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THE VARIETIES OF *PLANORBIS CAMPANULATUS*  
SAY

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The group of freshwater shells to which *Planorbis campanulatus* belongs is one in which variation occurs along certain more or less definite lines. The shells are coiled in such a way, and are so subject to environmental factors, that to name each minor variation would be to complicate the synonymy needlessly. That certain noticeable variations occur more frequently than others, however, is apparent to anyone who has worked with almost any of the freshwater mollusks. Tryon (Structural and Systematic Conchology, Vol. III, p. 106, 1884) writes of *Planorbis* as follows: "The plan of the spiral of this genus is such as to yield readily to pressure; hence monstrosities are rather frequent. They consist of a tilting up of the whorls on one side, or even a conical elevation of the spire. The smaller species, in America and Europe, appear to be most liable to this distortion."

It is to be expected that intermediates between the typical and varietal forms occur, but it seems that varieties which are as well-marked as those of *Planorbis campanulatus* hereinafter noted should be named. Until a careful analysis of the ecological factors involved can be made, and extensive laboratory experiments in breeding carried out, the heritability of the varietal characters cannot be known. Meantime, it is useful to name varieties in this as in other groups, to designate and analyze the particular characters which separate them from the typical facies.

In considering the two new varieties included below it has been necessary to review the collection of the Museum of Zoology and the literature, to distinguish between the forms already described under *Planorbis campanulatus*. Original descriptions are included in the following survey and figures have been prepared of all the varieties, for comparison and to assist in fixing the characteristics of each variety. *Planorbis multivolvus* Case is included, as exhibiting the extreme of variation which results in a form with many closely-coiled whorls and an elevated spire.

*Planorbis campanulatus* Say

Pl. I, figs. 1, 2, 3

Journal Academy of Natural Sciences, Vol. II, p. 166, 1821.

Original description: Shell sinistral, not depressed; whorls four, slightly striate across; longer than wide; spire hardly concave, often plane; body whorl abruptly dilated near the aperture, and not longer behind the dilatation than the penultimate whirl; suture indented, well-defined to the tip, the summits of the volutions being rounded; aperture dilated; throat narrowed abruptly; umbilicus profound, the view extending by a minute foramen to the apex. Greatest length of the body whorl one-fourth of an inch. Breadth from tip of the labrum, one-half of an inch; at right angles to the last, two-fifths of an inch.

This shell abounds in some of the small streams, which discharge into Cayuga Lake, where it was collected by Mr. Jessup, who presented specimens to the Academy and to me. It is readily distinguished from our other species by the sudden dilatation of the outer whirl, near the aperture in the adult shell, forming a large oval chamber. The summit of the outer whirl, behind the dilated portion, is not, or hardly elevated above the summits of the other volutions.

The shell figured shows the typically rounded whorls of the spire.

*Planorbis campanulatus minor* Dunker

Pl. I, figs. 4, 5, 6, 7

Conchylien Cabinet, Linnæiden, p. 52, Pl. 9, fig. 10, 1850.

This variety was never formally described, but the figure shows the under side of an immature specimen in outline. It is a small shell, closely coiled and diminutive in all its proportions. A lot of about ninety shells, all dead and bleached, recently collected from Crooked Lake, Montmorency County, Michigan, is almost entirely typical *minor*, only two of the specimens approaching the normally larger size of typical *campanulatus*. Figured are two shells from this lot, one mature and the other immature and practically identical with Dunker's figured specimen.

*Planorbis campanulatus rudentis* Dall

Pl. I, figs. 8, 9, 10

Harriman Alaska Expedition, XIII, Land and Fresh Water Mollusks, p. 90, 1905.

Original description: Variety *rudentis*: Knee Lake, Hayes River, Keewatin, N. Lat. 55° (E. A. Preble): . . .

A form which may prove distinct, or a variety of this species, was collected by Mr. Preble at Knee Lake. The comparative measurements are:

	Whorls	Major Diam.	Minor Diam.	Axis
Type .....	4.75	15.0 mm.	11 mm.	6.5 mm.
Variety .....	5.25	17.5 mm.	14 mm.	6.0 mm.

Very similar specimens were obtained from Anticosti Island and from Marl Lake, Michigan, in which the coil is even more irregularly wound, a condition I take to be pathological. The most noticeable difference, after the axially shorter whorls and larger size, is in the umbilicus, which in the variety is, as it were, reamed out, exhibiting three and a half whorls; while in the more compact type the umbilicus when examined with a lens shows only two and a half whorls, which diminish in size much more rapidly than in the variety. The campanulate aperture is about the same size in both forms, but seems larger in the type because the rest of the shell is so much more tightly wound. The

suture on the apical side seems deeper and wider than in the type. Nine specimens of the type were obtained, and I suggest for it the name *rudentis*, from the similarity of the whorls to a coiled hawser.

The shell figured is from Marl Lake, Roscommon County, Michigan. A series of six shells from this lake vary in size from 15 x 12 x 5.5 mm. to 13.8 x 11.3 x 5.6 mm.

*Planorbis campanulatus smithii* Baker

Pl. II, figs. 11, 12, 13

Nautilus, XXV, p. 118, 1912.

Original description: Shell discoidal, solid, the aperture sinistral; periostracum light horn colored, frequently stained reddish from the iron oxide in the water; surface shining, lines of growth very heavy, more or less rib-like, equidistant; spiral lines absent or very faint; whorls  $4\frac{1}{2}$ , closely coiled; spire flat, or a little convex, all but the last whorl coiled in the same plane; umbilicus wide and deep, somewhat funnel-shaped, exhibiting two and one-half whorls; the whorls are sharply carinated above and below, the last whorl being particularly so marked; this carination of the whorls causes a flattening of the periphery; the last whorl at a point about midway bends suddenly upward, causing the aperture to be elevated half the diameter of the whorl above the spire, and also causing the umbilicus to form a crater-like contour when viewed laterally; aperture campanulate, wider below than above; the sutures distinctly marked, even channeled in some specimens; outer lip sharp; inner lip appressed to the body whorl, which is covered with a callus.

Height of last whorl	Greatest diameter	Least diameter	Aperture height	Aperture breadth
9.00	17.00	12.50	9.00	6.50
8.50	16.75	13.50	8.50	8.50
8.00	15.00	11.75	7.00	6.00
7.50	18.00	13.50	8.50	8.00

. . . The spire of *rudentis* is flat and elevated above the last whorl, forming, as observed by Dall, an aspect like a miniature coiled hawser. In *smithii* the spire is depressed and more or less funnel-shaped. . . . In *smithii* the last whorl is elevated far above the plane of the spire. The umbilical region is also very different in *smithii*. The sharply carinated whorls also afford a striking difference. . . . *P. smithii* was at first thought to be a good species, but the presence of the typical form in the lake, which shows marked variation toward the *smithii* type, leads to its restriction as a strongly marked variety. Over 200 speci-

mens of the new variety have been examined and its novelty seems constant. Both *rudentis* and *smithii* represent extremes of variation of a common type. . . .

A specimen from Douglas Lake, Cheboygan County, Michigan, is shown. The corded carinae, deep funnel-shaped umbilicus, and elevated aperture distinguish this marked variety.

***Planorbis campanulatus wisconsinensis*, nov. var.**

Pl. II, figs. 14, 15, 16

*Description*: Whorls five and one half, closely coiled, increasing slowly in diameter and constricted back of the aperture; lines of growth distinct, rib-like, equidistant, the spaces between them occupied by very fine parallel striæ; traces of revolving striation; spire elevated but with the apex slightly sunken; whorls carinated above sharply with the exception of the last whorl, and below obtusely; umbilicus narrow and deep, exhibiting all the whorls. The last whorl bends upward and the aperture is appressed at an angle to the upper two-thirds of the whorl. Aperture angulated above, sharp-edged, flattened somewhat at the periphery, obtusely angulated and somewhat wider below. Sutures distinct, almost channeled where the carinae are most pronounced.

Greatest diameter 12.2 mm., least diameter 10.3 mm., altitude 6.5 mm., height of aperture 5.5 mm., width of aperture 4.7 mm.

*Type Locality*: Little Arbor Vitae Lake, Vilas County, Wisconsin.

*Type Specimen*: Museum of Zoology, University of Michigan, No. 35890. Paratypes in the collections of Dr. Bryant Walker and F. C. Baker.

The largest specimen of the lot measures: greatest diameter 15.2, least diameter 12.7, and altitude 7.2 mm.; the flattest shell measures in greatest diameter 13.0, least diameter 10.0, altitude 5.2 mm. The average for twenty-five fully adult shells is: greatest diameter 13.568, least diameter 10.5, altitude 6.32 mm.

A large series of this variety was taken at the type locality by Dr. Jan Metzelaar and Mr. Thomas H. Langlois during the summer of 1925 while collecting for the Michigan Fish Commission and for the Museum of Zoology. About 300 specimens were taken, and as a whole they exhibit remarkable uniformity in the varietal characters of elevated spire, carinated whorls, and the proportions of diameter to altitude. Little Arbor Vitae Lake is a part of the Tomahawk drainage system in northern Wisconsin. Dr. Metzelaar has supplied data on it as follows: a large lake of very irregular outline, wooded shores, bottom of coarse gravel with a thick vegetation of *Ceratophyllum* and *Elodea*. The temperature on September 19th, when the collection was made, was 19° Centigrade. The shells occurred in a few inches of water a few feet from shore, in such quantity that a bushel was collected in one haul of the fish net. Four quarts were brought back, and contained several species of mollusks besides the *Planorbis c. wisconsinensis*. The complete list is appended, as it indicates the characteristic association of forms and the northern character of the fauna:

<i>Planorbis trivolvis winslowi</i> Baker <sup>1</sup>	<i>Physa gyrina</i> Say
<i>Planorbis antrosus</i> Say var. <sup>2</sup>	<i>Ferrissia kirklandi</i> Walker
<i>Planorbis deflectus</i> Say	<i>Valvata tricarinata</i> Say
<i>Planorbis hirsutus</i> Say	<i>Valvata sincera nylanderi</i> Dall
<i>Planorbis exacuus</i> Say	<i>Amnicola limosa porata</i> Say
<i>Lymnæa stagnalis sanctæ-mariæ</i> Walker	<i>Amnicola</i> sp. <sup>3</sup>
<i>Lymnæa emarginata wisconsinensis</i> Baker	<i>Amnicola walkeri</i> Pilsbry
	<i>Pisidium scutellatum</i> Sterki
	<i>Pisidium ferrugineum</i> Prime

No Unionidæ were taken. The specimens of *Planorbis antrosus* var. are distinctly striated and sharply carinated, almost corded, above and below, approaching *percarinatus* Walker but differing from that variety in the smaller size and more

<sup>1</sup> *Nautilus* XXXIX, p. 116, April, 1926.

<sup>2</sup> F. C. Baker will diagnose this variety.

<sup>3</sup> F. C. Baker considers this the male form of *Amnicola limosa porata*. If it is not that form it is probably new.

rounded whorls. They seem to be about midway between *striatus* Baker and *percarinatus* Walker. Only one specimen of *Valvata sincera nylanderi* was found in the material, but it is identifiable even though dead and somewhat broken. Each of the *Lymnaeas* is represented by a very large number of specimens, all of which exhibit the varietal characters consistently. The shells of *Planorbis hirsutus* are fresh, with the epidermal bristles practically intact. *Planorbis deflectus* is represented by six mature specimens. Only three *Planorbis exacuous* were collected, all dead shells.

The new variety of *Planorbis campanulatus* seems characteristic of the north and middle western part of the United States, and of southern Canada. Various lots in the collection of the Museum of Zoology have been referred to this variety. They are from the following localities:

#### Michigan—

*Charlevoix County*: Pickerel Lake, northeast of Petoskey (30372); Crooked Lake at Conway (29839); Pine Lake (29834-6, 30219).

*Mackinac County*: Whitefish Lake, Mackinac Island (28146); Brevort Lake (28155).

*Chippewa County*: Cedarville (30368).

*Huron County*: Port Crescent (28204).

*Lake County*: Sauble Lakes (28152).

*Houghton County*: Otter Lake.

*Luce County*: Bodi Lake; Twin Lakes near Newberry.

*Dickinson County*: Brown Lake (7246, 7247, 7249); Norway (7250).

*Clare County*: Arnold Lake (10229).

#### Wisconsin—

*Vilas County*: Little Arbor Vitae Lake; Tomahawk Lake; Big Arbor Vitae Lake; St. Germain Lake; Madeline Creek, Tomahawk drainage.

*Oneida County*: State Hatchery at Woodruff.

Records from other collections, so far as ascertained, are as follows:

#### Canada—

*Quebec*: Blue Sea Lake (Whittaker).<sup>4</sup>

<sup>4</sup> *Nautilus*, XXXII, p. 127. E. J. Whittaker discusses and analyzes the variations in the shells of *Planorbis campanulatus* from Blue Sea Lake. His figures 2 and 3 are typical of the variety *wisconsinensis*.

*Ontario*: Minaka, Winnipeg River; White Dog, Winnipeg River; Star Lake, near Reddit; Alice and Onion Lakes, near Minaki; English River, near its junction with the Winnipeg River. (Alan Mozley).<sup>5</sup>

*Manitoba*: Falcon Bay, Waugh (Bryant Walker); Indian Bay Station, Falcon Bay (Alan Mozley).<sup>5</sup>

***Planorbis campanulatus davisii*, nov. var.**

Pl. II, figs. 17, 18, 19

*Description*: Whorls five, increasing moderately in diameter, spire plane, the apex slightly sunken, lines of growth even, distinct, crossed by obsolescent revolving striae; umbilicus wide, exhibiting four whorls; whorls obtusely angulated above, somewhat angulated below; the last whorl scarcely elevated above the plane of the preceding whorls, the aperture moderately expanded and somewhat thickened within.

Greatest diameter 11 mm., least diameter 9.1 mm., altitude 5 mm., height of aperture 4.75 mm., width of aperture 4 mm.

*Type Locality*: Pinnebog River, Huron County, Michigan.

*Type Specimen*: Collection of Bryant Walker, No. 9974; paratype in the Museum of Zoology, University of Michigan.

This form was sent us by Dr. Walker from a lot collected by the late Professor C. A. Davis, formerly of the faculty of the Botany Department of the University of Michigan. The variety resembles *rudentis* in its proportions, but it is very much smaller. The same form has been found at Sand Point, Huron County (No. 7241).

*Planorbis multivolvis* Case

American Journal of Science, Series 2, Vol. III, p. 101, text figs. 4 and 5, 1847.

Original description: Shell about five-eighths of an inch in diameter; whorls seven, about half of the last whorl overlapping the preceding one, sometimes the last whorl suddenly distorted and expanded for the last half of its length; right side concave, left side slightly acuminate and considerably carinate; throat campanulate; aperture opening towards the left, but projecting on both sides beyond the preceding whorl.

This shell I also obtained from Captain Stannard, who found it in the northern part of Michigan. . . .

<sup>5</sup> Nautilus, XXXIX, p. 126, 1926.



For a complete discussion of this species and its rediscovery in Howe Lake, Marquette County, Michigan, see Walker: "Notes on *Planorbis*, I" in *Nautilus*, XXI, pp. 60-64, 1907, and the excellent figures on Plate VIII. This form represents the extreme of variation of *campanulatus*, resulting in a large number of closely-coiled whorls, and in elevation of the spire, which seems literally to have been pushed out from below.

To summarize, the group may be briefly reviewed as follows:

- Planorbis campanulatus*—whorls rounded, the spire plane or slightly concave
- P. c. minor* —smaller in all dimensions than the other forms, tightly wound
- P. c. rudentis* —whorls rounded, spire flat or slightly convex, diameter great in proportion to altitude, umbilicus wide
- P. c. smithii* —whorls flattened at the periphery, carinated above and below, spire concave, umbilicus funnel-shaped
- P. c. wisconsinensis* —whorls carinated above, altitude great in proportion to diameter, umbilicus deep, spire elevated
- P. c. davisii* —like *rudentis* but smaller in all dimensions, low in proportion to diameter, whorls all in the same plane
- P. multivolvis* —whorls carinated above, many in number, spire elevated, often conical

PLATE I

FIGS. 1-3. *Planorbis campanulatus* Say. x2.

FIGS. 4-6. *Planorbis campanulatus minor* Dunker. Crooked Lake, Montmorency County, Michigan. x2.

FIG. 7. *Planorbis campanulatus minor* Dunker. Crooked Lake, Montmorency County, Michigan. x2.

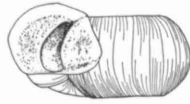
FIGS. 8-10. *Planorbis campanulatus rudentis* Dall. Marl Lake, Roscommon County, Michigan. x2.



1



2



3



4



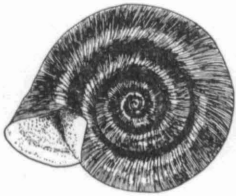
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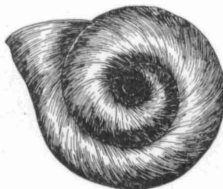
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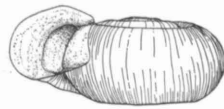
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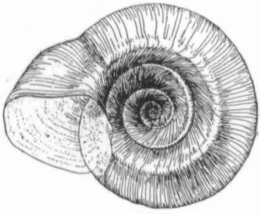
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PLATE II

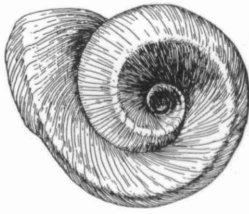
FIGS. 11-13. *Planorbis campanulatus smithii* Baker. Douglas Lake, Cheboygan County, Michigan. x2.

FIGS. 14-16. *Planorbis campanulatus wisconsinensis*, nov. var. Little Arbor Vitae Lake, Vilas County, Wisconsin. Type. x2.

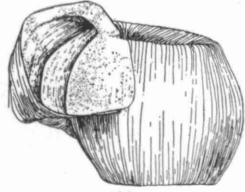
FIGS. 17-19. *Planorbis campanulatus davisii*, nov. var. Pinnebog River, Huron County, Michigan. Type. x2.



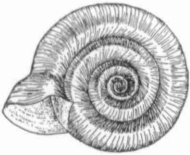
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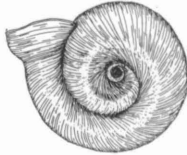
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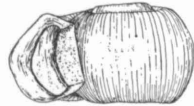
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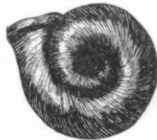
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