17.3 mm. high, and 16.2 mm. in diameter, with an aperture 13.6 × 12 mm. (ANSP 182241). On September 22, I found another living periwinkle there. It was about the same size as the first one. At last, *Littorina littorea* had reached Delaware Bay.

It has taken longer to come from Atlantic City to Delaware Bay than it took to come all the way from Nova Scotia to Atlantic City, so it may be assumed the species is nearly as far south along the east coast as it can go.

Primarily a rock-inhabiting mollusk, *Littorina littorea* is still far from common in New Jersey where sandy beaches extend along the entire seacoast.

Additional records for New Jersey including the date of collection where available are: Point Pleasant, before November 27, 1894 (Stewardson Brown). Longport, in tidal pool along sea wall of Weidner Home, 1919 (L. H. Bregy). High Point, 4 miles south of Barnegat Light, November 25, 1922 (William O. Abbott). Ocean City, 1945 (C. J. Lode). Neptune City, Monmouth County (Johnsonia, no. 7, p. 5).

A NEW PYRGULOPSIS FROM OREGON

By S. STILLMAN BERRY, Redlands, California

In the course of reviewing for other purposes some of the many interesting Mollusca of the Klamath River drainage basin, I find myself unable to make a satisfactory disposition of the little-known *Pyrgulopsis* from Upper Klamath Lake (see Henderson, 1928, 1929) except by describing it as new.

Pyrgulopsis archimedis, new species (Pl. 7, fig. 6).

Shell minute, almost perfectly conical in main outline, the periphery sharply angulate and abruptly pinched out into a prominent and extremely heavy rounded keel, which descends the spire a trifle above the narrow and rather dim suture. Apex subacute, the whorls 6 or a little less; side-slopes convex on early whorls, falling away almost vertically or sometimes even sloping inwardly below the keel on the latter turns, then

more straightly outward into the keel again. Aperture large, triangular-pyriform, or possibly better described as stirrup-shaped, subangulate posteriorly, its outer margin pinched out in continuity with the strong interior groove which hollows the keel; base rounded but not greatly produced. Surface sculpture absent except that strong illumination brings out traces of fine spiral lines.

Alt. 4.24, max. diam. 2.89, diam. aperture excluding keel 1.46 mm.

Holotype: Cat. no. 8068 Berry collection. Paratypes: Cat. no. 7932 Berry collection; others to be deposited in the collections of the California Academy of Sciences, the U. S. National Museum, the San Diego Museum of Natural History, and the private collection of Allyn G. Smith of Berkeley.

Type locality: Upper Klamath Lake, near Algoma, Oregon; Allyn G. Smith, 16 June, 1931.

This is an extraordinarily curious and attractive little species, clearly allied with its neighbor, *P. nevadensis* (Stearns, 1883),[1] but differing in the much more powerfully developed keel, concave whorls, and particularly the large acutely angled aperture and less produced base. Furthermore, the spiral sculpture seems appreciably stronger on shells of *P. nevadensis,* but this may in part be due to their bleached condition.

Shells from Winnemucca Lake, Nevada, appear sufficiently different from those of the typical Pyramid Lake race to deserve a name of their own, but I withhold a separate denomination of them until I can secure a more widely representative series of both fossil and living shells of this genus than I at present possess.

Quite recently, Cockerell (1946: 235) has attributed *P. nevadensis* to the Cahuilla alluvium of the Colorado desert in southern California on the basis of a single shell discovered there by Dr. W. O. Gregg. The report is somewhat premature however, since the specimen in question represents not this species but an altogether distinct and apparently undescribed form, which now awaits only the recovery of a little more material to be made the subject of a further appropriate communication either from Dr. Gregg or myself.

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[1] Cf. my no. 2874, west shore of Pyramid Lake, Nevada; J. H. Paine, June, 1911.

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SOME MOLLUSCA OF ILLION GORGE, HERKIMER COUNTY, NEW YORK

BY C. L. BLAKESLEE

The January, 1943, issue of Nautilus contained an article written by William Henry Fluck relating a collecting experience he enjoyed, in days gone by, in the Illion Gorge, one of two gorges that emerge out of the high hills south of the town of Illion, N. Y., and terminate at that place. In this gorge Mr. Fluck collected several hundred snails, mostly *Mesodon zaletus* Binney, in one day's time. After reading Mr. Fluck's contribution, I immediately began to plan a trip to the gorge notwithstanding that the round distance was over three hundred miles. However, the war was on and the gas was not to be had so I impatiently settled down in the hope that I would not have to wait very long before the enemies would be subdued and the trip could be undertaken. The desire never flagged throughout the many months. The war ended too late in 1945 for the undertaking and so it was carried over into the spring of this year.

[2] Cf. Nautilus 43: 103 and 53: 137.—H. B. B.

In the meantime, I had written to Mr. Fluck for more specific directions for finding the site in the gorge. He replied that it was a rather insignificant lateral ravine coming down into the main gorge and occupied by a small stream. It was to be found "just beyond the houses" which referred to a cluster of dwellings along the gorge road after leaving the town and that it might be recognized by its association with a calcareous tufa-like formation. In the Nautilus, Mr. Fluck says: "It is filled with snails, especially *Mesodon exoleta,*" and later he wrote: "Be sure and examine the crevices in the rocks."

Turning to Dr. Pilsbry's "Mollusca of North America," I found an expected reference to the region (Mohawk) and that the ancestors of the *M. zaletus* found there were introduced from Ohio by Dr. James Lewis in 1874. The record states that they were released at Mohawk but, as that town is only two or three miles from the Illion end of the gorge, descendants of the Lewis introduction may have migrated over the intervening distance in the seventy years interim.

Plans were made to make the trip to the gorge the early part of June, the time recommended by Mr. Fluck, but one thing and another acted as a deterrent until July 8th. The start was then made and the gorge was entered from the south end at the town of Winfield. Its entire length of thirteen miles was run for the purpose of noting sites such as described by Mr. Fluck. Reaching Illion, the route was retraced until a lateral ravine, occupied by a small stream and located beyond a group of houses, appeared to meet the description that had been given.

Getting over to the mouth of it, the search was begun. Rain apparently had fallen during the night, for the ground was wet and the thick vegetation carried a fair amount of moisture. Some unrecognized plants with large leaves were abundant and I soon found that the undersides were concealing an abundance of feeding snails. An examination showed that they were not *M. zaletus* but that they might be immature *Mesodon thyroidus.* Then finding one with a lip the question arose as to whether they were *Mesodon mitchellianus* or *M. clausus.* Remembering that *M. clausus* was not an inhabitant here, it was decided the species was *M. mitchellianus.* About fifty mature specimens were found in about fifteen minutes and also two dead *M. zaletus.* At least over one hundred immature *M. mitchellianus* were observed.

A couple of weeks later, Morrie K. Jacobson, whom I had previously invited, stopped over on a trip he was making to the west, to become acquainted and to do some shell collecting. After he had rested a day, Mrs. Blakeslee, Mr. Jacobson and myself set out to again visit the gorge. In due time, we found ourselves at the site previously visited. With great expectations, we hurried from the car over to the collecting site but not a single live *M. mitchellianus* or *M. zaletus* could be found. The daylight, temperature and time of day were nearly identical with the conditions prevailing at the time of the first visit and the ground was damp with some moisture on the vegetation.

Mr. Jacobson decided to scale the steep and slippery water worn bed of the ravine stream and see if altitude would affect the possibilities. Mrs. Blakeslee resolved to wander a distance up the road to a bridge spanning a stream that had been accompanying the gorge road for some distance and at that point had decided to explore the opposite side.

Standing at the foot of the water worn lateral ravine watching Mr. Jacobson negotiate his difficult ascent, I was startled out of a subconscious reflection on the vagaries of mollusks by an agonized call from Mrs. Blakeslee. Getting over to where she was much too slowly for her agitated state, I found that she attained her destination at the brdge she had nearly stepped into a party of several snakes sunning themselves or else out for other purposes of their own. Being "allergic" to such reptiles, apparently she thought calling would be more effective than running.

I could not forego the dormant juvenile urge to stir them up with the end of a weed stalk and, while one or two of them took the ten foot plunge to the stream below and others disappeared under abutment stones, two made off into the grass bordering the pavement of the road. In trying to keep them in sight, one of us (Mr. Jacobson had joined us) saw a *M. mitchellianus* in the grass through which the snakes were escaping. Then others, and instantly we two men were down on our knees picking mature shells from out the growth. We soon had what we considered enough and with lighter hearts, purged of disappointment, we headed out into the west for the long ride home.

The paucity of *Mesodon zaletus* and the abundance of *M. mitchellianus* may indicate that the site selected was not the one

visited by Mr. Fluck. If this is a fact, which will be verified next year, it gives a promise of a richness of molluscan life in the gorge that would well repay any conchologist who can visit it during any of the summer months.

COLOR VARIATION IN OLIVELLA UNDATELLA

By D. S. and E. W. GIFFORD

Four days of collecting on the sandy palm-fringed shore of lovely Santiago Bay near the city of Manzanillo, Colima, Mexico, yielded three species of olive shells: *Agaronia hiatula* Gmelin, *Olivella zonalis* Lamarck, and *Olivella undatella* Lamarck. The days were January 30 and 31 and February 1 and 2, 1946. The tides were in the afternoon. We had the aid of our friends, Mr. and Mrs. George M. Foster, in garnering a series of 2,641 *Olivella undatella.* This was our first acquaintance with this beautiful and highly variable species, except for archaeological specimens in the form of beads from an ancient aboriginal site near Indio, Riverside County, California. These ancient examples must have been traded to the Southern Californians from a source much closer than the state of Colima—probably the shores of the Gulf of California.

In its range from pure white to very dark shells, *Olivella undatella* is reminiscent of *Olivella biplicata.*[1] Tryon has called attention to this great range in coloration in *Olivella undatella.* After describing the predominant coloration of the species, he remarks:[2] "The above description is that of the typical coloration, but the variation in color and markings is so great that it is wonderful that a number of species have not been separated from it. One of the principal variations is a pure white, with indefinite cloudings, maculations or zigzags of chocolate; another white, with pink longitudinal zigzag markings, etc." Tryon's comment about separation of "a number of species" does not refer to the process of evolution, but to the penchant of some malacologists to attach new names to color variants.

[1] D. S. and E. W. Gifford, The Nautilus, vol. 56, pp. 43–48, 1942.

[2] George W. Tryon, Jr., Manual of Conchology, vol. 5, p. 70, 1883.

We elected to rigorously segregate albinos with even a speck of color from the pure albinos, which are absolutely immaculate. It is of interest to note that the immaculate albino group amounts to 20 per cent of the population. Incidentally, we should state that on the beach we collected indiscriminately, exercising no selection as to color whatsoever. Consequently, our series of 2,641 should represent the range and percentages of colors with fair accuracy. The percentage of immaculate albinos is high in comparison to the 12 per cent occurrence of albinism in *Olivella biplicata*[3] from Santa Cruz and Monterey, California. Moreover, included as albinos in the California series are white shells with orange color within the aperture.

The white of the albino *Olivella undatella* is of two qualities or appearances. That of the body whorl is translucent like thin porcelain, while that of the fasciole and columella base is opaque, due to the thicker enamel.

Once the 524 pure albinos are set to one side, no two colored shells are identical. In other words we have 2,117 shells with individually distinctive markings. We have grouped these into eleven categories, ranging more or less from light to dark. The presence of longitudinal zigzag vermiculations and stripes on most of the colored shells increases the amount of individual variations, which is not just a matter of solid colors but of pattern of markings as well.

Group 1: Albinos, immaculate 524
Group 2: Albinos, except for one to several faint brown spots on body whorl near suture and (or) near fasciole 32
Group 3: Albinos, except for more or less yellow on fasciole and one to several brown spots on body whorl near suture and (or) near fasciole, plus more or less yellow on the fasciole with longitudinal chestnut stripes; white at base of columella and within lip of body whorl 12
Group 4: Albinos, except for varying dark brown and gray markings (sometimes obsolete or veiled) on body whorl near suture and near fasciole; some chocolate areas within lip of body whorl; fasciole white except some with brown stripes; more or less piebald appearance 81
Group 5: Flesh-colored with fawn-colored zigzag longitudinal vermiculations; whitish band beneath sutures with more or

[3] Gifford, op. cit., p. 45.

less obsolescent fawn markings; fasciole usually plain whitish or ivory, rarely yellow 24

Group 6: Longitudinal zigzag vermiculations of reddish brown veiled with pearl gray to plumbeous; band beneath sutures whitish with brown marks; fasciole white without stripes; varying amounts of chocolate brown at base of columella and within lip of body whorl 85

Group 7: Xanthochroistic,[4] without vermiculations or stripes; body whorl tending toward whitish in central portion 1

Group 8: Xanthochroistic with longitudinal vermiculations; yellowest one matches Maerz and Paul, pl. 12, 8L, antique gold or golden Y; within lip all have more or less golden brown; band beneath sutures, and fasciole, with chestnut longitudinal stripes 7

Group 9: Yellowish brown, vermiculate, sometimes overlying olive green, suggesting somewhat the combination of colors in *Oliva tricolor;* bishop purple and other purples inside lip of body whorl; band beneath sutures, and fasciole, yellow with chestnut longitudinal stripes. Cf. Tryon, pl. 17, fig. 38; pl. 33, fig. 31 158

Group 10: White or whitish ground color with conspicuous reddish brown to gray longitudinal vermiculations; band beneath sutures, and fasciole, yellowish with chestnut longitudinal stripes; more or less dull purple inside lip of body whorl. Cf. Tryon, pl. 17, fig. 35 147

Group 11: "Ash-gray, with zigzag chestnut markings [vermiculations], distinct or obsolete, but forming two well-marked revolving bands by the color becoming more emphasized; a yellow band marked with chestnut beneath the sutures; fasciole yellowish, strigated with chestnut; interior and base of columella chocolate-colored." Tryon, p. 70. Cf. his figure: pl. 16, fig. 18 1253

Group 12: Dark ground color, usually solid on body whorl, but sometimes broken by tendency to two bands of vermiculation; color range shown on Maerz and Paul, pl. 48. Some colors represented in our series are designated as "egg plant, Spanish raisin, pewter, admiral," etc., but all seem to be on this single plate. Band beneath suture, and fasciole, yellowish to brownish yellow with longitudinal chestnut stripes; base of columella and inside lip of body whorl usually body-whorl color. Cf. Tryon, pl. 17, figs. 36, 37 317

As should be reiterated, our color groupings are on the basis of impressions as to general resemblances, since no two speci-

[4] A. Maerz and M. R. Paul, A Dictionary of Color, pl. 19, 4I, 1930.

mens are identical. The majority of colored shells have a yellowish fasciole with chestnut stripes. Exceptions are the pure albinos (group 1) and groups 2, 4, 5, and 6. Even the very dark shells have the yellowish fasciole, which is evidently one of the striking characteristics of the species, but not a universal one. Tryon calls attention to it in his description of the typical coloration, which we have quoted.

Variation in shape of the shells is not obtrusive. Scanning our series for obese and slender examples, we have selected two extremes. These yield length-breadth indices of 51 for the obese shell and 47 for the slender shell.

ONE HUNDRED SIX YEARS OF AMNICOLA

By J. P. E. MORRISON [1]

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Since 1927, shortly before the publication of the late F. C. Baker's "Monograph of Wisconsin Freshwater Mollusca," the writer has been interested in the critical determination of the species of small gastropods usually referred to the genus *Amnicola*. This abbreviated history of the genus is written to correct mistakes of 100 years' standing in regard to the genotype, and the consequent erroneous usage of the generic name.

July, 1840, is the earliest valid date of publication of *Amnicola*. On page 3 of part 1 of his Monograph, Haldeman restricted *Paludina* to exclude his new genus *Amnicola*, which was monobasic and monotypic, the type by original designation being *Paludina lustrica* Say, 1821. In October, 1840, on page 3 of his "Supplement," Haldeman again described *Amnicola*, but without mention of species.

Amnicola Gray, 1840 (Syn. Contents Brit. Mus., edn. 42, p. 147) is a *nomen nudum*, being without description or included species.

Gould (Invert. of Mass., 1841, p. 228) more fully described

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[1] Published by permission of the Secretary of the Smithsonian Institution.

Amnicola, including the genotype, *P. lustrica* Say, and five other species. He did not confuse *P. lustrica* with *A. porata*, the only species described by him from Massachusetts.

Isaac Lea (Obs., vol. 4, p. 16, 1844) stated: "The genus *Amnicola*, proposed by Dr. Gould, and adopted by Mr. Haldeman, in his table of 'Water-breathing Lymniades,' is separated from the genus *Paludina; Paludina lustrica* Say being made the type." This paraphrased restatement by Lea of Haldeman's original designation confirmed *P. lustrica* Say, 1821, as the genotype.

In part 8 of his Monograph (June, 1845), Haldeman cites three different uses of *lustrica*. On page 10 he describes *Amnicola limosa* Say, with "*Amnicola lustrica* Hald. in letters" in its synonymy. This *Amnicola lustrica* Haldeman dates from June, 1845; as a homonym it has no bearing on *Amnicola lustrica* (Say), 1821. On page 12, Haldeman places *Paludina lustrica* C. B. Ads. (Hist. of Vt., app., pp. 2, 19, 1842) in the synonymy of *Amnicola pallida* Hald., Jan., 1842. On page 16, he accords *Amnicola lustrica* (Say), 1821, the rank of a distinct species, citing only the original reference and quoting Say's description verbatim.

In the footnote on page 16, Haldeman mentions the existing Philadelphia Academy specimen received from Say. The measurements of this specimen (5 or 6 mm. long) preclude its being *P. lustrica*, originally described by Say as "less than 1/10th inch" long. This shell was figured by Binney (L. & F. W. Shells of N. Am., 3, fig. 189, 1865) and was considered typical by Tryon (Continuation of Hald. Mon., p. 57, 1870), Pilsbry (Nautilus 4: 53, 1890), and F. C. Baker (F. W. Moll. Wis., 1, p. 162, 1928), with the placing of *Paludina lustrica* in the synonymy of *Pomatiopsis lapidaria*. Since this (misidentified) specimen was not mentioned in publication prior to 1845, it can have no bearing on the status of *Paludina lustrica* Say, 1821, or upon the status of the name *Amnicola*.

Herrmannsen's (1846, p. 38) designation of *Amnicola porata* (Say), 1821, as genotype is doubly invalid; *A. porata* was not included in the original description of *Amnicola*, and *P. lustrica* Say, the only species included, was actually named as type by Haldeman.

Amnicola lustrica Pilsbry, 1890, is a homonym of *Amnicola lustrica* (Say), 1821, and so untenable. The name *Amnicola lacustris* Pilsbry, 1891 (Nautilus, 4, index, p. iii, 1891), is available but not clear in validity; it is hereby declared to be a nomen novum for the species well known as *Amnicola lustrica* Pilsbry 1890.

Euamnicola Crosse & Fischer (Miss. Sci. Mex., Moll., 2: 261, 1891) is an absolute synonym of *Amnicola s.s.* Their inclusion of the alternative or synonymy "(ou *Amnicola sensu stricto*)" in any case automatically fixed the type of *Euamnicola* in 1891 as identical with that of *Amnicola.* Since Haldeman in 1840 had originally designated the type of his monobasic genus *Amnicola,* Pilsbry's designation (Nautilus 57: 69, 1943) of *Amnicola porata* (Say) as type of *Euamnicola* Crosse & Fischer is invalid and superfluous.

In 1904, Jackson & Taylor (Journ. of Conch., 11: 9–11) described the habits and reproduction of *Paludestrina taylori* E. A. Smith (Ann. Mag. Nat. Hist., ser. 7, 7: 192, 1901) from England. The shell and egg capsules figured by them showed *P. taylori* to be very closely related to *Amnicola limosa porata* (Say) which they regarded as typical of the American *Amnicola* species. These authors referred *P. taylori* to the genus *Amnicola* on this basis.

When F. C. Baker, in 1928, separated as subgenera "*Amnicola, s.s.* (type: *A. limosa* Say, 1817)" (F. W. Moll. Wis., 1: 93) and *Marstonia* (type: *A. lustrica* Pilsbry, 1890, non Say, 1821 = *A. lacustris* Pilsbry, 1891) (ibid., p. 103) he made another invalid type designation. The species *A. limosa* was not included in the original generic description; also it cannot be the type by subsequent designation, when *A. lustrica* (Say) is the type by original designation.

Altena in 1936 submitted evidence (Basteria, I, 68: 1936) to prove that *Paludestrina taylori* E. A. Smith from England is synonymous with *Hydrobia steinii* Martens from continental Europe, and proposed the new genus *Marstoniopsis* for *H. steinii.* He showed that the egg capsules and verge of *M. steinii* are of the same type as those known for *porata.* Likewise, the differences noted by Altena between the radula of *steinii* and that of *Marstonia* at once relate *steinii* to the group of *Amnicola*

porata (Say), incorrectly called *Amnicola, s.s.* by F. C. Baker (cf. fig. 44, p. 96, F. W. Moll. Wis., I, 1928).

E. G. Berry has recently monographed the Amnicolidae of Michigan (Misc. Publ., Mus. Zool., U. of Mich., No. 57, 1943) with excellent anatomic detail. The extreme difference between the verge of *A. limosa* and that of *A. lacustris* (*lustrica* Pils.), indicated by Dr. Berry, has been personally corroborated by dissection of animals from other localities. This difference requires the recognition of *Marstonia* F. C. Baker 1926 (Trans. Wis. Acad. Sci., 22: 195, 1926) as a genus, biologically distinct from the group of "*Amnicola, s.s.*" of F. C. Baker; in other words biologically distinct from *Marstoniopsis.*

The generic synonymy to date is thus:

AMNICOLA Haldeman, July, 1840 (non Gould, 1841). Genotype: *Paludina lustrica* Say, 1821.

Euamnicola Crosse & Fischer, 1891. Genotype: *Paludina lustrica* Say, 1821.

? *Marstonia* F. C. Baker, 1926. Genotype: *Amnicola lustrica* Pilsbry, 1890, non (Say) 1821 = *Amnicola lacustris* Pilsbry, 1891.

MARSTONIOPSIS Altena, 1936. Genotype: *Hydrobia steinii* Martens, 1858.

Amnicola Gould, 1841 et auct. (non Haldeman, 1840). Genotype: *Paludina porata* Say, 1821.

This author's present opinion is that *Amnicola, s.s.* will finally prove identical to *Marstonia.* Because of the known shell differences, it probably cannot be the *porata* group, named *Marstoniopsis* by Altena. Whether *Amnicola* Haldeman, 1840, will eventually displace *Marstonia,* or *Marstoniopsis,* or neither, has not yet been determined. *Amnicola lustrica* (Say), 1821, must be rediscovered at the type locality (Cayuga Lake, New York) and anatomic material examined before the name *Amnicola* can be properly and permanently allocated either taxonomically or biologically.

OUR WEST COAST MARINE FAUNA

By A. SORENSEN

Any young person in a West Coast high school who takes biology as his major has a wonderful opportunity before him. He can specialize in any branch of biology that he likes with the assurance that nowhere else has he a better chance to find nature in all its richness. And if he goes in for marine biology, then he has the Pacific Ocean and its myriad of life before him.

The shore line from Alaska to Panama furnishes specimens of mollusks, crustacea and echinoderms of a wide and interesting variety, and with all this material before him it is no wonder that the schools and colleges are crowded with enthusiasts, many of whom should prove noted scientists in the future.

Several wide awake and nationally known conchological clubs exist on the West Coast and their influence is constantly increasing.

At this point, as W. Clench and P. Bartsch so forcefully emphasized at the recent meeting of the Malacological Union in Washington, D. C., the numerous amateur students and collectors all over the country should be encouraged, and even urged, to send in to our museums or other recognized centers of learning, full information about their finds and discoveries. Such information should not only give a detailed description of the specimen, but it should also give the exact time and the place where it was found.

In this way, science will be advanced and much new information secured, both as to the new species and the extention of range of previously known species. The necessity for such voluntary information should be obvious, for it is a well known fact that our centers of higher learning are badly understaffed and overworked and but limited opportunity is given for field work, so if the work of amateurs is well coordinated much benefit should result all around.

Originally it was intended that this article should confine itself to mollusks, preferably those from deep water, so we had better get to work.

During the war, many beaches, bays and inlets were closed to the public and so were also such strategic headlands as Point

Pinos, Point Firmin, Point Conception and Point Loma, all well known to conchologists. Only recently they are being opened and joy reigns again among shore collectors. Commercial diving for abalones and drag-netting for bottom fish were also restricted and they are not yet in full swing.

It is hard to tear oneself away from shore collecting where both univalves and bivalves are so plentiful. The rocky shores provide many species of *Acmaea, Thais, Littorina, Oliva, Chiton, Murex,* etc., while on the sandy beaches are found a multitude of clam-like bivalves both large and small.

But occasionally the collector finds something that puzzles him. It is something the waves have washed up or it may be that a hermit crab has brought a shell in far from its home in deep water. The strangeness of these specimens that evidently are not from the intertidal zone sets him to wishing that he could explore the ocean depths or at least could learn some of its secrets. Sometimes after storms, large pieces of shale-rock may be found on the Monterey beaches. They are honey-combed with passages of piddocks, the rock boring clams. One such rock contained four large live *Pholadidea californica* Conrad. They were from four to six inches long and three inches in diameter. Other pieces contained *Botula falcata* Gould, *Lithophaga attenuata* Desh., *Irus lamellifera* Conrad and other species of rock-borers. These rocks came from a ledge in ten to twenty-five fathoms.

Now he is fully interested and soon makes arrangements with the operators of so called drag-net boats to go out with them.

When the sardine season closes in February, several of the smaller purse-seine boats begin drag-netting for soles, flounders and other bottom fish.

The southern half of Monterey Bay has a fairly smooth bottom north for about fifteen miles and out for ten miles and to about one hundred fathoms after which the depth increases rapidly. Here is where the boats operate and their nets bring up, besides the fish, different species of mollusks, crabs and star-fish, and here is where the conchologist comes in. Ordinarily, everything that is not a commercial fish is washed overboard, but after you get the crew interested, they soon learn to pick out what you want.

Drag-netting is an interesting process and requires special equipment and much skill. The so-called otter-trawl, in common use, is a purse-net of heavy construction with side nets or wings that are kept open with spreader-boards heavily weighted and so connected that, when the boat pulls forward, the boards move sidewise at an angle and thus open the net. Heavy lines or cables are used and they are let out to three times the length of the perpendicular depth of the water, so when the net gets out to seventy-five fathoms it is a quarter of a mile behind the boat.

The California law forbids drag-netting inside of twenty-five fathoms and this is rigidly enforced.

Of the mollusks most frequently taken are *Polinices draconus* Dall in thirty to sixty fathoms and *Eunaticina oldroydi* Dall in forty to eighty fathoms. Neither of these lives in shallow water like the *Polinices lewisii* and *P. reclusiana,* but at times empty shells are brought in by hermit crabs. The lewisiis and reclusianas are very plentiful in Morro Bay, Newport Bay, Mission Bay and in parts of Puget Sound, but never in deep water.

Watching closely on deck when the net is emptied one may occasionally get the beautiful *Surculites carpenterianus* Gabb or a *Chryodomus tabulatum* Baird or a stray *Cancellaria cooperi* Gabb or different species of *Nassarius.* If the net has come across crabs you are sure to get *Randalia ornata* Randall closest in, then *Murcia gaudichaudii* Milne Edwards and *Lopholithodes foraminatus* Stimpson and several species of spider crabs. The *Lopholithodes foraminatus* lives only on a sandy or muddy bottom and not in the rocks like the *Lopholithodes mandtii* Brandt which it closely resembles. Both are decapods (ten legged); still they have only eight visible legs, for the last pair, in vestigial form, are found under the carapace and within the body. What strange things evolution is doing.

It wouldn't do to omit mentioning the many kinds of starfish brought up, especially the basket star (*Gorgonocephalus caryi* Lyman) with its hundreds of tendril-like rays, or the twenty-rayed *Pycnopodia helianthoides* Brandt which attains a size of thirty inches and the still lower forms Aphrodita (sea

mouse), Crinoids (sea lilies), rose colored sea pens and the five foot long *Balticina finmarchica* Nutting. If you were not satisfied with the amount of mollusks found you could examine the stomachs of the soles and you would get many shells of *Yoldia scissurata* Dall, *Yoldia ansifera* Dall, *Yoldia thraciaeformis* Storer, and *Leda taphria* Dall and others.

The *Eunaticina,* previously mentioned, is one of the mysteries of the deep. The fishermen call it the long seasnail. It is five to six inches in length with a shell only one and a half inches in diameter which is very thin and brittle and only a very small part of the animal can be concealed within the shell. It is unlike the *Polinices lewisii,* which although very large when extended can expel the water contained in cells within its foot and then reduce its size to fit the shell.

The *Eunaticina* has no water in cells, hence cannot reduce its size. Nor has it an operculum, so it is reasonable to suppose that it will ultimately become a true slug.

On one trip, the net passed through an egg mass attached on the bottom. They were the eggs of the Pacific squid (*Loligo opalescens* Berry). They filled the net completely and the egg clusters were so attached to the net walls that it was a real job to clear it and separate the fish from this slimy mess. A boat a half mile away had a similar experience. Many thousand tons of squid are brought in to Monterey annually. Some are frozen and shipped to Eastern markets, but most of them are canned and sold in Latin countries.

The drag-net boats explore the smooth sandy bottoms pretty well, but it takes the fully equipped deep sea divers to study the rocky bottoms. These divers work in from twenty to one hundred and twenty feet deep for *Haliotis* for the market. Here on the West Coast *Haliotis* are called abalones, in the East they are known as ear shells, in England as ormers and in Australia as mutton fish. They make delicious eating and therefore are much sought after commercially, especially the large *Haliotis rufescens* Swainson which grow to ten or eleven inches in length. The general public may take them along the shore if seven inches in size, while commercial fishermen can take only those from eight inches up and only in twenty feet or deeper.

It was the good fortune of the writer to get acquainted with

one of the very best deep-sea divers on the Coast, Mr. Delmer Reviea, who has done valuable investigating for the California Fish and Game Commission, besides other important deep sea work.

While out with him, and learning from his experience, it was easy to establish the varying depths at which the different species of *Haliotis* live. The black abalone, a smaller species (*Haliotis cracherodii* Leach), is a shore dweller and very rarely is found outside of twenty feet deep. But the large *Haliotis rufescens,* the real commercial abalone on the California coast, lives on and among the rocks from the shore out to sixty or eighty feet deep. It is strictly a vegetarian and feeds on the short algae which it rasps off with its long tongue or radula. From forty or fifty feet out to one hundred feet, two smaller species are found. The most common of these is *Haliotis assimilis* Dall.

But on one trip, Mr. Reviea sent up to the boat some smaller ones, somewhat resembling *Haliotis assimilis,* but with other variations. The writer sent some of them to the U. S. National Museum where Dr. Bartsch pronounced them a new species and named them *Haliotis aulaea.*

At these outer depths Mr. Reviea also located several northern species that are shore dwellers in their native haunts, namely, *Haliotis kamtschatkana* Jonas and *Haliotis wallalensis* Stearns. This was along the San Luis Obispo County Coast.

On another trip between Point Conception and Santa Barbara a diver brought up four large pink abalones altogether unlike the *Haliotis rufescens* which they most resembled. In Washington, Dr. Bartsch described them as new and honored the writer by naming them for him. They were evidently strays from farther south for they have since been found south to Cedros Island off the Mexican coast.

Haliotis fulgens Philippi is the beautiful green abalone found from Los Angeles south to Point Lucas at the south end of Baja California, Mexico. On the south half of this peninsula, there is also found a subspecies named by Dr. Bartsch *Haliotis fulgens turveri* for a friend who regularly goes to Mexico with the writer. *Haliotis corrugata* Gray is also a southern species, but occasionally found as far north as Morro Beach. Nearly fifty species of

Haliotis have found their way to the writer's collection from many parts of the world.

That mollusks that normally live in the shallow waters of Bering Sea and along the Alaskan coast may be found in quantities off the California coast, but in extreme deep water, was positively demonstrated recently.

Fishermen from Monterey and Santa Cruz rigged up to fish for the so-called black Alaska cod which in this latitude lives in from twelve hundred to three thousand feet depth. They had good luck getting cod, but they also had a new experience for when they fished on rocky bottoms off Santa Cruz many of their hooks brought up a number of different kinds of shells that they had not seen before. These shells had from one to half a dozen sea-anemones growing on them and when a fish hook caught in one of these tough bodies up came the whole mollusk to the boat. One of the fishermen was thoughtful enough to bring a good quantity to the dock several times. Among these were: *Argobuceinum oregonensis* Redfield; *Cancellarea cooperi* Gabb, *Chrysodomus tabulatus* Baird; *Spirotropis perversa* Gabb; *Chrysodomus ithius* Dall, and *Colus severinus* Dall. In addition, the hooks brought up such rare crabs as *Chionoecetes tanneri* Rathbun and *Paralithodes rathbuni* Benedict. And, ordinary dredging in ten to twenty-five fathoms in Monterey Bay generally brings good results.

A NEW SUBSPECIES OF MONADENIA FROM NORTHERN CALIFORNIA

By ROBERT R. TALMADGE, Eureka, California

MONADENIA FIDELIS TRINIDADENSIS, **new subspecies.**

Shell similar in general features to *M. fidelis subcarinata,* but much smaller and rougher in physical appearance. Shell solid, slightly polished at base, with open umbilicus, partially covered by the narrow peristome. Spiral sculpture prominent on first and second whorls. Periostracum generally worn off of the apex of spire, often down to third whorl. Some specimens slightly keeled. Color of shell horn brown, but spire often with

greyish tinge, due to worn periostracum. On some specimens, a faint light band may be distinguished on first whorl.

Measurements (average of 20 shells): maximum diameter 28.5 mm., minimum diameter 24 mm., altitude 17.5 mm.; whorls 6¼.

Holotype in Talmadge collection; paratypes in same collection, in collection of S. Stillman Berry, and no. 182505, Academy Nat. Sci. of Philadelphia.

Type locality: Little River Rock, about 3 miles south of Trinidad, Humboldt County, California, and ¼ mile out to sea. Four examples gathered on 2 June, 1946. Additional locality: an unnamed rock about ½ mile north of Little River Rock; 16 examples collected.

So far as known, this subspecies inhabits only the grass-covered off-shore rocks. How their ancestors reached these rocks is unknown, but, in the writer's opinion, the separation from the closely related mainland subspecies is definite, although *M. f. trinidadensis* may be a dwarf form of the mainland *subcarinata*. The lack of food and the exposure to the elements would have a decisive effect on animal life. All living specimens were taken either in the grass or from natural crevices in the rock.

ON THE ANATOMY AND THE SYSTEMATIC PLACE OF THE LAND-MOLLUSK GENUS JANULUS

By HENRY A. PILSBRY

The genera *Gastrodonta, Zonitoides, Ventridens, Striatura* and *Poecilozonites,* composing the subfamily Gastrodontinae, are all confined to North America with the exception of several palearctic species of *Zonitoides,* which are either closely related to American species (*Z. excavatus* Bean), or identical with them (*Z. nitidus* Müll.)

From this it might be inferred that the subfamily had its genesis in America, a few species invading the Old World only in Pliocene or later time. Wenz, 1923, referred several European Paleocene and Miocene to Recent species to *Zonitoides;* but with no intention of casting doubt upon his classification, which is probably correct, it must be admitted that the shell characters

of these small, simple Zonitidae are sometimes hardly distinctive enough for positive generic allocation. By themselves, these fossils would hardly be thought conclusive evidence of Gastrodontinae in European Tertiary.

There is, however, another European genus having some conchologic resemblance to certain Gastrodontinae. I refer to *Janulus* Lowe,[1] represented by about a dozen species from Upper Oligocene to Pliocene of middle Europe, two living species in Madeira and one in the Canary Islands.

Janulus has been variously classified. Wenz (1923)[2] formed a subfamily Janulinae in the Zonitidae for *Janulus* only. Pfeffer, 1929,[3] proposed Janulinae anew for *Janulus* and the Mexican *Pycnogyra,*[4] the numerous whorls and the narrow aperture being given as its chief characters. Thiele [5] placed *Janulus* in the Endodontidae, but gave no new information upon its structure beyond a brief account of the radular teeth, quoted below.

Information on the anatomy of *Janulus* up to this time relates to the jaw and teeth of *J. stephanophora* (Desh.) and *J. bifrons* (Lowe), examined by W. G. Binney, 1879.[6] He described the jaw of *Janulus stephanophora* (Desh.) as "strongly arched, ends pointed, cutting margin with a sharp, greatly produced median projection." He says of *J. bifrons* (Lowe) : "Jaw smooth with median projection. Lingual membrane with 34–1–34 teeth, of which 4 on each side are laterals. All as in *Zonites,* i.e., centrals tricuspid, laterals bicuspid, marginals aculeate." No figures were given.

The only further note on the anatomy which I have found is by Thiele [7] in his generic definition of *Janulus:* "Mittel- und Seitenplatten der Radula mit inneren und äusseren Nebenzacken." This does not agree with Binney's observations and is

[1] *Janulus* Lowe, 1852, Ann. Mag. N. H. (2) 9: 115, for *Helix calathus* Lowe.

[2] Fossilium Catalogus 1, pars 17, p. 300.

[3] Geol. u. päl. Abhandl. 17 (21), Heft 3, p. 33.

[4] See H. B. Baker, 1928, Proc. Acad. N. S. Philadelphia 80: 27.

[5] Handb. Syst. Weichtierkunde 1: 576.

[6] Bull. Mus. Comp. Zool. 5: 332, 333; repeated in 1884, Ann. N. Y. Acad. Sci., 3: 87.

[7] Handbuch Syst. Weichtierkunde 1: 573.

wholly at variance with mine. Species of *Oxychilus, Vitrea* and some related genera have tricuspid lateral teeth, but such teeth are not known in Gastrodontinae. Unfortunately Thiele did not mention from what species his note on the teeth was taken. I imagine that he misread Binney's description.

I have examined *J. bifrons* (Lowe)[8] from Madeira. The sole is plain, not tripartite; pedal groove deep, the foot-fringe below it is vertically grooved. No noticeable caudal pit seen.

The lung (fig. 3) is plain, showing no venation except the principal pulmonary vein. The rather narrow wedge-shaped kidney is about one and one-half times the length of the pericardium and contained about two and a half times in that of the lung. The secondary ureter appears to be complete.

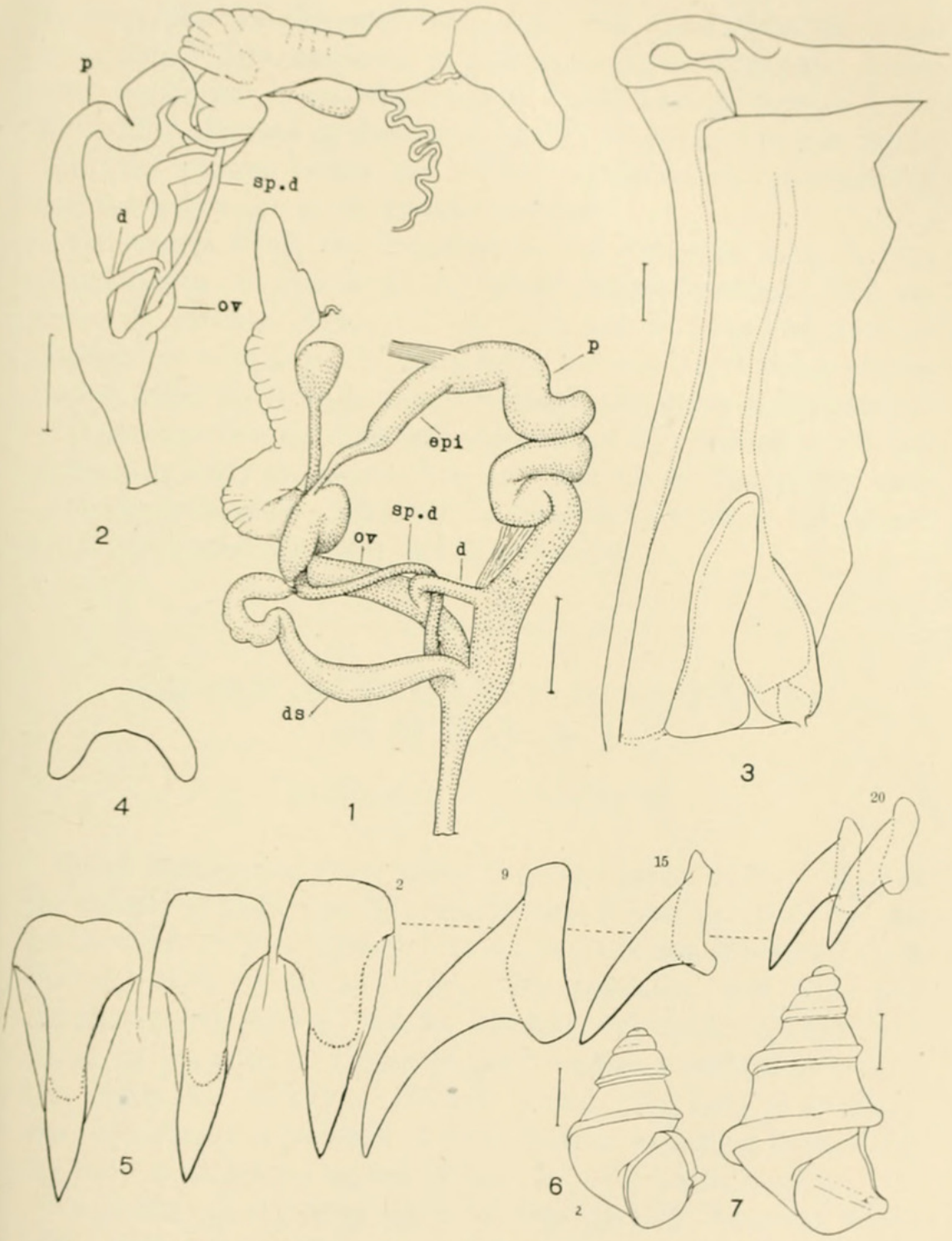
The genitalia (figs. 1, 2) show a long atrium from which the oviduct, spermathecal duct, penis and dart-sac branch at about the same level, no vagina being developed. The long, rather thick penis terminates in a short stout epiphallus leading to a short vas deferens. The penial retractor is terminal on the penis. The dart-sac seated on the base of the penis, is arcuate, a very short connective from its summit to the spermathecal duct. No dart present (probably dissolved by the preservative). There are no coronal glands. A short duct (d) from the oviduct enters a sheath which envelopes the lower part of the penis (stippled in figure 1). It has no connection with the spermathecal duct. The free oviduct is long. The spermatheca is ovate, on a rather long duct. Other details of genitalia are as shown in the figures. My preparation of the posterior part was imperfect in detail owing to the vary hard material.

The jaw (fig. 4) is high-arched, smooth, without noticeable median projection on the cutting edge.

The radula has 24–1–24 teeth (fig. 5). Central and lateral teeth have single long cusps with overhanging edges, no ectocones. Marginal teeth with long curved cusps of the usual zonitid form.

The conflicting accounts of the teeth are perplexing. If

[8] The two specimens dissected were sent me by the Rev. R. Boog Watson in 1895; probably were collected some years earlier; and have therefore been in alcohol over fifty years. Having evidently been placed directly in strong spirit, they were contracted well within the shell and very hard.



Janulus bifrons (Lowe). Fig. 1, Genitalia. d, peni-oviducal duct; ds, dart-sac; epi, epiphallus; ov, oviduct; p, penis; sp.d., spermathecal duct. Fig. 2, Outline of genitalia of another individual. Fig. 3, Pallial region. Fig. 4, Jaw. Fig. 5, Central, two lateral, and 9th, 15th, and 20th marginal teeth.

Fig. 6, *Pyrgulopsis archimedis*, n. sp.; camera outline of holotype.

Fig. 7, *P. nevadensis* (Stearns); camera outline of shell (2874a, probably not fully mature) from type locality.

Thiele's data for the genus are correct for *J. calathus*, the genotype, then *J. bifrons* stands at least as a subgeneric group. However, we do not know what species Thiele had in view, and the teeth of *J. bifrons* as described by W. G. Binney do not agree with the radula before me. These conspicuous discrepancies call for a new study of *Janulus* radulae.

Summary: From the structure of the genitalia, it is obvious that *Janulus* belongs to the subfamily Gastrodontinae. The absence of coronal glands on the dart sac is a special feature though not unique in the subfamily, but otherwise the genitalia do not differ much from those organs in the genus *Gastrodonta*.[9]

It appears that the Gastrodontinae were represented in Europe at least as early as middle Tertiary, and up to the present time in Atlantic islands. Whether the subfamily arose in the Nearctic or the Palearctic areas is still undecided.

REPORT ON THE LAND MOLLUSKS OF CAPE MAY, N. J.

By ROBERT C. ALEXANDER

From Manasquan Inlet above Bayhead south to Cape May at the mouth of Delaware Bay, sandy island beaches flank the Atlantic coast of New Jersey. These beaches are separated from the mainland by bays, sounds, thoroughfares, and wide salt marshes penetrated by creeks winding far back to fields and woods at the edge of higher ground. After a collecting trip to this region, Dr. Henry A. Pilsbry wrote, "The littoral of southern New Jersey is perhaps as unpromising collecting ground for the land shell hunter as can be found in the eastern states."

Cape May is the only place on this part of the coast which offers even a moderately congenial environment for land snails. Here, good soil, extending down to the ocean, enables vegetation of the upland to intermingle with vegetation of the coastal region. This is particularly apparent at Cape May Point where woods of large deciduous trees, pines, cedars and holly are

[9] Land Mollusca of North America 2: 427, fig. 230.