

MINUTE SHELLS - Part 9

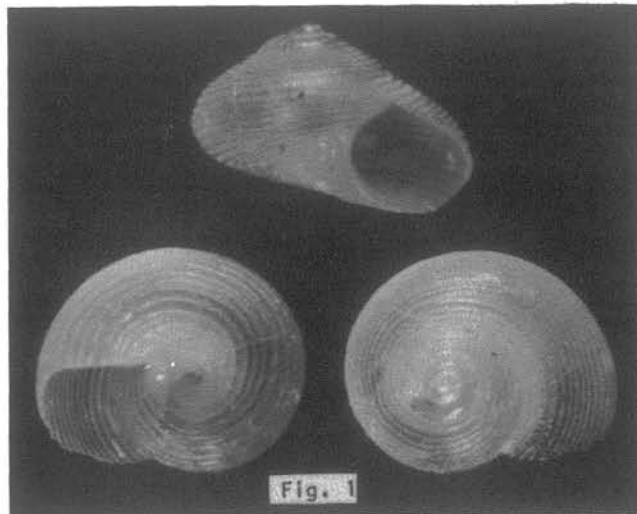
by Bert Draper

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Museum of Natural History

Continuing with the family Vitrinellidae, the next genus in the subfamily Vitrinellinae is *Leptogyra* Bush, 1897. This little-known genus is represented by only one species in the Eastern Pacific, *L. alaskana* Bartsch, 1910, from Alaskan waters as the name indicates. The shell is minute, usually less than a millimeter in diameter, with $2\frac{1}{2}$ whorls ending in an enlarged aperture. It has a tiny horn-colored nucleus and the balance of the shell is bluish white. There are usually twelve fine spiral lines on the upper surface and about as many somewhat stronger lines on the base. The umbilicus is deep, with flat walls, marked with fine spiral threads. The aperture has a thin flared lip. I would appreciate hearing from anyone who has shells which answer this description.

The next genus is *Parviturboidea* Pilsbry & McGinty, 1950. This genus includes several species described from the Panamic province. General characteristics of this genus are well rounded whorls marked with sharp, rather closely spaced, spiral ridges and weaker axial riblets, forming square or rectangular pits. The nuclear whorls are smooth, clear and glassy. They have small but deep rounded umbilical wells, surrounded by a weak spiral callous wall. *P. monile* (Figure 1) is the best known and most abundant species. It has a conical shape with slightly rounded shoulders on the whorls. The spiral sculpture is typical of the genus, with ridges and riblets equally spaced apart, thus creating tiny square pits. The spacing of both the spiral and axial ribs is quite variable in this species, even between certain sections of the same shell. This variability has led to the separation of at least one species which has axial riblets farther apart than normally, making the pits rectangular in shape

instead of square. This form was named *P. copiosus* (Pilsbry & Olsson, 1945).



Parviturboidea monile (Carpenter, 1857) LACM
66-19. 5-20 ft. Pulmo Bay, Baja Calif., Mex.
Legit. McLean & Oringer, April 1966. Diam. 1.6
mm.

Parviturboidea decussatus (Carpenter, 1857), shown in Figure 2, is shaped much like *P. monile*, but has stronger shoulders on the whorls, and both spiral and axial ribs are stronger and farther apart, giving a much coarser appearance to the sculpture. This species is also quite variable, and what appears to be a smaller and more coarsely sculptured variety has been named *P. decussatus clausus* Pilsbry & Olsson, 1945. One other species, *P. germanus* Pilsbry & Olsson, 1945, has a much lower spire than either *P. monile* or *P. decussatus*. The axial riblets are farther apart than the spirals, as in *P. copiosus*, and weaker, and there is a larger area of callous behind the aperture than in the other species. Judging from the figure, *P. monilifer* (Carpenter, 1857) appears similar to and perhaps the same as *P. germanus*, but it is too poorly des-

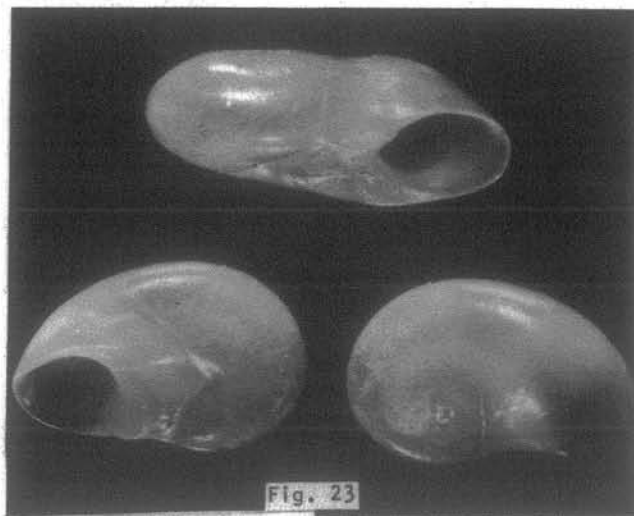
spire is barely raised above the later whorls and is whiter than the rest of the shell, with this whiter color continuing as a spiral band along the sutures in the later whorls. Spiral sculpture of close-set striations, made wavy by fine lines of growth, covers all but the sutural band and umbilical callous, which is rather small in this species.

The third subgenus, *Idiorphe* Pilsbry, 1922 is represented by only one species from the Panamic province. *T. narina* Pilsbry & Olsson, 1945. The shells are thick, solid, well rounded but bent a little sharper at the periphery. No sculpture is present except a spiral line indicating the suture above and a boundary groove around the large umbilical callous below. The shells often reach slightly over 2 mm in diameter.

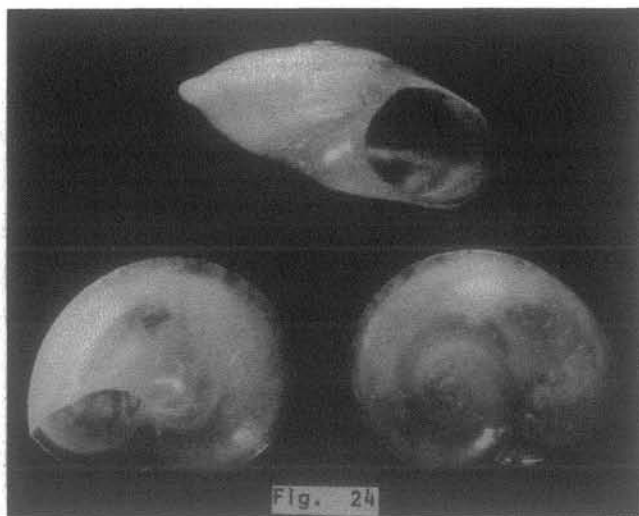
The fourth subgenus, *Pseudorotella* Fischer, 1857 includes at least 16 species from the eastern Pacific, some of which should perhaps be placed in synonymy with others in the subgenus. Figure 23 shows the best known of these species, *T. amplexans* Carpenter, 1857. This is a moderately large species reaching 3.5 mm in greatest diameter. The shells are translucent white, well rounded, and though the final whorl is considerably extended

it does not cause any enlargement of the aperture. The spire is almost completely buried with only the final whorl showing a suture mark. This suture line extends as a shallow groove down around the shell to the callous pad. The large callous pad extends from the inner lip of the aperture back to the umbilicus where it terminates in a continuation of the sutural line. *T. americanum* Pilsbry & Olsson, 1945 appears to be a southern form of *T. amplexans* and is no longer justified as a separate species or even as a subspecies since *T. amplexans* has been found throughout the Panamic province. *T. cecinella* Dall, 1919 also appears to be just an outer Baja representative of *T. amplexans*.

Teinostoma ecuadorium Pilsbry & Olsson, 1941 is a medium sized (2 mm) species, well rounded with no sculpture except for a spiral suture line on the top. The heart-shaped aperture is formed by a part of the callous pad extending over the inner lip. This callous pad is thick but not very large in area. The shell of *T. herbertianum* Hertlein & Strong, 1951 (Figure 24), is flatly convex above, with a slightly elevated spire. A strong peripheral keel stands out as the



Teinostoma amplexans Carpenter, 1857. LACM 41-1. Bahia de Adair, Son., Mex. Legit. E. Huffman, 1941. Diam. 3.3 mm.



Teinostoma herbertianum Hertlein & Strong, 1951. LACM 71-14. 10-50 ft. E. side of Punta Entrada, (N. entrance to Magdalena Bay) Baja Calif., Mex. Legit. J. McLean, Jan. 1971. Diam. 1.9 mm.

principal sculpture on this smooth and shiny shell, while two very weak spiral ridges mark the center of the base. The rather thick callous blends smoothly into the base with a slight mound over the columella. Three very similar species are: *T. lampetes* Pilsbry & Olsson, 1952; *T. lirulatum* Carpenter, 1857; and *T. myrae* Pilsbry & Olsson, 1952. All three are well rounded, with depressed spires which are practically buried in the shells, and all have rather large apertures. Spiral sculpture is present on each species, but differs considerably: *T. lampetes* has two spiral grooves immediately above and below the periphery, *T. lirulatum* has many closely spaced fine spiral grooves over much of the surface of the shell, and *T. myrae* has somewhat stronger spiral grooves which decorate only the upper part of the shell.

Teinostoma millepunctatum Carpenter, 1857 resembles the previous three species in general shape, but is somewhat smaller, and as shown in Figure 25, the entire shell is covered with tiny punctations arranged in both spiral and radial rows. The callous pad, which shows evidence of punctate sculpture, is rather small, but closes the umbilicus. *T. pallidulum* Carpenter, 1957; *T. rarum* Pilsbry & Olsson, 1945; and *T. tumens* Carpenter, 1857 all

appear to be quite similar, all are globular with the final whorl expanded outward and downward, making the aperture quite large. All three species also have heavy callous plates curving over the umbilical area. In *T. rarum* the expansion of the latter whorls is quite extreme, making the sutural spiral around the nucleus very tiny relative to the rest of the shell. In *T. pallidulum* the final whorl extends downward so much that the shell is as high as it is wide. In *T. tumens* the callous is so thick that it partially fills the aperture. So far no good specimens of any of these three species have shown up, so I am unable to provide photos of any of them.

Teinostoma soror Pilsbry & Olsson, 1945 (Figure 26) is fairly large, up to 4 mm in diameter, and is rather plentiful throughout the Panamic range. The shell is heavy with no sculpture other than incremental growth lines and a narrow sutural groove. Early whorls sometimes show some fine spiral striations which disappear or are worn off in the later whorls. The callous pad is quite large and circular, sometimes being outlined by a narrow groove at its outer edge. *T. percarnatum* Pilsbry & Olsson, 1945 is similar to *T. soror* but is smaller, has a

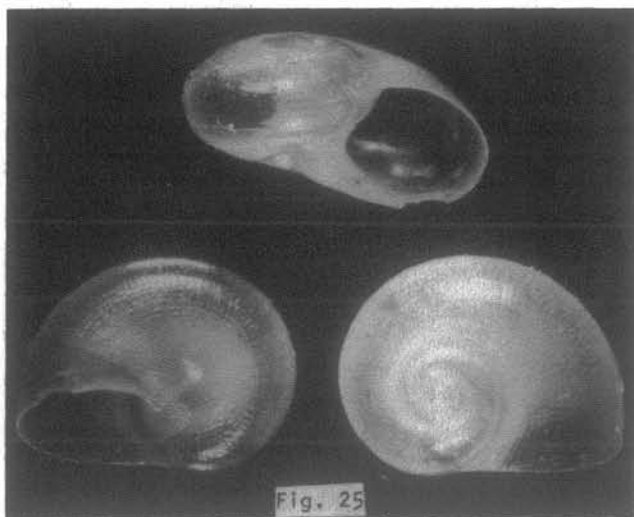


Fig. 25

Teinostoma millepunctatum Pilsbry & Olsson, 1945. LACM 70-9. Salina, Ecuador. Legit. J. McLean, March 1970. Diam. 1.3 mm.

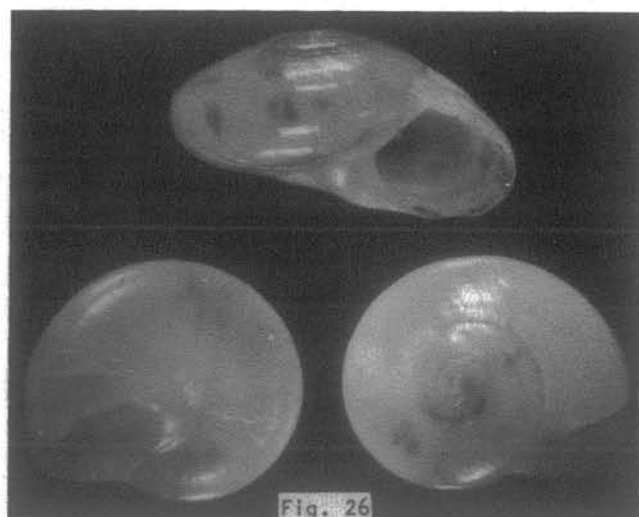


Fig. 26

Teinostoma soror Pilsbry & Olsson, 1945. LACM 63-15. 10 fath. Banderas Bay, Jal., Mex. Legit. C. Willis, April 1963. Diam. 3.8 mm.

sharp carina at its periphery, and has a thicker callous pad.

Teinostoma substriatum Carpenter, 1857 has a fairly flat shell, well rounded at the periphery and with a slightly elevated spire. It has weak spiral threads or lines and the callous pad is made up of a series of wrinkles which barely close the umbilicus. This species may belong in *Solariorbis* because of its peculiar callous pad. *T. sulcatum* (Carpenter, 1857) is much like *T. tumens* except it has a curved groove or sulcus in the callous near the base of the columella. Carpenter named it for two specimens he found which had this groove, and recently Carol Skoglund, of Phoenix, has found an additional three specimens with similar grooves.

Judging from their description and figures, *Teinostoma zacae* Hertlein & Strong, 1951 appears to be the same as *Solariorbis regularis*. However, a study of the type specimen will be necessary before this can be determined with certainty. *T. hemphilli* Strong & Hertlein, 1939 (Figure 27) is a beautiful crystal-clear shell, gracefully whorled, with a smoothly tapering spire and a large rounded aperture. Unfortunately the shells of this species are very delicate and easily bro-

ken, so few perfect specimens are collected. The shell I photographed was 2.2 mm in diameter and quite perfect, but it broke as I removed it from under the camera mount.

Figure 28 shows a species which was called *Teinostoma regularis* (C.B. Adams, 1852) by Baker, Hanna, & Strong in their 1938 paper. However, Adams' *T. regularis* is a *Solariorbis* with a higher spire and different aperture and callous pad. So this species should be *T. regularis* Baker, Hanna, & Strong, 1938. The shell is well rounded above, more flattened below, with a typical *Teinostoma* callous pad extending somewhat concavely from the inner lip completely over the umbilical area with a shallow groove around it. The aperture is quite oblique and has a strong thin lip.

There are at least five species of *Teinostoma* described and named from the Southern California province; however, only one or possibly two of these appear to be valid. *T. supravallatum* (Carpenter, 1864) is the one surely valid species. This species has a strong carination around the top of the shell, spiralling out from the nucleus. *T. invallatum* (Carpenter, 1864) is completely smooth on top, but the shells look like *T. supravallatum*

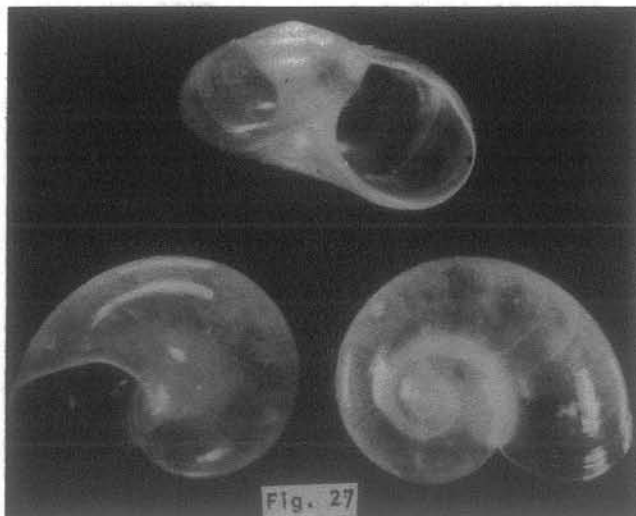


Fig. 27

Teinostoma hemphilli Strong & Hertlein, 1939
In tidal drift, Marua Estero, Puerto Penasco,
Son., Mex. Legit. B. Draper, Oct. 1973.
Diam. 2.2 mm.

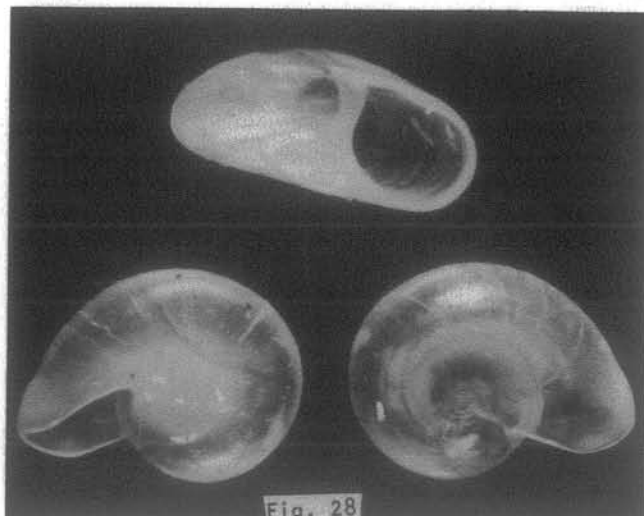


Fig. 28

Teinostoma regularis Baker, Hanna & Strong,
1938. LACM 70-18. Intertidal in hermit crab
colony, Ft. Amador Beach, Canal Zone, Panama.
Legit. J. McLean, March 1970. Diam. 2.3 mm.

from the bottom. Figure 29 shows three different views of both species, *T. supravallatum* below and upper left, *T. invallatum* center and upper right. Both types are found in about equal numbers in almost any lot of these shells I have examined. Some have been noted to have changed from smooth to carinated after an injury and others start with a carina, then become smooth as they grow larger. This makes it appear that they are simply dimorphic forms of the same species. The other three species named from Southern California are: *T. bibbiana* Dall, 1919; *T. salvania* Dall, 1919; and *T. sapiella* Dall, 1919. They all appear to have been described from variations of the smooth *invallatum* form of *T. supravallatum* at isolated localities, and to be of doubtful validity as species.

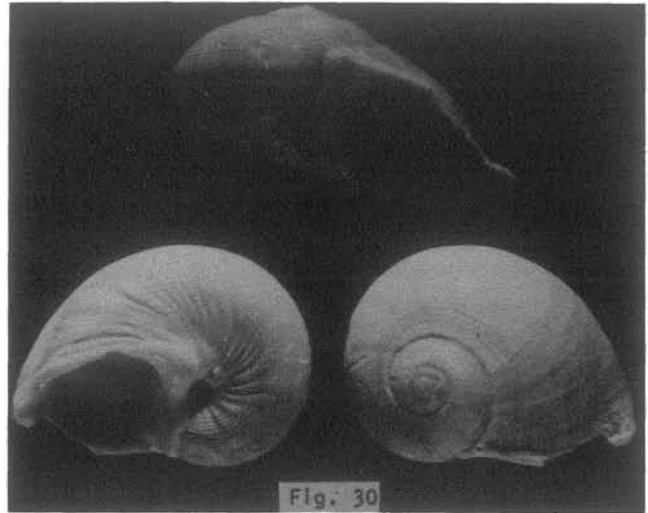


Teinostoma supravallatum (Carpenter, 1864)
(bottom and upper left) and
Teinostoma invallatum (Carpenter, 1864)
(center and upper right)
White's Point, San Pedro, Calif. Legit. B.
Draper, 1962. Largest shell diam. 2.1 mm.

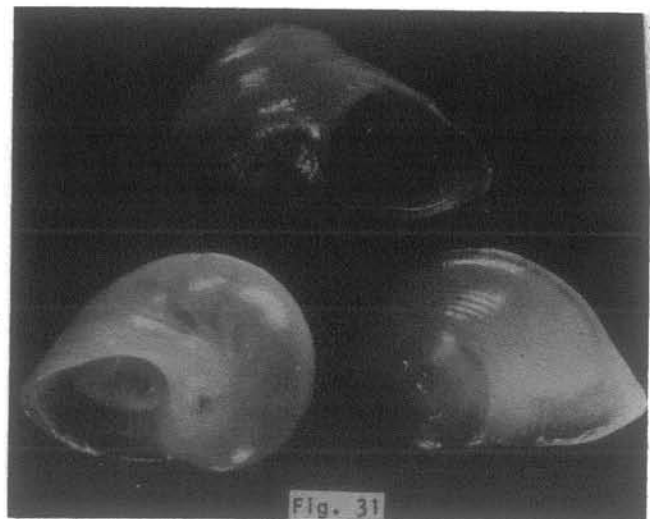
Teinostoma ochsneri Strong & Hertlein, 1939 has a shell quite similar to *T. supravallatum* although the carination is lower and there is a spiral thread around the outer edge of the base. Since *T. ochsneri* has only been reported from Bahia Honda, Panama, it is not likely to be closely related to

the California species which has only been taken from the cooler northern waters.

The genus *Anticlimax* Pilsbry & McGinty, 1946 is represented in the Panamic province by two species which have been assigned to the subgenus *Subclimax* Pilsbry & Olsson, 1950. The first species is *Anticlimax occidentis* Pilsbry & Olsson, 1952 (Figure 30) and



Anticlimax (Subclimax) occidentis Pilsbry & Olsson, 1952. LACM 61-2. 20 fath. S. of Punta Final, San Luis Gonzaga Bay, Baja Calif. Mex. Legit. Campbell, Shasky & Sphon, Jan. 1961. Greatest diam. 3.6 mm.

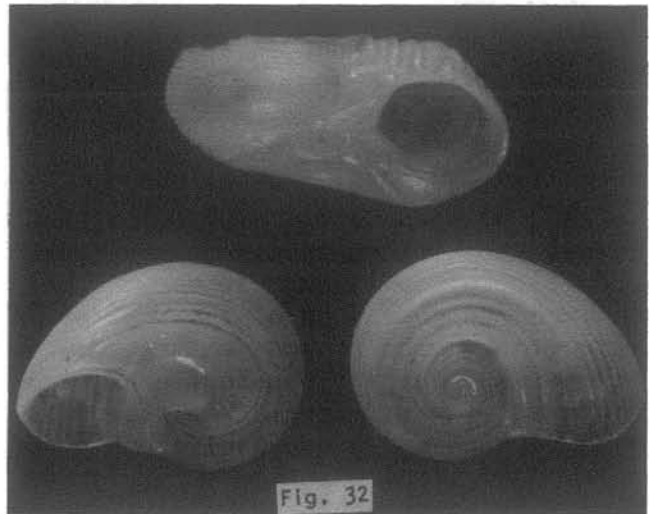


Anticlimax (Subclimax) willetti Hertlein & Strong, 1951. LACM 70-85. Intertidal in hermit crab colony, Ft. Amador Beach, Canal Zone, Panama. Legit. Ann Marti, March 1970. Diam. 2.5 mm.

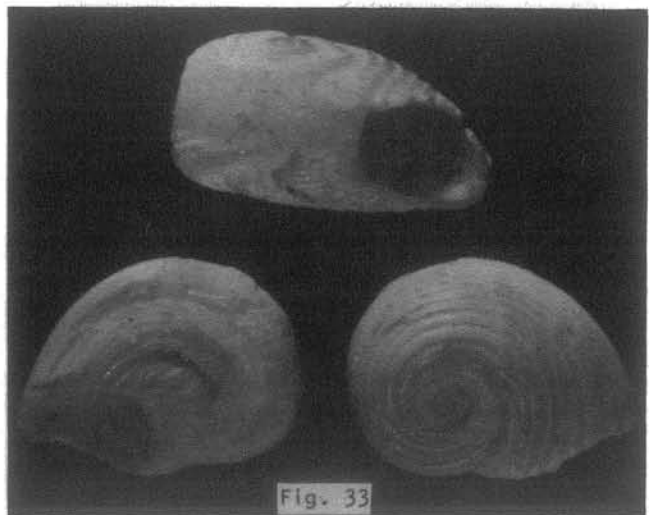
the second is *A. willetti* Hertlein & Strong, 1951 (Figure 31). Both show the typical conic shape with an elongated final whorl. *A. occidentens* develops a blunt carina at the periphery with a shallow groove above and below it on the final whorl. Fine linear grooves are closely spaced on both surfaces of the shell, while a few growth lines radiate a wrinkle above and more numerous folds radiate protractively from the small umbilicus about halfway out on the base. A spiral callous surrounds the umbilicus and enlarges into a strong round fold between the columella and the inner lip. *A. willetti* has a more rounded outer edge, and a shallow groove just above the periphery on the final half whorl. The spiral grooves on the upper part of the shell are coarser and farther apart than on *A. occidentens*, and the lower half is practically smooth except for a few protractive folds leading out from the umbilical area. The callous pad is more developed than in *A. occidentens* and nearly closes the umbilicus.

The genus *Panastoma* Pilsbry & Olsson, 1945 was set up to accommodate a single Pleistocene fossil species represented by three specimens from Panama. *P. azulense* Pilsbry & Olsson, 1945 was the name given to this species. Figure 32 shows the first shell of *P. azulense* taken in recent material. This shell and two more have appeared in minute shell material from Costa Rica. The characteristics of this species are its flat spire, its strong spiral grooves which continue to the upper edge of the aperture and overhang it, the finer spiral grooves around the periphery, which become stronger around the outer half of the base, and the two-pronged massive callous at the inner margin of the aperture, which covers the umbilicus by one of its prongs.

The final genus of this subfamily is *Woodringilla* Pilsbry & Olsson, 1951. One species, *W. glyptylus* Pilsbry & Olsson, 1951, has been described from the Panamic province and another, as yet unnamed, is known to exist. Figure 33 shows the better of two specimens



Panastoma azulense Pilsbry & Olsson, 1945
LACM 72-17. 5-25 ft., N. side of Bahia Jobo,
W. of Bahia de Salinas, Guanacaste Prov., Costa
Rica. Legit. LaFollette, Cadien & Ferreira,
Febr. 1972. Diam. 2.5 mm.



Woodringilla glyptylus Pilsbry & Olsson, 1951
LACM AHF 243. Bottom sample 11 fath., San
Gabriel Bay, Espiritu Santos Is., Baja Calif.
Mex. Legit. A. Hancock Found. Research Vessel-
Velero, Febr. 1936. Diam. 1.6 mm.

of this species which are available in the Los Angeles County Museum. The upper half of the shell is rather similar to *Panastoma azulense* with spiral grooves that continue to the overhanging upper edge of the aperture. However the spire is slightly elevated

and the periphery is broad and flattened. The base has a few obsolete spiral grooves but the unique characteristic of this species is its callous, which has deep grooves at right angles to the edge of the aperture. The callous appears to come up out of the umbilicus which it overrides. Shells of this species are quite small; the largest we know of is the one photographed, which is 1.6 mm in its greatest dimension. With this species I have completed my discussion of the extensive family Vitrinellidae.

REFERENCES CITED

All references cited for Parts 7 and 8 of Minute Shells, in the previous two issues of THE TABULATA, apply also to Part 9.

All photography was done by the author. All photographs show three or more views of the same specimen. Each specimen is selected as the most representative shell for that species available at the time of writing. I wish to express my thanks to the Los Angeles County Museum for so freely allowing me access to their specimens and literature in the preparation of these articles.

Correction of error: The shell shown in Figure 17 of Part 8 of Minute Shells was identified as *Cyclostremiscus (Miralabrum) unicornis* (Pilsbry & Olsson, 1945). Further study has shown that this shell should have been identified as *Anticlimax (Subclimax) occidentis* Pilsbry & Olsson, 1952 and it has been shown again in Part 9 with the correct identification. No specimens of *Miralabrum* are available, but the figure of the type shows a shell much like the one shown in my photograph, except it has an open umbilical well rather than the wrinkled callous as in *Anticlimax occidentis*. This error is strictly my own. B. Draper.



more....COLLECTING AT BANDOS ISLAND

Latirus smargadula Linnaeus, 1758

Latirus sp.

Peristernia nassatula Lamarck, 1822

Vasum ceramicum Linnaeus, 1758

Vasum turbinellus Linnaeus, 1758

Conus balteatus Sowerby, 1833

Conus distans Hwass, 1792

Conus ebraeus Linnaeus, 1758

Conus frigidus Reeve, 1848

Conus litoglyphus Hwass, 1792

Conus marmoreus bandanus Hwass, 1792

Conus miles Linnaeus, 1758

Conus rattus Hwass, 1792

Conus varius Linnaeus, 1758

Conus virgo Linnaeus, 1758

Conus zonatus Hwass, 1792



IN MEMORIAM

JOHN Q. BURCH

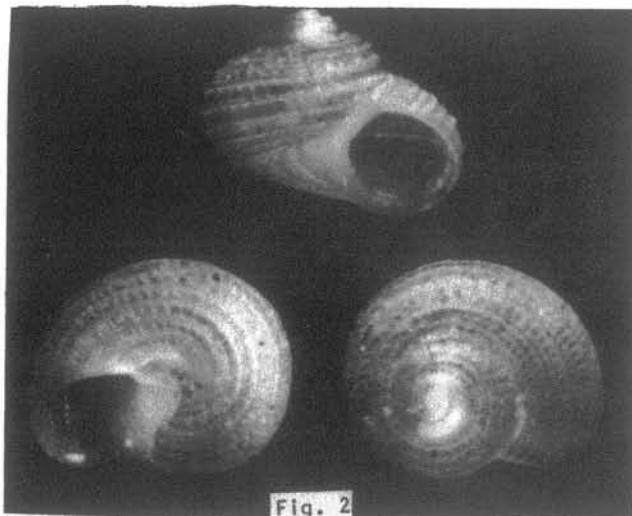
June 20, 1894 - August 7, 1974

A biographical account of this widely known conchologist was published in the January 1 1971 (vol. 4, No. 1) issue of The TABULATA.

We extend our sympathy to his widow, Rose Burch of Seal Beach, California, and his son Tom Burch of Honolulu, Hawaii.

cribed to be sure of this until the type can be studied.

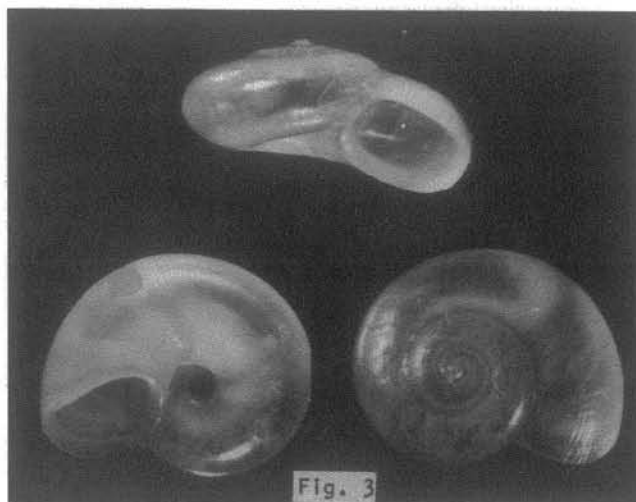
The genus *Solariorbis* Conrad, 1865 contains at least 27 species described from the Panamic province, and only one to the north. Four subgenera are recognized, based on shell characteristics. The primary characteristic used for assigning species to this genus is the umbilicus which is contracted by a spirally emerging cord or callous ridge from the inner edge of the aperture to the columella, often flattened where it forms the umbilical wall. The amount of closure varies greatly though usually a small umbilical crevice remains. My treatment of species in this genus follows Myra Keen's listing in SEA SHELLS OF TROPICAL WEST AMERICA.



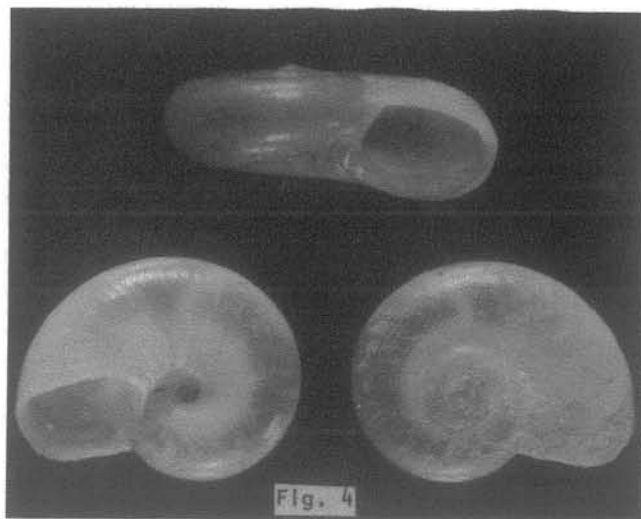
Parviturboides decussatus (Carpenter, 1857)
San Carlos Bay, Guaymas, Mex. Legit. George
Kanakoff, no date. B. Draper Coll. Diam.
1.25 mm.

The subgenus *Solariorbis* s.s. is the most numerous in terms of species. To assist in studying them I have divided the sixteen species into four groups, each having characteristics which are quite similar. The first group includes species whose shells are flat, low spired, and whose whorls are well rounded at the outer edge. Most species have fine spiral grooved sculpture, which appear more like rows of pits, due to their being crossed by

fine growth lines. The following species I have placed in this first group *S. ametabolus* Pilsbry & Olsson, 1952 (Figure 3) is large for the genus, reaching a diameter of 4 mm, and is well rounded with barely noticeable spiral sculpture on some portions of the shells; *S. hambachi* Strong & Hertlein, 1939 (Figure 4) is similar to *S. ametabolus* in size, but somewhat flatter and lower spired. *S. gibrালেonis*

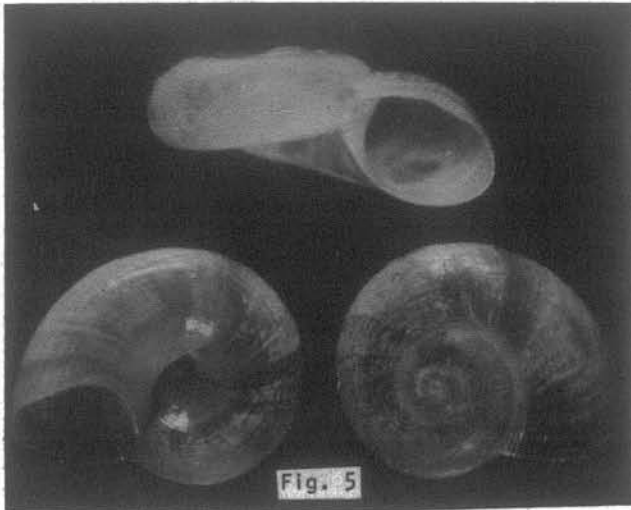


Solariorbis ametabolus Pilsbry & Olsson, 1952
LAMC 69-26. 5-25 ft. N. end of El Chollude
I., S. of Puertecitos, Baja Calif. Mex. Legit.
J. McLean, July 1969. Diam. 3.7 mm.



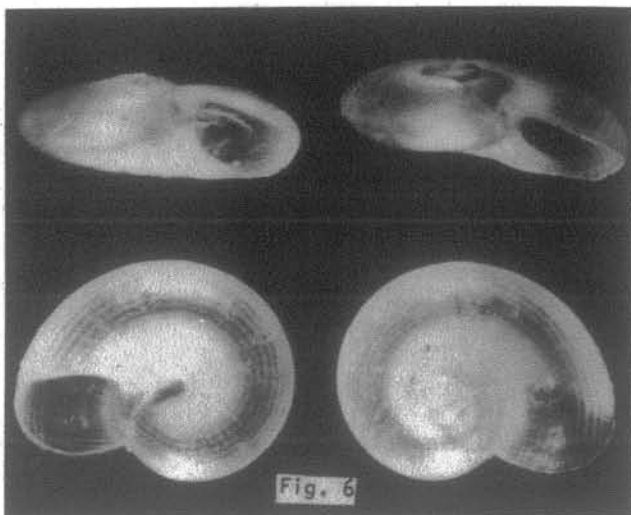
Solariorbis hambachi (Strong & Hertlein, 1939)
LACM 70-16. Intertidal, Veracruz, Panama.
Legit. J. McLean, March 1970. Diam. 4.0 mm.

Pilsbry & Olsson, 1952 (Figure 5) is also quite flat and low spired, but has stronger spiral sculpture, and the callous closes the umbilicus more than in the two previous species.



Solariorbis gibraleonis Pilsbry & Olsson, 1952
Marua Estero, Puerto Penasco, Son., Mex. in
tidal drift. Legit. B. Draper, Oct. 1973.
Diam. 2.3 mm.

Solariorbis minutus (C.B. Adams, 1952) appears to fall into this group although it is a much smaller species, seldom exceeding 1 mm in diameter. Figure 6 illustrates the depressed



Solariorbis minutus (C.B. Adams, 1852) LACM
70-11. Intertidal, NW. side of Punta Ancon,
Santa Elena Peninsula, Ecuador. Legit. J. Mc-
Lellan, March 1970. Diam. 1.1 mm.

shape and somewhat hazy spiral sculpture, as well as the callous which almost closes the umbilicus, leaving only a narrow constricted opening. I have included two other species, not pictured here, in this group, *S. arnoldi* (Bartsch, 1927) and *S. pyricallosus* (Carpenter, 1857). *S. arnoldi* is the only species of this genus which was reported from north of the Panamic province, the type and only specimen having been found at San Pedro, California. This shell is very similar to *S. ametabolus* and could be a shell of that species imported by accident. *S. pyricallosus* resembles *S. minutus* except for being somewhat less flattened. Carpenter described it from a single shell about 1.2 mm in diameter.

Group two includes three species which also have rather low spires and rounded whorls, but they have much stronger sculpture of raised spiral ridges. The first species, *S. hypolius* Pilsbry & Olsson, 1952 (Figure 7) has the general shape of this group, and has several strong spiral ridges on the upper part of each whorl, but is quite smooth on the base. The callous is rather weak although still visible around the umbilicus. This species reaches about 3 mm in diameter. The

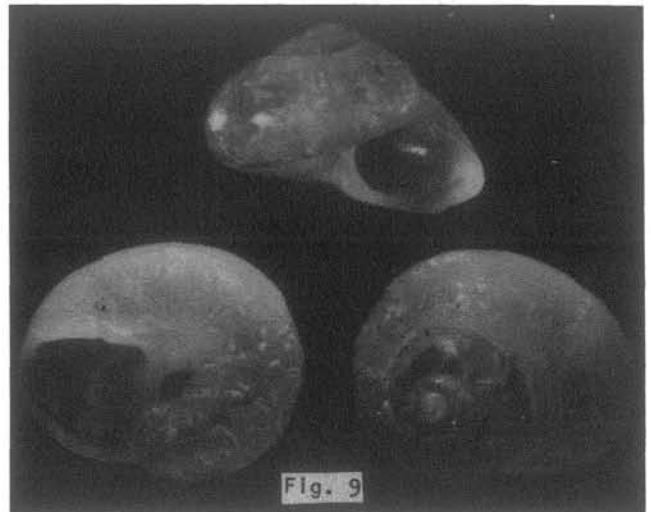


Solariorbis hypolius Pilsbry & Olsson, 1952
LACM 70-85. Ft. Amador Beach, Can. Zone, Pan.
Legit. Ann Marti, March 1970. Diam. 2.5 mm.

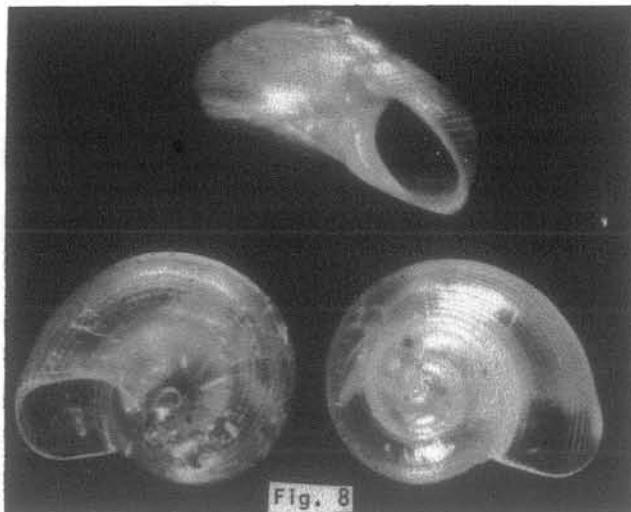
other two species of this group are slightly smaller. *S. allomphalus* Pilsbry & Olsson, 1952 has weak rounded spiral ridges on the base as well as stronger ridges above; the callous is also better developed than in *S. hypolius*. *S. bailyanus* Pilsbry & Olsson, 1952 is more rounded at the spire, has weaker spiral ridges both above and below, and has an even stronger callous, which almost closes the umbilicus leaving only a small round opening.

Group three includes three more species, all of which are higher spired and more conical in shape. In all three species the callous nearly closes the umbilicus. Figure 8 shows *S. harnai* (Strong & Hertlein, 1939) which is the only species of this group having any spiral sculpture. The shell is semi-transparent, quite small, 1.6 mm in diameter, and the umbilicus is almost completely closed by the spiral callous. *S. miguelensis* Pilsbry & Olsson, 1952 (Figure 9) is dull white with protractive whitish streaks, which do not show in the photograph. The shell is slightly more elevated in the conical spire than *S. harnai* and the umbilicus is a little more open. The final species of this group is *S. regularis* (C.B. Adams, 1852) shown in Figure 10. This species

was assigned to *Solariorbis* with a question mark because the basal callous often completely closes the umbilicus, as in the specimen photographed, although there is usually a slight crevice visible. The whorls are well rounded and more impressed at the sutures than the previous two species. In size, all three species are rather small, none of them reaching 2 mm in diameter.



Solariorbis miguelensis Pilsbry & Olsson, 1952
LACM 71-3. 20-30 ft. Punta Abreojos, Baja Calif., Mex. Legit. J. McLean, Jan. 1971.
Diam. 1.8 mm.



Solariorbis harnai (Strong & Hertlein, 1939)
LACM 72-30. 40-50 ft. S. of tip of Punta Santa Elena, Guanacaste Prov., Costa Rica. Legit. LaFollette & Cadien, Febr. 1970. Diam. 1.6 mm.

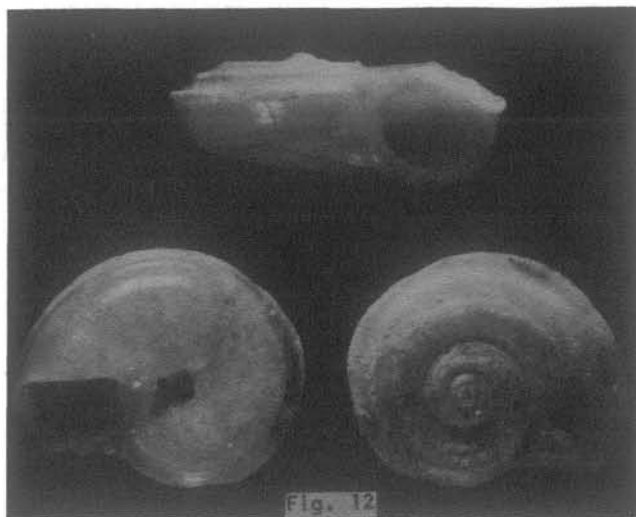


Solariorbis regularis (C.B. Adams, 1852) LACM 61-6. 10 mi. S. of San Luis Gonzaga Bay, Baja Calif., Mex. Legit. Campbell, Shasky & Sphon, Jan. 1961. Diam. 1.9 mm.

Group four includes five species which have a wider range of difference than those of the other three groups. They are low spired, tending to be rather flat, and have open umbilical wells, usually bordered by a somewhat wrinkled callous. *Solariorbis concinnus* (C.B.Adams, 1852) (Figure 11) is a small attractive species, maximum diameter about 1.5 mm, which was also described as *S. mccullochae* (Strong & Hertlein, 1939). Adams' single specimen came from Panama, the same locale of the 85 specimens of *mccullochae*. The shell I have shown came from Costa Rica, and has somewhat weaker sculpture; however, three specimens in my personal collection collected by R. Poorman at Guaymas, Mexico, show the same strong sculpture as is indicated in the type figures for both species. *Solariorbis narinensis* Pilsbry & Olsson, 1952 (Figure 12) is quite flat, with several strong rounded spiral ridges on the upper surface, and a stronger keel at the periphery. Below this keel, the shell's edge tapers inward to a weaker keel, which surrounds the concave base. The umbilicus is quite open and bordered by a wrinkled wall of callous.



Solariorbis concinnus (C.B. Adams, 1852) LACM 72-17. 5-25 ft. N. side of Bahia Jobo, Guanacaste Prov. Costa Rica. Legit. LaFollette, Cadien & Ferreira, Febr. 1972. Diam. 1.5 mm.



Solariorbis narinensis Pilsbry & Olsson, 1952 LACM 66-17. 10-20 fms. between Rancho El Tule & Rancho Palmilla, Baja Calif., Mex. Legit. McLean & Oringer, Apr. 1966. Diam. 2.8 mm.

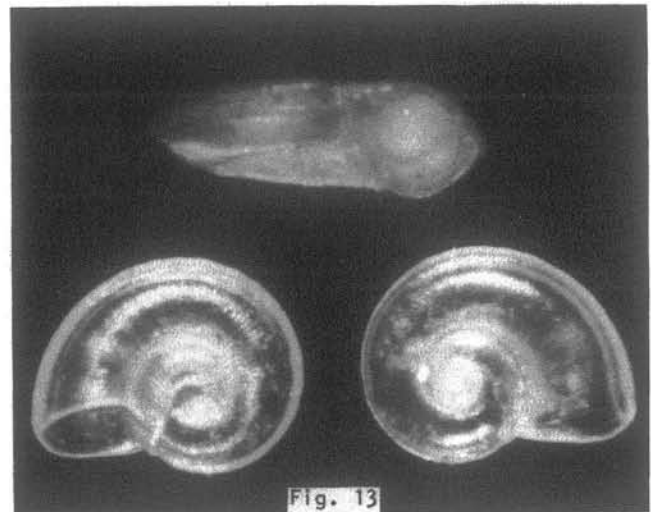
Solariorbis millepunctatus Pilsbry & Olsson, 1945 is also rather flat with a very depressed spire, and is well rounded at the periphery. The principal characteristic of this species is its many closely spaced rows of tiny punctations covering all of the shell except the nuclear whorls and the umbilical well. *S. bakeri* (Strong & Hertlein, 1939) is another rather flat species, but the spire is slightly raised, and a row of raised nodes spirals out from it, becoming obsolete on the final whorl. There are several low spiral ridges around the periphery of the shell, which is well rounded. These ridges continue part way into the base, leaving a flat area around the umbilical well, which is bordered by a strongly wrinkled callous. This completes the subgenus *Solariorbis s.s.*

The subgenus *Eulerema* Pilsbry & Olsson, 1952 includes only one named species. This is *S. pellucidus* Pilsbry & Olsson, 1952, a small, globose species found from Colombia to Peru. The spire and periphery of the shell are smoothly rounded with no sculpture except incremental lines of growth. The rounded base almost encloses the small umbilicus. The only sculpture

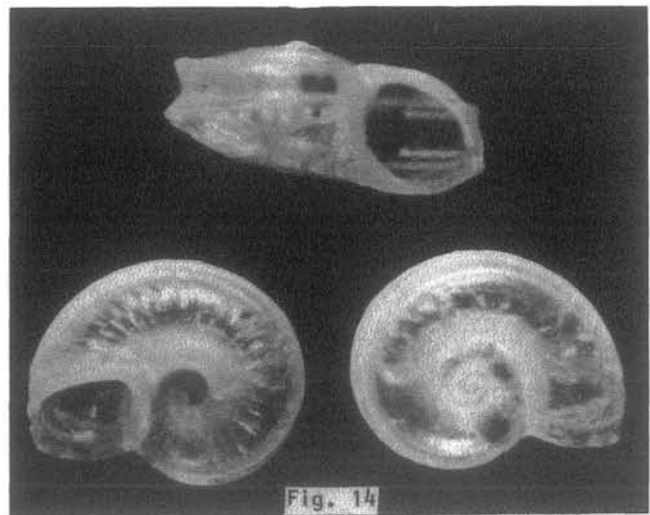
on the shell is a callous ridge around the umbilicus which sets it off from the base.

The third subgenus of *Solariorbis* is *Hapalorbis* Woodring, 1957, to which Keen has assigned eight species. In general members of this subgenus are flatly rounded above, with low spires, and flat to slightly concave below. The umbilical wells vary from moderately large and open to almost completely closed. Some spiral sculpture is usually present, especially around the outer edge of the shells and some species have axial ribs of varying strength. *S. carinatus* Pilsbry & Olsson, 1952 has a moderately raised spire, is flatly convex both above and below. There is a furrow at the suture bordered on the last whorl by a raised cord. The periphery has a keel around it with a distinct furrow just above it. The umbilicus is small, bordered vertically by a moderately thick callous. *S. carinatus* (Carpenter, 1857), shown in Figure 13, is a very minute species seldom reaching 1 mm in diameter. Live specimens have an amber colored shiny periostracum. The spire is very depressed and shell slopes convexly both above and below to a sharp peripheral keel. The umbilicus is almost closed by a thin callous plate that spirals around from the inner lip. Closely spaced axial threads radiate outward on both surfaces. *S. carinulatus* (Carpenter, 1857) was described from a single immature shell. The figure looks like the early whorls of *S. concinnus* in my specimens collection.

Solariorbis ditropis Pilsbry & Olsson, 1952 has a rather elegant shell as shown in Figure 14. The top of the shell rounds off flatly from the low spire to a sharp keel at the upper edge of the shell. A deep channel separates this from another equally strong keel at the lower edge, then the base slopes convexly to the umbilical well, which is surrounded by a rather large spiral callous plate. The upper surface has a few weak axial riblets, barely showing, while the base is decorated by stronger radial ribs extending from the callous plate



Solariorbis carinatus (Carpenter, 1857) LACM 72-17. 5-25 ft. N. side of Bahia Jobo, W. of Bahia de Salinas, Guanacaste Prov. Costa Rica. Legit. Lafollette, Cadien & Ferreira, Febr. 1972. Diam. 1.05 mm.



Solariorbis ditropis Pilsbry & Olsson, 1952 LACM 70-12. Punta Ancon, Santa Elena Peninsula, Ecuador. Legit. J. McLean, March, 1970. Diam. 1.6 mm.

almost to the lower peripheral keel. The next species, *S. exquisitus* Pilsbry & Olsson, 1952 must really live up to its name when perfect specimens are found. The rather battered specimens I have seen show how exquisite the



Fig. 15

Solariorbis exquisitus Pilsbry & Olsson, 1952
LACM 71-178. 70-100 ft. San Pablo Pt., outer
coast of Baja Cal., Mex. Legit. McLean & La-
Follette, Oct. 1971. Diam. 1.4 mm.

shells of this species are. Figure 15 shows the best of three specimens in the Los Angeles County Museum collection. The tiny shells, under 1.5 mm in diameter, exhibit spiral rows of beads around the spire, then strongly retractive axial riblets extending to a small sharp peripheral keel. A row of axial grooves sets off a series of nodes just below the peripheral keel, and four spiral threads are present just inside these nodes on the base. The only undecorated area on the shell is the white spiral callous plate around the umbilicus.

Solariorbis liriopae (Bartsch, 1911) is rather common throughout the Panamic province. It is another small species, usually under 2 mm in diameter. Figure 16 shows the biconvex shape of the shell and the strong peripheral keel set off by grooves both above and below, and weaker spiral keels bordering these grooves. The spire is distinct but low and the umbilicus is quite large, set off by a sharp callous around it. The shells are milky white, with a few retractive growth marks showing as darker curved streaks.

Solariorbis pacificus Pilsbry & Olsson, 1952 (Figure 17) is another

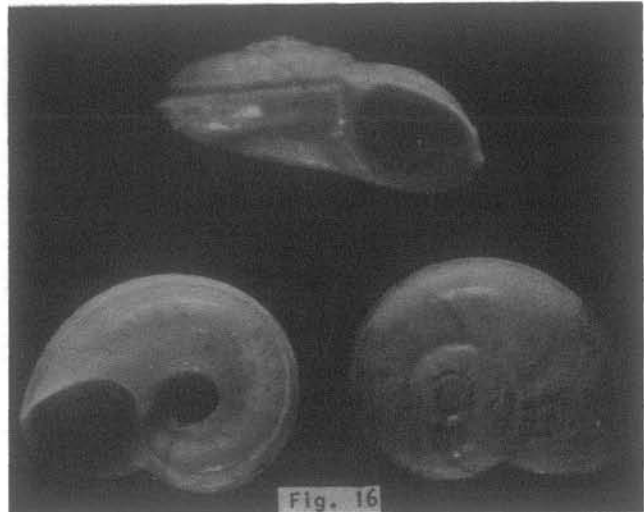


Fig. 16

Solariorbis liriopae (Bartsch, 1911) LACM AHF
2025. 30 fath. Mouth of Concepcion Bay, Baja
Calif., Mex. Legit. R/V Velero bottom samp-
les. Diam. 1.8 mm.

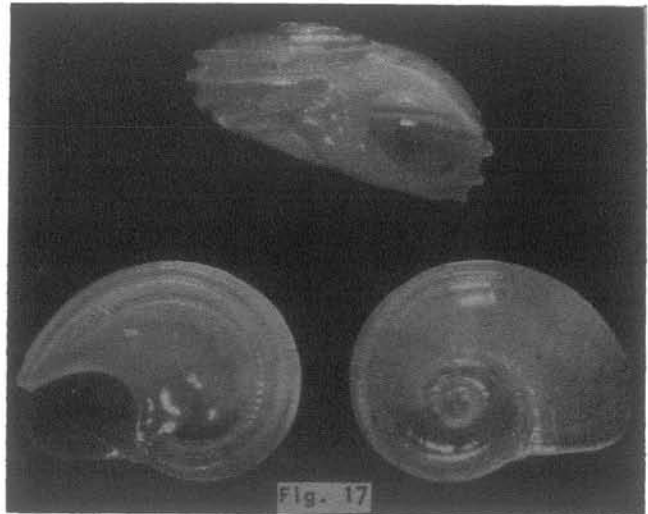
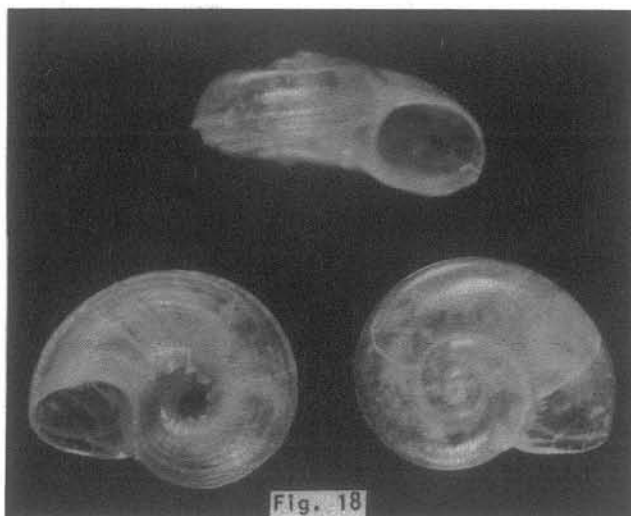


Fig. 17

Solariorbis pacificus Pilsbry & Olsson, 1952
LACM 70-85. Ft. Amador Beach, Can. Zone, Pan.
Legit. Ann Marti, Mar. 1970. Diam. 2.0 mm.

beautiful shell, just a bit larger than the last species. The strong solid shell is translucent white in color, with a shiny surface. It is described as being lens shaped with five deep spiral grooves defining four strong, subequal and evenly spaced cords. Minute axial riblets in the grooves create a beaded appearance. A heavy callous extends from the inner

edge of the aperture around the umbilicus almost completely closing it. The final species of this subgenus is *S. seminudus* (C.B.Adams, 1852), shown in Figure 18. The entire upper half of the shell is smooth, with no sculpture, rounding down to the periphery at which there is a small, but sharp, keel. Below this keel are two spiral cords set off by three spiral grooves. The inner half of the base is smooth and bound on its inner edge by a callous coating with deep V-shaped wrinkles, which borders the deep umbilicus.

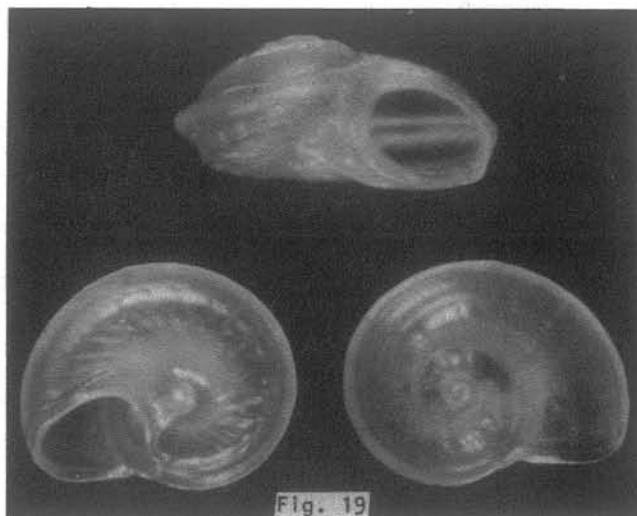


Solariorbis seminudus (C. B. Adams, 1852)
17 fath. San Carlos Bay, Guaymas, Son., Mex.
Legit. R. Poorman, Dec.1967. B. Draper Coll.
Diam. 1.6 mm.

The final subgenus of *Solariorbis* is *Systemomphalus* Pilsbry & Olsson, 1941 originally set up for fossil shells of western South America, and now including two recent species from the Panamic province. Figure 19 shows the first of these, *S. annulatus* (Carpenter, 1857) which is flatly rounded on top with the early whorls showing some axial sculpture of squared nodes which disappear on the final whorl. A strong rounded keel extends around the periphery of the shell with a recessed groove separating it from the rather flat base. Retractive axial riblets decorate the base and edge of the shell, but are hidden on their inner ends by the callous pad, which extends

from the inner edge of the aperture around and over the umbilicus, which it almost covers.

S. elegans Pilsbry & Olsson, 1952 is the second species in this subgenus. It is quite similar to *S. annulatus* except for more ornate sculpture around the spire and somewhat different basal sculpture. Figure 20 shows these differences which include two spiral cords around the outer edge of



Solariorbis annulatus (Carpenter, 1857) LACM
63-37. Concepcion Bay, Baja Calif., Mex.
Legit. R. Maynard, June 1963. Diam. 1.6 mm.



Solariorbis elegans Pilsbry & Olsson, 1952.
Intertidal NW. side of Punta Ancon, Santa Elena Pen., Ecuador. Legit. J. McLean, March 1970. Diam. 2.3 mm.

the base, and no axial sculpture there. The callous around the umbilicus extends farther out on the base but does not enclose the umbilical well, as in the previous species.

We have now completed the subfamily Vitrinellinae and are ready to start with the subfamily Teinostomatinae. This subfamily includes only about 37 species from the eastern Pacific, far fewer than the previous subfamily. Five genera have been named to include these species. The first and most numerous by far is *Teinostoma* A. Adams, 1851. The genus is subdivided into four subgenera, of which *Teinostoma s.s.* will be considered first. A single Panamic species, *T. politum* A. Adams, 1851, is shown in Figure 21. The shell is large for the family, reaching more than 10 mm in greatest dimension. The white shells are highly polished and hardly show the suture lines on the completely depressed spire. A few spiral striations may or may not be evident in the early whorls. The aperture is greatly extended and elongated, making the shell almost pointed. The inner lip develops a smooth strong callous which extends entirely around and over the umbilicus, which shows through as only the dark outline of its outer edge. Two subspecies have been named based on minor variations in the appearance of the shells. They are *T. p. gallegosi* Jordan, 1936, and *T. p. ultimum* Pilsbry & Olsson, 1945. With more specimens now

available for study, it appears that there is little justification for separating these two subspecies, hence I am considering them as conspecific, and not justified to be more than varieties.

The second subgenus of *Teinostoma* is *Esmeralda* Pilsbry & Olsson, 1952 with three species described from the Panamic province. *T. concavaxis* Pilsbry & Olsson, 1945 has minute, thin translucent white shells which are lens shaped. Both surfaces are covered with closely spaced, very fine spiral striations broken into a beaded appearance by minute lines of growth. A strong rounded callous pad covers the somewhat sunken umbilical area. I have not yet located any shells of this species to photograph. *T. esmeralda* Pilsbry & Olsson, 1945 fits the same description, but has stronger spiral sculpture, and is more flattened in shape, coming almost to a sharp edge at the periphery. The callous pad also is smaller, barely hiding the umbilicus. The third species, *T. imperfectum* Pilsbry & Olsson, 1945, has larger shells, reaching 2 mm in diameter. The species was described from shells of Panama. Figure 22 shows the shape and sculpture of this species, as found at Cholla Bay in the northern part of the Gulf of California. The

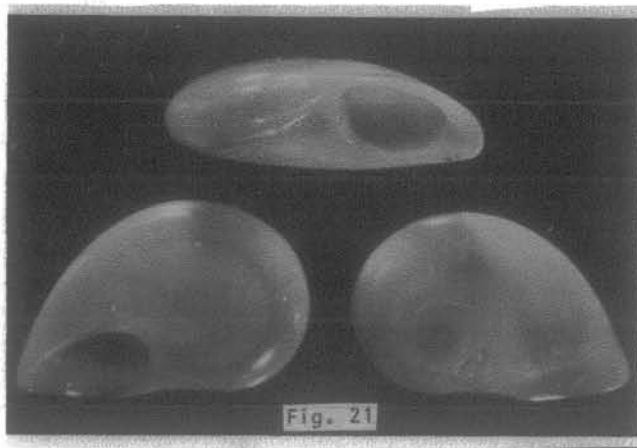


Fig. 21

Teinostoma politum A. Adams, 1851. Puerto Penasco, Son., Mex. Legit. E.P. Chace, 1958. B. Draper Coll. Largest, diam 10 mm.



Fig. 22

Teinostoma imperfectum Pilsbry & Olsson, 1945. Low tide, bottom skim, Cholla Bay, Son., Mex. Legit. B. Draper, Oct. 1973. Diam. 1.8 mm.