose at the edge, the nodes armed with minute prickles directed toward the aperture; within the basal and outer walls, at the last third of the base, a low, rather blunt columellar lamella and a forwardly curving series of five (or six) unequal basopalatal folds; first and second folds large and high, the second longer; two or three following folds low and thin, the one immediately above the periphery usually longer, and in some specimens another fold above it (modified from Pilsbry, 1948, p. 854).

Ecology.—Found under loose bark of logs, in half-decayed wood, among dead leaves and in sod at bases of trees (Pilsbry, 1948, p. 854).

Burch (1955, Naut. 69, p. 66) has noted the relationships of this species to soil factors in eastern Virginia. Oughton (1948, p. 94 ff.) found it in Ontario, in damp woodlands, especially those of deciduous trees. Lindeborg (1949, Naut. 62, p. 130) found it under logs and on tree moss after a rain, in Ontario also. Teskey (1955, Naut. 69, p. 70-71) recorded it from leaf mold on loose shale and in detritus in crannies of stone walls and rotting timbers of an old mill in the Warm Springs area of Georgia.

The following notes refer to the form or variety *virgo.* H. B. Baker (1922b) found it abundant in hardwoods and the drier habitats in Dickinson County, Michigan. He listed it for 13 specific localities, some of which are detailed here because of their special interest: (36) outcrop of Quinnesec schist, in dead leaves and humus, collected in hollows of the rocks, thickly overgrown with bearberries and scattered hardwoods and conifers; (37) outcrop of Sturgeon quartzite: cliffs along Fern Creek, scattered hardwoods and plants; (38) sandy outwash plains, in pine and second growth; (39) young hardwoods, in small hollow between two granitic ridges; partially burned, some low-growing plants; (40) virgin hardwoods of the Menominee Trough; (42) cedar-tamarack bog; shells under bark of freshly cut cedar stumps; (47) floodplain of Hancock Creek, about 2 feet above July level of water. Archer (1934c, p. 139) found it common both in the limestone talus and in the hardwoods under leaves on Mackinac Island, Michigan.

Associations.—Living: MICHIGAN-1, 4, 9; MINNESOTA-1, 2, 3, 4, 5, 6, 7, 8; OHIO-43; ONTARIO-10. Fossil: P-1; K-6; I-5; W-28, 56, 57, 58, 59, 60. "*S. labyrinthica virgo,*" living: MICHIGAN-40; OHIO-43.

General distribution (fig. 569).—Manitoba, east to New Brunswick and Maine; south to Georgia and Alabama.

Distribution in Ohio (inset, fig. 569).—Over the State: records are not as numerous as might be expected, but this may be due to lack of collecting in many areas. The species has been found in counties where intensive collecting has been done, for example, in northwestern and west-central Ohio, Williams, Fulton,

Mercer, and Auglaize Counties.

Geologic range.—Kansan (Indiana) to late Wisconsin. F. C. Baker (1920a, p. 388) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash" for the type form and Aftonian, Yarmouth, and Peorian for the form *virgo*. Hibbard and Taylor (1960, p. 121) gave the range of the species as late Pliocene to Recent. Recent collections in Ohio are for the following deposits: Jewell Hill (Mowery, 1961, p. 12) and Castalia (Clark, 1961, p. 26) Castalia marl (Sterki, 1920, p. 179); Farmdale? loess, Cleveland, Ohio (Leonard, 1953, p. 372 ff.); pro-Kansan loess, Putnam County, Indiana (Wayne, 1954, p. 1320); Oklahoma, probably Illinoian (Taylor and Hibbard, 1955, p. 8).

Strobilops affinis Pilsbry 1893
Fig. 570

Strobilops affinis Pilsbry 1892, Acad. Nat. Sci. Philadelphia Proc., p. 404 (no description).

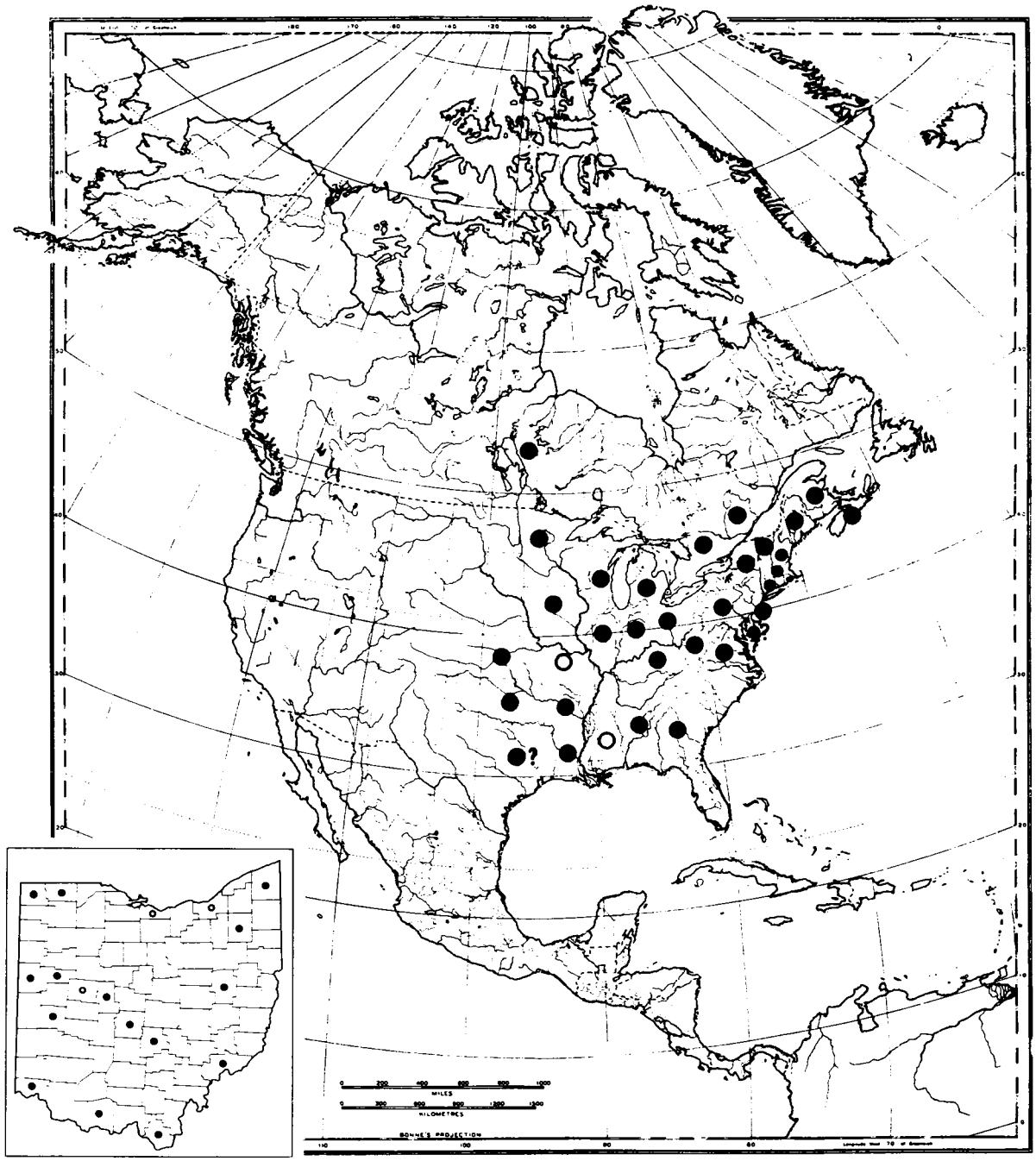

FIGURE 569.—Distribution of *Strobilops labyrinthica* in North America; *inset*, distribution in Ohio.

Strobilops affinis Pilsbry 1893, Nautilus, v. 7, p. 57.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
--- --- Pilsbry 1927, Man. Conchology, v. 28, p. 27.
--- --- Goodrich 1932, Moll. Mich., p. 20.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 279.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 66.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 860, fig. 465, 1-5.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 330.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 53.

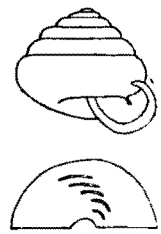

FIGURE 570.–*Strobilops affinis*, magnified; after Walker (1928, p. 159, fig. 244).

Type locality.–Upper Red Hook, Dutchess County, New York (Pilsbry, 1948, p. 860).

Diagnosis.–Shell convexly conic with obtusely angular periphery; base moderately convex, rather strongly so in its last third; glossy, brown, with pale apex; narrowly umbilicate; shell with 6 moderately convex whorls, the first two smooth, the rest sculptured with narrow, somewhat retractive ribs; ribs obsolete on the first half of the base, weak over the last half; peristome well expanded, thickened within, its face convex and fleshy brown in color; parietal callus moderately strong; parietal lamella emerging to the edge of the callus and penetrating inward about two-thirds of a whorl; infraparietal lamella low and weak, deeply immersed, not visible in a front or basal view; interparietal lamella short and very weak; an obliquely radial series of about 8 folds a third of a whorl within: a short low lamella on the columellar axis, followed by two folds larger and higher than the rest, and an oblique series running to the suture, composed of 4 to 7 short subequal folds (modified from Pilsbry, 1948, p. 860).

Ecology.–Oughton (1948, p. 94 ff.) recorded this species from wetter locations than those of damp woodlands; it may be collected from stream drift, indicating that it probably lives on floodplains of creeks and rivers, ponds and marshes.

Associations.–Living: MICHIGAN - 20, 21; WISCONSIN - 140, 141, 142, 143. Fossil: W - 28.

General distribution (fig. 571).–Ontario and Massachusetts to Minnesota and Kansas, south to northern New Jersey and west of the Alleghenies to northern Alabama and Oklahoma.

Distribution in Ohio (inset, fig. 571).–"Summit Co.; probably over the state" (Sterki, 1907a, p. 378); Portage County (Pilsbry, 1948, p. 862); Erie and Meigs Counties (Eggleston, ms. records). Castalia marl, Erie County (Sterki, 1920, p. 179).

Geologic range.–F. C. Baker (1920a) gave Sangamon and "Wabash" for this species. Pleistocene, Syracuse, New York (Pilsbry, 1948, p. 860); Castalia marl (Sterki, 1920, p. 179).

Strobilops aenea Pilsbry 1926
Fig. 572

Strobilops labyrinthica strebeli Pfr., Pilsbry, 1893, Nautilus, v. 7, p. 57, and elsewhere; not *Helix strebeli* Pfeiffer.
Strobilops labyrinthica of authors, not of Say.
Strobilops aenea Pilsbry 1926, Nautilus, v. 40, p. 69.
--- --- Pilsbry 1927, Man. Conchology, v. 28, p. 29.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 279.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 65.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 862, fig. 465, 6-12.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 330.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 52.

Type locality.–Cazenovia, New York.

Diagnosis.–Shell narrowly umbilicate, low conic, with obtuse, rounded summit, the periphery distinctly but bluntly angular; base somewhat flattened below the periphery, elsewhere moderately convex; whorls 5½, convex, slowly increasing, the first 1½ smooth, corneous, the rest dark brown with a red-golden gleam; sculptured with narrow riblets which are somewhat oblique, retractive, rather fine and close; base rather smooth, marked with growth striae only, except on its last third, where the riblets of the upper surface continue over the base; aperture semilunar, low but wide; outer and basal lips brown, well expanded, somewhat thickened, the columellar margin dilated; parietal lamella emerging to the edge of the parietal callus, penetrating inward a half whorl; infraparietal lamella weakly emerging; midway between the lamellae there is a very weak, low, deeply placed interparietal lamella; these lamellae nodose far within, the nodes roughened, shortly prickly; the internal barrier, one-third of a whorl from the aperture, radial but slightly oblique, consisting of a short, weak columellar fold and four basal folds, visible through the shell; the second and fourth folds from the axis long, the first short, the third weak or sometimes wanting; there is no fold above the periphery.

Ecology.—Often found associated with *S. labyrinthica*. The relationships of this species to soil factors in eastern Virginia have been noted by Burch (1955, Naut. 69, p. 66). Oughton (1948, p. 94 ff.) recorded it for damp woodlands, especially those of deciduous trees in Ontario. Burch (1954, Naut. 68, p. 32) found it mainly under the bark of oak logs, fairly common in Henrico County, Virginia.

Associations.—Living: OHIO - 29.

General distribution (fig. 573).—Southern Ontario, New York, and Massachusetts to Michigan, Illinois and Missouri, south to southern Florida, Alabama, and Louisiana.

Distribution in Ohio (inset, fig. 573).—Portage County (Pilsbry, 1948, p. 863); Fulton, Allen, Hancock, and Auglaize Counties (University of Michigan records).

Geologic range.—Clark (1961, p. 26) identified this species from the Castalia deposit, Ohio.

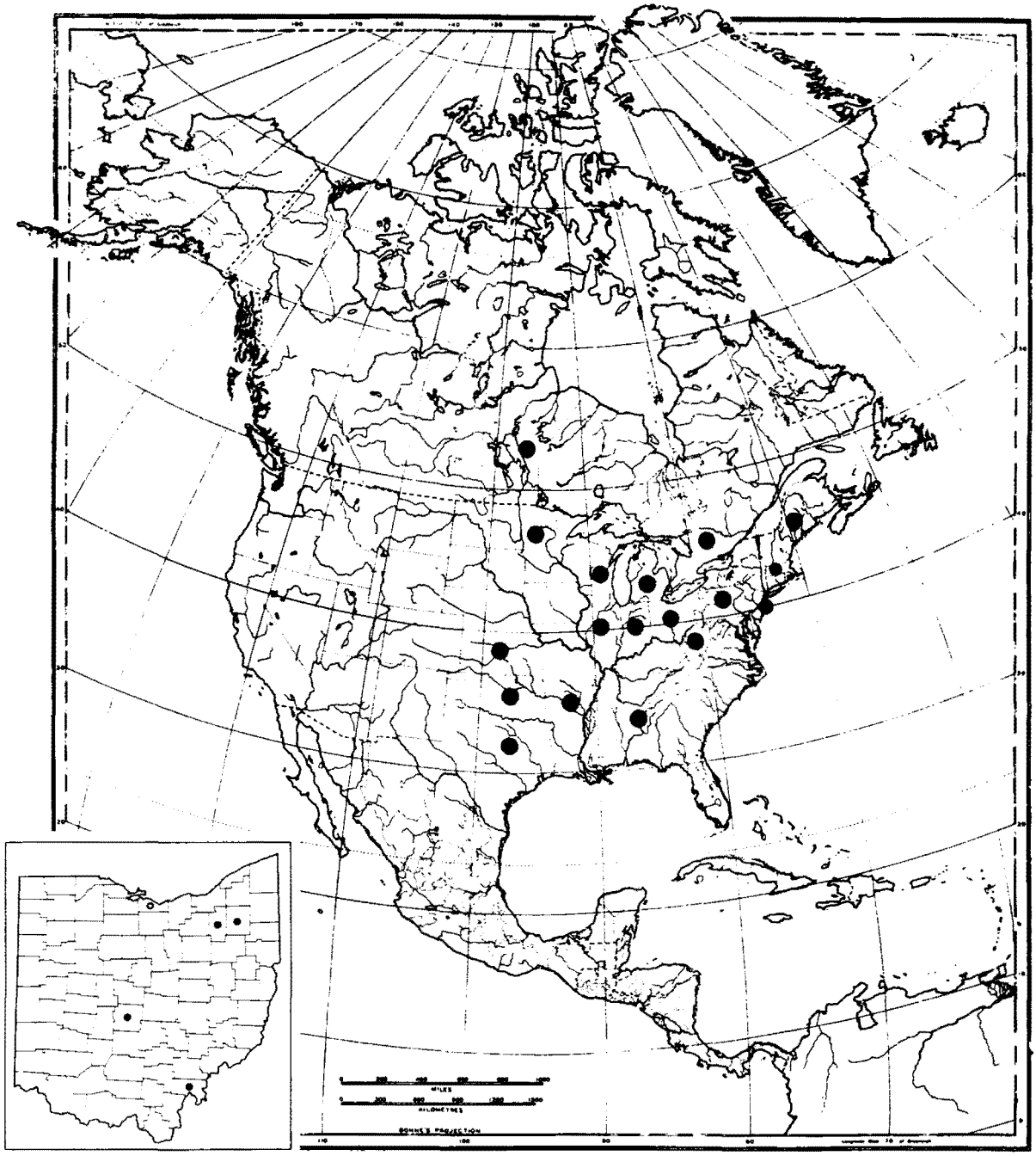

FIGURE 571.—Distribution of *Strobilops affinis* in North America; *inset,* distribution in Ohio.

FIGURE 572.—*Strobilops aenea*, magnified; after Walker (1928, p. 157, fig. 243).

Remarks.—Pilsbry (1948, p. 863 ff.) recognized the form *micromphala* Pilsbry and the subspecies *spiralis* Pilsbry, both unrecorded for Ohio but to be looked for in collections from this State.

Family PUPILLIDAE Turton 1831

Pupilladae Turton 1831, Man. land and fresh-water shells Brit. Isles, p. 8, 97.

Vertiginidae Stimpson 1851, Shells New England, p. 53.

Pupillidae Pilsbry 1916-1935, Man. Conchology, v. 24-28.

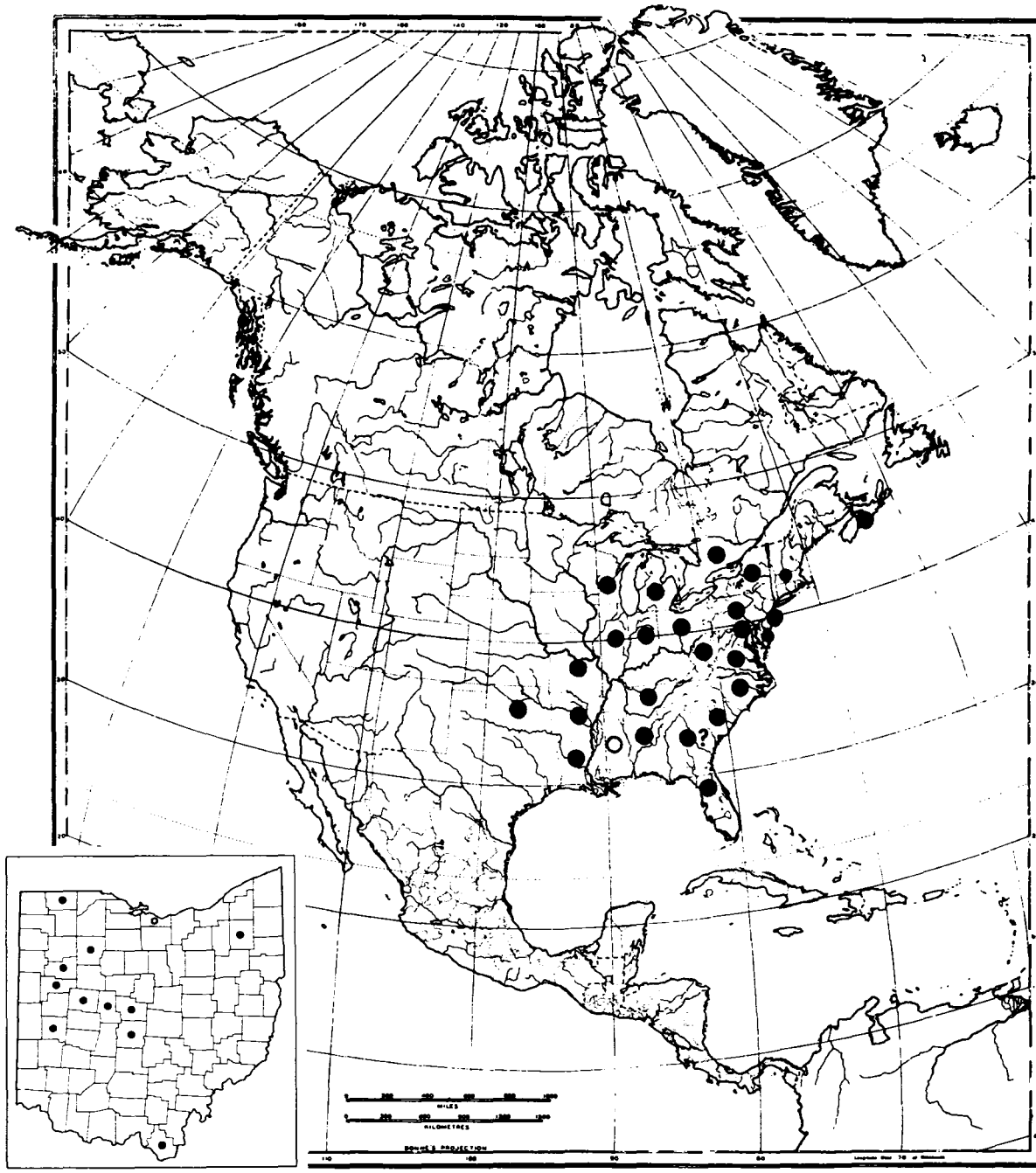

FIGURE 573.—Distribution of *Strobilops aenea* in North America; *inset*, distribution in Ohio.

Pupidae, in part, of many early authors.
Pupillidae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 868.

Diagnosis.—Shell elongate, ovate to cylindric or rarely depressed, rimate or umbilicate, typically with five laminae or teeth, any or all of which may be lacking, in the truncate-oval or rounded aperture.

General distribution.—All continents and most islands; the family includes over 40 genera and nearly 700 recent species.

Geologic range.—The oldest Pupillidae (genera *Strophites, Dendropupa, Anthracopupa,* and *Maturipupa*) are from the Pennsylvanian of various localities in North America. Their assignment to the family is based on shell characters but these are so closely similar to those of living Pupillidae that the assignment appears to be correct. Henderson (1935, p. 148 ff.) has given references to the Pennsylvanian and Tertiary genera and species. It is rather surprising to find no record of Mesozoic pupillids for North America in this catalog. The Pleistocene species are closely related to living ones.

Subdivisions.—The family is divided into numerous subfamilies; the genera considered in this report belong to the Gastrocoptinae, Pupillinae, and Vertigininae.

Subfamily GASTROCOPTINAE Pilsbry 1918

Gastrocoptinae Pilsbry 1918, Man. Conchology, v. 24, p. x; 1935, *ibid.*, v. 28, p. ix.

Diagnosis.—Shell rimate or perforate, cylindric or ovate-conic, with angular or parietal lamellae more or less completely united into one biramose, bifid, lobed, or sinuous lamella (or rarely the angular lamella is wanting); columellar lamella present; palatal folds present (except in *G. corticaria*); lip well expanded (Pilsbry, 1948, p. 871).

General distribution.—Nearly worldwide in tropical and temperate regions, but wanting on many oceanic islands and in the recent European fauna, though represented there as Oligocene to Pliocene fossils. Absent on the west coast of North America.

Geologic range.—Oligocene to Pliocene of Europe; late Pliocene and Pleistocene of North America, possibly also earlier.

Subdivisions.—Two North American genera are listed by Pilsbry (1948, p. 870 ff.); only one, *Gastrocopta,* occurs in the region under consideration. The other, *Chaenaxis,* is confined to Arizona and the State of Sonora, Mexico.

Genus *Gastrocopta* Wollaston 1878

Gastrocopta Wollaston 1878, Testacea Atlantica, p. 515.
Leucochilus Boettger 1881, Conchologische Mitt. 1, p. 64 (not *Leucochila* von Martens, 1860).
Bifidaria Sterki, *in* Pilsbry 1891, Acad. Nat. Sci. Philadelphia Proc., p. 315.
Eubifidaria Sterki 1893, Nautilus, v. 6, p. 101.

Type.—*Gastrocopta acarus* (Benson).

Diagnosis.—Shell rimate or perforate, cylindric or ovate-conic, with the angular parietal lamellae more or less completely united into one biramose, bifid, lobed or sinuous lamella (or rarely the angular lamella is wanting); columellar lamella present; palatal folds present (except in *G. corticaria*); lip well expanded (Pilsbry, 1948, p. 871).

General distribution.—Nearly worldwide in tropical and temperate regions, but wanting on many oceanic islands and in the recent European fauna, though represented there as Oligocene to Pliocene fossils. Absent on the west coast of North America but widespread elsewhere on this continent.

Geologic range.—Oligocene to Pliocene of Europe; Paleocene(?) of Utah (La Rocque, 1960b); widespread in the Pleistocene.

Gastrocopta armifera (Say) 1821
Pl. 17, fig. 13

Pupa armifera Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 162.
Leucochila armifera Call 1900, Moll. Ind., p. 397, pl. 6, fig. 11a-c.
Bifidaria armifera Billups 1902, Nautilus, v. 16, p. 51.
——— ——— Dall 1905, Harriman-Alaska Exped., v. 13, p. 27, fig. 10.
——— ——— Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
——— ——— F. C. Baker 1920, Life of Pleistocene, p. 388.
Gastrocopta (=Bifidaria) armifera Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
Gastrocopta armifera Ahlstrom 1930, Nautilus, v. 44, p. 44.
——— ——— Goodrich 1932, Moll. Mich., p. 21.
——— ——— Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 275.
——— ——— Oughton 1948, Zoögeogr. study, Ontario, p. 50.
——— ——— Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 874, fig. 472, 1-4.
——— ——— Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 35, pl. 3, fig. 7; pl. 4, fig. 6.
——— ——— Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 29, pl. 6, fig. P.
——— ——— Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 19, pl. 5, fig. L.
——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 330.
——— ——— Wayne 1954, Geol. Soc. America Bull., v.

65, p. 1320.
Gastrocopta armifera Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 8, 11.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 124.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 72.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 36.

Type locality.—Germantown, Philadelphia, Pennsylvania (Pilsbry, 1948).

Diagnosis.—Shell perforate and rimate, oblong, the summit obtusely conic; thin, paraffin white, glossy, weakly marked with very oblique, irregular growth striae; whorls about 6½, moderately convex, the last compressed around the axis; aperture irregularly rounded; peristome thin, well expanded, the margins approaching, in many cases (and typically) connected by a short callus with raised edge across the parietal wall; angular lamella joined to the outer lip near its insertion, united with the parietal lamella, its summit projecting as a short spur on the right side; columellar lamella, as seen in a shell broken to show the interior, subvertical, advancing slightly downward, then retracted toward the base; giving off a short, horizontal branch in front, and visible in the aperture; basal lamella low and inconspicuous in many specimens; palatal folds stand upon a white callus; lower palatal fold short, entering, the upper one shorter; a small suprapalatal tubercle standing above it (modified from Pilsbry, 1948, p. 875).

Ecology.—Prefers limestone districts. Taylor recorded it for protected situations among vegetation: grass, shrubs, or wooded area, but noted that it does not require woods. Oughton (1948, p. 94 ff.) noted it somewhat doubtfully from floodplains of creeks and rivers. In Ontario, he noted that it is confined to Paleozoic terranes (mainly limestones). In central Ohio it is very abundant in disused quarries and in the crevices formed by bedding planes of limestones along roadsides, river banks, and hillside gullies, in some cases in exposed situations without protective cover. It is the commonest pupillid in stream-drift collections in Ohio.

Burch (1955, Naut. 69, p. 66) has shown the relationships of this species to soil factors in eastern Virginia. Grimm (1959, Naut. 72, p. 125) has collected it in Maryland under debris near railroad tracks, in leaf litter along railroad tracks, in the ruins of buildings, in marble quarries, and around the foundations of an old burned house. In Tennessee, Lutz (1950, Naut. 63, p. 105) found it in the foothills of the Cumberland Mountains, in hardwood forests.

Associations.—Living: MICHIGAN-32, 33, 35; OHIO-1, 2, 7, 43; ONTARIO-11; WISCONSIN-143, 144. Fossil: N-2; K-3, 6, 7, 10, 17, 21, 26, 27; I-3(?), 4, 5; S-1, 2, 3, 4, 5, 6; W-1, 9, 24, 28, 62, 63, 64, 65, 70, 73.

General distribution (fig. 574).—Alberta, Manitoba, Ontario, Quebec, and southward to New Mexico, Texas, and Florida.

Distribution in Ohio (inset, fig. 574).—Entire State; records are more plentiful for the western and southern counties.

Geologic range.—F. C. Baker (1920a, p. 388) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash" (late Wisconsin). Pro-Kansan loess, Indiana (Wayne, 1954, p. 1320); Yarmouth to Recent (A. B. Leonard, 1950, p. 29); "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); Castalia marl (Sterki, 1920, p. 179). Hibbard and Taylor (1960, p. 124) recorded it from the early Pliocene Laverne local fauna of Oklahoma.

Variation.—Two poorly differentiated forms of this species have been recorded for Ohio. *Gastrocopta armifera similis* Sterki 1909 (see Pilsbry, 1948, p. 877) is said to be found from "northern New York to Iowa, Minnesota," a range that would include at least northern Ohio. *G. armifera affinis* Sterki 1909 (see Pilsbry, 1948, p. 877) was described from Fairport, Lake County, Ohio, and recorded also for Michigan, Indiana to Minnesota and Kansas, and Wisconsin. These two forms are noted here in case future workers should consider them distinct enough to be recognized.

Gastrocopta contracta (Say) 1822
Fig. 575

Pupa contracta Say 1822, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 374.
Leucochila contracta Call 1900, Moll. Ind., p. 398, pl. 6, fig. 10; text fig. 12.
Bifidaria contracta Billups 1902, Nautilus, v. 16, p. 51.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 27, fig. 11.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379, 402.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
Gastrocopta contracta Sterki 1920, Ohio Jour. Sci., v. 20, p. 180.
--- --- F. C. Baker 1920, Jour. Geology, v. 28, p. 455.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 45.
--- --- Goodrich 1932, Moll. Mich., p. 22.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 275.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 50.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 880, fig. 474, 9-12.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 35, pl. 4, fig. 1.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 30, pl. 6, fig. I.

Gastrocopta contracta La Rocque 1953, Cat. Recent Moll. Canada, p. 331.
--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 8, 11.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 126.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 37.

Type locality.—Occoquan, Virginia.

Diagnosis.—Shell rimate, ovate-conic, tapering from the last whorl to the obtuse apex, bluish-milky or spermaceti-colored, imperfectly transparent, glossy, marked with fine growth striae; whorls 5 1/3, very convex, the last half of the last whorl straightened, pinched at the base, impressed over the lower palatal fold, and on both sides of a low rounded ridge which stands a short

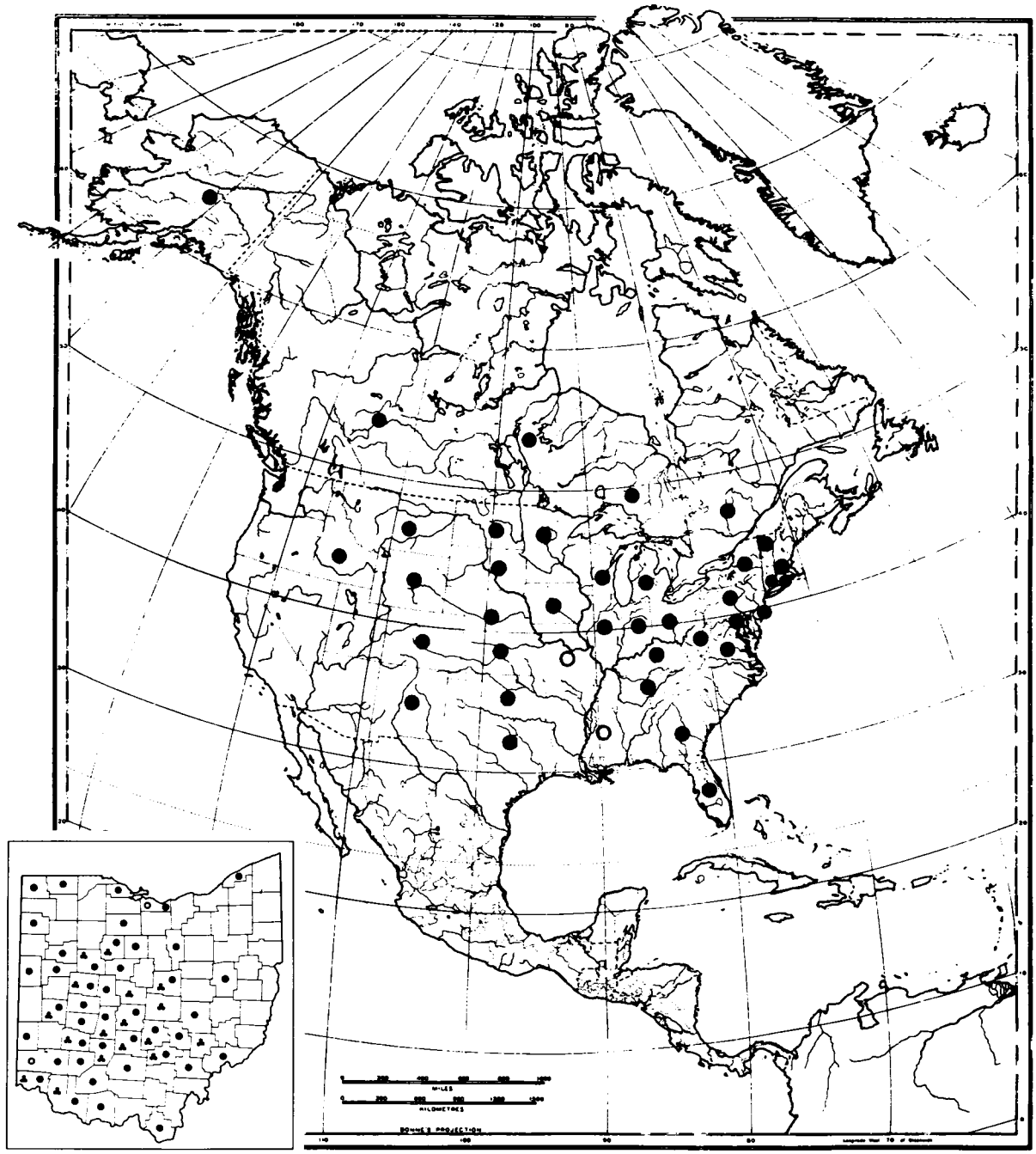

FIGURE 574.—Distribution of *Gastrocopta armifera* in North America; *inset,* distribution in Ohio.

distance behind the peristome; aperture rounded-triangular, almost closed by large teeth; anguloparietal lamella joining the lip, angularly bent to the right near the middle, then abruptly becoming much lower and bent inward; columellar lamella large, thin, very deeply placed, subvertical, the upper end curving forward; a subvertical callus standing in front of it, near the margin; palatal folds two, connected by a low callus, the lower one obtuse, transverse, more deeply placed and larger than the tuberculiform upper fold; peristome thin, well expanded, continuous (modified from Pilsbry, 1948, p. 881).

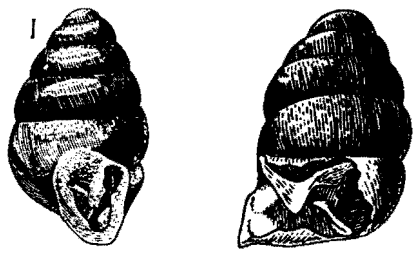

FIGURE 575.—*Gastrocopta contracta,* magnified; after F. C. Baker (1939a, p. 97).

Ecology.—Taylor summarized the habitat of this species as protected situations among vegetation: grass, shrubs, or wooded areas, but noted that it does not require woods. Oughton (1948, p. 94 ff.) recorded it in Ontario for wet places, margins of ponds, streams, and marshes; seeping hillsides, and sandy flats that receive water by percolation. H. B. Baker (1922b) found it one of the more common shells of the hardwoods in Dickinson County, Michigan, specifically from the following hibitats: (36) outcrop of Quinnesec schist, in dead leaves and humus, collected in hollows of the rocks, thickly overgrown with bearberries and scattered hardwoods and conifers; (39) in young hardwoods, in small hollow between two granitic ridges; partially burned, some low-growing plants; (40) virgin hardwoods of the Menominee Trough; (41) hardwood-covered moraine ridges of the Calumet Trough, particularly in maple logs; (48) floodplain of the Menominee River, with brush of tag alders, dogwoods, hazels, and small ashes.

Burch (1955, Naut. 69, p. 66) has shown the relationships of this species to soil factors in eastern Virginia. Muchmore (1959, Naut. 72, p. 85-88) has collected it under stones in various woodland areas in New York State. In Virginia, Burch (1954, Naut. 68, p. 31) found it fairly common, usually around or under the bark of damp hardwood logs and stumps, and in all cases associated with forested stream valleys. Grimm (1959, Naut. 72, p. 125-126) collected it in Maryland from ruins of buildings, leaf litter along railroad tracks, and a quarry.

Associations.—Living: MICHIGAN-5, 21, 22, 23, 25, 26, 32, 33, 40; OHIO-1, 4, 7, 43; ONTARIO-2, 3, 10, 11, 12, 14; WISCONSIN-140, 142, 143. Fossil: K-2, 15, 17, 25; S-1, 2, 3, 4, 5, 6; W-24, 26, 28, 56, 57, 58, 59.

General distribution (fig. 576).—Manitoba, Ontario, Quebec, and Maine, south to Florida, Texas, and Mexico. Cuba and Jamaica, probably introduced.

Distribution in Obio (inset, fig. 576).—Over the State, according to Sterki (1907a, p. 379), but unpublished Eggleston records are oddly concentrated in a triangle from Erie County to Adams and Washington Counties and I have no records for the western and eastern counties.

Geologic range.—Early Pliocene to Recent (Hibbard and Taylor, 1960, p. 126). Aftonian, Yarmouth, Sangamon, Peorian, "Wabash" (F. C. Baker, 1920a, p. 388). Yarmouth to Recent (A. B. Leonard, 1950, p. 30); "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); "Defiance sandy deposit (loess?)" (Sterki, 1907a, p. 402); Castalia marl, common (Sterki, 1920, p. 180); Sangamon(?), Bartholomew County, Indiana (Baker, 1920b, p. 455); probably Illinoian, Oklahoma, and Sangamon, Kansas (Taylor and Hibbard, 1955, p. 8, 11). Castalia, Ohio, deposit (Clark, 1961, p. 27).

Gastrocopta holzingeri (Sterki) 1889
Pl. 17, fig. 14

Pupa holzingeri Sterki 1889, Nautilus, v. 3, p. 37, 96, 119.
Bifidaria holzingeri Dall 1905, Harriman-Alaska Exped., v. 13, p. 28.
——— ——— Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
Gastrocopta holzingeri Pilsbry 1916, Man. Conchology, v. 24, p. 25, pl. 2, figs. 4-6.
Bifidaria holzingeri F. C. Baker 1920, Life of Pleistocene, p. 388.
Gastrocopta holzingeri Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.
——— ——— Oughton 1948, Zoögeogr. study, Ontario, p. 51.
——— ——— Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 883, figs. 474, 4-6; 475.
——— ——— Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 35.
——— ——— Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 31, pl. 6, fig. A.
——— ——— Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 20, pl. 5, fig. B.
——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 331.
——— ——— Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 11.
——— ——— Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 126.
——— ——— Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 72.
——— ——— Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 39.

Type locality.—Will County, Illinois.

Diagnosis.—Shell cylindric, transparent or whitish; whorls 5, convex, the last with an oblique crest some distance behind the outer lip; aperture broadly oval, the peristome thin, expanded, not continuous; inner end of the parietal lamella curving strongly toward the periphery, and its anterior end produced forward of the junction with the angular lamella, the two lamellae diverging forward, the whole, when viewed from the base, shaped somewhat like a mirror image of the letter y; columellar lamella thin, high, and curving down at the inner end; palatals on a callus ridge (modified from Pilsbry, 1948, p. 883).

Ecology.—Oughton (1948, p. 94 ff.) listed this species for damp woodlands, especially those of deciduous trees; in Ontario, it is confined to Paleozoic terranes (mainly limestones). In the Ottawa region, I have

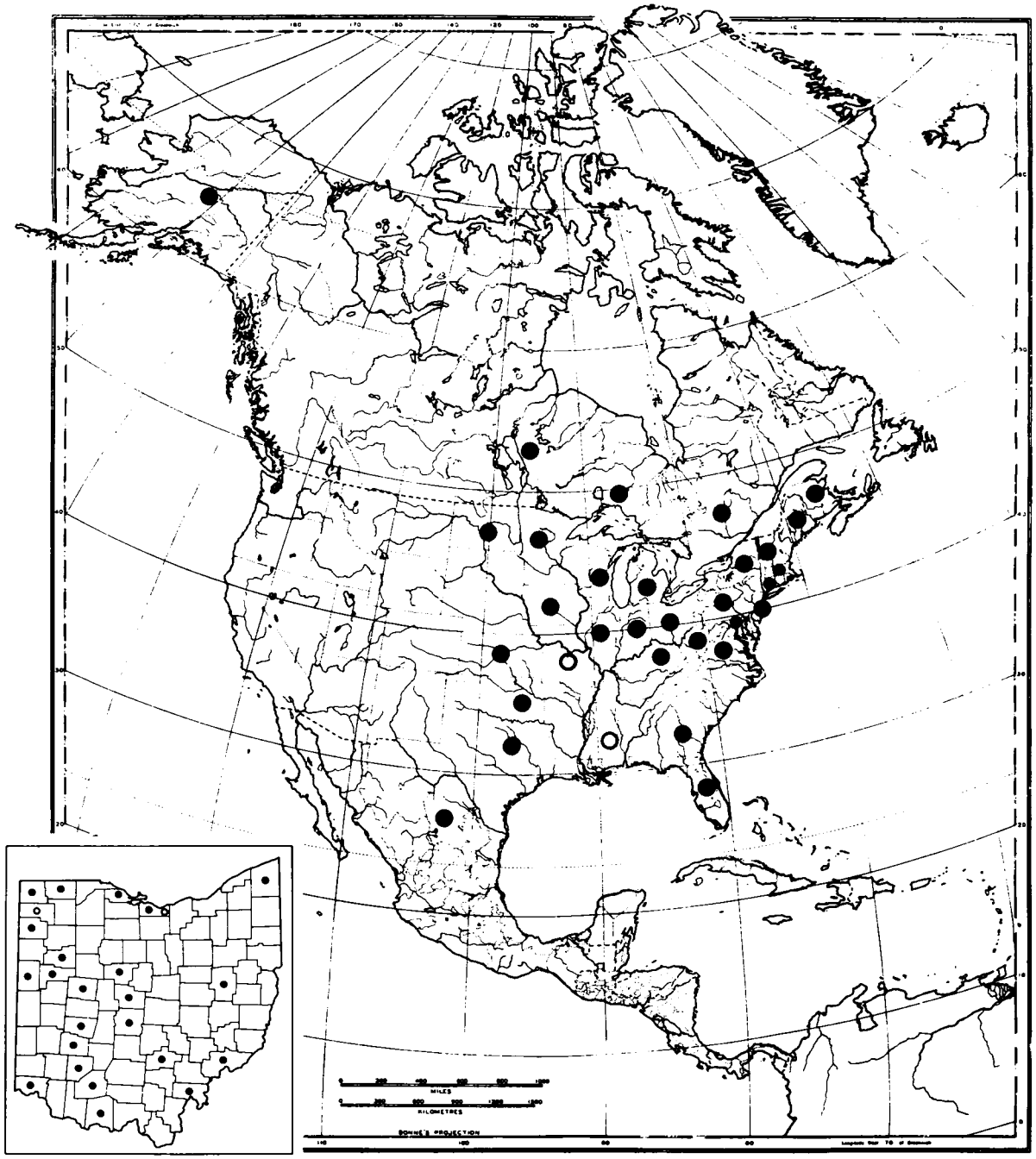

FIGURE 576.—Distribution of *Gastrocopta contracta* in North America; *inset,* distribution in Ohio.

found it particularly abundant in the rich soil accumulated in crevices along bedding planes of Ordovician limestone, in light second-growth woods along the Rideau River.

Associations.—Living: OHIO-1, 4, 7. Fossil: P-1, 3; K-13, 24; S-1, 2, 3, 4, 6; W-6.

General distribution (fig. 577).—Ontario and western New York to Montana, south to Illinois, Kansas, and New Mexico.

Distribution in Ohio (inset, fig. 577).—Apparently rare; Sterki (1907a, p. 379) had it only for Hamilton and Miami Counties and for Put-in-Bay and Kelleys Island in Lake Erie. I have no other records.

Geologic range.—Yarmouth and Sangamon (F. C. Baker, 1920a, p. 388); Aftonian to present (A. B. Leonard, 1950, p. 31); no record as a fossil in Ohio, but to be expected in Wisconsin deposits. Late Pliocene to Recent (Hibbard and Taylor, 1960, p. 126).

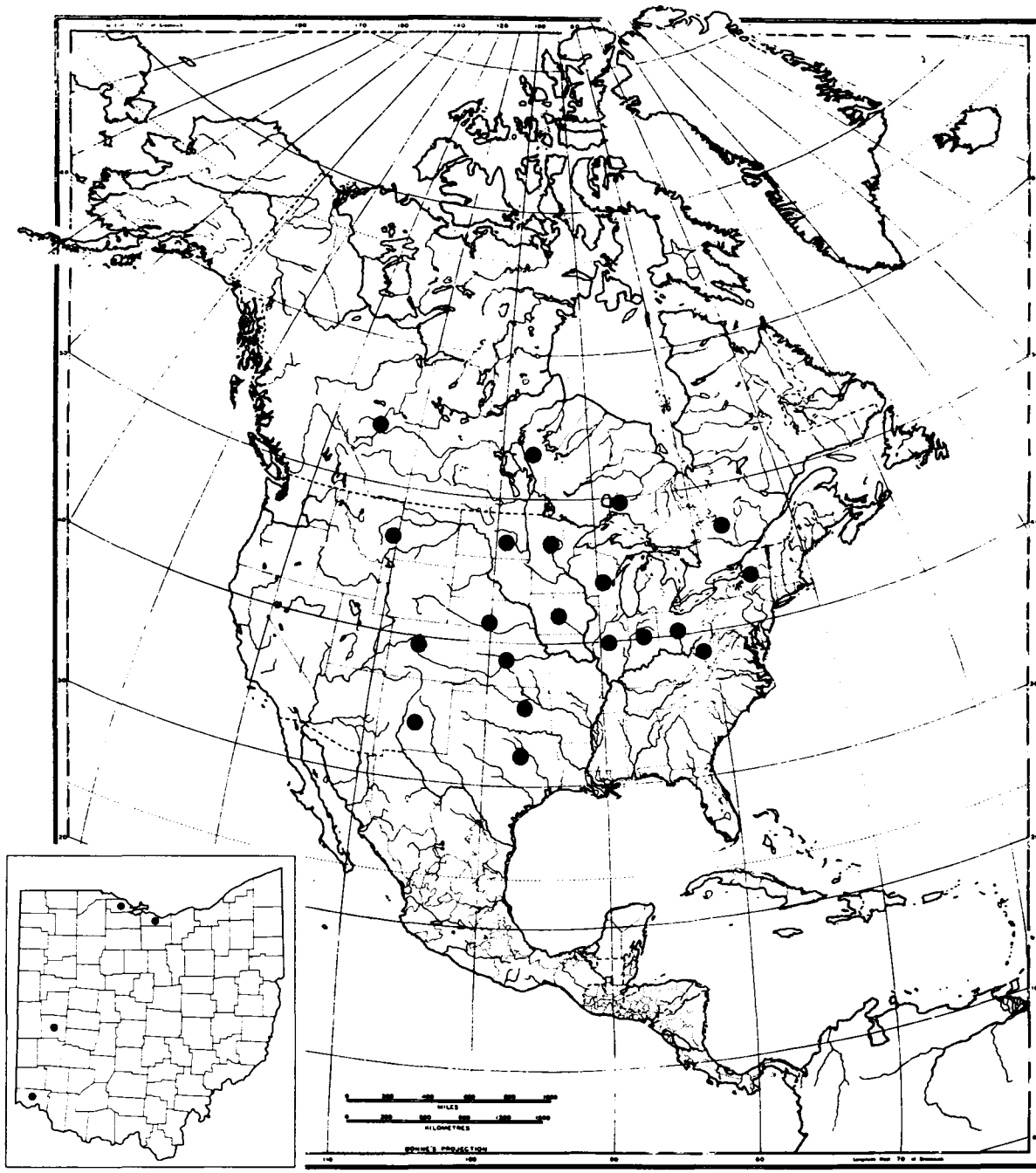

FIGURE 577.—Distribution of *Gastrocopta holzingeri* in North America; *inset,* distribution in Ohio.

Subgenus *Vertigopsis* Sterki 1893
Gastrocopta pentodon (Say) 1821
Fig. 578

Vertigo pentodon Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 376.
Pupa curvidens Gould 1841, Invert. Mass., p. 109.
Pupa cincinnatiensis Judge 1878, Quart. Jour. Conchology, v. 1, p. 343.
Pupilla floridana Dall 1885, U.S. Natl. Mus. Proc., v. 8, p. 261.
Pupa montanella Cockerell 1889, Jour. Conchology, v. 6, p. 63.
Pupa curvidens gracilis Sterki 1890, Nautilus, v. 3, p. 119.
Pupilla pentodon Call 1900, Moll. Ind., p. 396, pl. 6, figs. 8, 8a.
Bifidaria pentodon Dall 1905, Harriman-Alaska Exped., v. 13, p. 28, figs. 12a-c.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
Bifidaria pentodon gracilis Sterki 1907, *ibid.*
Gastrocopta pentodon Pilsbry 1916, Man. Conchology, v. 24, p. 28, pl. 3, figs. 2, 3, 5-8.
Bifidaria pentodon F. C. Baker 1920, Life of Pleistocene, p. 388.
Gastrocopta pentodon Sterki 1920, Ohio Jour. Sci., v. 20, p. 180.
--- --- Goodrich 1932, Moll. Mich., p. 22.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 52.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 886, fig. 477, 2, 3, 5-8.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 35, pl. 4, fig. 5.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 331.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 40.

Type locality.—Pennsylvania.

Diagnosis.—Shell rimate, oblong-conic with obtuse summit, clear corneous or whitish, smooth; whorls 5, convex, the last with a rounded ridge or crest (low or well developed) close behind the lip, and flattened near the base behind the ridge; teeth typically five, the anguloparietal lamella almost simple and straight, columellar lamella thin, horizontal; the palatal folds standing upon a low callus ridge, the lower fold compressed and entering a little more deeply than the smaller, tuberculiform upper one; accessory denticles are usually developed in the subcolumellar, basal, and interpalatal positions; peristome thin, narrowly expanded, with a thin, straight, parietal callus between the widely separated ends (modified from Pilsbry, 1948, p. 886, 888).

Ecology.—Lives on wooded hillsides or in well-drained groves, among leaves in the underbrush; also common among moss and grass in forest and on open slopes.

In Ontario, Oughton (1948, p. 94 ff.) listed this species from damp woodlands, especially those of deciduous trees. Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. Burch (1955, Naut. 69, p. 66) gave data on its relationships to soil factors in eastern Virginia. In South Carolina, Rehder (1949, Naut. 62, p. 125) found two specimens under boards and around planks near a board walk, Myrtle Beach.

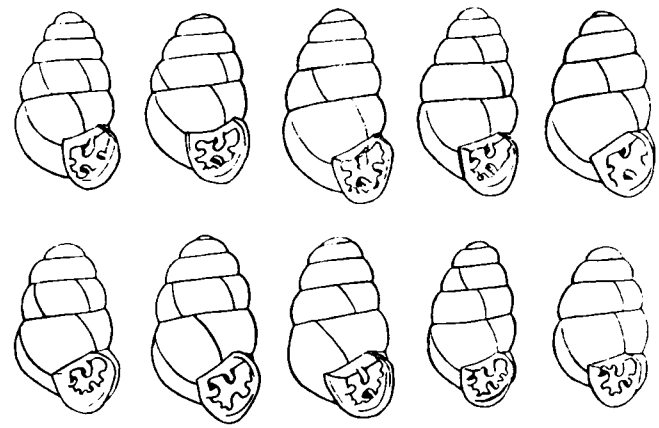

FIGURE 578.—*Gastrocopta pentodon,* magnified; several specimens, to show variation; after Walker (1928, p. 133, fig. 201).

Associations.—Living: MICHIGAN-18, 25, 26, 32, 33, 34, 36; OHIO-1, 4, 43; ONTARIO-2; WISCONSIN-143. Fossil: S-1; W-28, 48, 49, 50, 51, 67.

General distribution (fig. 579).—Prince Edward Island, Maine, Quebec, Ontario, Manitoba, and British Columbia, south to Mexico and Guatemala, but not on the Pacific slope.

Distribution in Ohio (inset, fig. 579).—"Over the state" (Sterki, 1907a, p. 379), but actual records are rare. Sterki (1907a, p. 379) gave Tuscarawas County and Eggleston (ms. records) gave Brown and Washington Counties. I have no other records, except those for fossil occurrences.

Geologic range.—F. C. Baker (1920a, p. 388) gave Yarmouth, Sangamon, Peorian, and "Wabash" for this species. Sterki (1920, p. 180) has recorded it for the Castalia marl, late Wisconsin, Ohio. More recently, Zimmerman (1960, p. 20) has identified it in the Newell Lake deposit and Mowery (1961, p. 12) from the Jewell Hill deposit, both in Ohio.

Gastrocopta tappaniana (C. B. Adams) 1842
Fig. 580; pl. 17, figs. 11, 12

Pupa tappaniana "Ward" C. B. Adams 1842, *in* Thompson's History of Vt., p. 158.

Bifidaria tappaniana Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
Gastrocopta tappaniana Pilsbry 1916, Man. Conchology, v. 24, p. 33.
Bifidaria tappaniana F. C. Baker 1920, Life of Pleistocene, p. 388.
Gastrocopta tappaniana Sterki 1920, Ohio Jour. Sci., v. 20, p. 180.
--- --- Goodrich 1932, Moll. Mich., p. 22.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 53.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 889, fig. 477, 9.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 36, pl. 4, fig. 2.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr.,

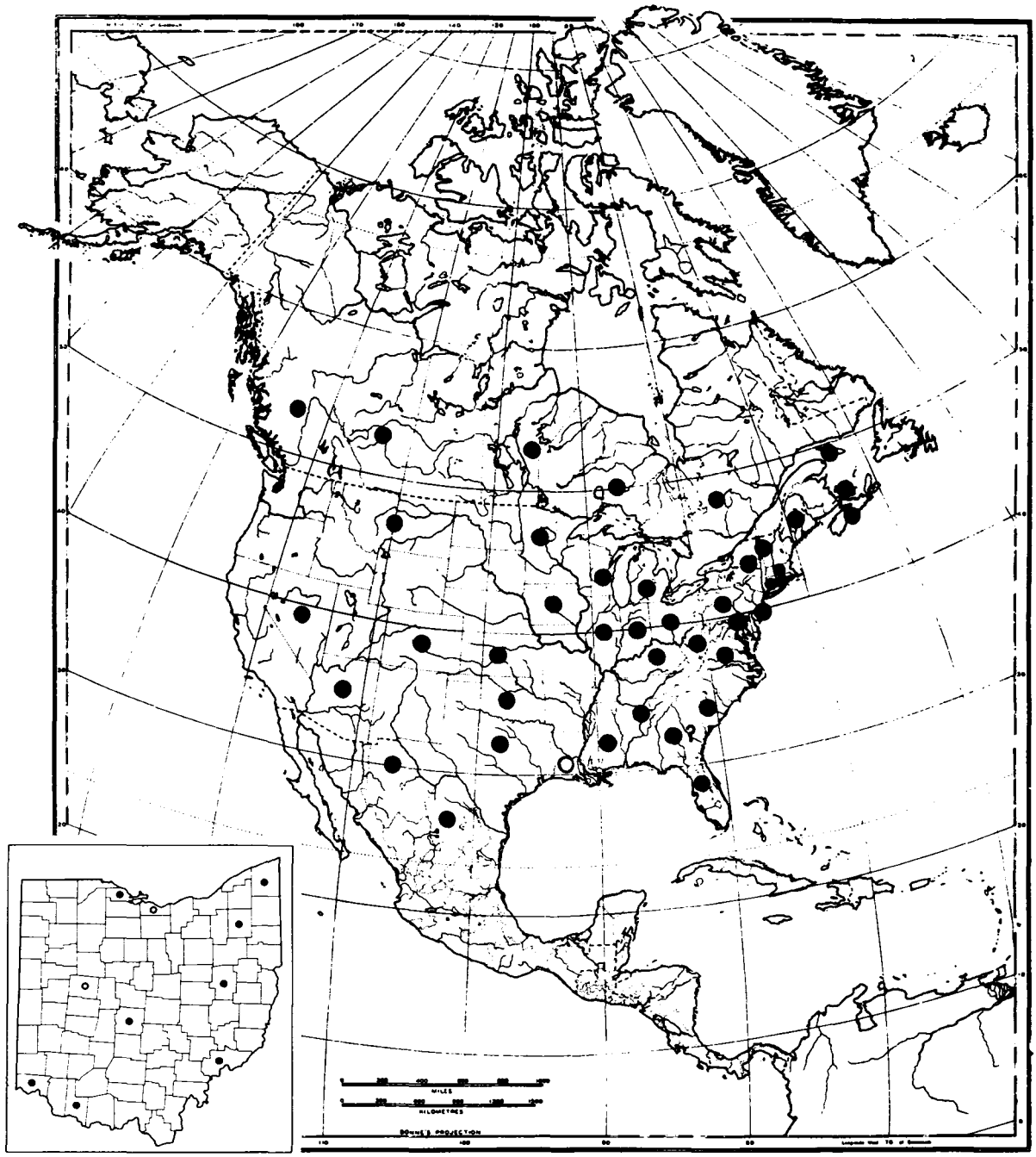

FIGURE 579.–Distribution of *Gastrocopta pentodon* in North America; *inset,* distribution in Ohio.

Moll., art. 3, p. 31, pl. 6, fig. D.
Gastrocopta tappaniana Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 20, pl. 5, fig. E.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 332.
--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 8, 11.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 127.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 72.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 42.

2, 3, 4, 5, 6; W-28, 52, 54, 56, 57, 58, 59, 70.

General distribution (fig. 581).—Ontario and Maine to Virginia and Alabama, west to South Dakota and Kansas, southwest to Arizona, but not known from the southeastern Atlantic states, Virginia to Florida.

Distribution in Ohio (inset, fig. 581).—"Over the state, common" (Sterki, 1907a, p. 379); definite records are rare; I have only two, for Fulton and Mercer Counties, based on specimens in the University of Michigan collections, and another, for Erie County, fossil (Eggleston, ms. records).

Geologic range.—F. C. Baker (1920a, p. 388) gave Yarmouth and "Wabash." A. B. Leonard (1950, p. 31) extended this to Aftonian to Recent; but not in the Peoria Loess of Kansas (Leonard, 1952, p. 20); probably Illinoian of Oklahoma (Taylor and Hibbard, 1955, p. 8); Sterki (1920, p. 180) had already recorded the species from the Castalia marl (late Wisconsin) of Ohio. Hibbard and Taylor (1960, p. 127) extended the range still further, from late Pliocene to Recent. Two occurrences from Ohio deposits have been cited recently: Aultman deposit (Sheatsley, 1960, p. 109), and Castalia deposit (Clark, 1961, p. 27).

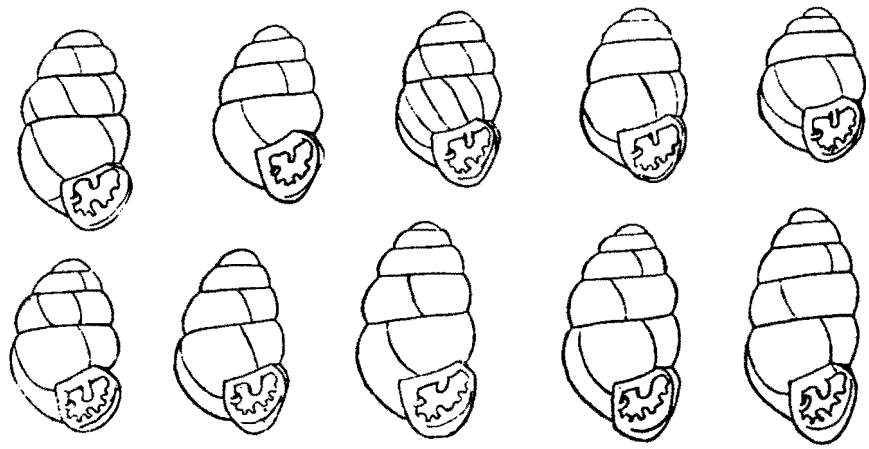

FIGURE 580.—*Gastrocopta tappaniana,* magnified; several specimens, to show variation; after Walker (1928, p. 135, fig. 203).

Type locality.—Vermont.

Diagnosis.—Shell larger than that of *G. pentodon,* markedly conic though obtuse; only one tooth on the parietal wall, generally six on the columellar, basal and outer margins, those on the latter standing on a strong rib; lower palatal fold generally not so long and entering as in *G. pentodon* (modified from Pilsbry, 1948, p. 889).

Ecology.—Found living in low, moist places, under wood, often with *Vertigo ovata,* whereas *G. pentodon* lives in drier situations.

Oughton (1948, p. 94 ff.) found this species in rather wet locations in Ontario, such as margins of ponds, streams, and marshes; seeping hillsides; sandy flats that receive water by percolation. H. B. Baker (1922b) noted it for one habitat in Dickinson County, Michigan, an alder swamp, with tag alder, dogwoods, and a few maples and ash with scanty undergrowth. This is one of the species found by Muchmore (1959, Naut. 72, p. 85-88) to live under stones in various woodland areas of New York State.

Associations.—Living: MINNESOTA-3, 4; OHIO-1. Fossil: P-1, 3, 4; N-1, 2; A-1; K-7, 10, 11, 12, 13, 15, 17, 18, 19, 21, 22, 24, 25, 26, 27; I-3; S-1 *(cf.)*

Remarks.—Sterki (1894, p. 5) has described a form *curta* from New Philadelphia, Ohio, which has little, if any, taxonomic value.

Gastrocopta carnegiei (Sterki) 1916

Bifidaria minuta Sterki 1916, Nautilus, v. 29, p. 105; not *P. minuta* "Say" Pfeiffer, 1842, =*Gastrocopta procera.*
Bifidaria carnegiei Sterki 1916, Nautilus, v. 30, p. 84.
Gastrocopta carnegiei Pilsbry 1916, Man. Conchology, v. 24, p. 35.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 890, fig. 480, 5.

Type locality.—Woods north of Geneva, Ashtabula County, Ohio.

Diagnosis.—Similar to *Gastrocopta tappaniana,* "but differs from that species as follows: it is much smaller, more conical, the whorls are less in number, more rapidly increasing, more convex, the last is comparatively larger; there is no callus in the palate or a very slight one, the palatal folds are longer and there are no secondary ones" (Sterki, quoted by Pilsbry, 1948, p. 890).

Ecology.—"Woods north of Geneva, Ashtabula County, Ohio" (Pilsbry, 1916).

General distribution.—Geneva, Ashtabula County, Ohio; no other locality is given by Pilsbry (1948, p. 890). No fossil record.

Remarks.—This species is based on three specimens collected by Sterki of which only one, the type, is perfect. It has not been collected by later workers.

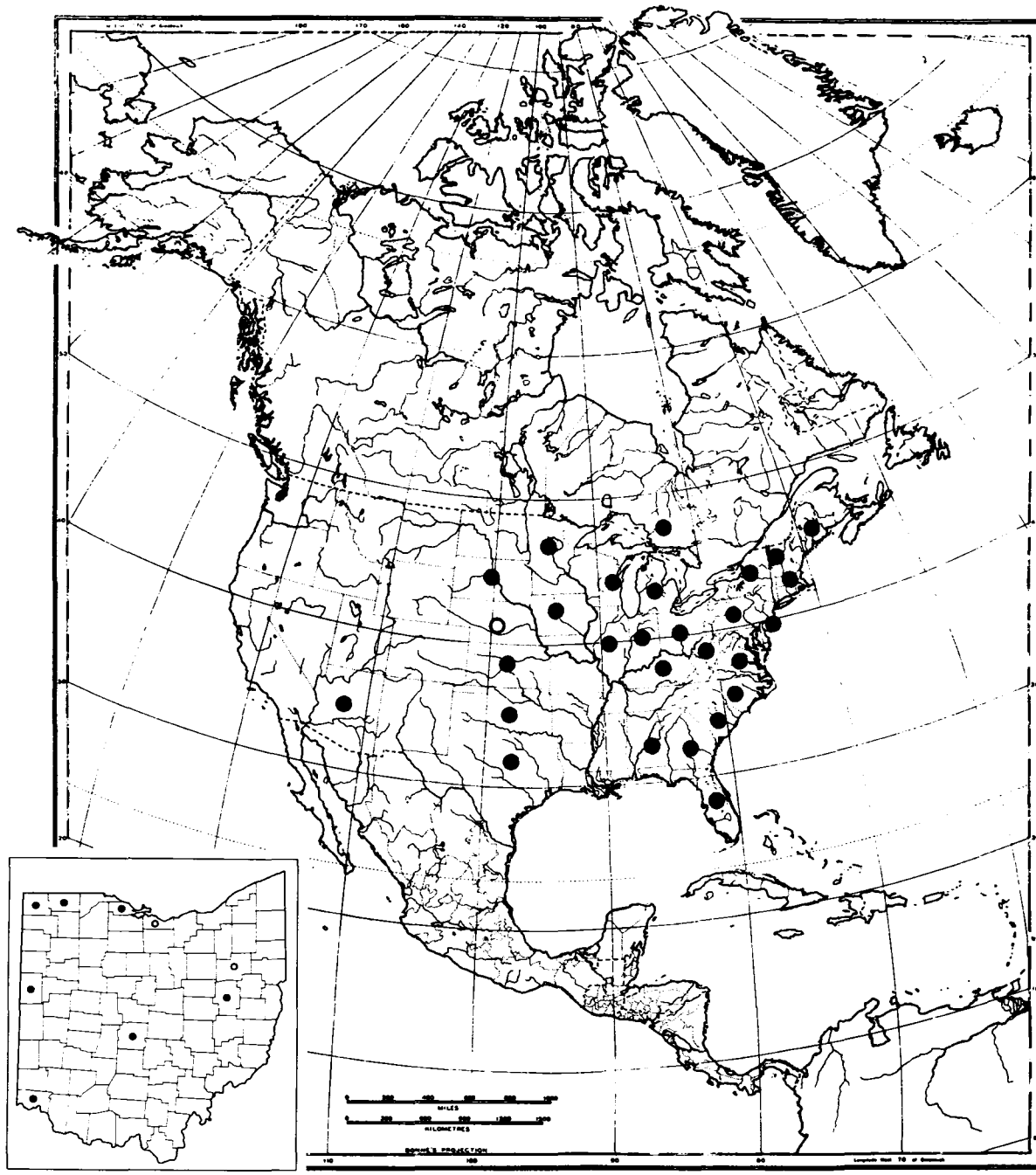

FIGURE 581.—Distribution of *Gastrocopta tappaniana* in North America; *inset,* distribution in Ohio.

Pilsbry (1948, p. 890) says that it appears to be distinct from *G. pentodon* and *G. tappaniana* "but in so variable a group further specimens are required for a full understanding of its relation to these species."

Subgenus *Privatula* Sterki 1893
Gastrocopta corticaria (Say) 1816
Fig. 582

Odostomia corticaria Say 1816, Nicholson's Encycl., Am. ed., v. 2, pl. 4, fig. 5.
Pupa corticaria W. G. Binney 1878, Terr. Moll., v. 5, p. 209.
Leucochila corticaria Call 1900, Moll. Ind., p. 399, pl. 6, figs. 12, 12a-c; text fig. 13.
Bifidaria corticaria Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
Gastrocopta corticaria Pilsbry 1916, Man. Conchology, v. 24, p. 52.
Bifidaria corticaria F. C. Baker 1920, Life of Pleistocene, p. 388.
Gastrocopta corticaria Sterki 1920, Ohio Jour. Sci., v. 20, p. 180.
--- --- Goodrich 1932, Moll. Mich., p. 22.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 51.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 894, fig. 480, 1-4.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 36, pl. 4, fig. 24.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 331.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 38.

FIGURE 582.—*Gastrocopta corticaria*, magnified; after Call (1900, pl. 6, fig. 12).

Type locality.—Philadelphia, Pennsylvania.

Diagnosis.—Shell minutely rimate, nearly cylindric, tapering slightly to the very obtuse summit; thin, translucent white, almost smooth, very faintly marked with growth lines; whorls 5½, quite convex, the last rounded basally, without a crest behind the lip; aperture irregularly oval; peristome thin, well expanded, the lip ends widely separated; angular and parietal lamellae united into one small bilobed lamella, or almost separate; columellar lamella very low, subvertical, a minute tubercle in front of its lower end (Pilsbry, 1948, p. 894).

Ecology.—Often found crawling upon trees a foot or two from the ground (Pilsbry, 1948, p. 894). In Ontario, Oughton (1948, p. 89) found it confined to Paleozoic terranes (mainly limestones). In Dickinson County, Michigan, H. B. Baker (1922b) noted it for hardwood-covered moraine ridges of the Calumet Trough, particularly in maple logs.

Associations.—Living: MICHIGAN-25; OHIO-43; ONTARIO-3, 11. Fossil: W-28.

General distribution (fig. 583).—New Brunswick, Maine, and Ontario, west to Minnesota, south to Louisiana, Alabama, Georgia, and Florida.

Distribution in Ohio (inset, fig. 583).—"Over the state" (Sterki, 1907a, p. 379); actual records are few: Williams and Allen Counties (University of Michigan collections); Washington County (Eggleston, ms. records).

Geologic range.—F. C. Baker 1920a, p. 388) gave Yarmouth, Sangamon, and Peorian. Castalia marl, "very scarce" (Sterki, 1920, p. 180).

Subgenus *Gastrocopta* Wollaston 1878
Gastrocopta procera (Gould) 1840
Pl. 17, fig. 15

Pupa procera Gould 1840, Boston Jour. Nat. History, v. 3, p. 401; v. 4, p. 359.
Bifidaria procera Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.
Gastrocopta procera Pilsbry 1916, Man. Conchology, v. 24, p. 62.
Bifidaria procera F. C. Baker 1920, Life of Pleistocene, p. 388.
Gastrocopta procera Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 907, fig. 492, 1-5.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 36, pl. 4, fig. 11.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 32, pl. 6, fig. J.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 331.
--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 11.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 123.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 67.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 41.

Type locality.—Baltimore, Maryland.

Diagnosis.—Shell shortly rimate, cylindric, with convexly conic, obtuse summit; red-brown, paler at the summit, somewhat glossy, lightly, irregularly striate; whorls 5¾, rather strongly convex, the last one flattened in the region of the lower palatal fold, and slightly impressed over the basal fold; having a more or less prominent low crest close behind the outer lip; aper-

ture with five teeth; anguloparietal lamella sinuous, showing a distinct spur on the right side, in a front view; in basal view this spur seen to be the inner end of the angular lamella, whereas the parietal lamella forms a very inconspicuous projection of the outline on the left side, and its inner end curves slightly to the right; columellar lamella stout, transverse, nearly a half whorl long; below it a low tubercle, variable in prominence and not visible in a face view in some specimens; upper palatal fold short, situated exactly opposite the spur of the parietal, and rather deep within; lower palatal fold much longer, more deeply placed, its inner end reaching a dorsal position; basal fold short, about as deep within as the upper palatal; peristome thickened within by a strong, cinnamon callus ridge, in front of the lip teeth, and excavated near the upper insertion (modified from Pilsbry, 1948, p. 907).

Ecology.—D. W. Taylor (1960) gave protected situ-

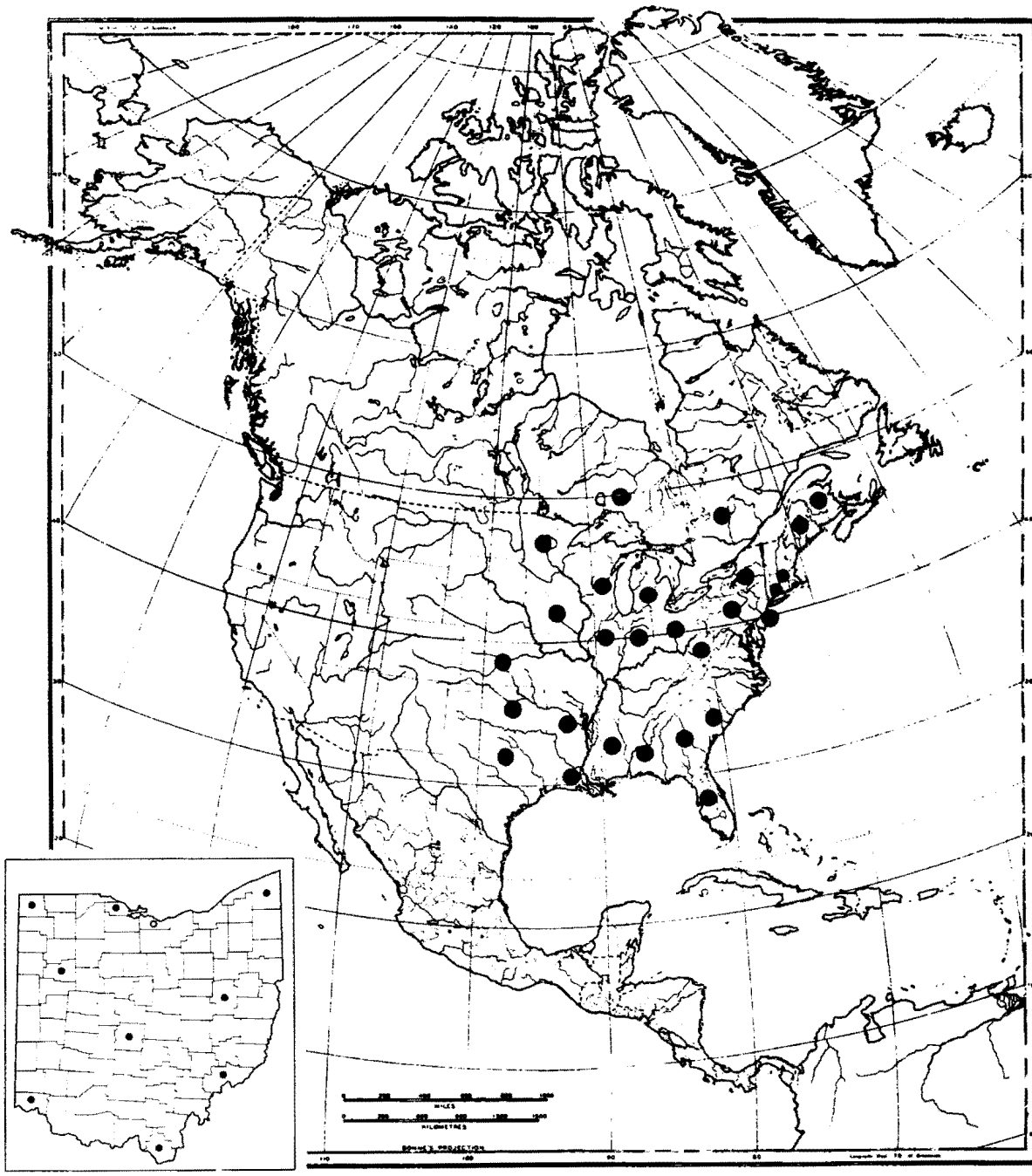

FIGURE 583.—Distribution of *Gastrocopta corticaria* in North America; *inset,* distribution in Ohio.

ations among vegetation: grass, shrubs, or wooded area, but noted that woods are not required.

Associations.—Fossil: W-73.

General distribution (fig. 584).—Ontario (La Rocque, 1953, p. 331, probably quoted from Robertson and Blakeslee, 1948); eastern United States, Maryland to South Carolina, west to Shawnee County, Kansas, and Payne County, Oklahoma; south to Alabama and eastern Texas.

Distribution in Ohio (inset, fig. 584).—Butler, Hamilton, Brown, Highland, and Franklin Counties (Sterki, 1907a; University of Michigan collections; Eggleston, ms. records; Pilsbry, 1948). It does not seem to have progressed much north of the Ohio River in this State.

Geologic range.—F. C. Baker (1920a, p. 388) gave Sangamon, Peorian, and "Wabash" for this species. A. B. Leonard (1950, p. 32) gave Aftonian to Recent; Hibbard and Taylor (1960, p. 123) gave early Pleisto-

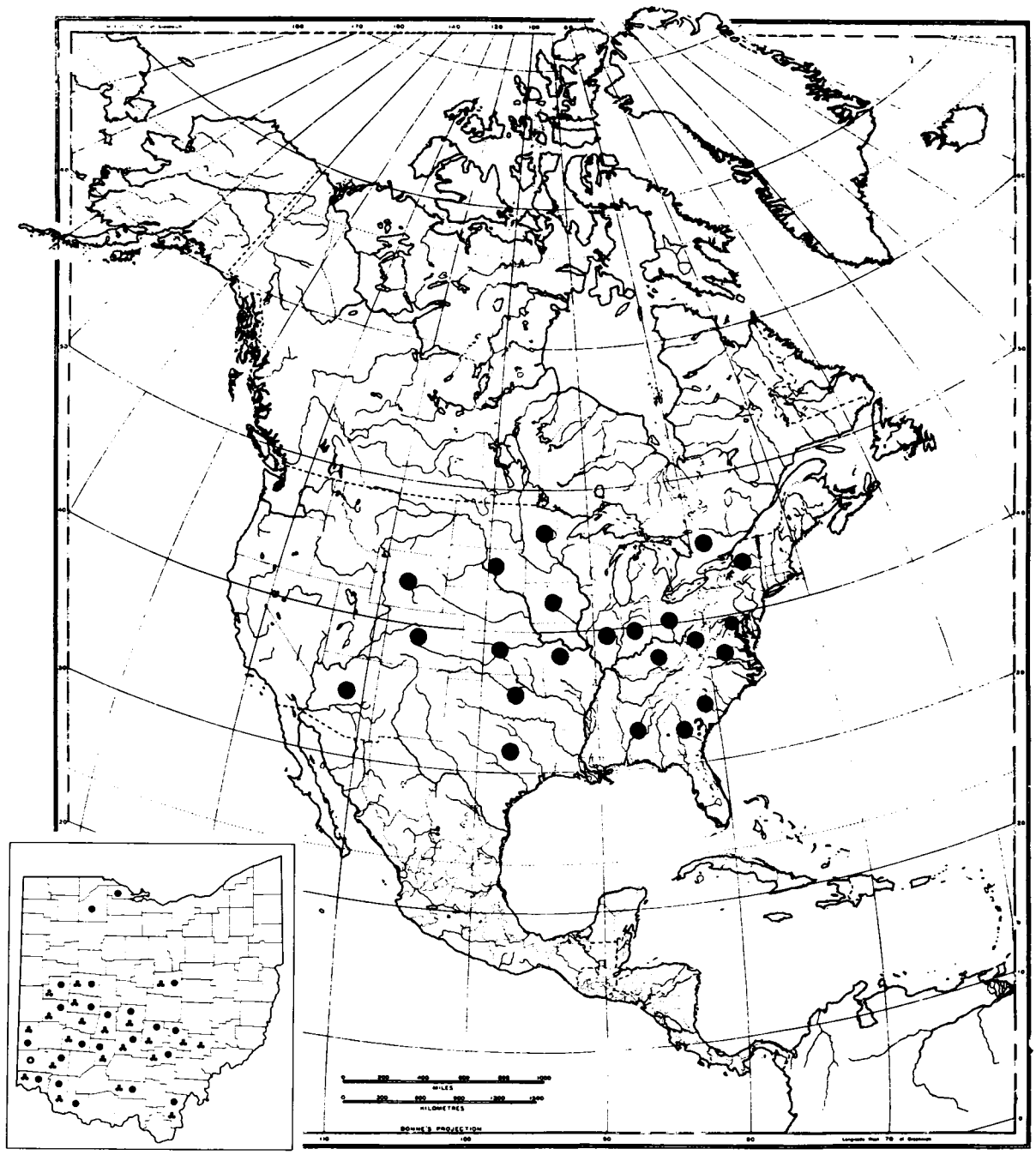

FIGURE 584.—Distribution of *Gastrocopta procera* in North America; *inset,* distribution in Ohio.

cene (Nebraskan or Aftonian); Taylor (1960, p. 67) noted that Pliocene records for *G. procera* should be placed under another species, *G. franzenae* Taylor. So far, there is no fossil record for *G. procera* in Ohio.

Subfamily PUPILLINAE

Diagnosis.—Shell rimate or perforate, long-ovate to cylindric; internal lamellae absent or reduced in number (0-5) and size; significant characteristics in the soft parts.

General distribution.—All continents.

Geologic range.—Lower Pliocene to present.

Subdivisions.—Two genera only, *Pupoides* and *Pupilla,* both of them widely distributed in North America and present in the living fauna of Ohio.

Genus *Pupoides* Pfeiffer 1854

Pupoides Pfeiffer 1854, Malak. Bl., v. 1, p. 192.
Leucochila von Martens 1860, Die Heliceen, p. 296.
Leucochiloides Pfeiffer 1878, Nomencl. Hel. Viv., p. 292.
Pupoides Pilsbry 1921, Man. Conchology, v. 26, p. 108, 137.
Themapupa Iredale 1930, Victorian Naturalist, v. 47, p. 120.
Pupoides Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 920.

Type.—*Pupoides nitidulus* Pfeiffer.

Diagnosis.—Shell long, rimate; long-ovate, turreted or rarely cylindric, with obtuse apex and few (generally 5-6) rather long whorls; aperture ovate, toothless except for a small tuberculiform angular lamella close to the insertion of the outer lip, or united with it, in some specimens wanting; peristome expanded, reflected and generally thickened within; internal axis slender, perforate (modified from Pilsbry, 1948, p. 920).

General distribution.—All of the continents except Europe. Eastern North America from Ontario and Maine to the Gulf of Mexico, west to the Dakotas, Colorado and western Arizona (Yuma County); in northern Mexico on islands in the Gulf of California, at Monterrey and Tampico. Cuba, Haiti, Puerto Rico, Bermuda.

Geologic range.—Oligocene, Tampa Silex beds, two species (Henderson, 1935, p. 152).

Pupoides albilabris (C. B. Adams) 1841
Pl. 17, fig. 1

Cyclostoma marginata Say 1821, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 172; not *C. marginatum* G. Fischer, 1807.
Pupa albilabris "Ward's letter," C. B. Adams, 1841, Am. Jour. Sci., v. 40, p. 271.
Pupa fallax Gould 1843, Boston Jour. Nat. History, v. 4, p. 357; not *Pupa fallax* Say.
Pupa (Modicella) arizonensis Gabb 1866, Am. Jour. Conchology, v. 2, p. 331, pl. 21, fig. 6.
Leucochila fallax Call 1900, Moll. Ind., p. 397, pl. 6, fig. 9; text fig. 11.
Pupoides marginatus Billups 1902, Nautilus, v. 16, p. 51.
Pupoides marginata Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.
——— ——— Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
Pupoides marginatus F. C. Baker 1920, Life of Pleistocene, p. 388.
Leucochila fallax F. C. Baker 1920, *ibid.*
Pupoides marginata Goodrich 1932, Moll. Mich., p. 21.
Pupoides albilabris Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 277.
——— ——— Oughton 1948, Zoögeogr. study, Ontario, p. 54.
——— ——— Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 921, fig. 499, 1-7.
——— ——— Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 40, pl. 4, fig. 15.
——— ——— Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 29, pl. 6, fig. Q.
——— ——— Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 22, pl. 5, fig. M.
——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 332.
——— ——— Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 8, 11.
——— ——— Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 128.
——— ——— Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 74.
——— ——— Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 43.

Type locality.—Upper Missouri (Say).

Diagnosis.—Shell minutely perforate, rimate, slowly tapering from the last whorl to the obtuse summit, cinnamon or slightly darker, somewhat glossy; surface lightly marked with striae of growth; whorls rather strongly convex, the last half-whorl somewhat compressed laterally, tapering to the narrowly rounded base; aperture oval; peristome expanded and reflected, strongly thickened within, its face flattened; outer lip more strongly arched near the upper insertion; parietal callus transparent, bearing a short low tubercle connected with the outer lip (Pilsbry, 1948, p. 921).

Ecology.—This common snail prefers limestone soils, though also found elsewhere. It lives under stones or at the roots of grass, in well-drained but often sunny places; following rains it is sometimes found on trees a few feet from the ground. It occurs in all the states from Arizona and Colorado eastward, but never at high elevations. The living shell is usually more or less coated with dirt. Taylor (1960) recorded this species for damp to dry habitats: damp protected places, or relatively dry exposed habitats, more tolerant

of drought than others, and requiring little cover. Oughton (1948, p. 95) recorded it somewhat doubtfully from floodplains of creeks and rivers, which would help explain its widespread dispersal. It undoubtedly lives in areas flooded by rivers and creeks, even though this may happen only occasionally, as it is one of the most frequent species in the stream drift from floodplains in Ohio. In the Asheville, North Carolina, region, Archer (1935c, p. 82) found it in the grass in a clearing. Grimm (1959, Naut. 72, p. 126) recorded it along railroad tracks and around the foundation of an old burned house in Maryland. In Virginia, Burch (1954, Naut. 68, p. 31) collected it in and around decaying oak and maple stumps. Rehder (1949, Naut. 62, p. 125) found it fairly common, under boards and around planks near a boardwalk, Myrtle Beach, South Carolina, and under logs and debris along the edge of Tar River, in North Carolina (1949, Naut. 62, p. 123-124).

Associations.—Living: MICHIGAN-32, 33; OHIO-43; WISCONSIN-144. Fossil: P-1, 3, 4; N-1, 2; A-1; K-3, 5, 10, 11, 13, 18, 22, 24, 25, 26, 27; I-3, 4; S-1, 2, 3, 4, 5, 6; W-24, 28, 73.

General distribution (fig. 585).—Ontario, Quebec, and Maine, south to northern Mexico; west to North Dakota, South Dakota, Colorado, and Arizona.

Distribution in Ohio (inset, fig. 585).—"Over the state" (Sterki, 1907a, p. 378), but records are concentrated in the southern and western parts of the State: Washington and Erie Counties (Eggleston, ms. records); Auglaize and Hamilton Counties (University of Michigan collections); Greene, Hamilton, Brown, and Adams Counties (Eggleston, ms. records).

Geologic range.—F. C. Baker (1920a, p. 388) gave Yarmouth, Sangamon, and Peorian for this species under *Leucochila fallax* (Say), and Sangamon and "Wabash" under *Pupoides marginatus* (Say). Hibbard and Taylor (1960, p. 128) gave early Pliocene to Recent. In Ohio, it occurs in the Jewell Hill deposit (Mowery, 1961, p. 12) and in the Castalia deposit (Clark, 1961, p. 27).

Genus *Pupilla* Leach 1831

Pupilla (Leach ms.) Fleming 1828, Brit. Animals, p. 268.
Pupilla Pilsbry 1921, Man. Conchology, v. 26, p. 152.
Pupilla Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 926.

Type.—*Pupa marginata* Draparnaud =*P. muscorum* Linnaeus.

Diagnosis.—Shell cylindric, with rounded, obtuse ends, rimate and commonly perforate, of short, slowly increasing whorls, the sutures but slightly oblique; small aperture with 0-5 teeth, the parietal, columellar and palatal teeth deeply placed when present; no basal fold; no teeth present in immature stages; peristome narrowly reflected; shell axis small, perforate (modified from Pilsbry, 1948, p. 926).

General distribution.—North America, Eurasia, Africa, Australia, almost wholly in temperate and cold regions.

Geologic range.—Upper Oligocene to present in central Europe. Pleistocene (Yarmouthian) to present in North America. A Paleocene species, *P. inermis* Russell, from Alberta, Canada (Henderson, 1935, p. 151), should be placed elsewhere according to Pilsbry (1948, p. 928, footnote).

Speciation.—Six species of the genus are described by Pilsbry (1948, p. 928 ff.); only one, *P. muscorum*, has been recorded for Ohio, both as a Pleistocene fossil and as a living snail. The other five species are western but are not confined to the Pacific slope.

Pupilla muscorum (Linnaeus) 1758
Pl. 17, fig. 7

Turbo muscorum Linnaeus 1758, Syst. Nat., 10th ed., p. 767.
Pupa badia C. B. Adams 1840, Boston Jour. Nat. History, v. 3, p. 331, pl. 3, fig. 18.
Pupilla muscorum Dall 1905, Harriman-Alaska Exped., v. 13, p. 28, figs. 14-16.
——— ——— Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
——— ——— F. C. Baker 1920, Life of Pleistocene, p. 388.
——— ——— Goodrich 1932, Moll. Mich., p. 25.
——— ——— Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 277.
——— ——— Oughton 1948, Zoögeogr. study, Ontario, p. 54.
——— ——— Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 933, fig. 503, 12-16.
——— ——— Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 40, pl. 4, fig. 7.
——— ——— Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 28, pl. 6, fig. N.
——— ——— Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 22, pl. 5, fig. J; fig. 12.
——— ——— Leonard 1953, Am. Jour. Sci., v. 251, p. 372.
——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 332.
——— ——— Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
——— ——— Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 8, 11.
——— ——— Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 132.

Type locality.—Sweden.

Diagnosis.—Shell shortly rimate, cylindric, auburn or some similar brown shade, white or light behind the lip, moderately solid; summit rounded, obtuse; postembryonic whorls with fine blunt uneven striation, moderately convex; last half of the last whorl tapering

downward, compressed, rising to the aperture, having a strong whitish crest near and parallel to the outer and basal lip; aperture somewhat oblique, truncate-rounded, typically without teeth (but in various varieties or mutations provided with one to three teeth); peristome narrowly reflected outwardly, broadly on the columellar side, having a strong pale callus within (modified from Pilsbry, 1948, p. 933).

Ecology.—Especially abundant in rocky areas such as limestone quarries and escarpments, under limestone slabs with accumulations of rock powder and soil, and in joints and fissures of rocks.

In Ontario, Oughton (1948, p. 95) was somewhat doubtful about this species living on floodplains of creeks and rivers. He pointed out that in Ontario it is confined to Paleozoic terranes, mainly limestones (1948, p. 89). My stream drift records in Ohio indicate that if it does not live on floodplains, it must be

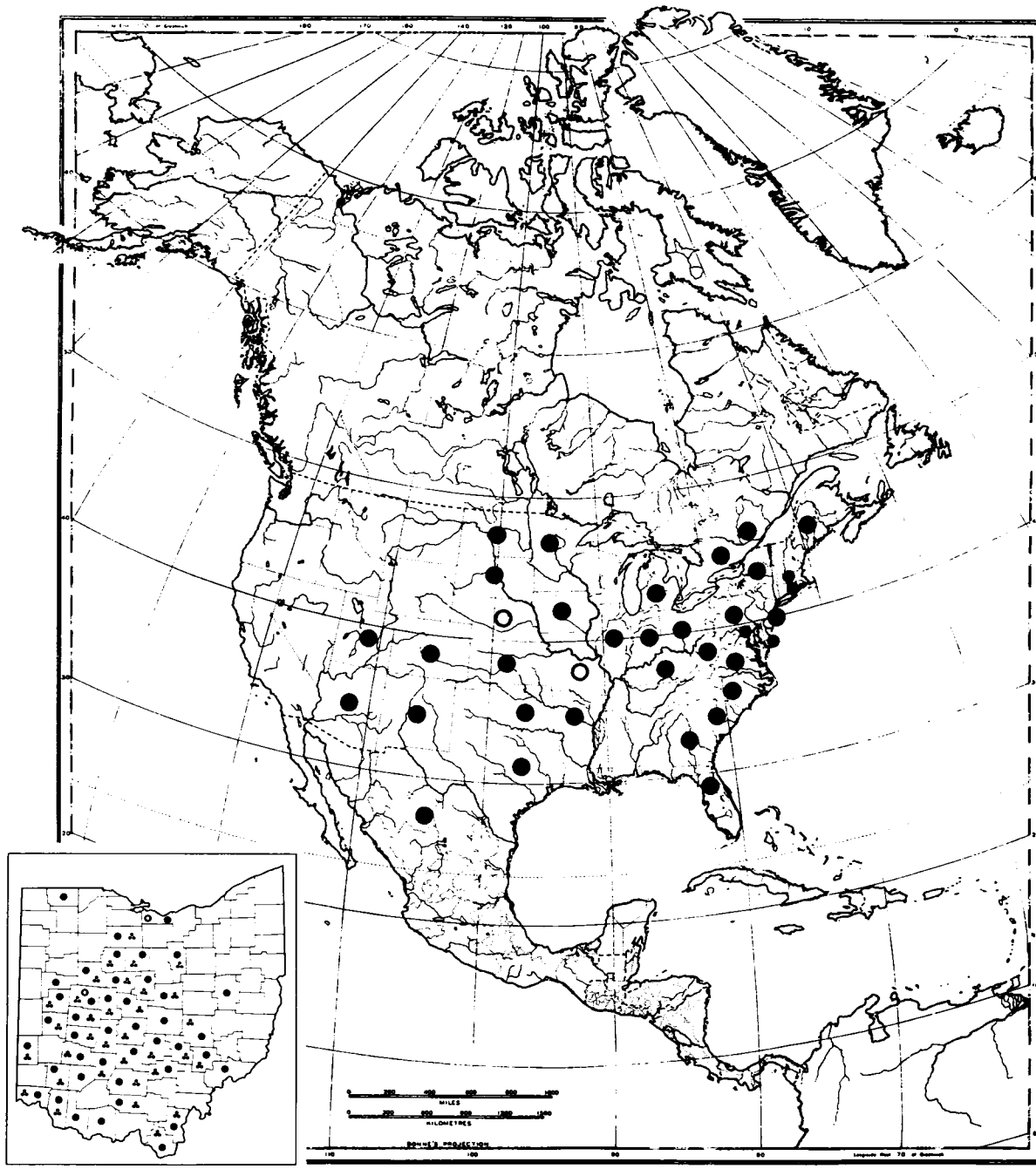

FIGURE 585.—Distribution of *Pupoides albilabris* in North America; *inset,* distribution in Ohio.

washed down from drier habitats, probably high banks, for it is an abundant species in such associations. Archer (1934c, p. 139) found a few in the limestone talus on Mackinac Island, Michigan, and Goodrich (1932) found it abundant on the sides of a well on the same island. In Maryland, Grimm (1959, Naut. 72, p. 126) has recorded it from under debris near railroad tracks. Wayne (1959b, p. 93) found it beneath cardboard debris or fallen spruce wood between one and three meters above the muskeg at Churchill, Manitoba.

Associations.—Living: MANITOBA-39. Fossil: K-2, 4, 6, 7, 9, 12, 13, 14, 15, 19, 20, 21, 23, 24, 26, 27; S-6, 7; W-1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 60, 61, 62, 64, 65, 66, 67, 68, 69, 70, 73.

General distribution (fig. 586).—Alaska south and east to New Mexico and Arizona; in the east, Newfoundland and Anticosti south to New Jersey; westward

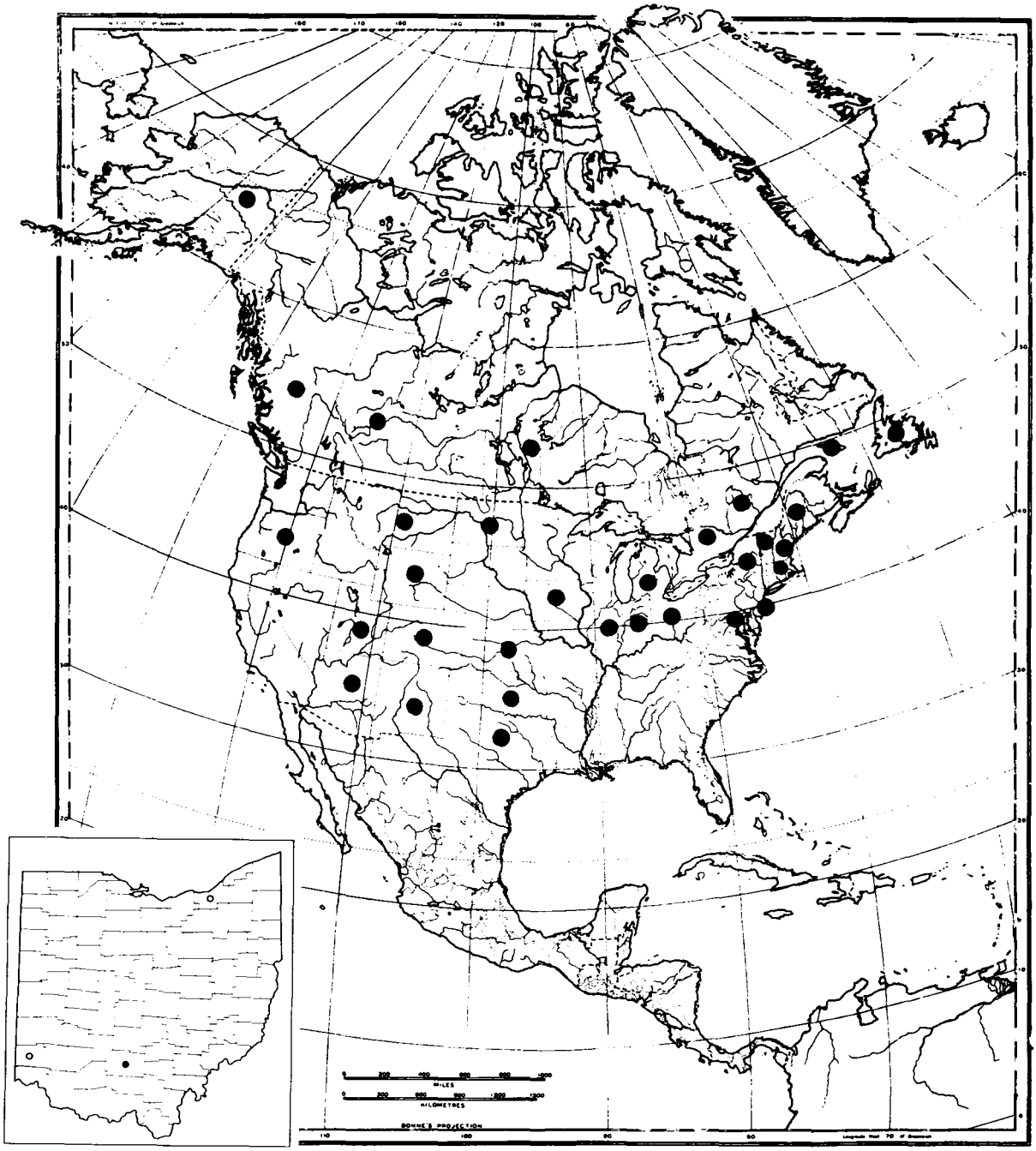

FIGURE 586.—Distribution of *Pupilla muscorum* in North America; *inset,* distribution in Ohio.

in Canada and the northern tier of states to Oregon.

Distribution in Ohio (inset, fig. 586).—"Cited from Ohio (and no doubt to be found, being known from New York, Michigan and Illinois)" (Sterki, 1907a, p. 379). It is undoubtedly rare in the State as a living snail; Eggleston (ms. records) has no specimens and the only records for the State are fossils.

Geologic range.—F. C. Baker (1920a, p. 388) gave Yarmouth, Sangamon, and Peorian. Wayne (1954, p. 1320) has recorded it from pro-Kansan loess, Putnam County, Indiana; Leonard (1950, p. 28) gave Yarmouth to Recent. In Ohio, Leonard (1953, p. 372 ff.) has recorded it from Sangamon, Farmdale? Loess, lower and upper pro-Tazewell loess, both from the Cleveland area. Hibbard and Taylor (1960, p. 132) gave late Miocene to Recent but noted that the earliest North American record is middle Pliocene.

Remarks.—In Yarmouth interglacial beds of Kansas (Leonard, 1950, p. 28) the species is represented by a sinistral form, *P. muscorum sinistra* Franzen, which occurs as a pure population at the type locality but as a minor element (25 percent) of a dextral population elsewhere.

European and American populations of the species are subject to much variation in the number of the teeth. The typical form, also present in North America, has no teeth; in form *marginata* Drap. there is a short parietal lamella; this is the form described by Adams as *Pupa badia* from Crown Point, New York. In form *masclaryana* Paladilhe, there is a tubercular or short parietal lamella and a small tubercular lower palatal fold. Another form, unnamed by Pilsbry, has a columellar tooth more or less well developed; it has been observed in America only in the mountain states of the west but has also been recorded from France.

Subfamily VERTIGININAE

Diagnosis.—Pupillidae with compact, oval, ovate or cylindric shells of quite small or minute size, 1½ to 3 mm. long, from brown to amber or olivaceous color, with the typical 6 teeth of the family, or varying to none or to a greater number; axis perforate, but commonly closed in the adult stage (modified from Pilsbry, 1919, p. 68).

General distribution.—Abundant in Holarctic, Polynesian, and Hawaiian faunas, almost wholly wanting in South American and African.

Geologic range.—Two species of *Vertigo* are recorded by Henderson (1935, p. 151) for the Eocene of Wyoming. For the distribution of Pleistocene species, see under genus *Vertigo*.

Subdivisions.—According to Pilsbry (1919, p. 69) the genera fall into two main geographic divisions: 1, northern or mainly Holarctic, including *Vertigo, Columella, Truncatellina, Sterkia* and their satellite groups, and 2, Polynesian and Tropical, with *Nesopupa* and the associated groups.

Genus *Vertigo* Müller 1774

Vertigo O. F. Müller 1774, Verm. Terr. et Fluv. Hist., v. 2, p. 124.
Isthmia Gray 1821, London Med. Repository, v. 15, p. 229.
Alaea Jeffreys 1930, Linnaean Soc. London Trans., v. 16, p. 357.
Nearctula Sterki 1892, Nautilus, v. 6, p. 5.
Haplopupa Pilsbry 1908, Nautilus, v. 11, p. 119.
Vertigo Pilsbry 1919, Man. Conchology, v. 25, p. 69 ff.
Vertigo Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 943.

Type.—*Vertigo pusilla* Müller.

Diagnosis.—Shell small, deeply rimate, oval, cylindric-oblong or ovate, with very blunt summit, generally glossy and some shade of brown; aperture with the typical six teeth of Pupillidae, none of them concrescent, part or all of them commonly wanting; angular lamella not reaching the margin, when present; outer lip straightened or looped inward in the middle (modified from Pilsbry, 1948, p. 943).

General distribution.—Practically the entire Holarctic realm, from near sea level to at least 10,000 feet.

Geologic range.—Eocene (Yen, 1946b, p. 498, figs. 10, 11); Pliocene (Kansas), Pleistocene to present.

Subdivisions.—The American species are placed in three subgenera, *Vertigo s. s., Angustula,* and *Vertillaria.* The species in this report are grouped under the first two subgenera, following Pilsbry (1948, p. 944 ff.). Subgenus *Vertillaria* has not been recorded for Ohio.

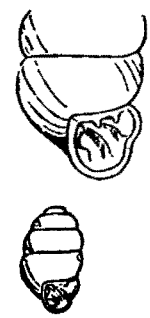

FIGURE 587.—*Vertigo milium,* magnified; after Walker (1928, p. 148, fig. 227).

Subgenus *Angustula* Sterki 1888
Vertigo milium (Gould) 1840
Fig. 587

Pupa milium Gould 1840, Boston Jour. Nat. History, v. 3, p. 402; *ibid.*, v. 4, p. 359.
Isthmia (Vertigo) milium Call 1900, Moll. Ind., p. 400.
Vertigo (Vertilla) milium Dall 1905, Harriman-Alaska Exped., v. 13, p. 32, fig. 24.
Vertigo milium Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 181.
--- --- F. C. Baker 1920, Life of Pleistocene,

p. 388.
Vertigo milium Goodrich 1932, Moll. Mich., p. 23.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 59.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 944, fig. 509.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 37.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 26, pl. 6, fig. C.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 25, pl. 5, fig. A.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 334.
--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 11.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 135.
--- --- Taylor 1960, U.S, Geol. Survey Prof. Paper 337, p. 76.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 46.

Type locality.—Oak Island, Chelsea, near Boston, Massachusetts.

Diagnosis.—Shell shortly oval, cinnamon or paler, glossy, weakly striate; last whorl with external impression over the lower palatal fold and a swelling in front of it, below a deeper impression which runs to the lip, over the upper palatal fold; angular lamella high, short, and situated inward from the insertion of the outer lip; parietal lamella high and long, entering deeply; strong columellar lamella entering horizontally at first, then turning downward, being crescent shaped; upper palatal fold long and high, slightly curved; lower palatal fold a little immersed, high, thin, and entering to the dorsal side, where it curves downward; basal fold somewhat immersed, short and high; small, tubercular suprapalatal fold in some specimens; outer lip somewhat expanded and strongly biarcuate; parietal callus generally rather thick (modified from Pilsbry, 1948, p. 944).

Ecology.—Apparently confined almost entirely to lime-rich areas. Hibbard and Taylor (1960; see Association S-2, this bulletin, p. 32) recorded this species for moist leaf mold and plant debris: under logs and bark, or among leaves, moss, or grass in moist situations not far from water. Oughton (1948, p. 94 ff.) recorded it, somewhat doubtfully, from floodplains of creeks and rivers, confined to the Paleozoic terranes, mainly limestones, in Ontario. Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State.

Associations.—Living: OHIO-1, 43. Fossil: P-1, 2, 3, 4; N-1, 2; A-1; K-1, 5, 9, 11, 13, 15, 17, 19, 21, 24, 25; S-1, 2, 3, 4, 6; W-3, 13, 28, 56, 57, 58, 59.

General distribution (fig. 588).—Maine, Quebec, and Ontario west to South Dakota, Colorado, and southeastern Arizona; southward to Florida and Mexico. Jamaica; Santo Domingo.

Distribution in Ohio (inset, fig. 588).—"Over the state" (Sterki, 1907a, p. 379); Eggleston (ms. records) does not list the species, but three county records, for Fulton, Allen, and Auglaize Counties, are in the University of Michigan collections. The species should be more widely distributed in the State as lime-rich soils are widespread in Ohio. Perhaps its apparent absence from the Ordovician and Devonian areas of outcrop in the State is merely due to insufficient collecting because of its small size.

Geologic range.—F. C. Baker (1920a, p. 388) gave Yarmouth, Peorian, and "Wabash." Leonard (1950, p. 26) gave Aftonian to Recent and (1952, p. 25) Blanco deposits to Recent. Hibbard and Taylor (1960, p. 135) gave late Pliocene to Recent. In Ohio, Sterki (1920, p. 181) and Clark (1961, p. 27) have identified it from the Castalia deposit, late Wisconsin.

Remarks.—According to Pilsbry (1948, p. 944) this species and two others form an American group of the genus *Vertigo* that is subgenerically distinct from others.

Subgenus *Vertigo s. s.*
Vertigo morsei Sterki 1894
Fig. 589

Vertigo morsei Sterki 1894, Nautilus, v. 8, p. 89.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
--- --- Pilsbry 1919, Man. Conchology, v. 25, p. 81, pl. 6, figs. 8, 9.
Vertigo morsei Sterki 1920, Ohio Jour. Sci., v. 20, p. 180 (err. typ. for *morsei*).
Vertigo morsei F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Goodrich 1932, Moll. Mich., p. 23.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 61.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 952, fig. 513, 1-3, 4, 7.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 36, pl. 4, fig. 8.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 335.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 47.

Type locality.—Joliet, Illinois.

Diagnosis.—Shell large for the genus, cylindric-ovate, some shade of brown, glossy, with few, weak striae; whorls slowly increasing, the last scarcely higher than the penult, with a moderate crest behind

the lip, and a wide depression over the palatal folds; there is a distinct crease from the crest to the lip point; aperture relatively small, outer margin angularly inbent near the middle; teeth typically nine: three on the parietal wall, as in *V. ovata;* a strong columellar lamella, a smaller basal fold, subcolumellar in position; upper and lower palatal folds high and rather long; small tubercular suprapalatal and infrapalatal folds; infraparietal and infrapalatal tubercles rudimentary or wanting in some specimens; peristome a little expanded.

Ecology.—Oughton (1948, p. 94 ff.) recorded this species somewhat doubtfully for floodplains of creeks and rivers.

Associations.—Fossil: W-28, 52, 53, 54, 55, 56, 57, 58, 59.

General distribution (fig. 590).—New York and New Jersey west to Grand Rapids, Michigan, Indiana, and

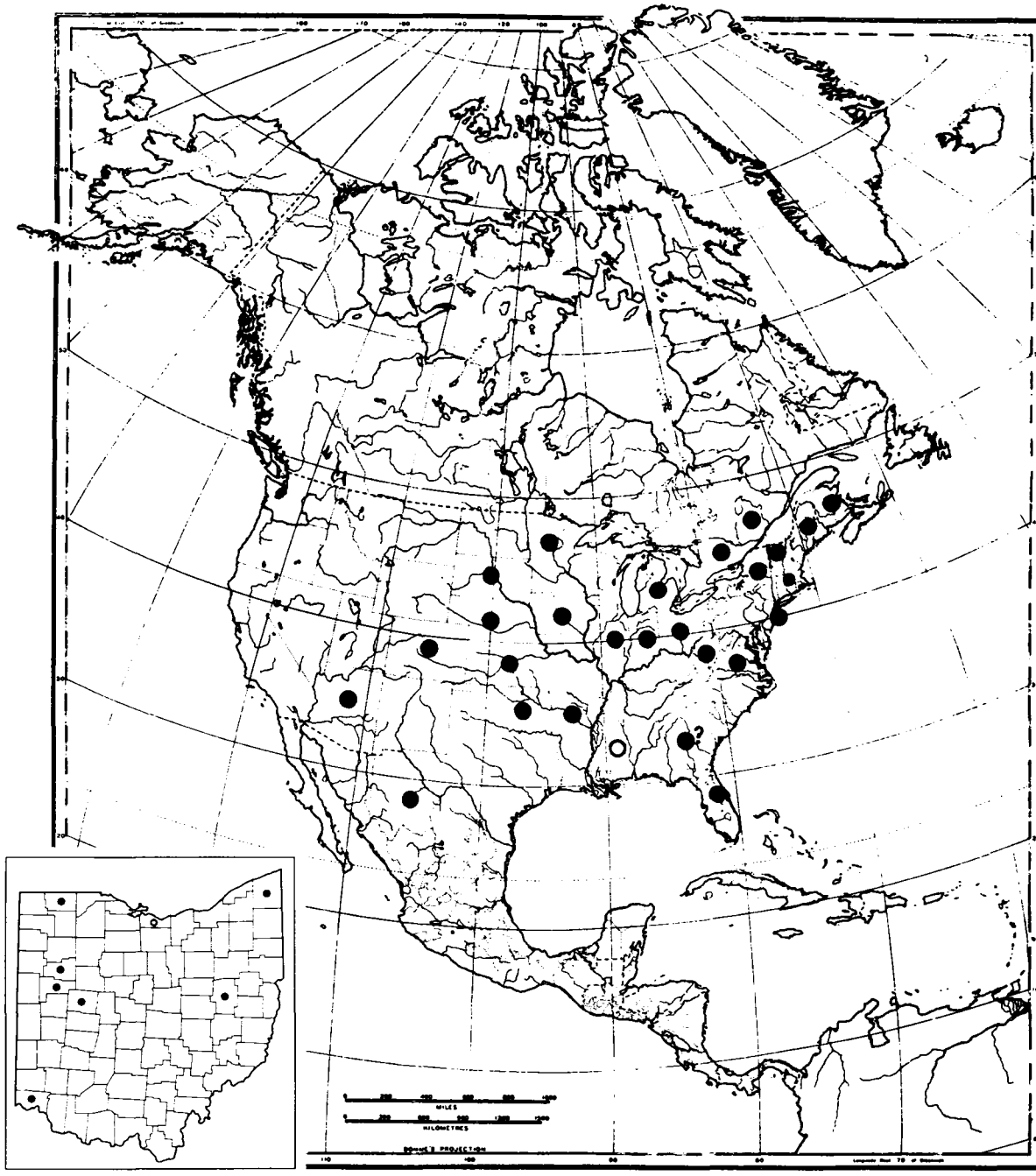

FIGURE 588.—Distribution of *Vertigo milium* in North America; *inset,* distribution in Ohio.

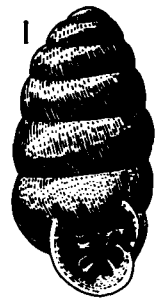

FIGURE 589.—*Vertigo morsei*, magnified; after F. C. Baker (1939a, p. 104).

Illinois. In Ontario it is not known north of Hastings County.

Distribution in Ohio (inset, fig. 590).—"Castalia, Erie Co." according to Sterki (1907a, p. 379); this probably refers to the Pleistocene record mentioned below. Sterki continues "and probably over the northwestern part of the state, being known from north-east Indiana, and Michigan." This seems to indicate that he had no living specimens, at least at the time of

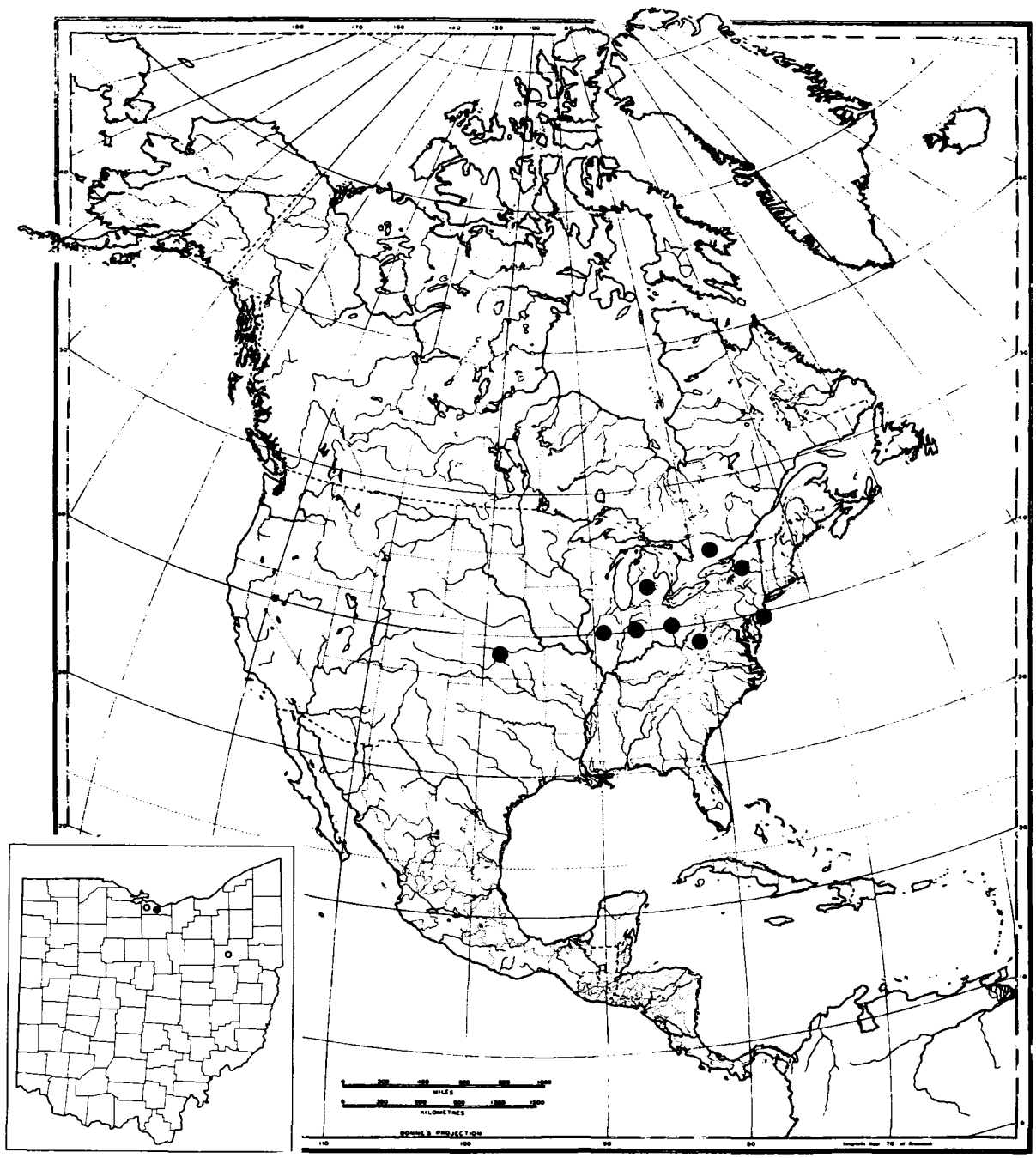

FIGURE 590.—Distribution of *Vertigo morsei* in North America; *inset*, distribution in Ohio.

writing, from Ohio. I have no further records and Eggleston (ms. records) lists only the fossil occurrence mentioned above.

Geologic range.—Late Wisconsin, Castalia marl, Erie County, Ohio (Sterki, 1920, p. 180), "very common." F. C. Baker (1920a, p. 388) gave only "Wabash." Recently, it has been identified from the Aultman deposit (Sheatsley, 1960, p. 116) and from the Castalia deposit (Clark, 1961, p. 27) of Ohio, both late Wisconsin in age.

Vertigo ovata Say 1822
Pl. 17, fig. 8

Vertigo ovata Say 1822, Acad. Nat. Sci. Philadelphia Jour., v. 2, p. 375.
Isthmia (Vertigo) ovata Call 1900, Moll. Ind., p. 400, pl. 6, fig. 13; pl. 7, fig. 1.
Vertigo ovata Dall 1905, Harriman-Alaska Exped., v. 13, p. 32, figs. 20-23.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 180.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Goodrich 1932, Moll. Mich., p. 23.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 62.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 952, fig. 513, 1-3, 4, 7.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 36, pl. 4, fig. 3.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 26, pl. 6, fig. F.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 26, pl. 5, fig. G.
--- --- La Rocque 1952, Moll. Orleton site, p. 12 ff.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 335.
--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 8, 11.
--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 135.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 774.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 48.

Type locality.—Philadelphia, Pennsylvania.

Diagnosis.—Shell ovate, very convexly conic, summit obtuse; color reddish brown, the apex paler; whorls increasing rapidly, the last much the largest, with a strong opaque light-colored crest behind the lip; a depression with two furrows behind it, and a deep furrow running from crest to lip point; aperture with a distinct sinulus defined by a strongly inbent point in the outer lip, which is thin and expanded; parietal lamella strong and rather long; angular lamella small; a minute infraparietal tubercle commonly present; columellar lamella strong; basal fold well developed but small and thin, in a subcolumellar position; a minute infrapalatal fold in the basal margin commonly below it; upper and lower palatal folds strong and standing on a tinted callus ridge, a minute suprapalatal tubercle commonly above them (modified from Pilsbry, 1948, p. 953).

Ecology.—Its wide distribution indicates that this is a species that can adapt itself to many variations of climate and of soil. Hibbard and Taylor (1960; see Association S-2, this bulletin, p. 32) described the habitat as moist leaf mold and plant debris: under logs and bark, or among leaves, moss, or grass in moist situations not far from water. Oughton (1948, p. 94 ff.) found it in wet locations, such as floodplains of creeks, margins of ponds, streams, and marshes, in Ontario. Burch (1955, Naut. 69, p. 66) has shown its relationships to soil factors in eastern Virginia. Beetle (1962, Naut. 76, p. 74) has collected it from moss, near a pond in Wyoming. Teskey (1955, Naut. 69, p. 70-71) has found it in a cattail swale at the edge of a man-made pond in Georgia. Dawley (1955, Naut. 69, p. 60) noted that it is found especially on cattails or grasses on the edge of lakes or swamps, in Minnesota.

Associations.—Living: MICHIGAN-17, 19, 22; OHIO-43; ONTARIO-2, 3, 7. Fossil: N-1, 2; A-1; K-1, 4, 5; Y-2, 3, 5, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20; S-1, 2, 3, 4, 5, 6; W-28, 35, 48, 49, 50, 51, 67.

General distribution (fig. 591).—Labrador west to British Columbia and Alaska; south to Florida, Mexico, and the West Indies. The typical form is not recorded south of Oregon on the west coast but it penetrates southward to Arizona and Texas and into Mexico.

Distribution in Ohio (inset, fig. 591).—Sterki (1907a, p. 379) gave "over the state" but records are few. Eggleston (ms. records) gave Athens County, and there are specimens from Fulton and Mercer Counties in the University of Michigan collections.

Geologic range.—F. C. Baker (1920a, p. 388) gave Yarmouth, Peorian, and "Wabash." Lower Pliocene (Laverne Formation, Kansas) to present. Late Wisconsin, Castalia marl, Erie County, Ohio (Sterki, 1920, p. 180). Hibbard and Taylor (1960, p. 135) gave early Pliocene to Recent. Additional Ohio records are for the Newell Lake deposit (Zimmerman, 1960, p. 20), the Jewell Hill deposit (Mowery, 1961, p. 12), and the Castalia deposit (Clark, 1961, p. 27).

Vertigo elatior Sterki 1894
Fig. 592

Vertigo ventricosa var. *elatior* Sterki 1894, Land and fresh water Moll., New Philadelphia, p. 5.
Vertigo gouldii lagganensis Pilsbry 1899, Acad. Nat. Sci. Philadelphia Proc., p. 314, fig. 1.
Vertigo elatior Sterki 1920, Ohio Jour. Sci., v. 20,

p. 181.

Vertigo elatior F. C. Baker 1920, Life of Pleistocene, p. 388.

Vertigo gouldii loessensis F. C. Baker 1928, Nautilus, v. 41, p. 135.

Vertigo elatior Pilsbry 1931, Man. Conchology, v. 28, p. 93, pl. 15, fig. 2.

Vertigo ventricosa elatior Goodrich 1932, Moll. Mich., p. 24.

--- --- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.

--- --- --- Oughton 1948, Zoögeogr. study, Ontario, p. 64.

Vertigo elatior Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 956, figs. 514; 515, 6.

Vertigo ventricosa elatior Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 37, pl. 4, fig. 22.

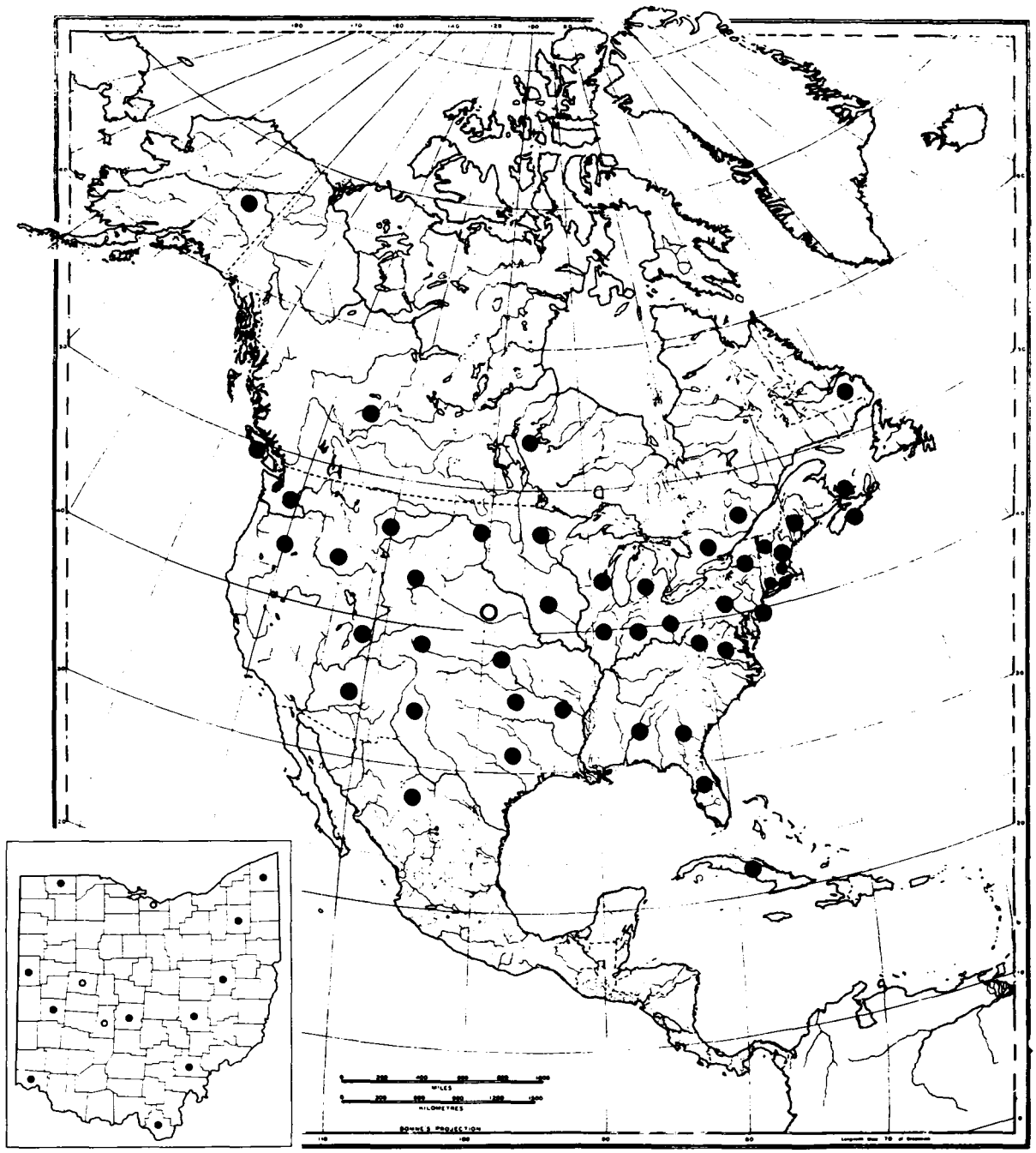

FIGURE 591.–Distribution of *Vertigo ovata* in North America; *inset,* distribution in Ohio.

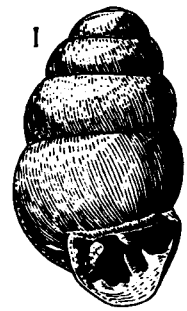

FIGURE 592.–*Vertigo elatior*, magnified; after F. C. Baker (1939a, p. 106).

Vertigo elatior La Rocque 1953, Cat. Recent Moll. Canada, p. 334.
--- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 44.

Type locality.–New Philadelphia, Tuscarawas County, Ohio.

Diagnosis.–Shell larger and more elevated than

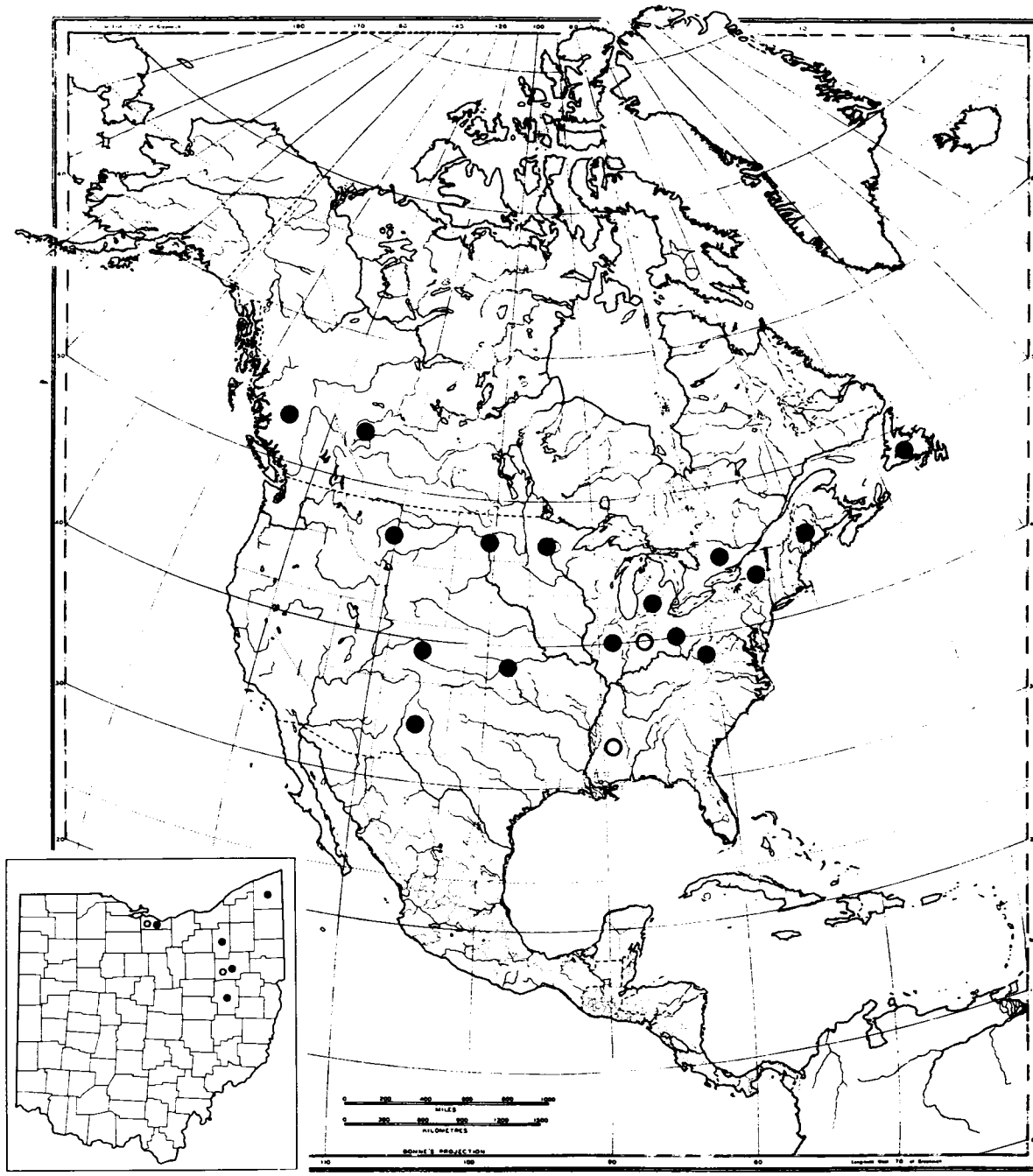

FIGURE 593.–Distribution of *Vertigo elatior* in North America; *inset*, distribution in Ohio.

that of *V. ventricosa,* with a rather acute apex; palatal callus strong, basal fold well developed; external impression over the lower palatal fold distinct, deeper than in *V. pygmaea;* suprapalatal fold commonly developed; angular lamella rarely present.

Ecology.—A hardy species typical of rigorous climate zones but able to survive in mountainous areas to the south.

H. B. Baker (1922b) recorded this species for the floodplain of Hancock Creek, about 2 feet above July level of water, in Dickinson County, Michigan. Beetle (1962, Naut. 76, p. 74) found it in an aspen grove, under leaves, in Wyoming.

Associations.—Living: MICHIGAN-40; OHIO-43. Fossil: K-6, 7; Y-1; I-5, 7; W-28, 63, 64, 65, 66, 69, 70.

General distribution (fig. 593).—Newfoundland west to British Columbia, south to New Mexico; absent on the west coast and from the Rocky Mountain region in general.

Distribution in Ohio (inset, fig. 593).—Summit, Stark, and Tuscarawas Counties (Sterki, 1907a, p. 379). Also found in the State as a fossil.

Geologic range.—Pleistocene (Aftonian to Wisconsin) in Indiana, Illinois, and Ohio (Castalia marl, Sterki, 1920, p. 181). F. C. Baker (1920a, p. 388) gave Sangamon and "Wabash." Wayne (1954, p. 1320) has recorded it for pro-Kansan loess in Putnam County, Indiana. Sheatsley (1960, p. 114) has identified it from the Aultman deposit, Ohio.

Vertigo ventricosa (Morse) 1865
Fig. 594

Isthmia ventricosa Morse 1865, N.Y. Lyceum Nat. History Annals, v. 8, p. 207.
Vertigo approximans Sterki 1890, Nautilus, v. 3, p. 136.
Vertigo ventricosa Dall 1905, Harriman-Alaska Exped., v. 13, p. 31, figs. 19a, b.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
--- --- Goodrich 1932, Moll. Mich., p. 24.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276, loess, Posey County.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 63.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 957, fig. 515, 1-3.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 336.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 51.

Type locality.—Not specified. Morse probably described Maine specimens but to my knowledge no type locality has been designated by him or by any subsequent author.

Diagnosis.—Shell umbilicate, ovate, conic, smooth, polished; apex obtuse; suture deep; whorls 4, convex; aperture semicircular, with five teeth, one prominent on the parietal margin, two smaller on the columellar margin, and two, prominent within, contracting the aperture at the base; peristome widely reflected, the right margin flexuose, within thickened and colored (Morse, quoted by Pilsbry, 1948, p. 957).

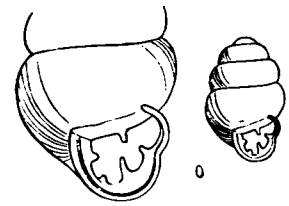

FIGURE 594.—*Vertigo ventricosa,* magnified; after Walker (1928, p. 144, fig. 221).

Ecology.—In Ontario, Oughton (1948, p. 94 ff.) found this species in wet locations, such as floodplains of creeks and rivers, margins of ponds, streams, and marshes. Muchmore (1959, Naut. 72, p. 85-88) collected it under stones in various woodland areas in New York State. Archer (1934c, p. 139) found it common in the limestone talus on Mackinac Island, Michigan. Grimm (1959, Naut. 72, p. 126) listed it from around foundations of an old burned house and from a field in Maryland.

Associations.—Living: MICHIGAN-8, 18; MINNESOTA-3, 4; OHIO-43.

General distribution (fig. 595).—Prince Edward Island and Quebec (Magdalen Islands) south to New England and New York, west to Ontario, Ohio, Illinois, and Missouri.

Distribution in Ohio (inset, fig. 595).—"Over the state" (Sterki, 1907a, p. 379). Eggleston (ms. records) has no specimens and the only record in the University of Michigan collections is for fossil specimens from Butler County. Its absence from the Castalia marl is notable.

Geologic range.—Loess of Posey County, Indiana (Goodrich and van der Schalie, 1944, p. 276). Pilsbry (1948) does not record it as a fossil.

Vertigo pygmaea (Draparnaud) 1801
Fig. 596

Pupa pygmaea Draparnaud 1801, Tabl. Moll. France, p. 57.
Vertigo callosa Sterki 1890, Acad. Nat. Sci. Philadelphia Proc., p. 31 (not of Reuss, 1849).
Pupa (Nearctula) superioris Pilsbry 1899, Nautilus, v. 12, p. 103.
Vertigo (Isthmia) pygmaea Dall 1905, Harriman-Alaska Exped., v. 13, p. 33.
Vertigo pygmaea Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 379.
--- --- Pilsbry 1919, Man. Conchology, v. 25, p. 96.

Vertigo pygmaea Oughton 1948, Zoögeogr. study, Ontario, p. 62.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 961, fig. 515, 11, 12.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 37, pl. 4, fig. 12.
--- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 336.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 49.

Type locality.—Europe. Draparnaud's specimens probably came from France.

Diagnosis.—Shell cylindric-oval, some shade of brown, glossy, with only weak traces of striation; whorls moderately convex, the last with a strong light-colored rounded crest a short distance behind the peristome; parietal lamella strong but rather short, median;

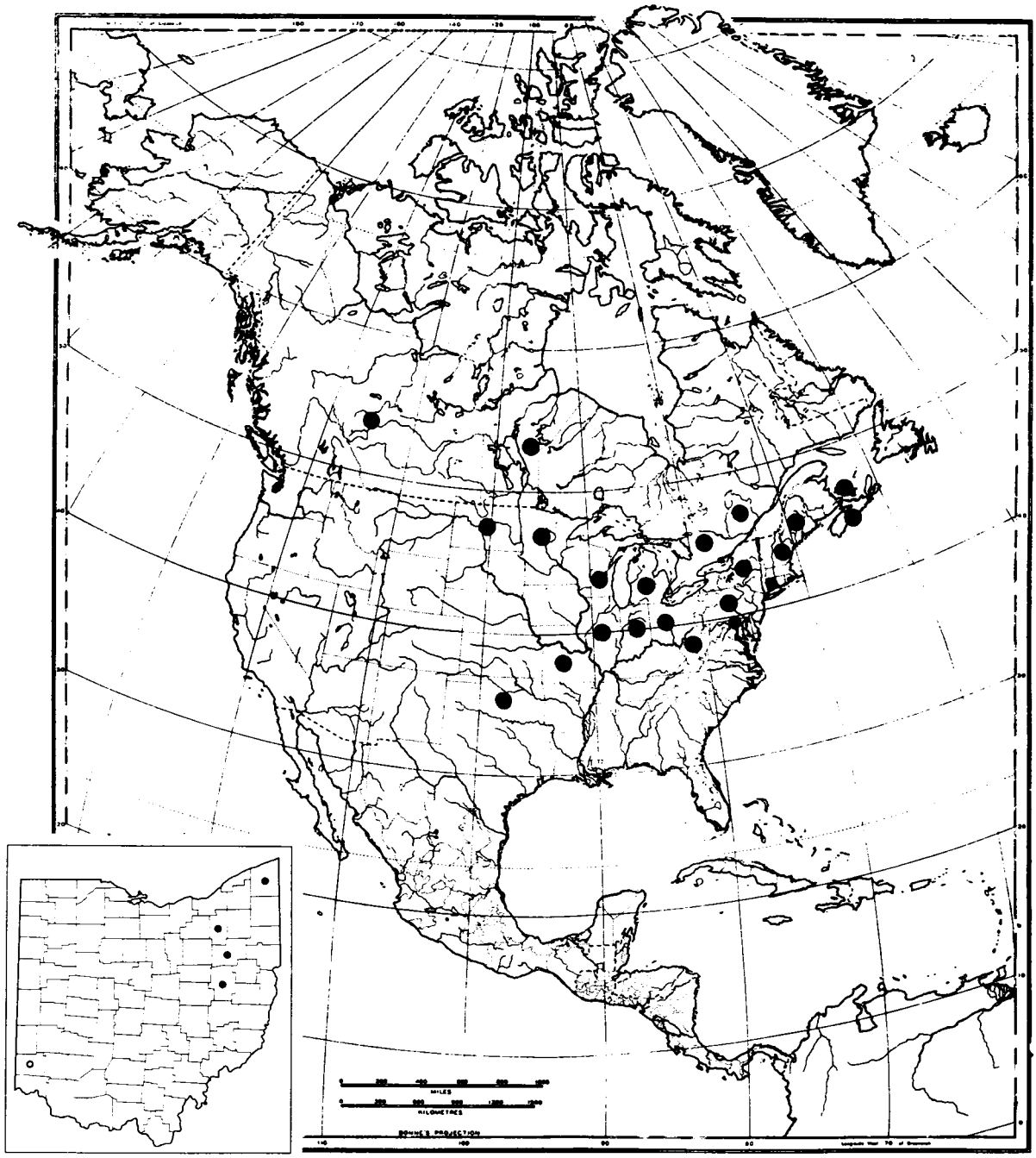

FIGURE 595.—Distribution of *Vertigo ventricosa* in North America; *inset,* distribution in Ohio.

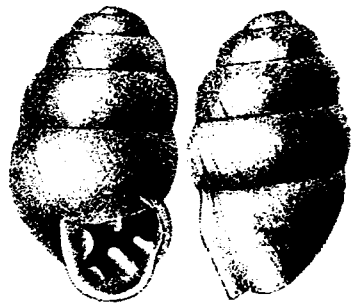

FIGURE 596.—*Vertigo pygmaea*, magnified; after Pilsbry (1948, p. 958, figs. 11, 12).

columellar lamella deeply placed, short, ascending inwardly; both palatal folds strong, the lower one longer, both standing on a strong callus; basal fold very small, rarely absent; a suprapalatal fold commonly present; peristome narrowly expanded, colored like the shell; the outer lip only slightly incurved (modified from Pilsbry, 1948, p. 961).

Ecology.—This species, at least in North America, seems to be partial to lime-rich Paleozoic soils; it is a hardy species, capable of surviving in the rigorous

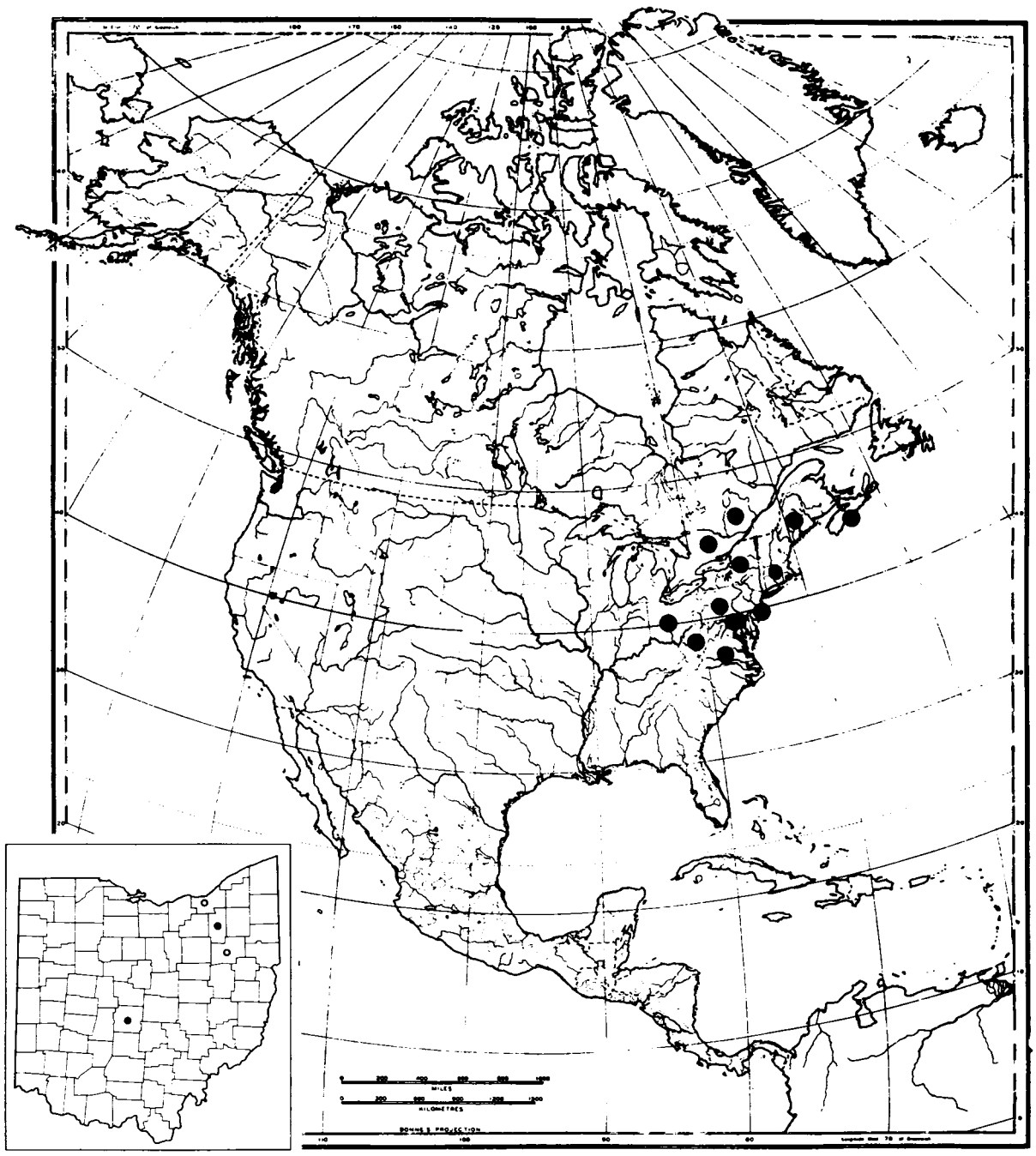

FIGURE 597.—Distribution of *Vertigo pygmaea* in North America; *inset*, distribution in Ohio.

climate of the Hudson Bay area, but it has spread as far south as Virginia so that it is probable that lime content of substrate is a more important factor for this species than cool climate.

Oughton (1948, p. 94 ff.) noted it somewhat doubtfully as a species of floodplains of creeks and rivers; in Ontario, it is confined to Paleozoic terranes, mainly limestones. Grimm (1959, Naut. 72, p. 126) found it in fields and near railroad tracks in Maryland.

General distribution (fig. 597).—Nova Scotia, Quebec, and Ontario; Maine to Virginia and west to Ohio.

Distribution in Ohio (inset, fig. 597).—It appears to be rare in the State, as the record rests on Sterki's (1907a, p. 379; 1914, p. 272) collections for Franklin and Summit Counties. I have no other record.

Geologic range.—Sangamon, Farmdale? loess; lower and upper pro-Tazewell loess, Cleveland area (Leonard, 1953, p. 372). Late Wisconsin, Aultman deposit, Stark County, Ohio (Sheatsley, 1960, p. 117).

Vertigo tridentata Wolf 1870
Fig. 598

Vertigo tridentata Wolf 1870, Am. Jour. Conchology, v. 5, p. 198, pl. 17, fig. 1.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380.
--- --- Pilsbry 1919, Man. Conchology, v. 25, p. 106.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 181.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Goodrich 1932, Moll. Mich., p. 24.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 276.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 63.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 965, fig. 518, 1-3.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 26, pl. 6, fig. G.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 26, pl. 5, fig. F; fig. 10.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 336.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 50.

Type locality.—Canton, Illinois.

Diagnosis.—Shell ovate to tapering oblong, honey yellow, shading to somewhat browner below, paler above; surface smooth, with only faint indications of striae, glossy; last whorl somewhat flattened externally over the lower palatal fold and with a rather narrow but generally distinct crest behind the lip; outer lip projecting forward and slightly inward near the middle; parietal lamella high, rather short; columellar lamella blunt, directed downward; lower palatal fold strongly developed; upper palatal fold quite small or occasionally wanting; these folds standing on a more or less distinct palatal callus; angular lamella and basal fold never developed (modified from Pilsbry, 1948, p. 965).

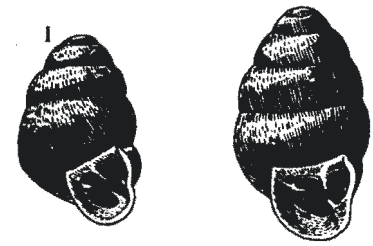

FIGURE 598.—*Vertigo tridentata,* magnified; after F. C. Baker (1939a, p. 106).

Ecology.—"Abundant in shady copses on green weeds, climbing as high as three feet from the ground. I collected 12,000 from standing weeds and not one from the ground, although it was searched well to find them" (Wolf, 1870).

Oughton (1948, p. 95) recorded it somewhat doubtfully as a species of floodplains of creeks and rivers in Ontario. H. B. Baker (1922b) found it in Dickinson County, Michigan, on high moraines with fine hardwood cover, particularly in maple logs. Grimm (1959, Naut. 72, p. 126) collected it from a quarry and from the ruins of a building in Maryland.

Associations.—Living: OHIO-43. Fossil: K-17; W-2, 28.

General distribution (fig. 599).—Maine and Quebec west to Ontario and Minnesota; south to New Jersey, Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Missouri, and Texas.

Distribution in Ohio (inset, fig. 599).—The only record is Sterki's (1907a, p. 380) for Summit, Tuscarawas, Franklin, Miami, and Hamilton Counties. Eggleston has no records and there are no Ohio specimens in the University of Michigan collections.

Geologic range.—F. C. Baker (1920a, p. 388) gave Sangamon and "Wabash." Yarmouth to Recent (Leonard, 1950, p. 26). Late Wisconsin, Castalia marl, Erie County, Ohio (Sterki, 1920, p. 181).

Vertigo alpestris oughtoni Pilsbry 1948
Fig. 600

Vertigo alpestris var., Oughton 1940, Nautilus, v. 53, p. 128.
Vertigo alpestris Oughton 1948, Zoögeogr. study, Ontario, p. 55.
Vertigo alpestris oughtoni Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 968, fig. 519.
--- --- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.
--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 333.

Vertigo alpestris oughtoni La Rocque and Forsyth 1957, Sidney Cut, p. 85 ff.

Type locality.—Lake Harbour, Baffin Island, Northwest Territories, Canada.

Diagnosis.—"The shortly cylindric shell, with rounded summit, convex whorls and well impressed suture, is like *V. alpestris* Alder . . . in form, and in the absence of a crest or of any external impressions behind the outer lip; but it is smoother than *V. alpestris*, the shining surface showing only weak, irregular striae (*V. alpestris* being distinctly, closely striate, especially on the penult whorl). The color is a dilute, slightly transparent hazel, fading to whitish on the summit. The slightly straightened but not in-bent lip is brown. Teeth are smaller than in *V. alpestris*, those present (typically) being the parietal, a low columellar (which is often wanting), and a small lower-palatal fold

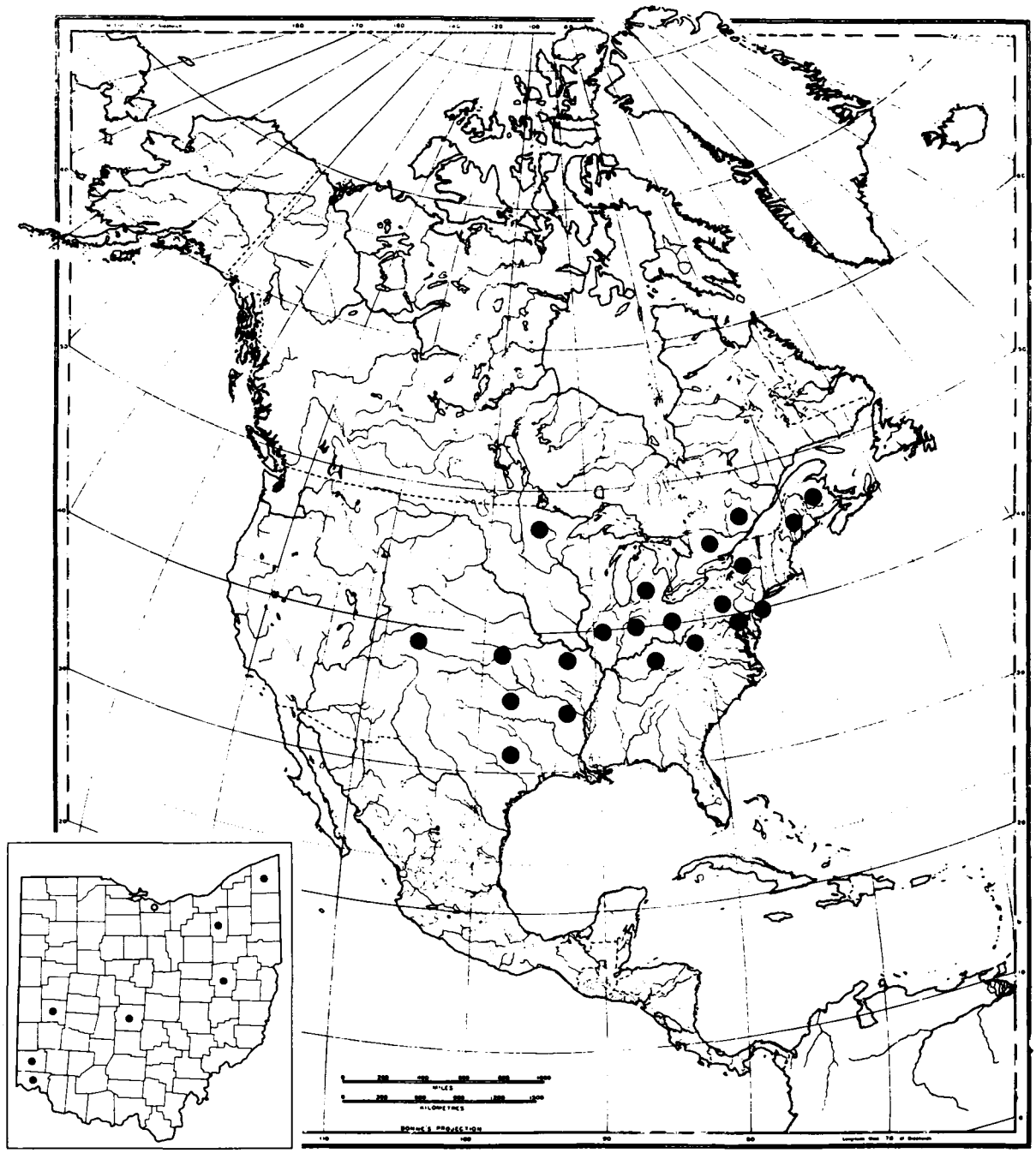

FIGURE 599.—Distribution of *Vertigo tridentata* in North America; *inset*, distribution in Ohio.

(which may be absent) (Pilsbry, 1948, p. 968-969, original description).

Ecology.—Wayne (1959b, p. 94) has collected living specimens from a boggy flat and from the adjacent slope up to about 2 meters above the muskeg water level at the Churchill, Manitoba, airstrip; most of the specimens were beneath pieces of fallen spruce wood and crating lumber.

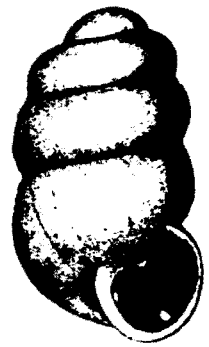

FIGURE 600.—*Vertigo alpestris oughtoni*, magnified; after Pilsbry (1948, p. 968, fig. 519).

Associations.—Living: MANITOBA-39. Fossil: K-6; S-7; W-43, 44, 60, 61, 64, 66, 67, 68, 69.

General distribution (fig. 601).—Europe and Siberia; Baffin Island, Northwest Territories; Quebec: Anticosti Island (doubtful); Ontario: Fort Severn, Hudson Bay. Pleistocene of Ohio and Indiana.

Distribution in Ohio (inset, fig. 601).—The species is known in the State only as a fossil; see below.

Geologic range.—Sangamon, Farmdale? loess; lower and upper pro-Tazewell loess, Cleveland area (Leonard, 1953, p. 372 ff.); early Wisconsin, Sidney Cut, Shelby County (La Rocque and Forsyth, 1957, p. 85 ff.). Indiana: Wisconsin silts. Clayton section, NE¼ NW¼ sec. 26, T. 15 N., R. 1 W., Hendricks County, 10.8 percent of assemblage (Thornbury and Wayne, 1957, p. 5); Cagle silt, Kansan, Putnam County, Indiana, 0.3 percent of assemblage (*ibid.*, p. 15); Wisconsin silt, Buckhart Creek section, Johnson County, 4.3 percent of assemblage (*ibid.*, p. 27). Aultman deposit, Stark County, Ohio (Sheatsley, 1960, p. 112).

Vertigo parvula Sterki 1890
Fig. 602

Vertigo parvula Sterki 1890, Nautilus, v. 3, p. 136.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380.
--- --- Pilsbry 1919, Man. Conchology, v. 25, p. 105, pl. 12, figs. 7, 9.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 969, fig. 518, 7, 9.

Type locality.—Summit County, Ohio. This type locality can be arrived at by elimination, although none is given by Pilsbry (1948, p. 969). In the original description (Sterki, 1890, Naut. 3, p. 136), specimens of this species are said to have come from Summit and Lake Counties, Ohio. In the Catalogue (Sterki, 1907a, p. 380) only Summit County is mentioned. Later (Pilsbry, 1919, p. 105) only Summit County is mentioned for Ohio, but the North Carolina locality is mentioned, apparently for the first time. The types are no. 270 of the Sterki collection and I assume that they came from the original lot, therefore from Summit County, Ohio.

Diagnosis.—Shell minute, subcylindric, tapering very little upward, the summit obtuse; thin, subtransparent, slightly yellowish, smooth and glossy, becoming finely striate behind the outer lip; whorls moderately convex, the last whorl well rounded, slightly impressed behind the projection of the outer lip; aperture somewhat triangular with three teeth; parietal lamella rather short and high; columellar lamella short, steeply ascending inwardly; lower palatal fold rather high in front, rapidly becoming lower as it recedes, penetrating to the dorsal side; peristome very little everted, slightly thickened, and having a distinct callus ridge within; outer lip projecting forward and slightly bent inward above the middle; length 1.55, diameter 0.85 mm.; barely 5 whorls (Pilsbry, 1948, p. 970).

Ecology.—Practically nothing has been recorded on the ecology of this species. Sterki (1890, Naut. 3, p. 136) described the species from Summit and Lake Counties in Ohio and later added that it also occurred "in the mountains of North Carolina." It has not, to my knowledge, been collected again in Ohio and the only recent mention of it that I know of is MacMillan's (1944, Naut. 57, p. 127-129) account of it, which includes no ecologic data. If the species was indeed collected in either Summit or Lake Counties in Ohio, it came from a glaciated region in which the bedrock is extremely varied. In Lake County, the bedrock may have been either Devonian shales, Mississippian limestones and sandstones, or the varied shales, limestones, and sandstones of the Pennsylvanian. In Summit County, the same rocks are represented but there is only a very small area of Devonian exposed. The variety of bedrock makes it hazardous to come to any conclusion on the relationship of this species to the calcium carbonate content of its presumed locality. The North Carolina locality is Hollow Poplar Creek, Mitchell County.

General distribution (fig. 603).—Ohio, Virginia, Tennessee, North Carolina.

Distribution in Ohio (inset, fig. 603).—Summit County, perhaps also Lake County. Lake County is mentioned in the original description but Sterki gives only Summit County in his Catalogue (1907a, p. 380). Apparently, there is no other record for the species in Ohio.

Geologic range.—Unknown.

Remarks.—This species has been collected only once, to my knowledge, in Ohio. Either it is a very rare species, as Pilsbry (1948, p. 970) believed, or it has been confused with other species in subsequent collections.

Vertigo gouldii (Binney) 1843
Pl. 17, fig. 10

Pupa gouldii Binney 1843, Boston Soc. Nat. History Proc., v. 1, p. 105.
Vertigo gouldii Dall 1905, Harriman-Alaska Exped., v. 13, p. 30, fig. 17a, b.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380.
--- --- Pilsbry 1919, Man. Conchology, v. 25, p. 98.
Vertigo gouldi Goodrich 1932, Moll. Mich., p. 24.
Vertigo gouldii Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 277.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 58.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 37, pl. 4, fig. 4.
Vertigo gouldi Pilsbry 1948, Land Moll. N. America,

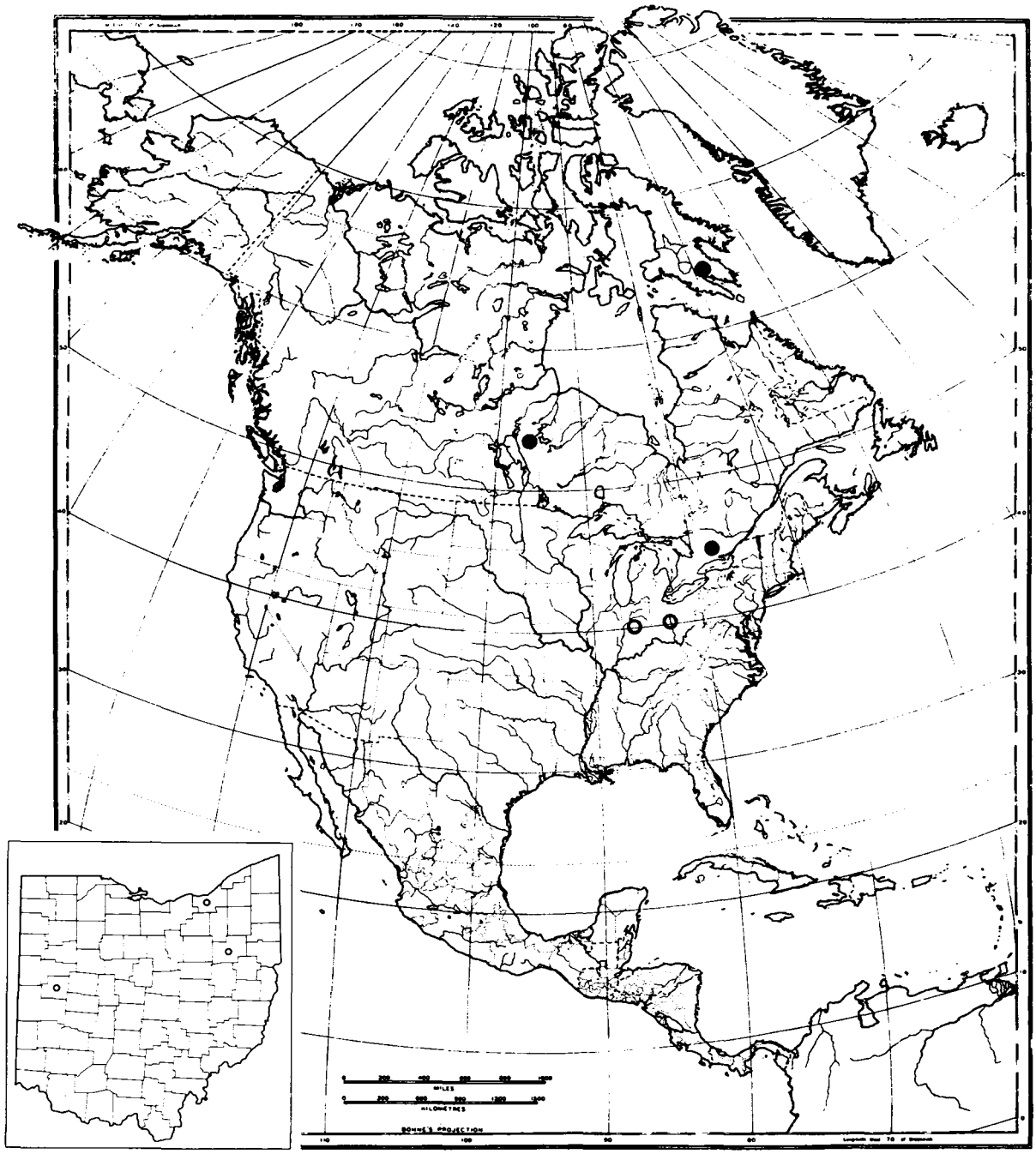

FIGURE 601.–Distribution of *Vertigo alpestris oughtoni* in North America; *inset,* distribution in Ohio.

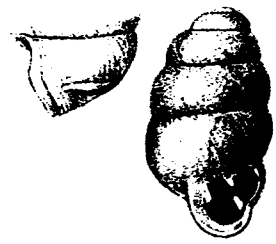

FIGURE 602.–*Vertigo parvula*, magnified; after Pilsbry (1948, p. 967, figs. 7, 9).

v. 2, pt. 2, p. 971, fig. 515, 4, 5, 8, p. 958.
Vertigo gouldi Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 27, pl. 6, fig. E.
Vertigo gouldii gouldii La Rocque 1953, Cat. Recent Moll. Canada, p. 334.
Vertigo gouldi Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 134.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 45.

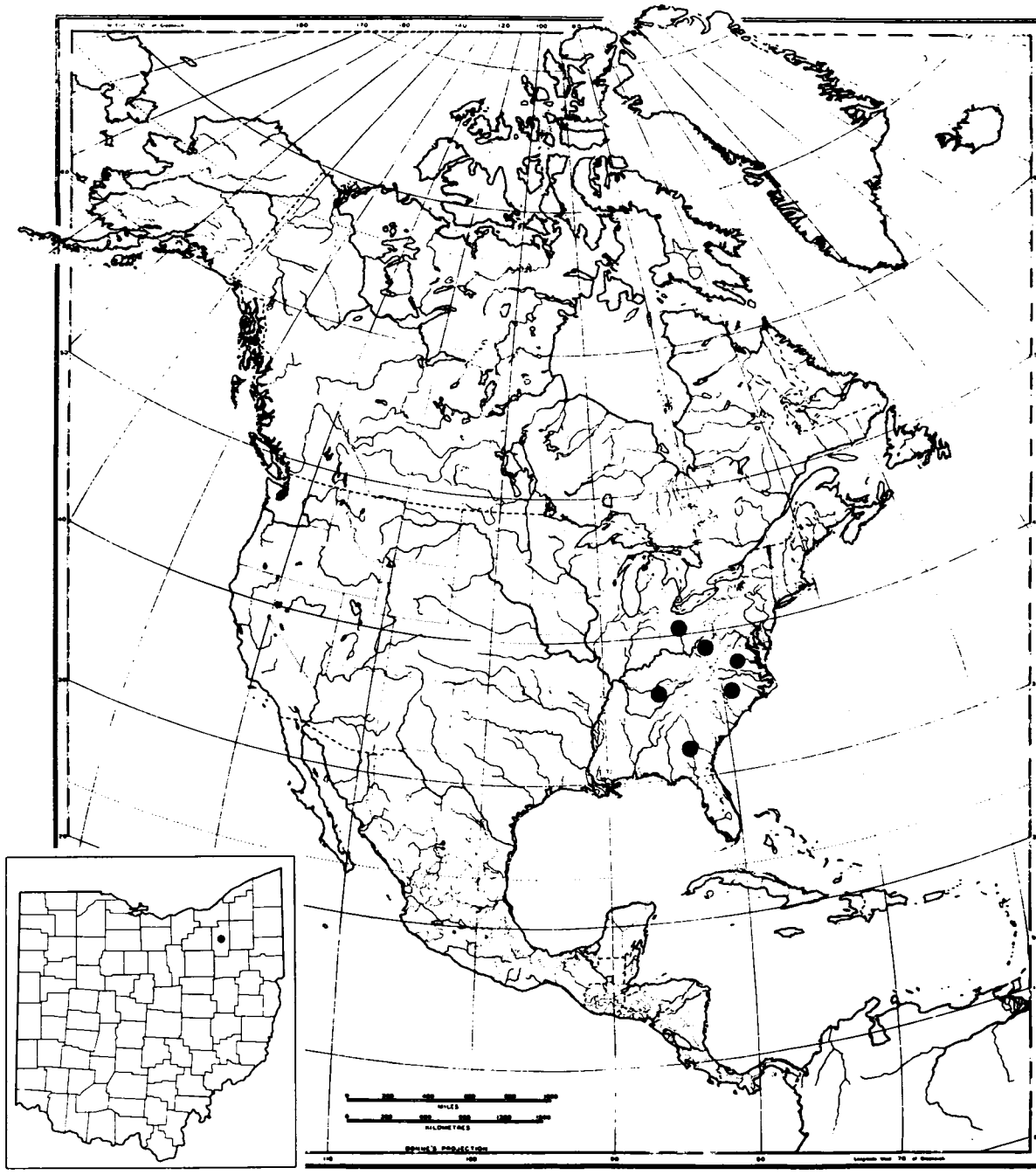

FIGURE 603.–Distribution of *Vertigo parvula* in North America; *inset*, distribution in Ohio.

Type locality.—Brookline, Massachusetts.

Diagnosis.—Shell oval to cylindric-oblong, light chestnut colored, closely and sharply striate, especially the penult whorl; last whorl with a crest close behind the lip; aperture with an upper bay or sinulus, the outer lip flattened or a little inflexed below it, being slightly biarcuate; teeth white; angular lamella only rarely present; parietal lamella strong and rather long; columellar lamella strong, a subcolumellar basal fold below it; two parietal folds strong, rather near together, the lower a little farther inward (Pilsbry, 1948, p. 972).

Ecology.—Hibbard and Taylor (1960; see Association S-2, this bulletin, p. 32) gave the habitat of this species as moist leaf mold and plant debris: under logs and bark, or among leaves, moss, or grass in moist situations not far from water. Oughton (1948, p. 94 ff.) found it in Ontario in wet locations. H. B. Baker (1922b) gave two habitats: (41) hardwoods on high mo-

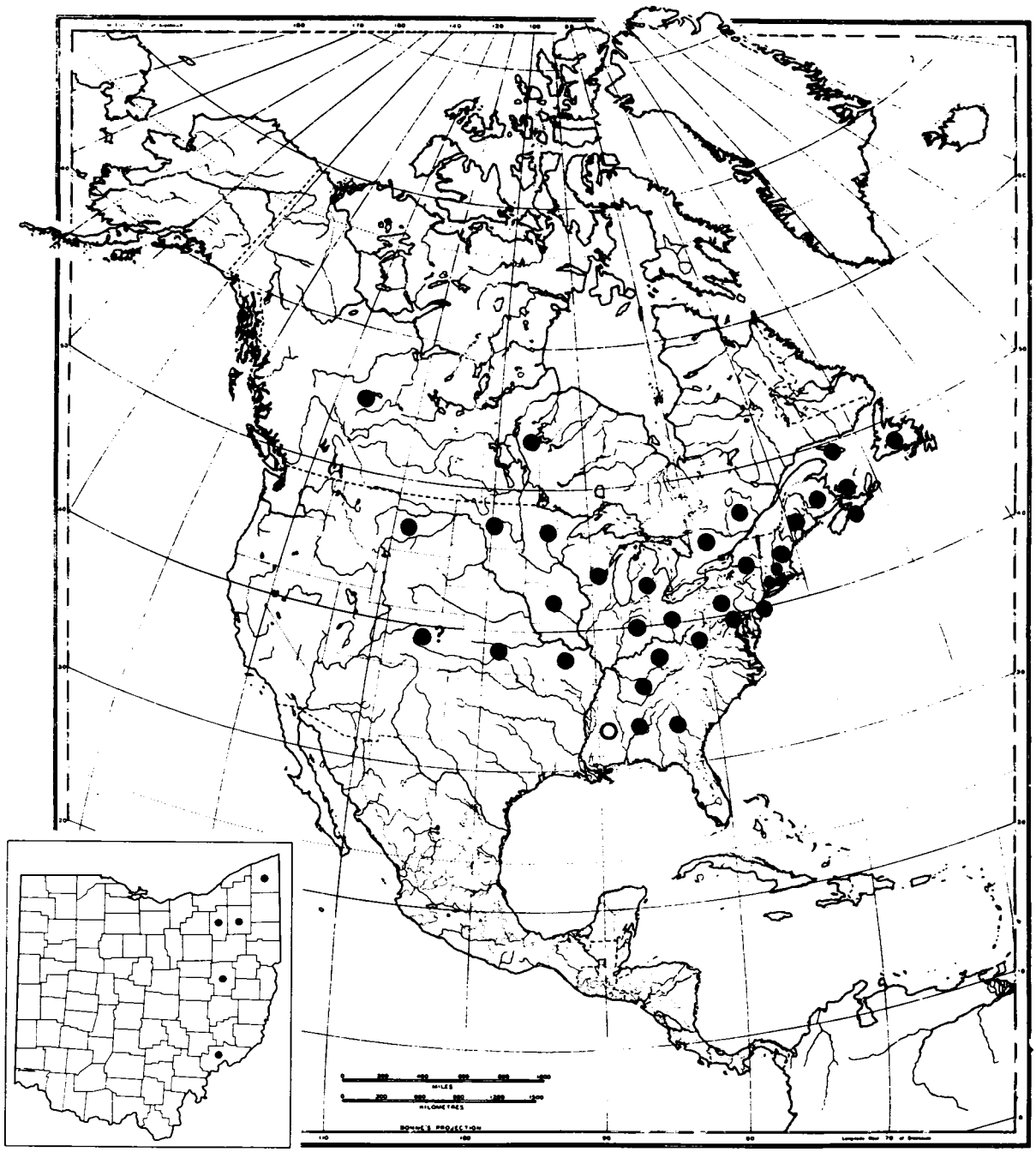

FIGURE 604.—Distribution of *Vertigo gouldii* in North America; *inset,* distribution in Ohio.

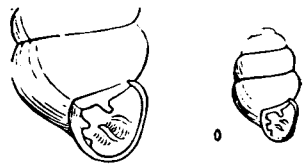

FIGURE 605.—*Vertigo bollesiana,* magnified; after Walker (1928, p. 146, fig. 223).

raines of the Calumet Trough, particularly in maple logs; (42) quite common in a cedar-tamarack bog, under bark of freshly cut cedar stumps; both localities in Dickinson County, Michigan. Muchmore (1959, Naut. 72, p. 85-88) recorded it under stones in various woodland areas in New York State.

Associations.—Living: OHIO-43; ONTARIO-2. Fossil: S-6; W-73. *V. gouldii hannai,* fossil: K-7; W-70. *V. gouldii hubrichti,* fossil: K-6; W-62, 65. *V. gouldii paradoxa,* fossil: W-4, 6, 7, 9, 12, 15, 17, 19.

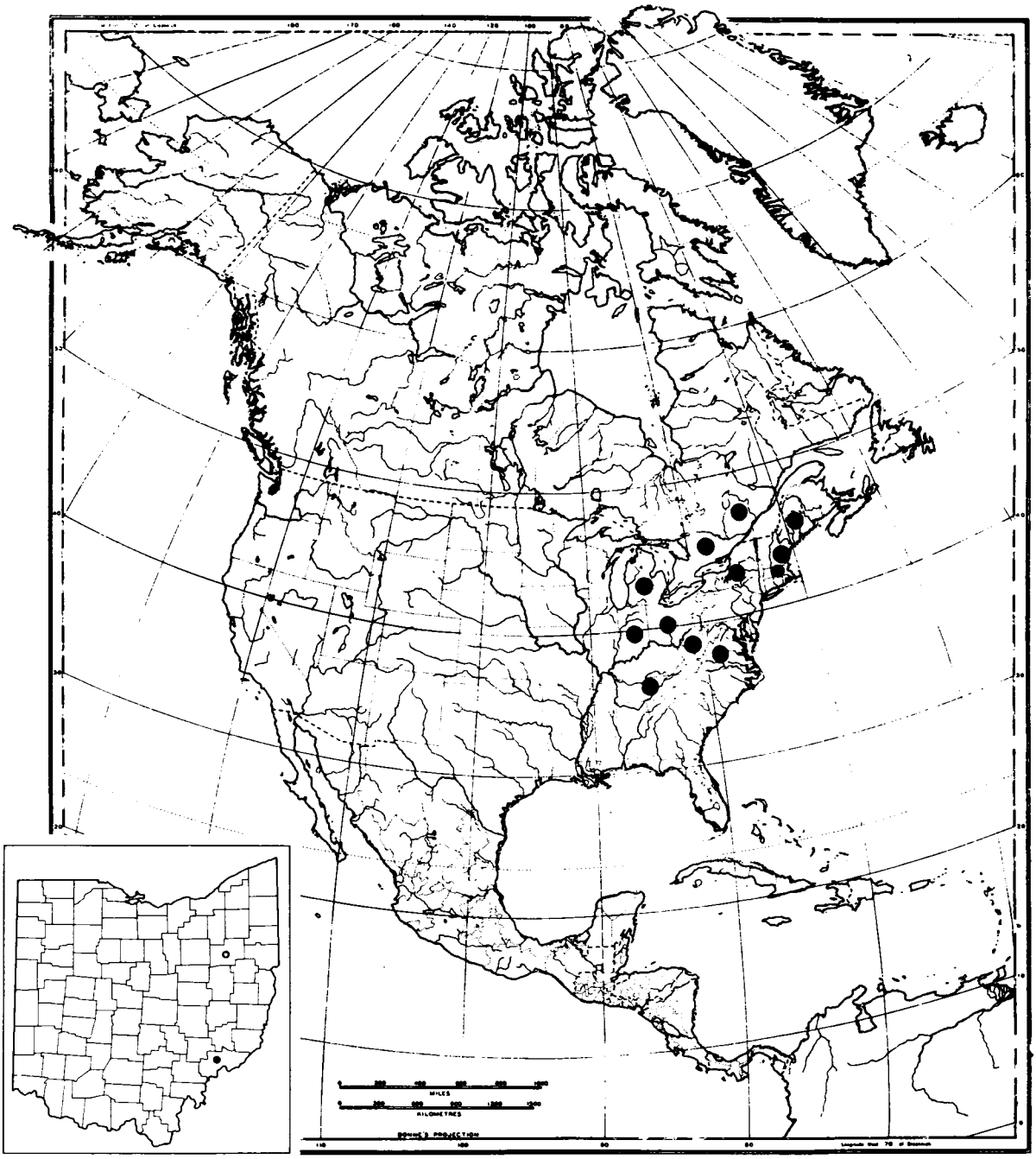

FIGURE 606.—Distribution of *Vertigo bollesiana* in North America; *inset,* distribution in Ohio.

General distribution (fig. 604).—Prince Edward Island, Quebec, Ontario, and Michigan, south to Maine, New York, Ohio, Kentucky, Tennessee, and Alabama, west to Indiana and Missouri (typical form); varieties are found much farther west.

Distribution in Ohio (inset, fig. 604).—Probably all over the state" (Sterki, 1907a, p. 380), but specifically mentioned only for Summit, Portage, and Tuscarawas Counties; Eggleston (ms. records) has specimens from Washington County.

Geologic range.—Yarmouth to Recent, Kansas (Leonard, 1950, p. 27). No specific record from Ohio Pleistocene deposits. Late Illinoian (Butler Springs local fauna) to present (Hibbard and Taylor, 1960, p. 134).

Remarks.—Many subspecies are recognized by Pilsbry (1948, p. 972 ff.) of which the following, and perhaps others, may be found in Ohio, either as living snails or fossils:

V. gouldi paradoxa Sterki has been recorded by Leonard (1952, p. 25) in Peoria loess in the Tazewellian faunal zone, in Kansas. It is found in Ontario (Oughton, 1948, p. 59) and Michigan (Pilsbry, 1948, p. 972) but not, so far, in Ohio.

V. gouldii cristata Sterki (Pilsbry, 1948, p. 973) is recorded by Oughton (1948, p. 58) from Lakes Erie and Ontario north almost to James Bay and Borthwick Lake. It may occur on the islands of Lake Erie and on the Lake Erie shore of Ohio.

Vertigo bollesiana (Morse) 1865
Fig. 605

Isthmia bollesiana Morse 1865, N.Y. Lyceum Nat. Hist. Annals, v. 8, p. 209, figs. 4-6.
Vertigo bollesiana Pilsbry 1919, Man. Conchology, v. 25, p. 101.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Goodrich 1932, Moll. Mich., p. 24.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 277.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 56.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 981, fig. 515, 9, 10, p. 958.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 37.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 333.
--- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.

Type locality.—Orono, Maine.

Diagnosis.—Shell minutely perforate, cylindrical-ovate, delicately striated, subtranslucent; apex obtuse; suture well defined; whorls four, subconvex; aperture suborbicular, somewhat flattened on its outer edge; with five teeth, one prominent and rather curved on the parietal margin, and two slightly elevated lamelliform teeth within and at the base, peristome subreflected and thickened (Pilsbry, 1948, p. 981).

Ecology.—Found under dead leaves and on bark, in hardwood groves. In Ontario, Oughton (1948, p. 94 ff.) has found this species both in damp woodlands, especially those of deciduous trees, and in drier more open woods or fields.

Associations.—Living: ONTARIO-2.

General distribution (fig. 606).—Maine, New York, Ontario, and Michigan, south to Indiana, Tennessee, and Virginia; the records west and south of New York are somewhat doubtful.

Distribution in Ohio (inset, fig. 606).—Sterki, quoted by Pilsbry (1948, p. 981), stated that he had no specimens from Michigan and Ohio. Eggleston (ms. records) had one lot from Washington County. I have no other records.

Geologic range.—F. C. Baker 1920a, p. 388) gave only Yarmouth. Pro-Kansan loess, Putnam County, Indiana (Wayne, 1954, p. 1320). This appears to be the only fossil record for the species but it suggests that it should be found in later Pleistocene deposits in the midwest and particularly in Ohio. Sheatsley (1960, p. 113) has recorded it for the Aultman deposit, Stark County, Ohio, late Wisconsin.

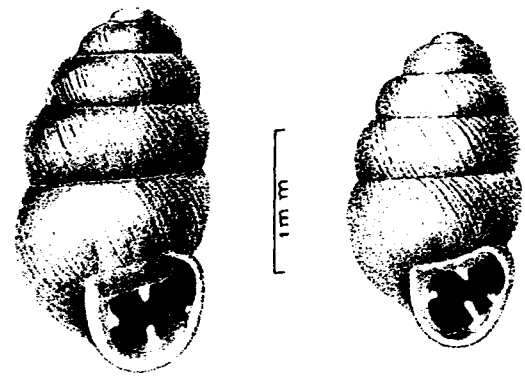

FIGURE 607.—*Vertigo modesta*, magnified; after Pilsbry (1948, p. 991, figs. 1, 2).

Vertigo modesta (Say) 1824
Fig. 607

Pupa modesta Say 1824, Long's Exped., App., p. 259, pl. 15, fig. 5.
Pupa decora Gould 1848, Boston Soc. Nat. History Proc., v. 2, p. 263.
Vertigo modesta Dall 1905, Harriman-Alaska Exped., v. 13, p. 29.
Vertigo decora Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380.
Vertigo modesta Pilsbry 1919, Man. Conchology, v. 25, p. 123.

Vertigo modesta F. C. Baker 1920, Life of Pleistocene, p. 388.
Pupilla decora F. C. Baker 1920, *ibid.*
Vertigo modesta Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 277.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 60.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 982, fig. 527; fig. 528, 1-3; p. 991, fig. 531, 1, 2.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 27, pl. 6, fig. H.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 25, pl. 5, fig. H.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 335.

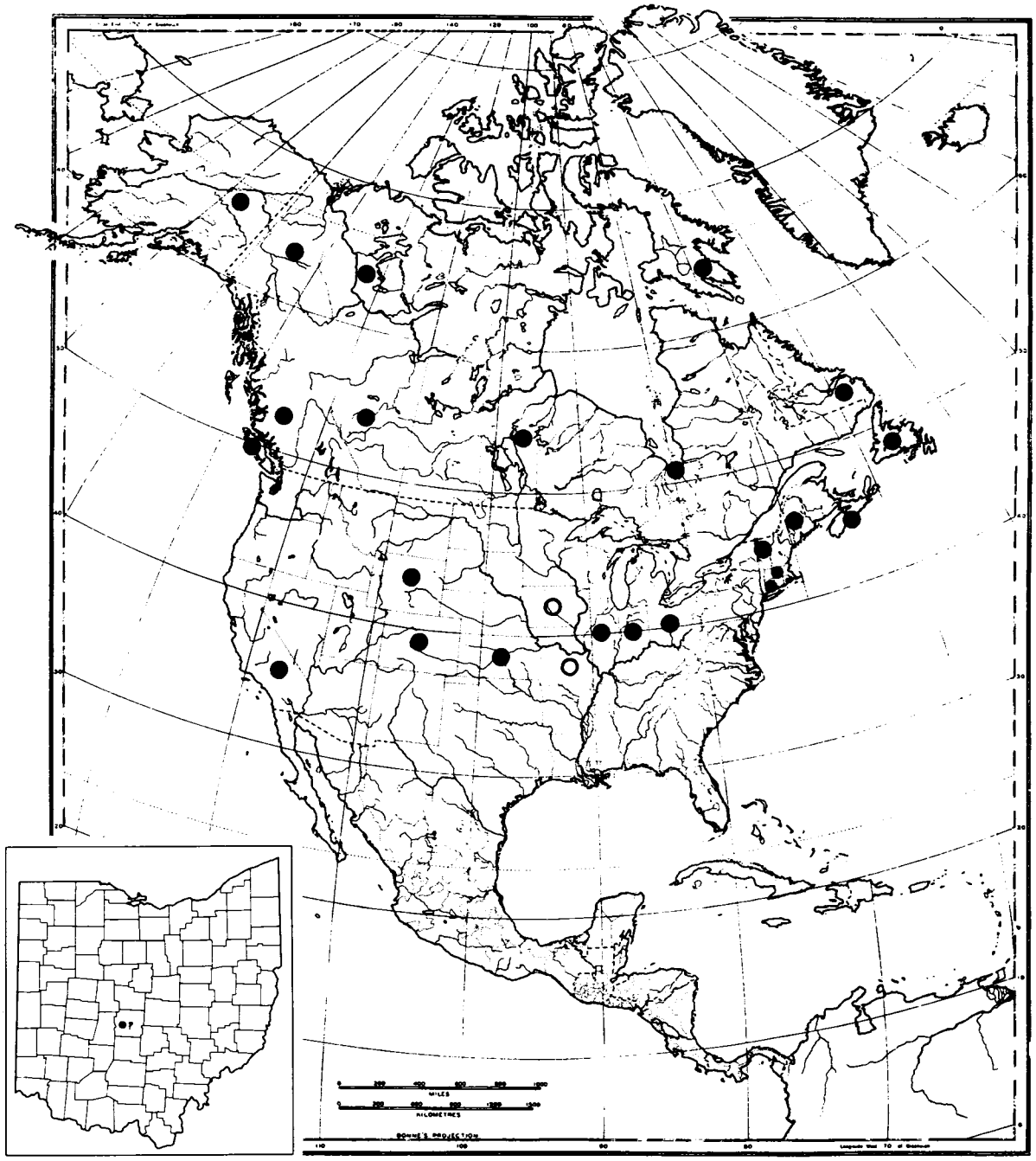

FIGURE 608.–Distribution of *Vertigo modesta* in North America; *inset*, distribution in Ohio.

Type locality.—"Northwest Territory . . . somewhere near or west of the western end of Lake Superior" (Pilsbry, 1948, p. 983).

Diagnosis.—Shell cylindric-oblong, tawny to cinnamon colored, glossy, rather weakly striate, the striation more distinct on the middle whorls; last whorl with a weak crest behind the obtuse, brown outer lip, which expands very little, and is not noticeably caught in to form a sinulus; teeth four, white: the parietal and columellar lamellae and lower palatal fold subequal, short; the upper palatal fold smaller (Pilsbry, 1948, p. 982).

Ecology.—In Ontario, Oughton (1948, p. 94 ff.) found it in wet locations, such as margins of ponds, streams, and marshes. Lindeborg (1949, Naut. 62, p. 130) collected it under logs in Ontario but did not specify the location further.

Associations.—Fossil: K-4, 6, 9, 14; Y-1 (*cf.*); I-5; W-4, 5, 6, 9, 12, 13, 15, 16, 17, 18, 19, 21, 22, 62, 64, 65, 73.

General distribution (fig. 608).—Alaska south to California (weakly differentiated races) east to James and Hudson Bays, Labrador, and Newfoundland; south to Maine, Vermont, and Connecticut, and to Ohio. The geologic range (see below) is much more extensive in the midwest.

Distribution in Ohio (inset, fig. 608).—The record for living specimens in the State is somewhat doubtful. Sterki (1907a, p. 380) gave the following: "Columbus, cited by Surface. The place seems to be outside of the range of its distribution, and probably *pygmaea* was mistaken for it, which I received, as *'modesta,'* from the late Hy. Moores." Eggleston has no records and there are no specimens in the University of Michigan collections. Nevertheless, it is quite possible that it will be found in Ohio as a fossil.

Geologic range.—F. C. Baker (1920a, p. 388) has recorded this species from the Peorian under *V. modesta* and *Pupilla decora.* Yarmouth to Recent (Leonard, 1950, p. 27); loess of Posey County, Indiana (Goodrich and van der Schalie, 1944, p. 277), not living.

Remarks.—Pilsbry (1948, p. 985 ff.) recognized several subspecies which should be looked for in Pleistocene deposits of Ohio.

Genus *Columella* Westerlund 1878

Paludinella Lowe 1854, Zool. Soc. Proc., p. 206 (*non* Pfeiffer, 1851).
Edentulina Clessin 1876, Deutsche Excursions-Moll.-Fauna, p. 208 (*non* Pfeiffer, 1855).
Columella Westerlund 1878, Fauna Europ. Moll. extramar. Prodromus, fasc. 2, p. 193.
Sphyradium (Agass.) Charpentier, Westerlund 1887, Fauna Paläarct. R. Binnenconch., v. 3, p. 125.
Columella Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1000.

Type.—*Pupa inornata* Michaud.

Diagnosis.—Shell cylindric or cylindric-tapering with obtusely conic summit and distinctly perforate axis, brown and nearly smooth, composed of 5 to 9 convex whorls; aperture subbasal, semicircular, oblique; peristome thin and sharp, the outer lip not expanded, regularly arcuate; columellar margin dilated.

General distribution.—Palearctic region of Europe and Asia, eastward to Japan; North America generally, south to Nicaragua; three Hawaiian species.

Geologic range.—Pleistocene of Europe and North America to present.

Columella edentula (Draparnaud) 1805
Fig. 609

Pupa edentula Draparnaud 1805, Hist. nat. Moll. France, p. 59, pl. 3, figs. 28, 29.
Pupa simplex Gould 1841, Boston Jour. Nat. History, v. 3, p. 403, pl. 3, fig. 21.
Vertigo simplex W. G. Binney 1878, Terr. Moll., v. 5, p. 219, pl. 73, fig. 3.
Sphyradium edentulum Dall 1905, Harriman-Alaska Exped., v. 13, p. 54, fig. 37.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 178.
Columella edentula Goodrich 1932, Moll. Mich., p. 37.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 277.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 48.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1002, fig. 535, 12-17.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 40, pl. 4, fig. 14.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 336.
--- --- Wayne 1954, Geol. Soc. America Bull., v. 65, p. 1320.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 35.

FIGURE 609.—*Columella edentula,* magnified; after Walker (1928, p. 153, fig. 238).

Type locality.—Not specified; probably France.

Diagnosis.—Shell perforate, oblong-ovate, tapering above, cylindric in the lower two whorls, or tapering slightly from the last whorl, the summit rounded; thin; cinnamon or a little darker colored, some specimens with whitish streaks; glossy, nearly smooth, but with microscopic irregular wrinkles of growth; whorls convex, the last two rather strongly so; aperture oblique, rounded, truncated by the preceding whorl, toothless; lip thin, sharp, unexpanded, the columellar margin

reflected; margins remote (modified from Pilsbry, 1948, p. 1002).

Ecology.—Oughton (1948, p. 94 ff.) listed this species from damp woodlands, especially those of deciduous trees in Ontario. Archer (1934c, p. 139) found it in limestone talus on Mackinac Island, Michigan. Burch (1955, Naut. 69, p. 66) gave a table showing the relationships of this species to soil factors in eastern Virginia. Lindeborg (1949, Naut. 62, p. 129) found it under logs in Ontario. Burch (1954, Naut. 68, p. 31) collected it in most cases under and among decaying maple, sweet gum, and oak leaves in Virginia. Grimm (1959, Naut. 72, p. 126) recorded it under stones, in marble quarries in Maryland.

Associations.—Living: MICHIGAN - 1, 40; OHIO - 43; ONTARIO - 2, 3. Fossil: K - 6; Y - 1; I - 5; W - 28.

General distribution (fig. 610).—Newfoundland, Labrador, Quebec, Ontario, Manitoba, British Columbia,

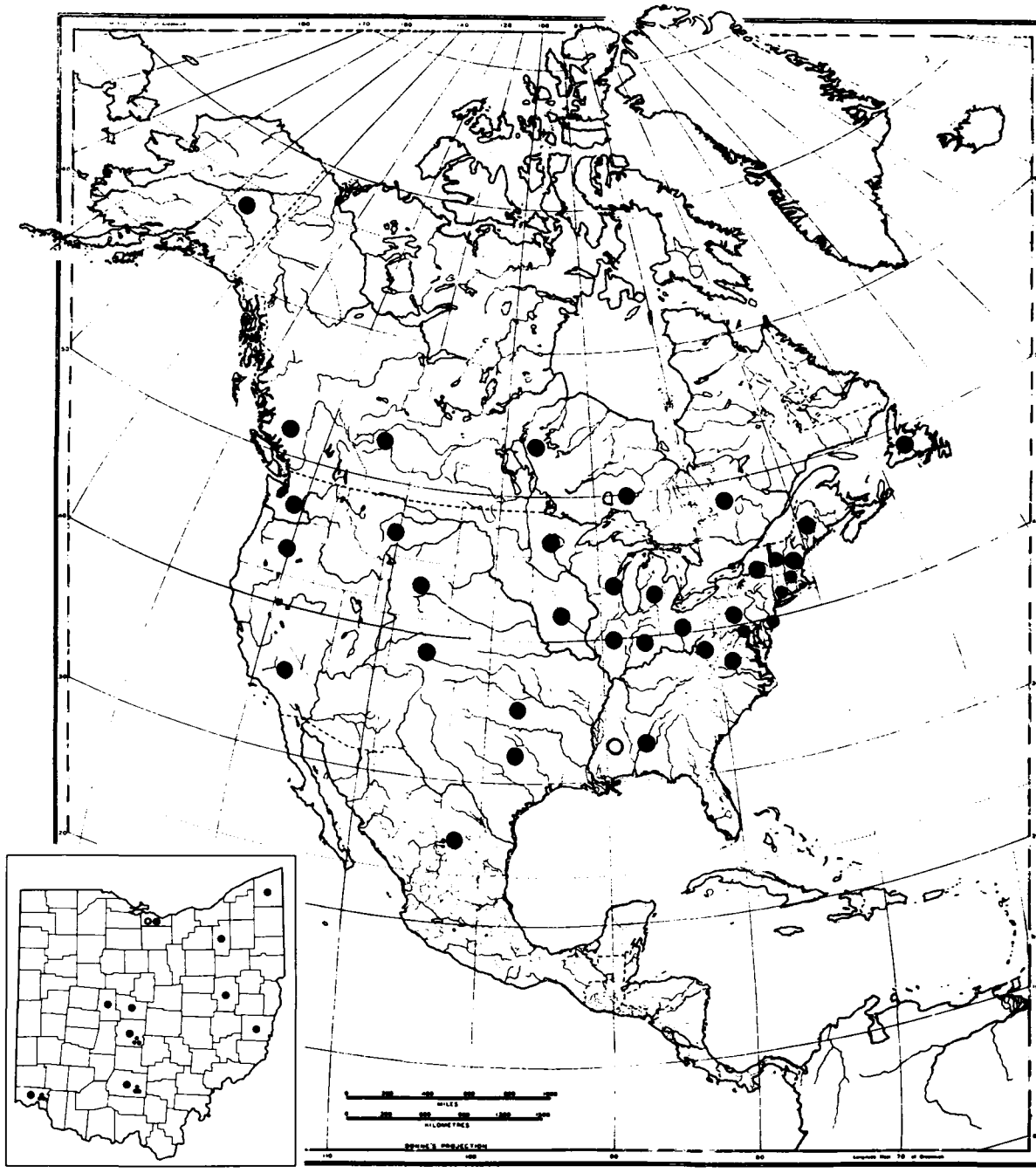

FIGURE 610.—Distribution of *Columella edentula* in North America; *inset,* distribution in Ohio.

and Alaska, southward to New Jersey, New York, Pennsylvania, Ohio, Indiana, Iowa, Montana, and Oregon; Alabama.

Distribution in Ohio (inset, fig. 610).—Hamilton, Summit, and Tuscarawas Counties; probably over the State (Sterki, 1907a, p. 378). Eggleston (ms. records) does not list the species.

Geologic range.—Pro-Kansan loess, Putnam County, Indiana (Wayne, 1954, p. 1320); Castalia marl (late Wisconsin), Erie County, Ohio (Sterki, 1920, p. 178).

Remarks.—Pilsbry (1948, p. 1003) stated that there is some reason for segregating the prevalent form in the eastern states as a local race, *C. edentula simplex* (Gould).

Columella alticola (Ingersoll) 1875
Fig. 611

Pupilla alticola Ingersoll 1875, Bull. U.S. Geol. and Geog. Survey Territories, v. 1, p. 128; 8th Ann. Rept. Hayden Survey, p. 391, fig.
Columella alticola Oughton 1948, Zoögeogr. study, Ontario, p. 48.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1003, fig. 536.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 18, pl. 5, fig. I; fig. 13.
--- --- Leonard 1953, Am. Jour. Sci., v. 251, p. 372 ff.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 336.
--- --- La Rocque and Forsyth 1957, Sidney Cut, p. 85 ff.

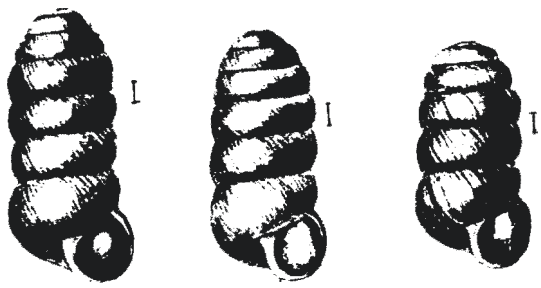

FIGURE 611.—*Columella alticola,* magnified; after Pilsbry (1948, p. 1004, fig. 536).

Type locality.—"Camp 26, Cunningham Gulch; Camp F; Rio La Plata" (Ingersoll, 1875); Pilsbry (1948) gave Cunningham Gulch as the type locality.

Diagnosis.—Shell perforate, cyclindric, with blunt apex and 6 to 7 whorls increasing very slowly, densely striate, subtranslucent, chestnut brown; last whorl larger than preceding ones; suture deeply impressed; aperture small, oblique, subtriangular, margins connected by a thin deposit, without teeth; lip simple, somewhat reflected over the umbilicus.

Ecology.—Henderson (1924, Naut. 37, p. 79) reported this species, together with a number of others, from aspen groves near Tolland, Colorado. Hanna (1925, Naut. 38, p. 123) found it near Unalaska, Alaska. Mozley (1926, Naut. 40, p. 54) reported it from Signal Mountain, 4,000 feet, in the Jasper Park region of Alberta. Berry (1931, Naut. 44, p. 114) reported it from Lamb's Canyon, Utah, which he described as follows: "The altitude rises from about 7,500 feet at the mouth to about 11,000 feet at its head, a distance of only seven miles. The dense verdure and frequent rainfalls which occur in this canyon create an ideal collecting ground for the conchologist." Eyerdam (1933, Naut. 46, p. 128) found it under *Heracleum lanatum,* with several other species of snails, in the Aleutian Islands, Alaska. Oughton (1940, Naut. 53, p. 128) found "about 200 shells from a boggy upland flat; in crevices at edge of temporary stream; under rocks beside a small brook" at Lake Harbour, Baffinland. Gregg (1942, Naut. 55, p. 143) found a number of specimens along the head of Mammoth Creek, southwest corner of Garfield County, Utah, under pieces of rotten wood in well-shaded places within a rather closely restricted area where the road diverges from the creek and turns south, altitude about 8,000 feet. He listed its associates at this point.

Associations.—Living: MANITOBA-39. Fossil: W-5, 6, 9, 12, 15, 17, 44, 61, 62, 63, 64, 66, 67, 69, 73.

General distribution (fig. 612).—Living colonies from Alberta and British Columbia south to New Mexico and Arizona, east to far northern Ontario; Wyoming and Colorado. As a fossil, it ranges much farther east.

Distribution in Ohio (inset, fig. 612).—All records for the State are for fossil specimens.

Geologic range.—F. C. Baker (1920a, p. 389) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash." Peoria Loess (Tazewellian zone) of Kansas (Leonard, 1952, p. 18; lower and upper pro-Tazewell loess, Cleveland, Ohio (Leonard, 1953, p. 372 ff.); early Wisconsin silt, Sidney Cut, Shelby County, Ohio (La Rocque and Forsyth, 1957, p. 85 ff.).

Family VALLONIIDAE

Valloniidae Pilsbry 1900, Acad. Nat. Sci. Philadelphia Proc., p. 564.
Valloniidae Pilsbry 1935, Man. Conchology, v. 28, p. 173.
Valloniidae Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1018.

Diagnosis.—"Minute orthurethrous snails with perforate or umbilicate shells of few whorls, from discoidal to ovate-conic in form, without internal laminae; often with sculpture of spaced cuticular ribs; the peristome either expanded, thickened, or simple; toothless (except in *Spelaeodiscus*) (Pilsbry, 1948, p. 1018).

General distribution.—America north of Mexico, Europe, northern and central Asia, and Japan.

Geologic range.—Paleocene, Eocene, Miocene, and Pliocene of Europe, and Pleistocene of Europe and America.

Subdivisions.—The three North American genera are *Vallonia, Planogyra,* and *Zoögenetes;* only the first of these is represented in the living fauna of Ohio; the other two are unknown for Ohio, either as living forms or fossils, but they are included here as they may eventually appear in Pleistocene deposits of the State.

Two subfamilies (Valloniinae and Acanthinulinae) have been recognized by some authorities but Pilsbry (1948, p. 1019) states that "their structural divergences seem insufficient."

Genus *Vallonia* Risso 1826

Vallonia Risso 1826, Hist. Nat. Europe Merid., v. 4, p. 101.

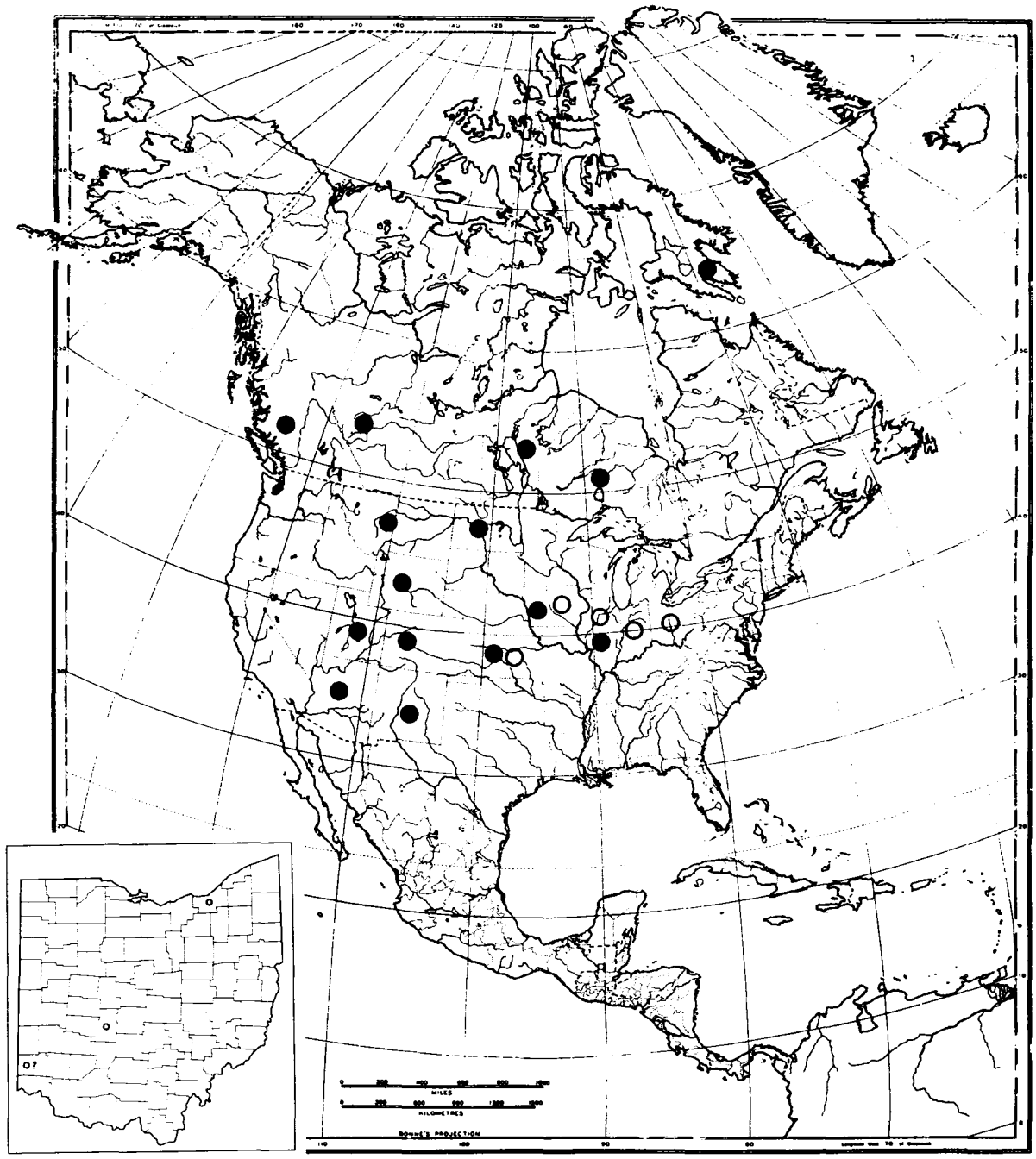

FIGURE 612.—Distribution of *Columella alticola* in North America; *inset,* distribution in Ohio.

Amplexis Brown 1827, Illus. Conch. Great Britain and Ireland, expl. of pl. 41.
Zurama Leach, in Turton 1831, Man. land and fresh-water shells Brit. Isles, p. 64.
Circinaria Beck 1837, Index Moll., p. 23.
Lucena "Hartmann" Gray 1840, *in* Turton's Man. land and fresh-water shells Brit. Isles, p. 142, *non* Hartmann, 1821.
Amplexus Brown 1844, *non* Sowerby 1815.
Glaphyra Albers 1850, Die Heliceen, p. 87.
Vallonia Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1019.

Type.—*Helix pulchella* (Müller).

Diagnosis.—Shell minute, widely or openly umbilicate, depressed, the spire low, convex, of 3 to 4½ rounded whorls, the last usually descending in front; color very light, uniform; surface smooth, or ribbed along lines of growth; aperture oblique, circular or rounded-oval, without teeth or laminae; peristome continuous or nearly so, expanded or reflected, often thickened within (Pilsbry, 1948, p. 1019).

General distribution.—North America north of Mexico, Europe, northern and central Asia, and Japan.

Geologic range.—Paleocene to Pleistocene of Europe; Pleistocene of North America.

Vallonia pulchella (Müller) 1774
Fig. 613

Helix pulchella Müller 1774, Verm. Terr. et Fluv. Hist., v. 2, p. 30.
Vallonia pulchella Sterki 1893, Man. Conchology, v. 8, p. 248, pl. 32, figs. 1-5.
--- --- Call 1900, Moll. Ind., p. 395, pl. 4, fig. 9.
--- --- Billups 1902, Nautilus, v. 76, p. 50.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 22, fig. 2.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.
--- --- Sterki 1920, Ohio Jour. Sci., v. 20, p. 179.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 44.
--- --- Goodrich 1932, Moll. Mich., p. 10.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 280
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 70.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1023, fig. 545a.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 46, pl. 3, figs. 5, 6.
--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 33, pl. 5, fig. B.
--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 25.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 338.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 76.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 62.

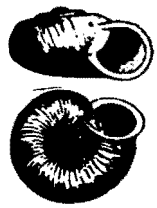

FIGURE 613.—*Vallonia pulchella*, magnified; after Call (1900, pl. 4, fig. 9).

Type locality.—Denmark.

Diagnosis.—Shell depressed, umbilicate, the umbilicus in its last half turn enlarging to double its former diameter; corneous and imperfectly transparent, or of somewhat milky tint; the surface glossy, very delicately and minutely striate, the striation stronger and more regular in the umbilicus, the apical whorl smooth; the 3½ convex whorls parted by a deep suture, which descends only very slightly to the aperture; the last whorl well rounded, not descending noticeably in front; aperture oblique, the peristome rather abruptly expanding, heavily thickened within, and forming about five-sixths of a circle (modified from Pilsbry, 1948, p. 1023).

Ecology.—According to Oughton (1948, p. 94 ff.) this species is found occasionally in drier more open woods and fields in Ontario, but it also occurs in wetter locations. In Ontario, it is confined to the Paleozoic terranes, mainly limestones. It survived after more than one week in dried forest litter (Oughton, 1948, p. 94 ff.). Oughton reported that Whitney (1938) kept it for 117 days in dry vials but that it was then able to produce viable eggs when moisture was restored. Dawley (1955, Naut. 69, p. 61) found it abundant in leaf mold in Minnesota. Grimm (1959, Naut. 72, p. 126) collected it from fields, railroad tracks, around foundations of an old burned house, and from marble quarries in Maryland.

Associations.—Living: MICHIGAN-31, 32, 33, 34, 35, 38; OHIO-1, 4, 7, 43; ONTARIO-7; WISCONSIN-139, 144. Fossil: N-1; K-3, 9, 15, 17, 18, 19, 22, 26, 27; W-24, 28, 73.

General distribution (fig. 614).—North Africa; Europe; Siberia east to the Amur; North America east of the Rocky Mountains: Newfoundland, Prince Edward Island, and Maine, west to Manitoba and Alaska, south to Colorado in the west and Massachusetts in the east. Its western and southern limits are ill defined because of the uncertain identity of published records and the likelihood of introduction, for example in California.

Distribution in Ohio (inset, fig. 614).—"Over the state, common, somewhat variable" (Sterki, 1907a, p. 378); Buckeye and Green Islands, in Lake Erie (Ahlstrom, 1930, p. 44); Hamilton County (University of Michigan collections); Auglaize, Clark, Adams, and Washington Counties (Eggleston, ms. records).

Geologic range.—F. C. Baker (1920a, p. 388) gave Yarmouth, Sangamon, Peorian, and "Wabash." Pleistocene of the Ohio and northern Mississippi valleys (Yarmouth stage to Recent) (Pilsbry, 1948, p. 1024); Yarmouth to Recent (Leonard, 1950, p. 33); "Old Forest bed of the Ohio River" (Billups, 1902b, p. 50); late Wisconsin, Castalia marl (Sterki, 1920, p. 179). D. W. Taylor (1960, p. 76) recorded the species for the Sand Draw local fauna (Nebraskan). In recent years, it has been identified from two Pleistocene deposits in Ohio: Newell Lake (Zimmerman, 1960, p. 20) and Jewell Hill (Mowery, 1961, p. 13).

Vallonia excentrica Sterki 1893
Fig. 615

Vallonia excentrica Sterki 1893, Man. Conchology, v. 8, p. 249, pl. 32, figs. 6, 9.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.

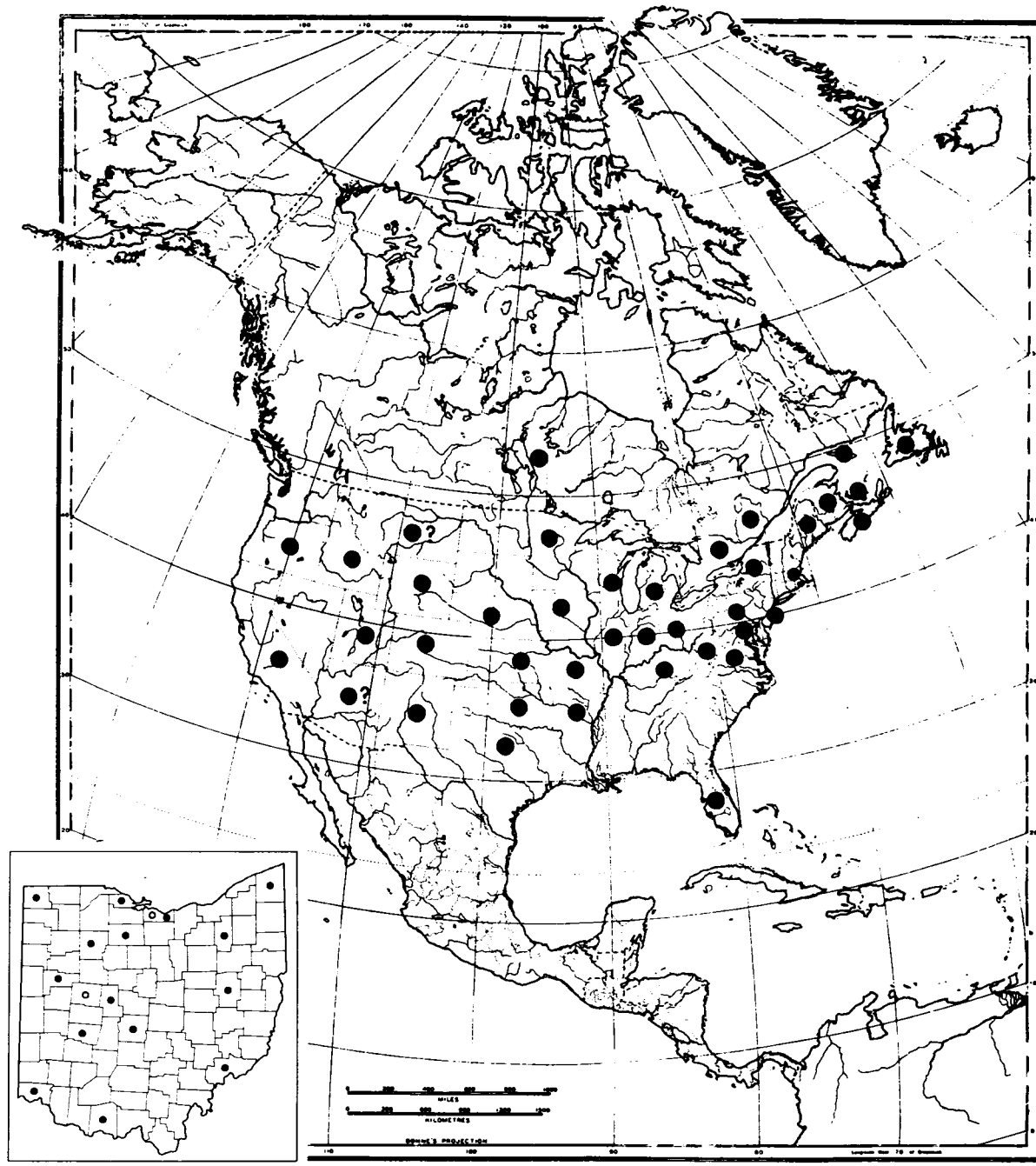

FIGURE 614.—Distribution of *Vallonia pulchella* in North America; *inset,* distribution in Ohio.

Vallonia excentrica Goodrich 1932, Moll. Mich., p. 10.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 280.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 70.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1025, fig. 545b.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 46, pl. 3, fig. 15.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 337.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 60.

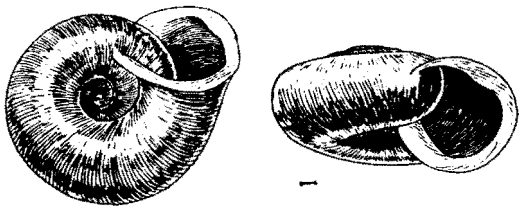

FIGURE 615.—*Vallonia excentrica,* magnified; after F. C. Baker (1939a, p. 118).

Type locality.—Staten Island, New York (Pilsbry, 1948, p. 1025).

Diagnosis.—Shell moderately umbilicate, the umbilicus elongate and rapidly widening in the last third of a whorl; pale corneous, transparent or nearly opaque, with a somewhat oily gloss; smooth, or very finely and irregularly striate, the first whorl smooth; the upper surface slightly convex; the 3 to 3½ whorls increasing rather rapidly and joined by a moderately deep suture; the last whorl relatively large, well rounded and expanding a little towards the aperture, not descending in front; aperture rather oblique; peristome forming five-sixths of a circle, and distinctly everted at the lower part only; the outer margin of the lip turned out very much less than in *V. pulchella;* strengthened within by a strong, white lip shining through the shell outside (modified from Pilsbry, 1948, p. 1025).

Ecology.—Burch (1955, Naut. 69, p. 66) has shown the relationships of this species to soil factors in eastern Virginia. Grimm (1959, Naut. 72, p. 126) has found it along railroad tracks in Maryland. Hibbard and Taylor (1960, their Association P-1) summarized its habitat as damp to dry: damp protected places or relatively dry exposed habitats. This species is more tolerant of drouth than others and requires little cover.

Associations.—Living: OHIO-4, 43. Fossil: K-6 (*cf.*); I-7 (*cf.*).

General distribution (fig. 616).—Europe. Madeira. South Africa. In North America, Ontario east to Newfoundland, Maine, and Nova Scotia, southward to Maryland, Ohio, Indiana, Illinois; Oregon, California, Mexico (probably introduced).

Distribution in Ohio (inset, fig. 616).—Lake, Tuscarawas, Guernsey, Hamilton, and Defiance Counties (Sterki, 1907a, p. 378); Wood and Champaign Counties (Eggleston, ms. records).

Geologic range.—None recorded.

Vallonia costata (Müller) 1774
Fig. 617

Helix costata Müller 1774, Verm. Terr. et Fluv. Hist., v. 2, p. 31.
Vallonia costata Sterki 1893, Man. Conchology, v. 8, p. 252, pl. 32, figs. 18-22; pl. 33, fig. 54.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 23.
--- --- Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 44.
--- --- Goodrich 1932, Moll. Mich., p. 10.
--- --- Leonard and Frye 1943, Am. Jour. Sci., v. 241, p. 457.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 280.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 68.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1026, fig. 546.
--- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 46, pl. 3, figs. 18, 19.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 337.
--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 59.

Type locality.—Fridrichsdal, Denmark.

Diagnosis.—Shell depressed, with a rounded umbilicus and slightly convex spire; color gray or faintly yellowish corneous, a little translucent; surface with a somewhat silky sheen, and sculptured with delicate retractive radial ribs, about 23 to 35 on the last whorl, the intervals having irregular microscopic striae in the direction of growth lines; embryonic 1½ whorls microscopically striate spirally; 3½ convex whorls united by a deep suture which descends to the aperture in front; aperture almost circular, oblique, the peristome well expanded, strongly thickened within except near the upper termination (modified from Sterki, 1893).

Ecology.—Oughton (1948, p. 94 ff.) found this species in wet locations, abundant in stream drift; it lives on floodplains of creeks and rivers, which may help explain its widespread dispersal. It has been recovered alive by him after more than a week in dried forest litter. Archer (1934, p. 139) found it common in the limestone talus on Mackinac Island, Michigan. Grimm (1955, Naut. 72, p. 126) found it around the foundation of an old burned house, in a marble quarry, and along

railroad tracks in Maryland.

Associations.—Living: MICHIGAN-32, 35; OHIO-43; WISCONSIN-140. Fossil: W-73.

General distribution (fig. 618).—Europe; Asia, east to the Amur Valley; North Africa. In North America, Alberta east to Quebec, Maine, and New York, south to Virginia, Ohio, Indiana, Illinois, but apparently absent (according to Pilsbry's records) from Montana, the Dakotas, Minnesota, Wisconsin, and Iowa.

Distribution in Ohio (inset, fig. 618).—"Over the state" (Sterki, 1907a, p. 378); Clark, Miami, and Ottawa Counties (Pilsbry, 1948, p. 1027); Hamilton County (University of Michigan collections); Highland County (Eggleston, ms. records).

Geologic range.—Illinoian and Wisconsin of northwestern Kansas (Leonard and Frye, 1943, p. 457). Not recorded as a fossil from Ohio or any of the surrounding states. F. C. Baker (1920a, p. 388) gave Aftonian,

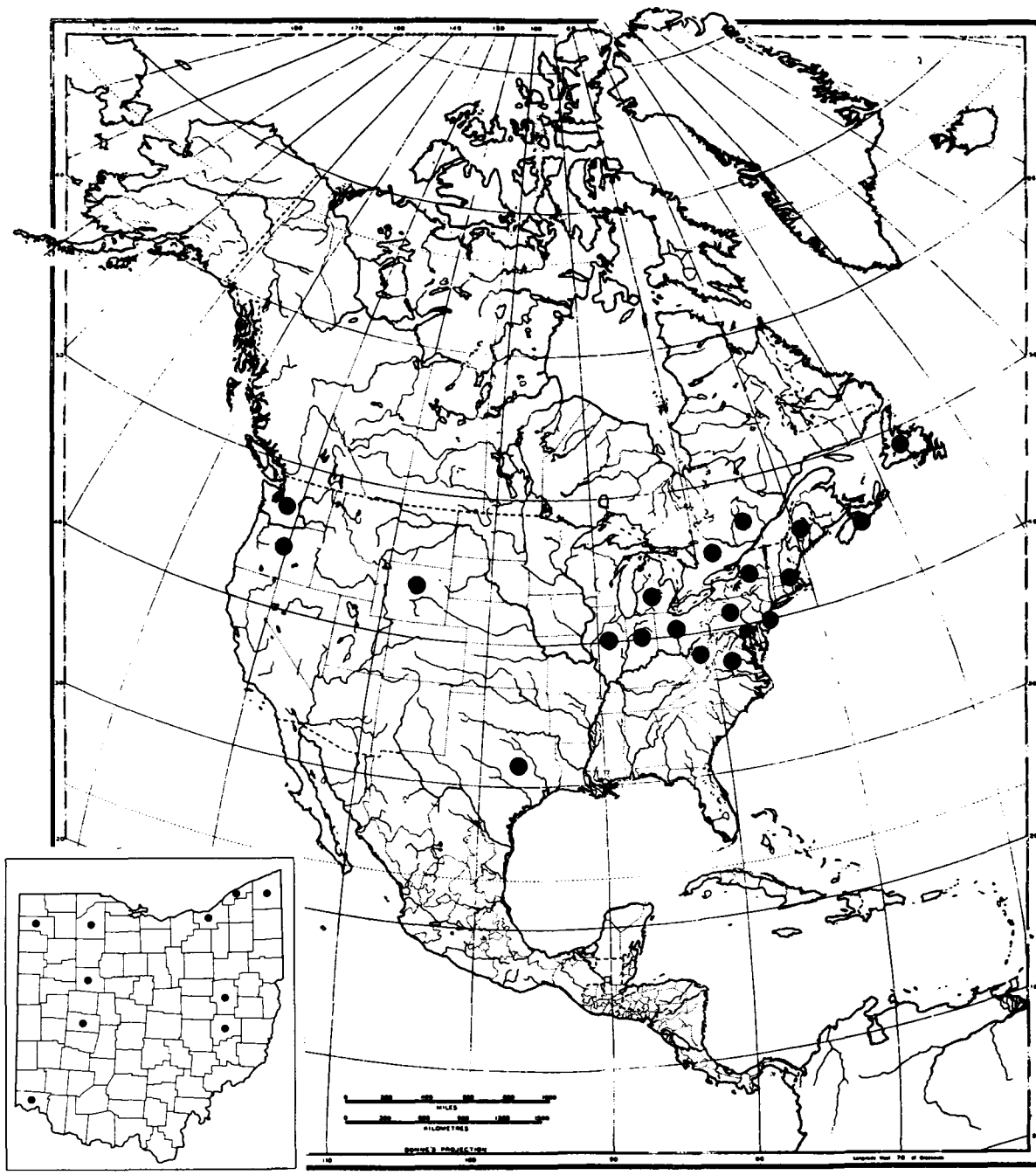

FIGURE 616.—Distribution of *Vallonia excentrica* in North America; *inset,* distribution in Ohio.

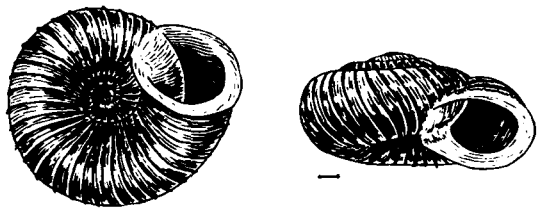

FIGURE 617.—*Vallonia costata,* magnified; after F. C. Baker (1939a, p. 119).

Sangamon, and Peorian for this species, but his records may include other, similar, species confused with *V. costata.*

Vallonia parvula Sterki 1893
Pl. 17, figs. 3, 4, 9

Vallonia parvula Sterki 1893, Man. Conchology, v. 8, p. 254, pl. 32, figs. 23-26.
Vallonia americana Ancey, ms., *in* Sterki, 1893, Acad.

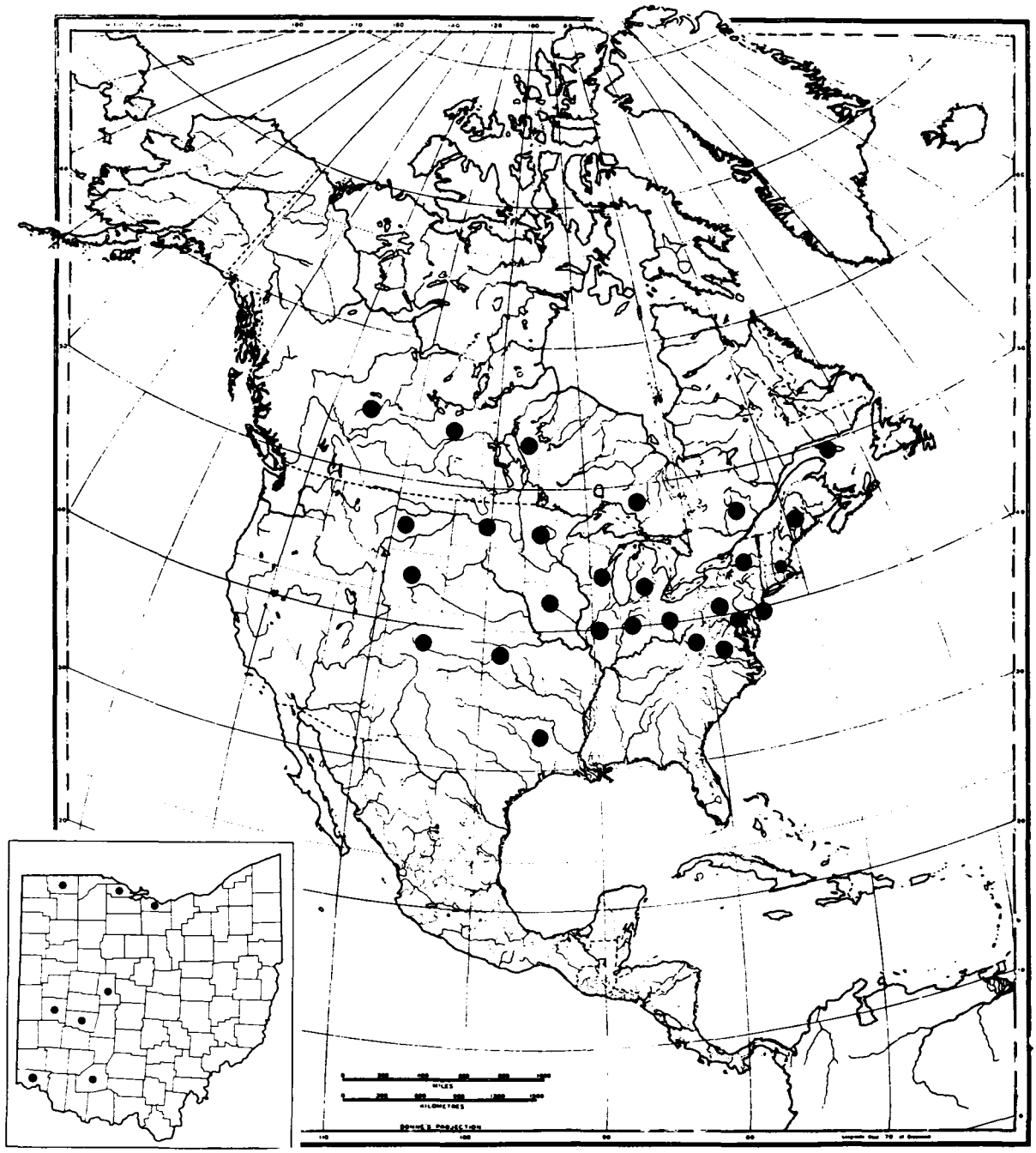

FIGURE 618.—Distribution of *Vallonia costata* in North America; *inset,* distribution in Ohio.

Nat. Sci. Philadelphia Proc., p. 266.

Vallonia costata var. *minor* Cockerell, Sterki 1893, Acad. Nat. Sci. Philadelphia Proc., p. 267.

Vallonia parvula Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 378.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.

--- --- Ahlstrom 1930, Nautilus, v. 44, p. 44.

--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 280.

--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 69.

--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1027, fig. 547.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 337.

--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 11.

--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 138.

--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 77.

--- --- Taft 1961, Ohio Biol. Survey Bull., n.s., v. 1, no. 3, p. 61.

Type locality.—Joliet, Illinois.

Diagnosis.—Shell small, widely umbilicated, especially for the last 1/3 to 1/2 whorl, quite flat above or with very inconspicuous apex, thin, horn colored to nearly colorless, with rather fine dense membranous ribs, about 30 to 38 on the last whorl, and microscopic intercrossing lines between them; nucleus with fine revolving lines; whorls a little over 3, slightly flattened above and below the periphery, with a deep suture; the last much wider than the penultimate, rather rapidly expanding toward the aperture and descending only at the suture in front; aperture very oblique, tangential and rather inclined, almost circular; ends of margin almost touching; peristome with a rather strong pale-horn-colored lip (modified from Sterki, 1893).

Ecology.—Hibbard and Taylor (1960, their Association P-1) have summarized the habitat of this species as follows: damp protected places or relatively dry exposed habitats. This species is more tolerant of drouth than others, and requires little cover.

Associations.—Living: OHIO-1, 4; ONTARIO-11, 14. Fossil: P-4; S-1, 2, 3, 4, 5, 6.

General distribution (fig. 619).—Ontario west to Manitoba, south to Texas, Iowa, Illinois, Indiana, and Ohio.

Distribution in Ohio (inset, fig. 619).—Sterki (1907a, records it only for Sandusky, Sandusky County, and Put-in-Bay, Erie County. Eggleston (ms. records) did not find it in southern and central Ohio.

Geologic range.—F. C. Baker (1920a, p. 388) gave Yarmouth and "Wabash" for the species. Hibbard and Taylor (1960, p. 138) have extended the record to the late Pliocene.

Vallonia gracilicosta Reinhardt 1883
Pl. 18, figs. 1-6

Vallonia gracilicosta Reinhardt 1883, Sitzungs Ges. Naturf. Fr. Berlin, 1883, no. 3, p. 42.

--- --- Sterki 1893 (in part), Man. Conchology, v. 8, p. 256, not pl. 33, figs. 48, 49.

Vallonia costata var. *montana* Sterki 1893, *ibid.*, v. 8, p. 254.

Vallonia gracilicosta Dall 1905, Harriman-Alaska Exped., v. 13, p. 23.

--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.

--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 69.

--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1028, fig. 549a.

--- --- Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 33, pl. 5, fig. D.

--- --- Leonard 1952, Kans. Univ. Paleont. Contr., Moll., art. 4, p. 24, pl. 4, figs. B, C; fig. 13.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 337.

--- --- Taylor and Hibbard 1955, Okla. Geol. Survey Circ. 37, p. 8, 11.

--- --- La Rocque and Forsyth 1957, Sidney Cut, p. 85 ff.

--- --- Hibbard and Taylor 1960, Mich. Univ. Mus. Paleontology Contr., v. 16, no. 1, p. 137.

--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 77.

Type locality.—Little Missouri River, North Dakota.

Diagnosis.—Shell flat, widely umbilicate, whitish gray in color; spire low, the apex projecting only a little above the body whorl; whorls 3½, convex, separated by a deep suture, with fine but distinct rather crowded ribs; the last whorl slightly angular around the umbilicus, strongly expanding and slightly descending toward the aperture; aperture moderately oblique, transversely oval, with strongly expanded and broadly white-lipped peristome; upper margin but little curved, lower margin more strongly curved, almost obtusely angular; margins at the insertions approaching and connected by a callus (modified from Sterki, 1893).

Ecology.—Henderson (1924, Naut. 37, p. 79) found this species, with others, in aspen groves near Tolland, Colorado. F. C. Baker (1929, Naut. 42, p. 135) recorded it from Birch Point, Big Bay, Vermilion Lake, St. Louis County, Minnesota, where he found it, along with other land snails, in wooded areas under logs, leaves, branches, and every sort of debris. Woodbury (1929, Naut. 43, p. 56) collected it in only one place in Zion National Park, Utah, under the dry leaves beneath cottonwood trees; he notes that it is rare and hard to find. Shimek (1930, Naut. 44, p. 40) stated that it is one of the most common land snails living in the prairie groves and border areas in Iowa; he denied that its

presence in fossil deposits is evidence of a cooler climate. Jones (1940, Naut. 54, p. 28) listed it in stream drift in Cedar Valley, Utah, from a stream arising in the Oquirrh Mountains. Gregg (1940, Naut. 54, p. 31) found it along Virgin River, at foot of Bridge Mountain, in Grotto Camp Ground, at Saddle Nook, and at other localities in Zion National Park, where it is quite common. Later he (1940, Naut. 54, p. 96) recorded an assemblage of snails in Parawan Mountains, Iron County, Utah, in a rock slide above timberline at an altitude of about 11,000 feet. Later still (1942, Naut. 55, p. 143-144), he recorded it for the head of Mammoth Creek, Garfield County, Utah, at 8,000 feet, under pieces of rotten wood in well-shaded places within a rather restricted area near a creek; and along North Fork of Asay Creek, Garfield County, without further details, but listing the accompanying species of snails.

Associations.—Living: MINNESOTA-2, 5. Fossil:

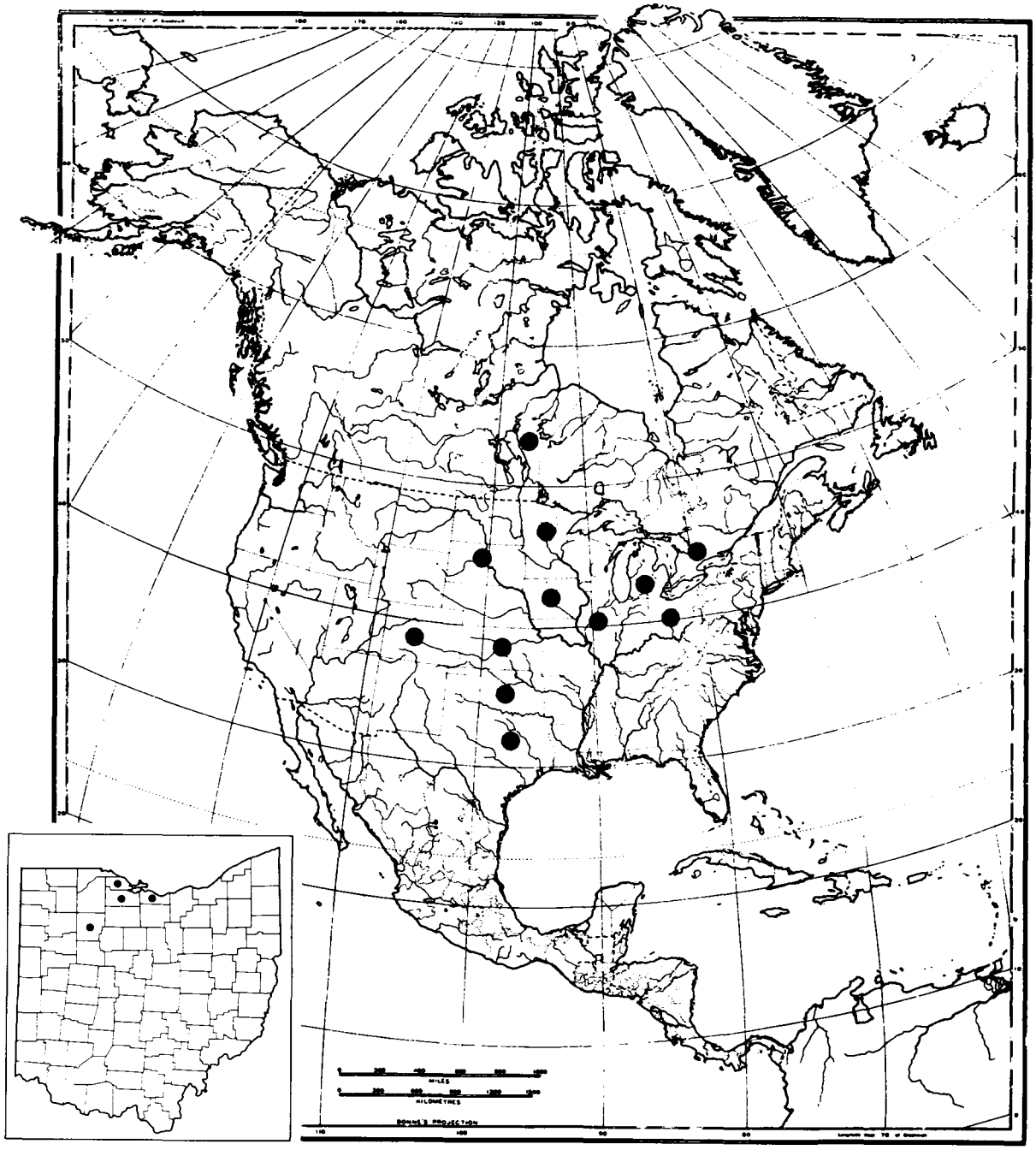

FIGURE 619.—Distribution of *Vallonia parvula* in North America; *inset,* distribution in Ohio.

P-3; K-1, 3, 4, 7, 9, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27; I-3; S-1, 2, 4, 6; W-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 43, 44, 63.

General distribution (fig. 620).—Alberta, Manitoba, and Ontario, south to California, Arizona, and New Mexico. Its range as a fossil is much more extensive.

Distribution in Ohio (inset, fig. 620).—A single record, fossil and rather doubtful, from Butler County (University of Michigan collections).

Geologic range.—F. C. Baker (1920a, p. 388) gave Aftonian, Yarmouth, Sangamon, Peorian, and "Wabash." Aftonian to Recent: Iowa, Kansas, Oklahoma, Texas (Leonard, 1950, p. 33); Blanco deposits to Recent (Leonard, 1952, p. 24); Sidney Cut, early Wisconsin, Shelby County, Ohio (La Rocque and Forsyth, 1957, p. 85 ff.); Bar M local fauna, probably Illinoian, Oklahoma (Taylor and Hibbard, 1955, p. 8). Late Pliocene

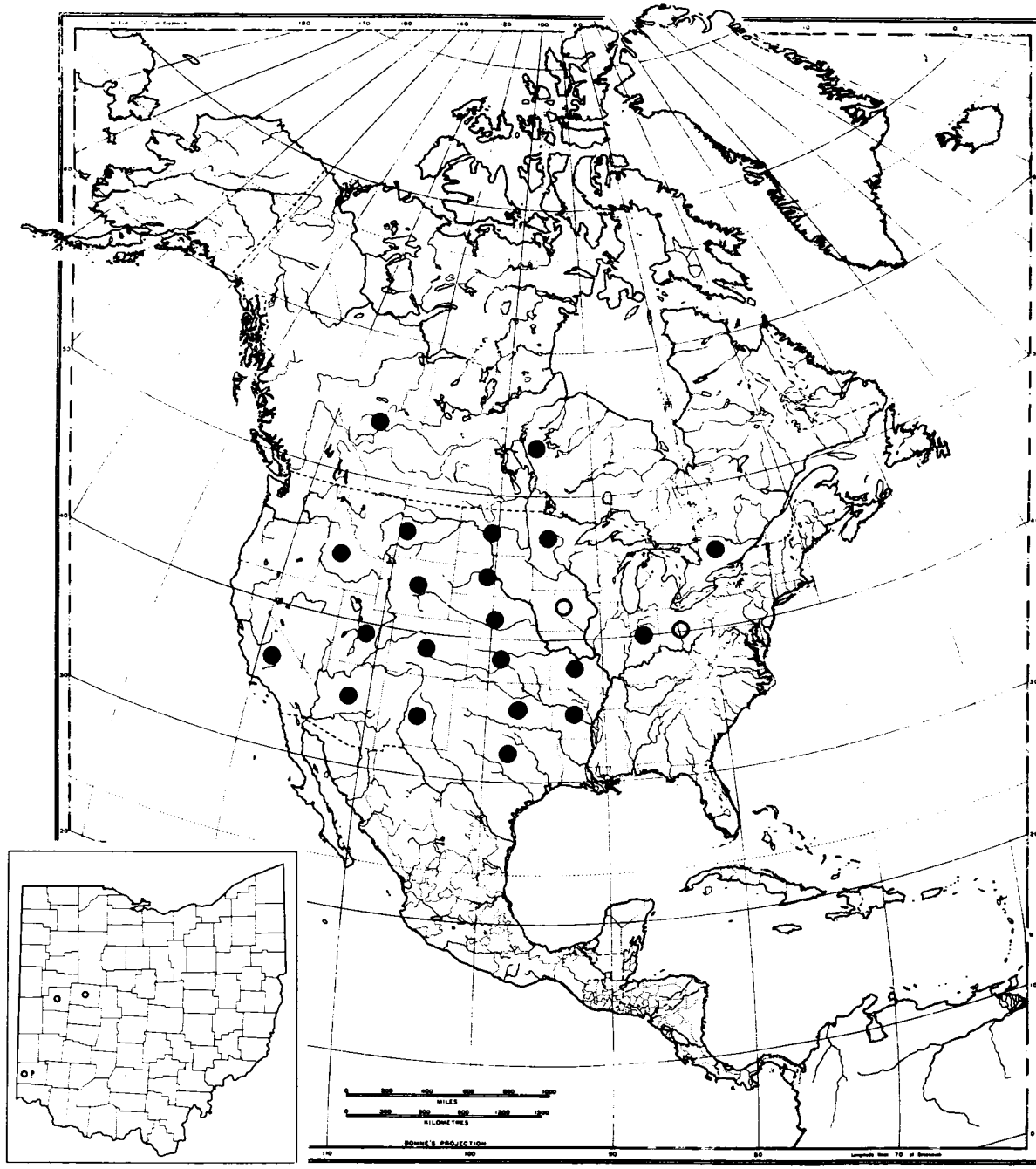

FIGURE 620.—Distribution of *Vallonia gracilicosta* in North America; *inset,* distribution in Ohio.

to Recent (Hibbard and Taylor, 1960, p. 137). It has been recently recorded from the Jewell Hill deposit, Ohio, by Mowery (1961, p. 12).

Vallonia perspectiva Sterki 1893
Fig. 621

Vallonia perspectiva Sterki in Sargent, 1892, Nautilus, v. 6, p. 77 (name only; Woodville, Alabama).
--- --- Sterki 1893, Man. Conchology, v. 8, p. 257, pl. 33, figs. 39-45.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1033, fig. 553.
--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 338.
--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 77.

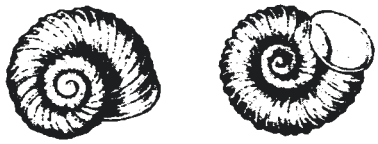

FIGURE 621.—*Vallonia perspectiva,* magnified; after Walker (1928, p. 163, fig. 252).

Type locality.—Woodville, Jackson County, Alabama (Pilsbry 1948, p. 1034).

Diagnosis.—Shell small, with widely open umbilicus, widening more in the last half whorl, flat, or a little elevated above, with rather dense, somewhat regularly set, moderately strong membranous ribs, about 35 on the last whorl, and with finer striae between them; nucleus without revolving lines; pale horn to colorless, thin, translucent; whorls 3 1/3, gradually increasing, a little flattened above and below the periphery, with a deep suture, the last rounded, comparatively narrow, little expanding toward the aperture, rather rapidly descending in general; aperture very inclined and oblique, almost tangential, transversely (short) ovoid and oblong; peristome continuous, shortly but not abruptly everted except near the suture, without (or with a very thin) lip (modified from Sterki, 1893).

Ecology.—Grimm (1959, Naut. 73, p. 22) has found this species under dry limestone near a creek, and on a hill in Shenandoah National Park in Maryland.

Associations.—Fossil: P-1, 3; N-2; A-1.

General distribution (fig. 622).—North Dakota, Minnesota, Illinois, West Virginia, and New Jersey, south to Utah, Arizona, New Mexico, Mexico, and Texas; absent from the middle and lower Mississippi Valley; east of the Mississippi it is found south to Alabama, but is not recorded on the coastal plain south of southern New Jersey.

Distribution in Ohio.—No definite record. Its presence in the State is probable since it occurs in Ontario to the north and West Virginia to the southeast.

Geologic range.—F. C. Baker (1920a, p. 388) gave only Sangamon for the species. Pliocene to Recent (D. W. Taylor, 1960, p. 77).

Remarks.—The distribution of this species is anomalous but this may be due to confusion with other species. The salient anomalies are its absence from the middle and lower Mississippi Valley, and the isolated West Virginia, New Jersey, Ontario, and Minnesota records. These anomalies may be explained by its wanderings in Pleistocene time, of which there is no record to my knowledge, or by the possibility that it is an extreme variant of some other species.

Genus *Planogyra* Morse 1864

Planogyra Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 24.
Planogyra H. B. Baker 1928, Nautilus, v. 41, p. 122; Man. Conchology, v. 28, p. 197, anatomy.
Planogyra Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1037.

Type.—*Planogyra asteriscus* (Morse).

Diagnosis.—Shell minute, openly umbilicate, nearly flat above, fragile, brown, of about 3½ convex whorls, the periphery rounded at all stages of growth; embryonic 1½ whorls with indistinct microscopic granulations, the rest with widely spaced cuticular laminae parallel to the growth lines; aperture nearly circular except for parietal excision, the peristome either thin or thickened within.

General distribution.—States and provinces bordering on the St. Lawrence and Great Lakes drainage, chiefly in the Canadian zone; New England; British Columbia to Oregon, west of the Cascade Range.

Geologic range.—Unknown.

Remarks.—The discontinuous range of the genus, represented by two distinct species in the east and west, points to considerable antiquity for the genus, at least into the Pleistocene, but geologic distribution, the key to the origin and migrations of the two species, remains unknown.

[*Planogyra asteriscus* (Morse) 1857]

Helix asteriscus Morse 1857, Boston Soc. Nat. History Proc., v. 6, p. 128.
Planogyra asteriscus Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 24, figs. 50, 52; pl. 2, fig. 5; pl. 8, fig. 53.
Pyramidula asteriscus Pilsbry 1893, Man. Conchology, v. 9, p. 45.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 51.
Planogyra asteriscus Goodrich 1932, Moll. Mich., p. 37.
--- --- Oughton 1948, Zoögeogr. study, Ontario,

p. 67.

Planogyra asteriscus Pilsbry 1948, Land Moll. North America, v. 2, pt. 2, p. 1038, fig. 555a-c.

--- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 338.

Type locality.—Bethel, Oxford County, Maine.

Diagnosis.—Shell minute, openly umbilicate, fragile, pale brown, imperfectly transparent; spire slightly convex, nearly flat, the first 1½ whorls indistinctly granular, the rest radially lamellose, the last whorl with 18 to 30 thin, sharp, prominent laminae parallel to the lines of growth, their edges somewhat waved or irregular in dry shells; the intervals sharply, minutely striate and faintly marked, chiefly on the base, with very close irregular spiral lines; aperture circular except for the parietal excision; lip generally thin, but in old shells distinctly thickened within basal and columellar

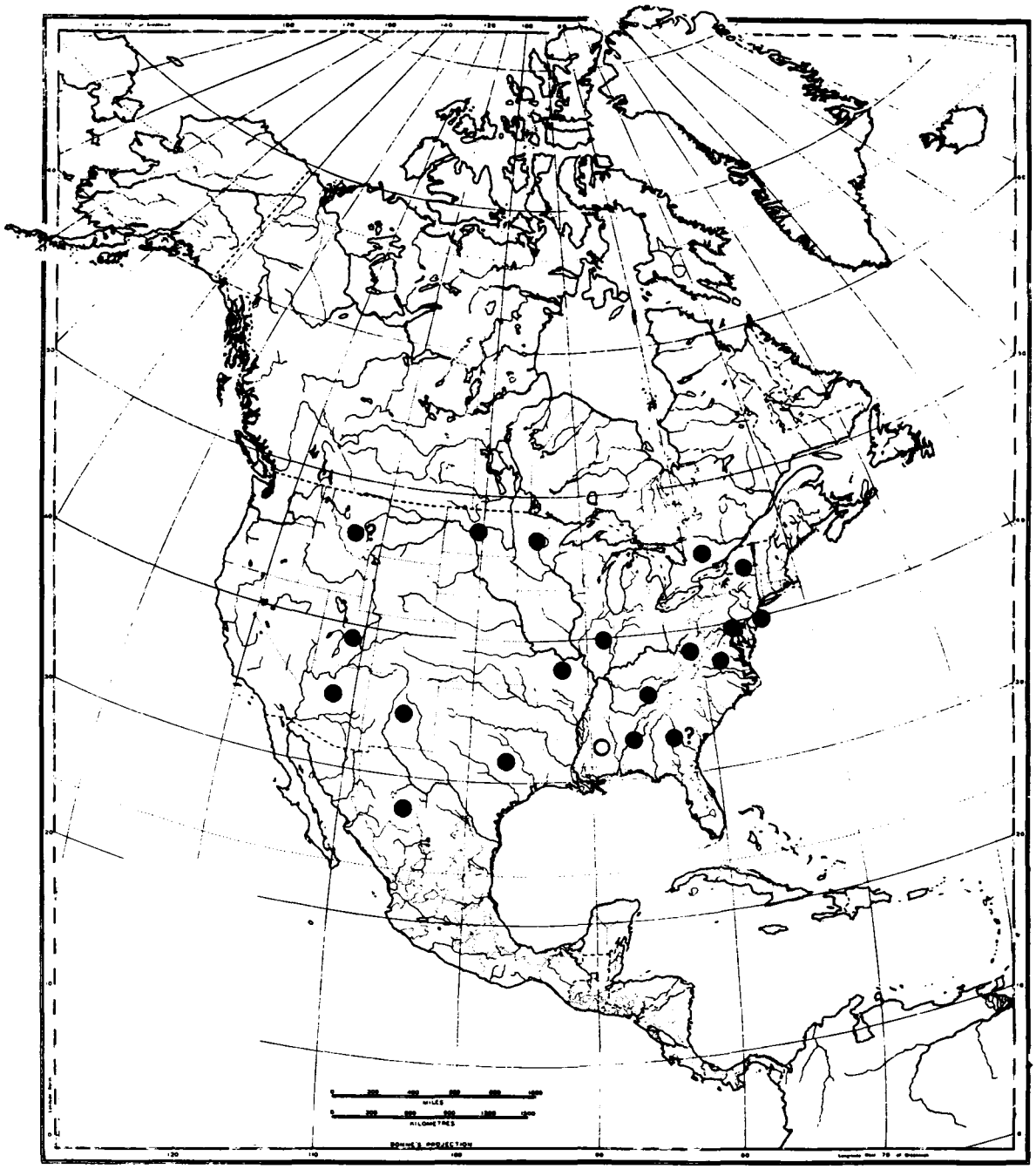

FIGURE 622.—Distribution of *Vallonia perspectiva* in North America.

margins (modified from Pilsbry, 1948, p. 1039).

Ecology.—Found in very wet, boggy places; in swampy alder thickets; under dead leaves in the strand line, between the water-soaked *Sphagnum* mats of the arborvitae-spruce bogs, and the fringe of low deciduous trees around their borders; common in damp swales between low fixed sand dunes; it seems to prefer the deeper layers of fallen leaves (Morse, original description, and H. B. Baker, 1928, p. 122 ff.).

This species is characteristic of damp woodlands, especially those of deciduous trees, according to Oughton (1948, p. 94 ff.). H. B. Baker (1928, p. 122) gave the following details from observations at Douglas Lake, Cheboygan County, Michigan: "*P. asteriscus* is quite common under dead leaves in the strand-line between the water-soaked *Sphagnum* mats of the arborvitae-spruce bogs and the fringe of low, deciduous trees around their borders. Although it occurs rarely outside of this zone, a very few feet in either direction makes a very remarkable difference in its frequency. Near the shore of Big Stone Bay, Straits of Mackinac (Emmet County), it is also quite common in the damp swales between the low, fixed sanddunes. *P. asteriscus* and *Carychium exile canadense* seem to prefer the deeper layers of the fallen leaves and are seldom found crawling on the surface or in the vicinity of logs."

Associations.—Living: MICHIGAN - 2; MINNESOTA - 7; ONTARIO - 3.

General distribution.—Ontario, Quebec, Prince Edward Island, Newfoundland, and Maine, south to Michigan, Massachusetts, and New York.

Distribution in Ohio.—The species has never been recorded living in Ohio and is not likely to be, unless it should have escaped attention, in the northern parts of the state, because of its very wet habitat and small size. It should be looked for in Pleistocene deposits but so far has not been found in any of those studied from the State.

Geologic range.—Unknown. It is remarkable that this very characteristic northern species should not have been found in any Pleistocene deposit of the northeastern states or Canada. It occurs now in areas that were heavily glaciated and which were certainly denied to it during the glacial advances of the Pleistocene. Its point of origin remains a mystery, unless it was to the east, perhaps in Newfoundland or New England.

Genus *Zoögenetes* Morse 1864

Zoögenetes Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 32.
Acanthinula W. G. Binney 1878, Terr. Moll., v. 5, p. 341.
Zoögenetes Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1041.

Type.—*Helix harpa* Say.

Diagnosis.—Shell small, thin and elastic, narrowly umbilicate, ovate-conic, higher than wide, of few rapidly increasing convex whorls, the first two rather smooth, the rest with delicate widely spaced oblique riblets; aperture ovate, oblique, the lip thin and simple, dilated near the columellar insertion, margins remote.

General distribution.—Boreal, Europe, Asia, and North America. In North America the single species, *Z. harpa* (Say), is widespread in Canada, rarer southward to the 40th parallel in Colorado, much less farther south in the east.

Geologic range.—None recorded.

Zoögenetes harpa (Say) 1824

Helix harpa Say 1824, Long's Exped., App., v. 2, p. 256, pl. 15, fig. 1.
Pupa costulata Mighels 1844, Boston Soc. Nat. History Proc., v. 1, p. 187.
Helix amurensis Gerstfeldt 1859, Mém. Acad. Imp. Sci. St. Pétersburg, v. 9, p. 17, pl. 9, fig. 26.
Zoögenites harpa Dall 1905, Harriman-Alaska Exped., v. 13, p. 21.
Zoögenetes harpa Pilsbry 1926, Man. Conchology, v. 27, p. 196.
——— ——— Goodrich 1932, Moll. Mich., p. 9.
——— ——— Oughton 1948, Zoögeogr. study, Ontario, p. 72.
——— ——— Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1043, fig. 559.
——— ——— La Rocque 1953, Cat. Recent Moll. Canada, p. 338.

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

Diagnosis.—Shell narrowly umbilicate, ovate-conic, thin, somewhat transparent, olive green, rather glossy; early whorls nearly smooth, the last two with sculpture of delicate widely spaced cuticular riblets or laminae in the direction of the growth lines, about 30 on the last whorl, becoming crowded towards its end; summit obtuse; whorls nearly 4, rounded; aperture oblique, ovate, the lip thin and simple, dilated at the axial termination (modified from Pilsbry, 1948, p. 1043).

Ecology.—A hardy snail, hibernating on "leaves just below the surface or secreted in acorn cups or nut shells, not deeply buried like most other snails" (Morse); it "has a life cycle of a year or thereabouts, is born in the summer or early autumn, matures in summer of the following year, then produces young and dies" (Charles Oldham, quoted by Pilsbry, 1948, p. 1045, from observations near Zermatt, Switzerland). In Ontario, Oughton (1948, p. 94 ff.) recorded this species for damp and drier more open woods or fields in woodlands, especially those of deciduous trees. Lindeborg (1949, Naut. 62, p. 130), also in Ontario, found this species under logs, except at one location where a few were collected on tree moss after a rain. In the northern peninsula of Michigan, Ross (1948, Naut. 61,

p. 103-104) listed it from the under surface of a pine board, near the north end of a bridge; and on Isle Royale, under moss, on exposed bedrock surfaces.

Associations.—Living: MICHIGAN-1, 5.

General distribution.—Northern areas of Europe, Asia, and North America. Alaska, Northwest Territories of Canada, Manitoba, Ontario, Quebec, Prince Edward Island, Newfoundland, and Maine, south to Massachusetts, New York, Michigan, Minnesota, and, in mountainous areas of the west, south to Colorado.

Distribution in Ohio.—Not recorded from the State. The nearest known occurrence is in Emmet County, Michigan, so it is not likely to occur, except as an isolated relict colony, within the borders of Ohio. It may eventually be found in Pleistocene deposits.

Geologic range.—None recorded. Its absence from Pleistocene deposits leads to the suspicion that it is a late arrival in North America, possibly after the last glaciation; if so, it has spread over a remarkably large area on this continent.

Family CIONELLIDAE

Cionellidae Kobelt 1880, Illustrirtes Conchylienbuch, p. 216.
Cochlicopidae of many authors.
Cionellidae Pilsbry 1948, Land Moll. N. America, v. 2, p. 1045.

Diagnosis.—Shell resembling that of the Pupillidae, but elongate, imperforate, smooth and glossy, subtranslucent; aperture ovate, longer than wide; lip not expanded, thickened within; parietal wall steeply sloping; columella slightly sinuate or truncate at base; no internal lamellae or tubercles developed; aperture never constricted just behind the lip and never notched behind the outer lip, as in some pupillids.

General distribution.—Palearctic region, with a single Holarctic genus and two other European genera, *Azeca* and *Spelaeoconcha.*

Geologic range.—According to Pilsbry (1948, p. 1045) the two genera *Cionella* and *Azeca* appear to have been evolved in the Cretaceous, as they are represented in Europe from the Paleocene on. The single American species, *Cionella lubrica,* is apparently a Pleistocene immigrant, its first known appearance being in the Yarmouth interglacial stage (Pilsbry, 1948; Leonard, 1950, 1952) or Kansan (Wayne, 1954, p. 1320).

Subdivisions.—Represented in Europe by three genera, *Azeca, Spelaeoconcha,* and *Cionella;* only the last of these present in North America.

Genus *Cionella* Jeffreys 1829

Cochlicopa Férussac, in part, 1821, Tabl. Syst. Fam. Limaçons, p. 24, undefined.
Cionella Jeffreys 1830, Linnaean Soc. London Trans., v. 16, p. 347.
Zua Leach, in Turton 1831, Man. land and fresh-water shells British Isles, p. 82.
Styloides Fitzinger 1833, in part, Beitr. Landesk. Oesterr., v. 3, p. 105.
Folliculus Agassiz MS., Charpentier 1837, Nouv. Mém. Soc. Helvét. Sci. Nat., v. 1, p. 14.
Chionella Swainson 1840, Malacology, p. 335 (misspelling).
Hydastes Parreys 1850, Syst. Verzeich. Oesterreich. Land- u. Fluss-Conchyl., *in* Berichte ueber die Mittheil. Freunden der Naturwissensch. in Wien, v. 6, p. 98.
Ferussacia Risso, W. G. Binney 1878, Terr. Moll., v. 5, p. 186 (*fide* Pilsbry).
Cionella Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1045.

Type.—*Cionella lubrica* (Müller).

Diagnosis.—Shell imperforate, oblong, the spire gradually tapering to an obtuse apex; thin, smooth, yellowish corneous, subtransparent and very glossy; whorls 5½ to 6, moderately convex; aperture subvertical, ovate, toothless; outer lip evenly arcuate, obtuse, bordered with yellow or reddish outside, thickened by a narrow, smooth, and continuous callous rib within; columella somewhat straightened, calloused, generally very indistinctly notched or sinuous at its junction with the basal lip; parietal callus thin, translucent (modified from Pilsbry, 1948, p. 1048).

General distribution.—Holarctic: Europe, Asia, North America. On the last continent, the genus is represented by a single species whose distribution is widespread, from Alaska to Mexico eastward to Labrador and Newfoundland, but with important gaps discussed under distribution of the species.

Geologic range.—Eocene to present (Pilsbry, 1948, p. 1046) in Europe; Pleistocene to present in North America.

Cionella lubrica (Müller) 1774
Fig. 623

Helix lubricus Müller 1774, Verm. Terr. et Fluv. Hist., v. 2, p. 104.
Bulimus lubricus Gould 1841, Invert. Mass., p. 193, fig. 124.
Bulimus lubricoides Stimpson 1851, Shells New England, p. 54 *(nom. nudum).*
Zua lubricoidea Morse 1864, Portland Soc. Nat. History Jour., v. 1, p. 30, figs. 79, 81, 84, pl. 10, fig. 82.
Cionella subcylindrica W. G. Binney and T. Bland 1869, Land and fresh-water shells N. America, v. 1, p. 224 (not *Helix subcylindrica* of Linnaeus).
Ferussacia subcylindrica Call 1900, Moll. Ind., p. 401, pl. 4, fig. 8.

Cochlicopa lubrica Billups 1902, Nautilus, v. 16, p. 51.
--- --- Dall 1905, Harriman-Alaska Exped., v. 13, p. 33.
Cionella lubrica Sterki 1907, Ohio Acad. Sci. Proc., v. 4, p. 380.
Cochlicopa lubrica Pilsbry 1908, Man. Conchology, v. 19, p. 312.
--- --- F. C. Baker 1920, Life of Pleistocene, p. 388.
--- --- Ahlstrom 1930, Nautilus, v. 44, p. 45.
--- --- Goodrich 1932, Moll. Mich., p. 24.
--- --- Goodrich and van der Schalie 1944, Revis. Moll. Ind., p. 280.
--- --- Oughton 1948, Zoögeogr. study, Ontario, p. 73.
Cionella lubrica Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1047, fig. 560a, b.
Cochlicopa lubrica Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 47, pl. 4, fig. 9.
Cionella lubrica Leonard 1950, Kans. Univ. Paleont. Contr., Moll., art. 3, p. 25, pl. 5, fig. G.
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--- --- Taylor 1960, U.S. Geol. Survey Prof. Paper 337, p. 77.
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FIGURE 623.—*Cionella lubrica,* magnified; two specimens, showing shell and living animal; after Call (1900, pl. 4, fig. 8).

Type locality.—Denmark.

Diagnosis.—Shell imperforate, oblong, spire gradually tapering to an obtuse apex; thin, smooth, yellowish corneous, subtransparent and very glossy; whorls 5½ to 6, moderately convex; aperture subvertical, ovate, toothless; outer lip evenly arcuate, obtuse, bordered with yellow or reddish outside, by a narrow, smooth, and continuous callous rib within; columella somewhat straightened, calloused, often very indistinctly notched or sinuous at its junction with the basal lip; parietal callus thin, translucent (modified from Pilsbry, 1948, p. 1048).

Ecology.—Lives among damp underleaves in densely shaded places; under wood, such as old board sidewalks; in chinks of stone walls and under stones; becomes active in the open six to eight hours before rain; sometimes found congregating in great numbers on stone or concrete walks, possibly for mating (condensed from Pilsbry, 1948, p. 1049).

Oughton (1948, p. 94 ff.) found it occasionally in damp woodlands, especially those of deciduous trees; he also noted it in wetter locations, margins of ponds, streams, and marshes; seeping hillsides, and other wet areas; he found it especially abundant on floodplains of creeks and rivers, but also in forest litter, dried but still alive after more than one week. The combination of floodplain habitat and resistance to desiccation may help account for its wide dispersal. H. B. Baker (1922b) also found it on a floodplain in Dickinson County, Michigan.

Goodrich (1931, p. 4) collected 20 specimens from a single rotten log in Keweenaw County, Michigan. Archer (1934c, p. 139) found it "very abundant in the limestone talus" on Mackinac Island, Michigan. In the Asheville, North Carolina, region, Archer (1935, p. 82) listed it as rather uncommon in leaf mold and under pieces of bark and rotten logs. The local form does not seem to share the tendency to live in cleared territory that is so usual in members of the species in other parts of the world.

Roscoe (1962, Naut. 75, p. 111-115) has summarized information on the habit of aggregation in this species. The individuals gather in large numbers from May or early June to late October, generally after a rain, but also 6 to 8 hours before, alone or in the company of other species. Whether this has anything to do with mating or is merely due to physical factors is not clear. Further details on another aggregation are given by Caesar (1946, Naut. 60, p. 72). Mapes (1951, p. 382-432) and Mapes and Krull (1951, p. 433-444) have given details on the ecology of this species in New York State.

Muchmore (1959, Naut. 72, p. 85-88) found it under stones in various woodland areas in New York State. Lindeborg (1949, Naut. 62, p. 129) collected it from under logs and on a moss bank in Ontario. Grimm (1959, Naut. 72, p. 126) found it in leaf litter along railroad tracks in Maryland. Burch (1955, Naut. 69, p. 66) has shown the relationships of variety *morseana* to soil factors in eastern Virginia.

In the Columbus area, I have often found it abundantly in disused quarries, hiding in the crevices of limestone and between bedding planes widened by erosion. It is also an abundant snail in stream drift since it inhabits river and creek floodplains.

Ingram (1946, Naut. 59, p. 91-92) reported the following from the Huyck Preserve, New York State:

"This small mollusk was typically found beneath fallen fence rails and discarded lumber piles on the shore of *Myosotis* lake. Careful search around the bases of wild blackberry bushes often revealed numerous individuals. Specimens too were found beneath humus and fallen bark in young maple stands. Clearing of forest areas from the preserve has no doubt numerically increased the population of this species on the preserve. In grass covered fields it was common at the bases of grass roots. It did not extend its range into climax forest stands."

Associations.—Living: MINNESOTA-1, 3, 4, 5, 8; OHIO-43; ONTARIO-3, 7, 8; WISCONSIN-140, 143. Fossil: K-6, 9, 13, 14, 18, 19, 20; Y-1; I-5; S-7; W-5, 6, 9, 24, 43, 44, 60, 61, 62, 64, 65.

General distribution (fig. 624).—Alaska and British Columbia east to Newfoundland; south in the east to Washington, D. C., in the midwest to southern Missouri,

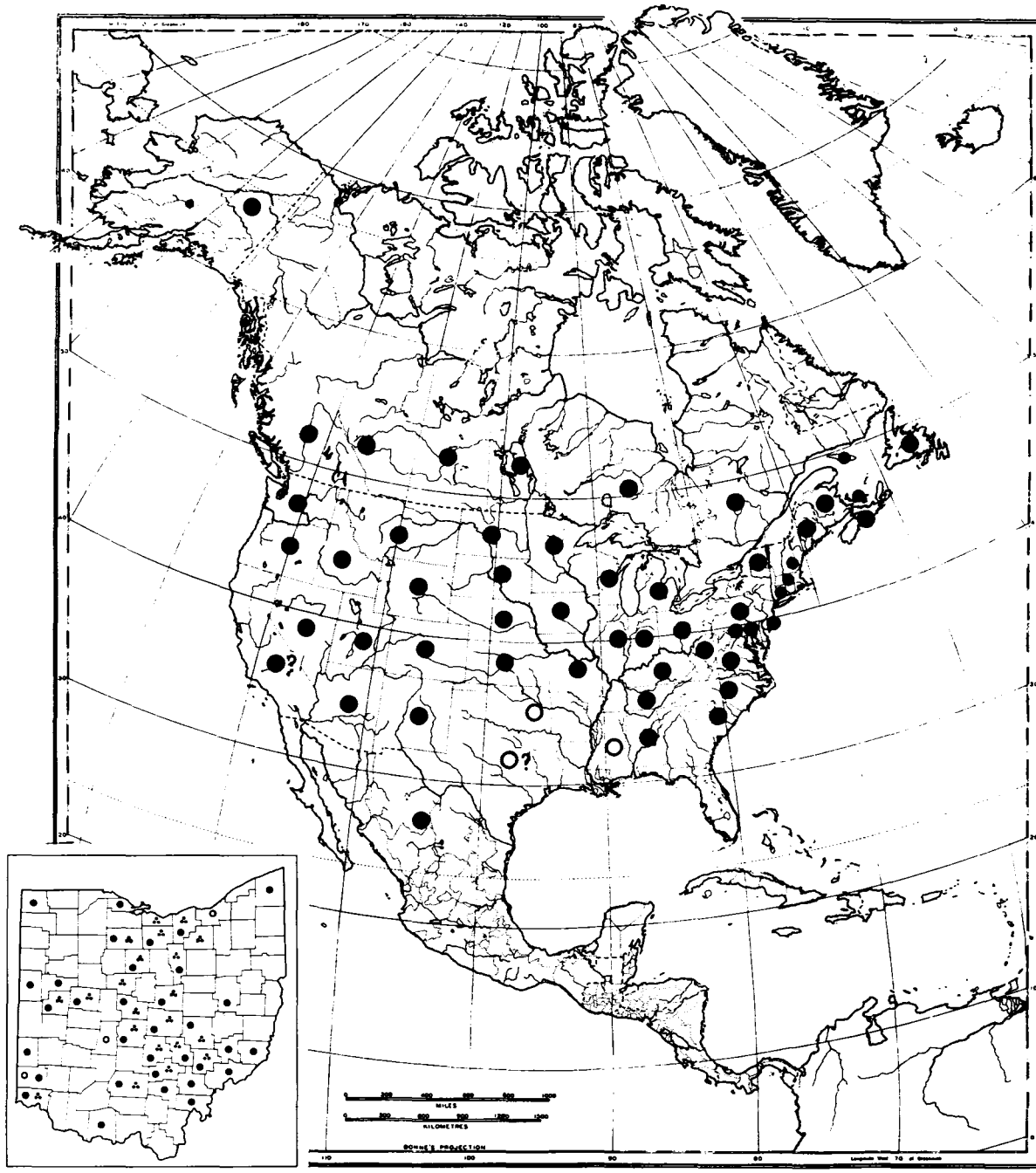

FIGURE 624.—Distribution of *Cionella lubrica* in North America; *inset,* distribution in Ohio.

in the Missouri Valley to Nebraska, in the Rocky Mountains to Mexico; absent from California.

Distribution in Ohio (inset, fig. 624).—Sterki (1907a, p. 380) gave "over the state." Records are available for many, though not all counties, but it is probable that apparent absence of the species is due more to lack of collecting than to actual limitation of range.

Geologic range.—F. C. Baker (1920a, p. 388) gave Yarmouth, Sangamon, and Peorian. Wayne (1954, p. 1320) has recorded this species for pro-Kansan loess in Putnam County, Indiana. Previously, it was known from Yarmouth to Recent (Leonard, 1950, p. 25; 1952, p. 18). Taylor and Hibbard (1955, p. 8) recorded it for the Illinoian of Oklahoma; more recently, Taylor (1960, p. 77) has identified it from the Pliocene; in Ohio, it occurs in the "Old Forest bed of the Ohio River" (Billups, 1902b, p. 51); in Sangamon, Farmdale? loess, lower and upper pro-Tazewell loess of the Cleveland region (Leonard, 1953, p. 372 ff.); and in the early Wisconsin silts of the Sidney Cut, Shelby County, Ohio (La Rocque and Forsyth, 1957, p. 85 ff.).

Remarks.—The weakly differentiated subspecies *C. lubrica morseana* is recognized, though somewhat doubtfully, in this report.

Cionella lubrica morseana Doherty 1878

Cionella (Zua) Morseana Doherty 1878, Quart. Jour. Conchology, v. 1, p. 342, pl. 4, fig. 2 (2 figs. and scale cross).

Cochlicopa lubrica morseana Pilsbry 1908, Man. Conchology, v. 19, p. 316, pl. 49, fig. 42.

Cochlicopa lubrica appalachicola Pilsbry 1908, *ibid.*, p. 317, pl. 49, fig. 43.

Cochlicopa lubrica morseana Goodrich 1932, Moll. Mich., p. 25.

--- --- --- Robertson and Blakeslee 1948, Moll. Niagara Frontier, p. 47.

Cionella lubrica morseana Pilsbry 1948, Land Moll. N. America, v. 2, pt. 2, p. 1049, fig. 560c.

--- --- --- La Rocque 1953, Cat. Recent Moll. Canada, p. 339.

Type locality.—"Kenton County, Kentucky, and Hamilton Co., Ohio" (Doherty, 1878, p. 342).

Diagnosis.—Shell longer, more slender, more cylindrical, the whorls flatter, the columella straighter, the apex and base more obtuse and the callous rim of the outer lip much thinner and narrower than in typical *C. lubrica.*

Ecology.—"Found in beds of leaves in woods . . .; it may be viviparous. In the winter it closes its shell with an opaque, white epiphragm, like that of *Helix profunda* or *H. pomatia*" (Doherty, 1878).

General distribution.—Michigan west to New York, south to Alabama and North Carolina.

Distribution in Ohio.—The only published record, to my knowledge, is the original one for Hamilton County.

Geologic range.—Unknown.

Remarks.—This race is recognized here following Pilsbry (1948, p. 1049), but it should be remembered that intergrades between the typical form and this one are hard to place.

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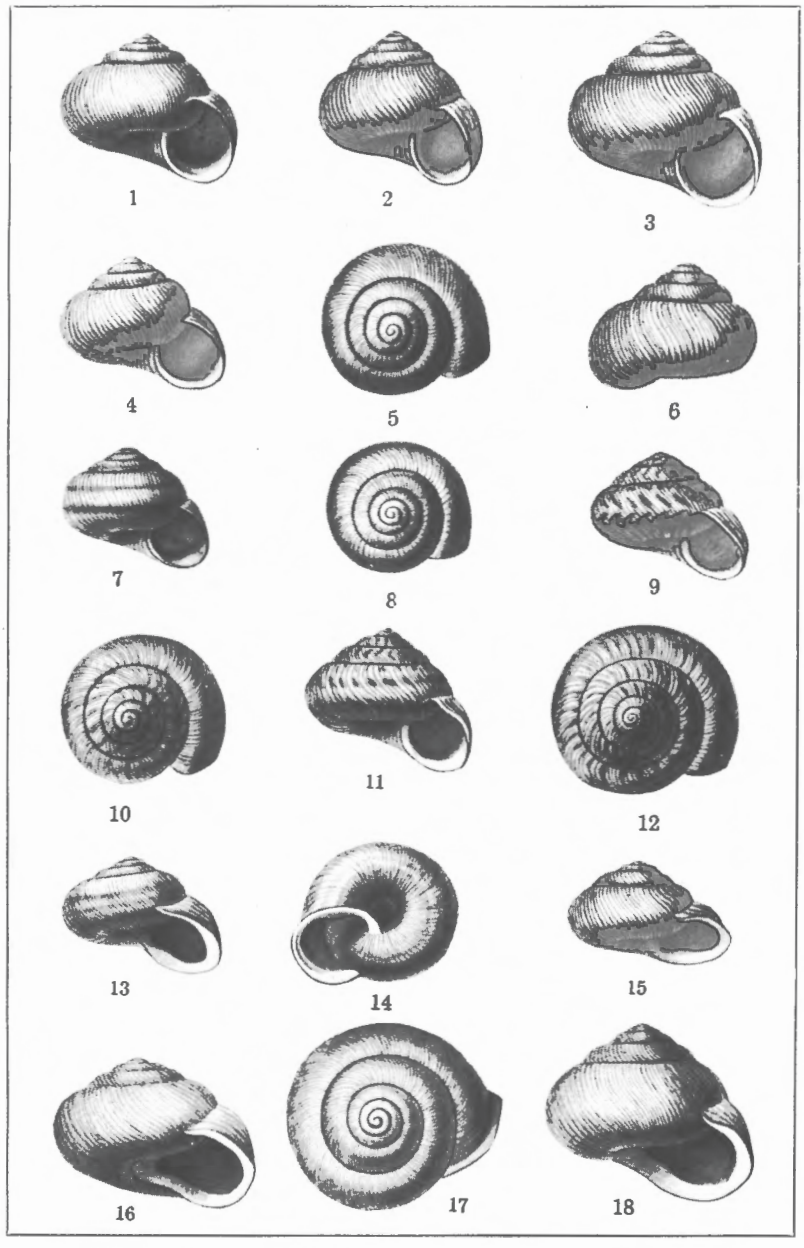

PLATE 15

Shells of *Allogona, Anguispira,* and *Triodopsis* (after Clapp, 1916, pl. XXXII; all shells of recently living animals; all figures approximately natural size)

1. *Anguispira kochi strontiana,* type
2. *Anguispira kochi strontiana,* most elevated form
3. *Anguispira kochi strontiana,* largest specimen
4. *Anguispira kochi roseo-apicata,* type
5. *Anguispira kochi roseo-apicata,* type
6. *Anguispira kochi roseo-apicata,* back view
7. *Anguispira kochi mynesites,* type
8. *Anguispira kochi mynesites,* type
9. *Anguispira alternata eriensis,* type
10. *Anguispira alternata eriensis,* type
11. *Anguispira alternata eriensis,* a very tall specimen
12. *Anguispira alternata eriensis,* top view of largest specimen
13. *Allogona profunda strontiana,* type
14. *Allogona profunda strontiana,* type
15. *Allogona profunda strontiana,* showing extreme elevation of spire
16. *Triodopsis albolabris goodrichi,* type
17. *Triodopsis albolabris goodrichi,* type
18. *Triodopsis albolabris goodrichi,* showing extreme height of spire

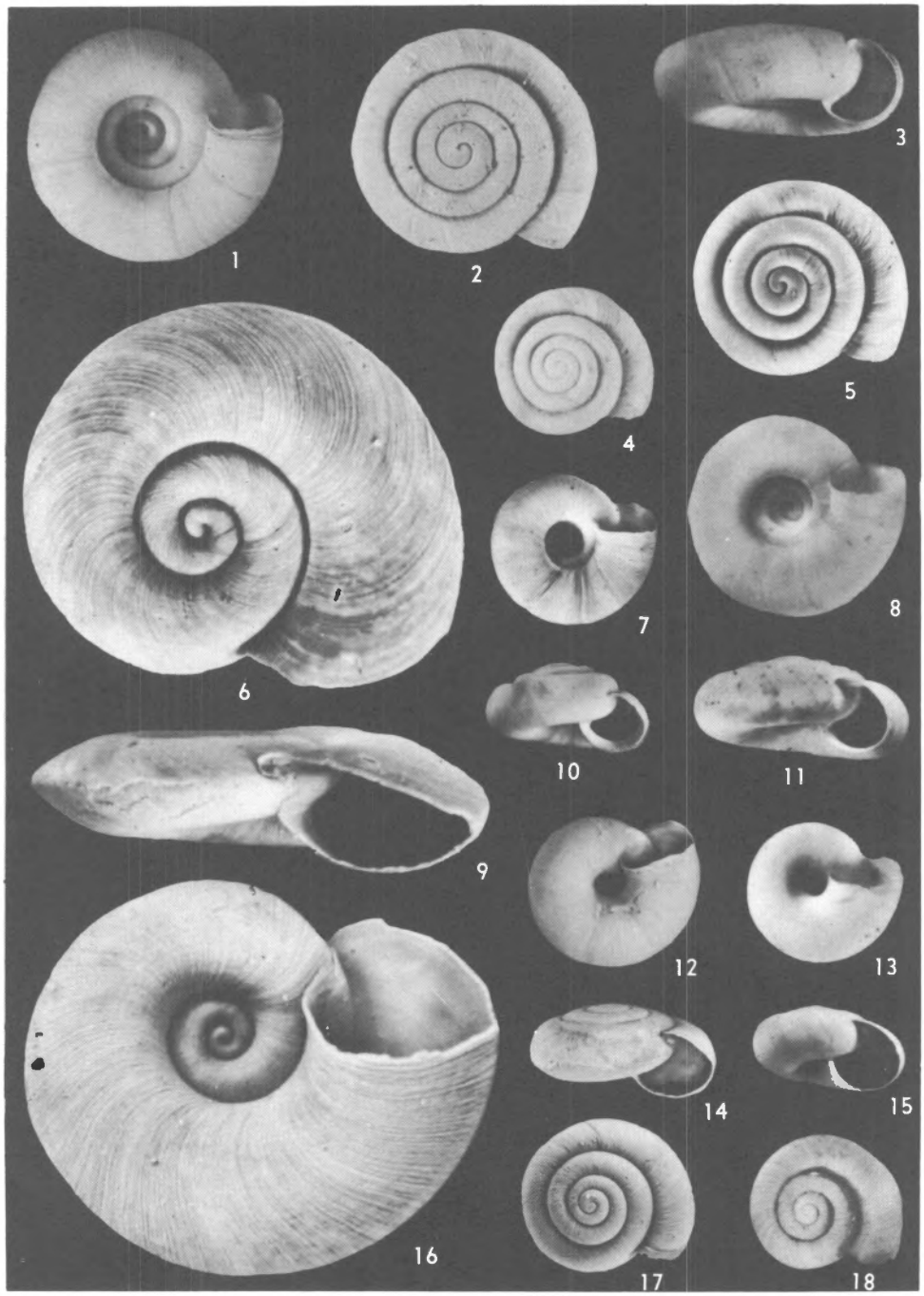

PLATE 16

Shells of *Hawaiia, Helicodiscus, Nesovitrea, Promenetus,* and *Zonitoides* (after Hibbard and Taylor, 1960, pl. XIV; Pleistocene, Kansas)

1. *Helicodiscus parallelus,* X10
2. *Helicodiscus parallelus,* X10
3. *Helicodiscus parallelus,* X10
4. *Hawaiia minuscula,* X10
5. *Helicodiscus singleyanus,* X10
6. *Promenetus kansasensis,* X20
7. *Hawaiia minuscula,* X10
8. *Helicodiscus singleyanus,* X10
9. *Promenetus kansasensis,* X20
10. *Hawaiia minuscula,* X10
11. *Helicodiscus singleyanus,* X10
12. *Zonitoides arboreus,* X5
13. *Nesovitrea electrina,* X5
14. *Zonitoides arboreus,* X5
15. *Nesovitrea electrina,* X5
16. *Promenetus kansasensis,* X20
17. *Zonitoides arboreus,* X5
18. *Nesovitrea electrina,* X5

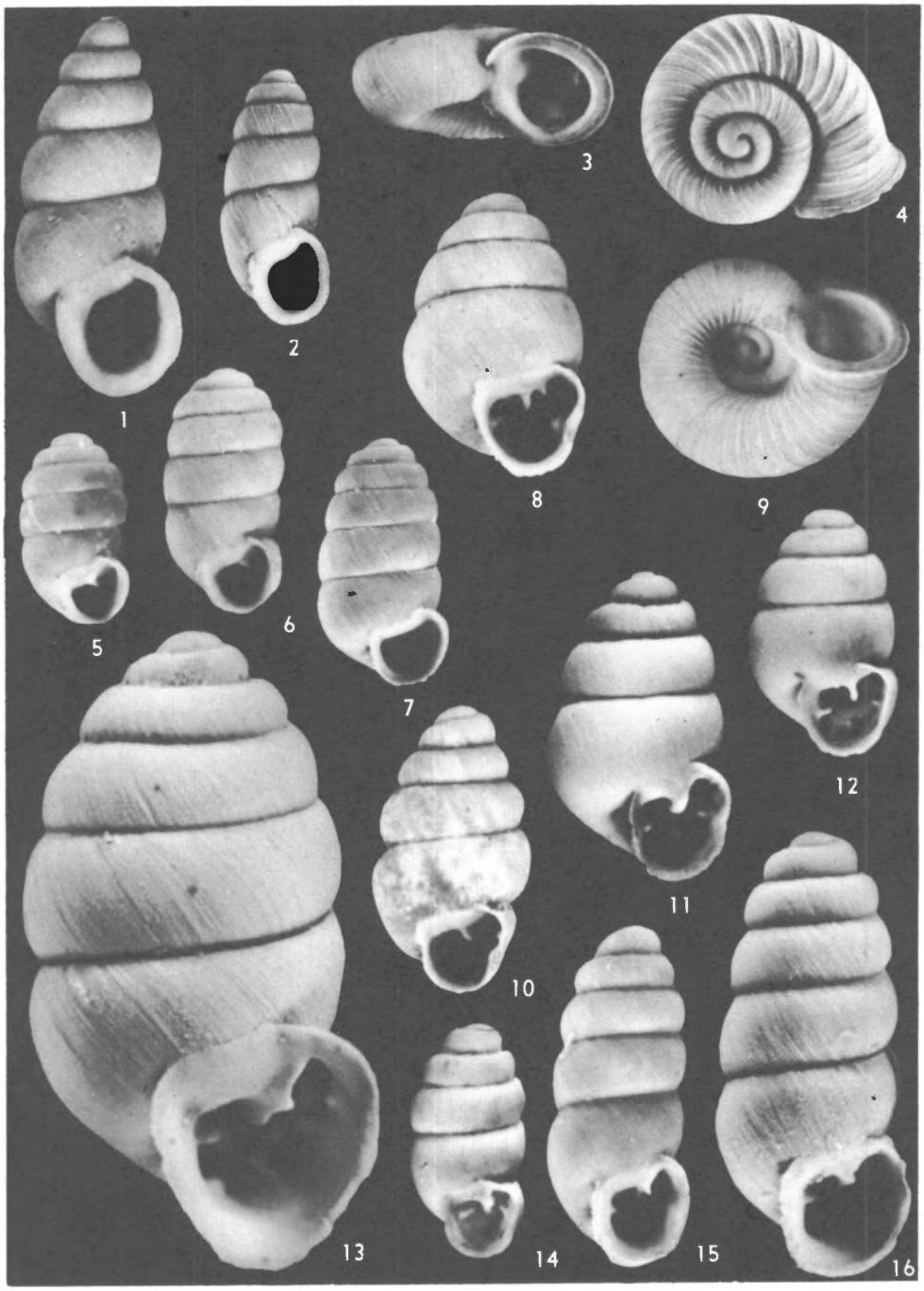

PLATE 17

Shells of *Gastrocopta, Pupilla, Pupoides, Vallonia,* and *Vertigo* (after Hibbard and Taylor, 1960, pl. XI, Pleistocene, Kansas)

1. *Pupoides albilabris,* X10
2. *Pupoides inornatus,* X10
3. *Vallonia parvula,* X20
4. *Vallonia parvula,* X20
5. *Pupilla blandi,* X10
6. *Pupilla blandi,* X10
7. *Pupilla muscorum,* X10
8. *Vertigo ovata,* X20
9. *Vallonia parvula,* X20
10. *Vertigo gouldi,* X20
11. *Gastrocopta tappaniana,* X20
12. *Gastrocopta tappaniana,* X20
13. *Gastrocopta armifera,* X20
14. *Gastrocopta holzingeri,* X20
15. *Gastrocopta procera,* X20
16. *Gastrocopta cristata,* X20

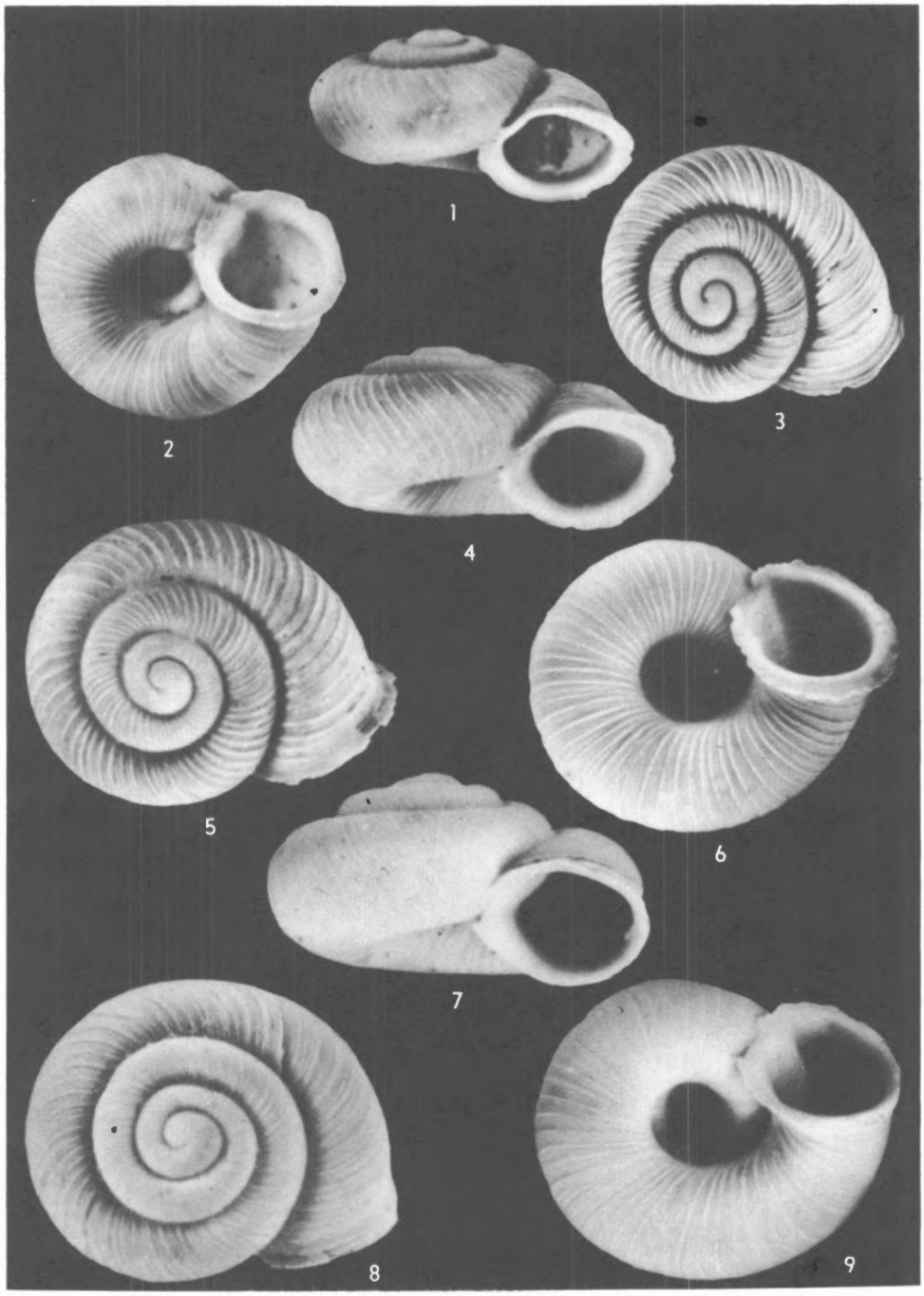

PLATE 18

Shells of *Vallonia* (after Hibbard and Taylor, 1960, pl. XII; Pleistocene, Kansas)

1. *Vallonia gracilicosta,* X20
2. *Vallonia gracilicosta,* X20
3. *Vallonia gracilicosta,* X20
4. *Vallonia gracilicosta,* X20
5. *Vallonia gracilicosta,* X20
6. *Vallonia gracilicosta,* X20
7. *Vallonia cyclophorella,* X20
8. *Vallonia cyclophorella,* X20
9. *Vallonia cyclophorella,* X20