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THE STATUS OF STROMBUS SAMBA CLENCH

By A. HYATT VERRILL

There appears to be a great deal of difference in opinion in regard to the status of *Strombus samba* Clench. Some conchologists consider it as merely a diseased or aberrant form of *S. gigas;* others regard it as merely a variety of *gigas;* still others think it possibly a hybrid of *S. gigas* and *S. costatus* (the native Bahaman name "samba" meaning a mixed breed), while still others feel that it is a valid species.

Although samba is an abundant shell in some areas, and thousands might be obtained readily, yet it is comparatively rare in most collections and, as far as I am aware, no one has ever made a really exacting study of the shell and its habits nor bothered with the characteristics of the animal.

During the past few months I have made a study of samba, having examined over 100 specimens and especially the animals in life. From these studies I am convinced that *S. samba* is a distinct and valid species. In the fully adult form the shell itself differs markedly and consistently from either *S. gigas* or *S. gigas verrilli.* Moreover, the animal is entirely unlike either of these species, both in color and form. Instead of having a dull olive or brownish body more or less mottled with lighter colors, the animal of *S. samba* is light buff with a pinkish tinge and is unmarked.

The mantle is ochreous, deepening to rose or salmon near the junction with the body, and, instead of having a blackish edge, it is spotted with blackish near the outer border. The eye-stalks are pale beige spotted with brown, and are much stouter than in *S. gigas* or var. *verrilli* and are much enlarged or swollen at the base so that there is no space between them, whereas the eye-stalks of *S. gigas* are separated by quite a wide space at their bases. Finally, the upper or dorsal surface of the foot is rich delft-blue—a most unusual and distinctive feature.

The operculum also differs from that of *gigas* or *verrilli,* being relatively larger, more curved and proportionately broader, with the posterior extremity more obtuse and angular.

Oddly enough, the natives of the Bahamas where samba is most abundant all maintain that they have never seen a young or a perfect shell of this species, all being massive and heavily encrusted with lime and marine growths, with the lips greatly thickened and with the enamel-like coating worn away by constant attrition, their whole appearance giving the effect of great age. That this shell should live on indefinitely is not surprising, for even the *Fasciolaria tulipa* (or "Cinch-killer") finds the thick shell of *S. samba* impenetrable, while the natives of the island consider the meat inedible. Hence the shells are seldom taken or disturbed.

However, I have discovered that the mystery of the absence of less senile or perfect specimens of *S. samba* is really no mystery at all, the explanation being that such shells are scarcely distinguishable from the same size specimens of *S. gigas* by a cursory examination.

But they are readily distinguished, both by the distinctive blue foot which is present in all specimens, and by the far heavier, thicker shell and the form of the aperture. In these younger, perfect specimens the lip usually is extended upward in a trough-like form and has a handsomely fluted or ruffled edge. The dorsal surface is much rougher than in *S. gigas,* with numerous conspicuous tubercles and with a shoulder or ridge near the lip. The transverse grooves, extending from the lip, are much more pronounced and deeper than in *gigas* or *verrilli.* Usually, too, one of the dorsal spines of the last whorl is much longer and wider than the others and is proportionately more massive than in *gigas* of the same size. All the spines are flattened rather than rounded as in *gigas.* Once one is familiar with the specific characteristics of these shells one may recognize *S. samba* at a glance, and while some may resemble *S. gigas* more than others the blue foot is always a distinguishing and unmistakable means of identification.

Up to the present time, I have been unable to obtain (or to recognize) the immature and very young shells of *S. samba.* All the perfect specimens I have collected are fully adult. Per-

haps the blue foot does not develop until the shell reaches the adult stage and immature specimens may be indistinguishable from those of *S. gigas* externally.

AQUATIC PULMONATES FROM LAKE TAHOE

By HENRY VAN DER SCHALIE and ELMER G. BERRY

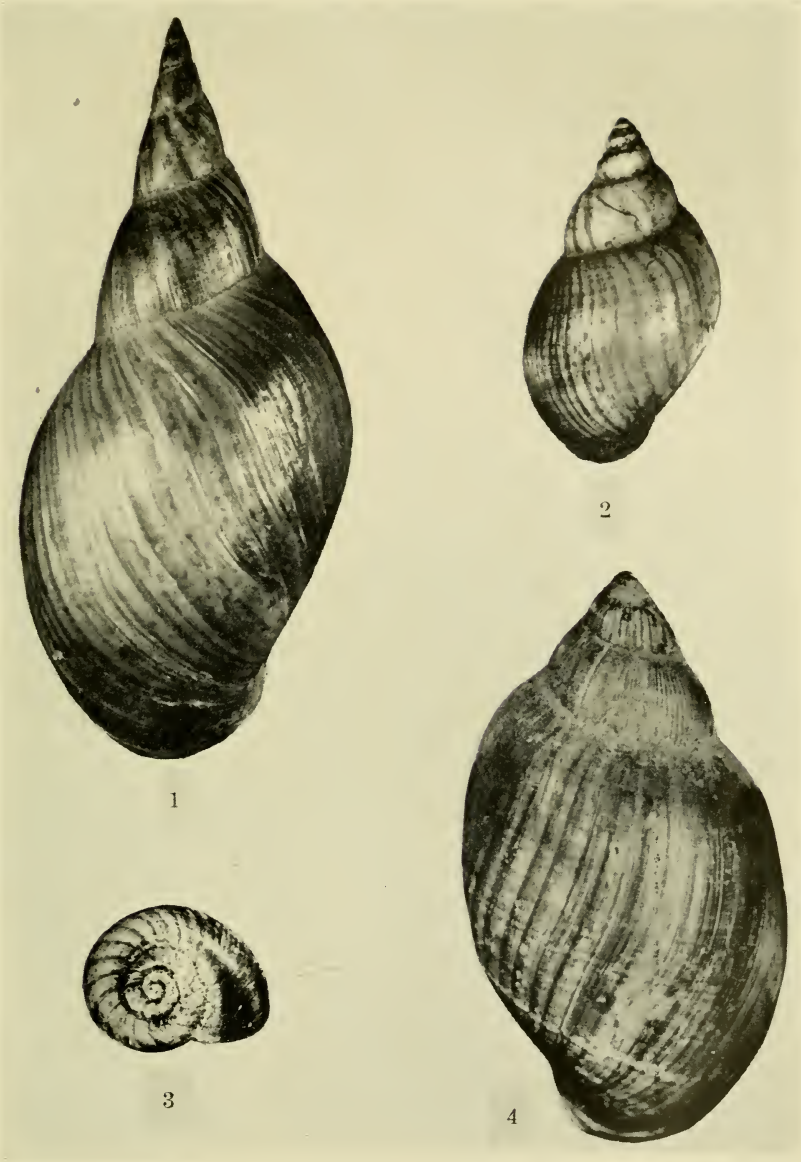
In 1937, G. D. Hanna and A. G. Smith (Calif. Fish and Game, 23: 244) published an interesting article, in which they called attention to the absence of records of mollusks from Lake Tahoe, California. They indicated that: "This seems strange in view of the size of the lake, the purity of its waters and the number of conchologists who have visited it." Their article was later reprinted in this journal (Nautilus, 52: 34–36, 1938). By deep water dredging in October, 1933, and again in August, 1936, at depths beyond 20 fathoms and as deep as 50 fathoms, they were able to collect the following species: *Pompholyx effusa* (Lea), *Carinifex newberryi* (Lea), *Valvata humeralis californica* Pilsbry, *Lymnaea* sp., and *Pisidium* sp.

Recently, while working with some unaccessed material, we found a small collection of shells taken from the shore of Lake Tahoe, on June 23, 1934. These specimens were collected along the west side of the lake at the town of Tahoe, while we were enroute to the American Malacological Union meetings at Stanford University. This collection is of special interest because it consists almost entirely of littoral pulmonates and in that way supplements the profundal records reported earlier. We found the following species living in abundance on a small rocky shoal: *Lymnaea stagnalis wasatchensis* (Hemphill), *Lymnaea bulimoides* Lea, *Gyraulus vermicularis* (Gould), and *Physa virgata* Gould. Only two dead and badly weathered specimens of *Carinifex newberryi* (Lea) and a similar dead, immature specimen of *Pompholyx effusa* were found; an observation which tends to support the habitat preference of these species as shown by Hanna and Smith.

A peculiarity of a majority of the specimens from this locality is the typical costate sculpture common to most specimens.

This peculiar appearance is indicated graphically by the accompanying figures (Pl. 11, figs. 1–4). The same phenomenon is described in the literature as characteristic of several species. For example, F. C. Baker (Lymnaeidae of North America, 1911: 460) in discussing the peculiar sculpture of *Galba utahensis* stated: "This curious form, dwarfed and peculiarly sculptured by its unfavorable environment, seems a representative of *Polyrhytis* Meek. . . . The costae are not always developed, some specimens (pl. XXIV, fig. 23) being almost smooth. The costae, however, may be detected in all specimens, though the development is but slight in some individuals." Junius Henderson (Nautilus, 49: 86), in discussing *Physa columbiana,* stated: "Most of the latter are of a rich chestnut color, the surface very finely rippled with minute, rather regular, somewhat rounded striae, instead of fine, sharp growth lines." There are perhaps many similar references to this unique sculpture. The Lake Tahoe specimens are striking in that this condition is not limited to a single group but is shown on both the species of *Lymnaea* found there, as well as among the *Physa* and *Gyraulus.*

What causes the development of this striate or costate sculpture? In the above quotation, F. C. Baker suggests it is brought about by an "unfavorable environment." Is it due to some chemical factor in the water, or is it a physical characteristic such as the sudden and extreme diurnal and nocturnal fluctuations in temperature which are reflected on the shell during the growing season? Seemingly, a locality like the one cited here for Lake Tahoe would be an ideal place for an inquiry into the factors causing this development in practically all the specimens regardless of genus or species.



1, *Lymnaea stagnalis wasatchensis* (35 mm. long). 2, *L. bulimoides* (8 mm. long). 3, *Gyraulus vermicularis* (max. diam. 4 mm.). 4, *Physa virgata* (13 mm. long).

MOLLUSCA OF THE EASTERN BASIN OF THE CHACO RIVER, NEW MEXICO

By ROBERT J. DRAKE

Department of Anthropology, University of New Mexico

An assemblage of land and freshwater shells has been obtained from the drift of the eastern tongue of the Chaco River, at Pueblo Bonito, Chaco Canyon National Monument, San Juan County, New Mexico. Collections were made in October of 1946, and April, June, July, August and October of 1947, in conjunction with archeological survey and excavation programs of the Department of Anthropology of the University of New Mexico. Most of the collection was made during the University Anthropology Field Sessions in the summer of 1947.

This collection of fifteen forms is significant in that the dead shells had lived in the enclosed basin of the eastern tongue of the river. Biotic provinces are represented in this area by the Upper Sonoran life zone (ca. 4000 to ca. 8000 feet), and Dice's Navahonian province, the latter a more geographic biome. The Continental Divide is at the eastern edge of the basin from 7500 to 8000 feet elevation. The source of the eastern tongue of the Chaco is (at ca. 7500 feet elevation) about 45 miles from Pueblo Bonito, and this large ruin is at ca. 6000 feet.[1]

The climate of the eastern tongue of the Chaco is normally cold desert, bordering on steppe (BWkfw, near BSkfw, following the Koeppen System of climatic determination). Seven or eight years out of ten are apparently desert years in precipitation. The mean average per year for rain is 8.18 inches. Adjoining mesas bordering the canyon are probably steppe as the canyon only lacks an average of one inch more rain a year to be entirely steppe.[2]

The rainy season for the area is from July to September. The Chaco is intermittent, flowing during the last of the rainy seasons, and following springtimes, when the high mountain snow deposits are melting. Some of the drift is at various levels, probably representing deposition when the raging torrent was higher or lower according to the amount of water concentrated

[1] Fisher, 1934, p. 19.

[2] Brand, Hawley, Hibben, *et. al.*, 1937, pp. 44–45.

in the arroyo normally from rain or during flash floods. As with drift I have collected from the Rio Grande and Rio Puerco systems in New Mexico, the Uncompahgre, Slate, and Gunnison systems in Colorado, and the Florido and Concho systems in Chihuahua, shells in concentrated deposits of rejectamenta apparently represent colonies of one form or fairly homogenous groupings of several landshell forms. Pupillidae and Vallonidae have been especially noticed in this respect.

Dead landshells of forms from the Chaco drift were observed on surfaces of ruins and anthills in the canyon and in dry clumps of vegetation at springs and seeps on the rimming mesas.

The vegetation of the canyon floor is mostly piñon pine, juniper, and shrubs (sagebrush, cacti, yucca, greasewood, rabbitbrush, and shadscale). Alder, cottonwood, walnut, and box elder grow in side canyons.

In the higher altitudes are found western yellow (or ponderosa) pine, spruce, oak, serviceberries, wild rose, occasional sagebrush and rabbitbrush, and very abundant herbs and grasses.[3]

Fifteen forms of gastropods discovered in the basin of the eastern tongue of the Chaco River are:

Landshells

Gastrocopta pellucida hordeacella (Pilsbry)
Hawaiia minuscula (A. Binney)
Hawaiia minuscula alachuana Dall
Pupilla cf. *blandi* Morse
Pupilla hebes (Ancey)
Pupoides hordaceus (Gabb)
Pupoides albilabris (C. B. Adams)
Succinea grosvenori Lea
Vallonia cyclophorella Sterki
Vallonia gracilicosta Reinhardt
Vertigo ovata Say

Freshwater snails

Fossaria parva (Lea)
Gyraulus circumstriatus (Tryon)
Helisoma tenue cf. *sinuosum* (Bonnet)
Stagnicola bulimoides cockerelli (Pilsbry and Ferriss).

[3] Elmore, 1943, pp. 10–11.

Pupilla cf. *blandi* Morse is represented by only two specimens. They were sent, in September of 1947, to Dr. S. S. Berry, Redlands, California, who examined them and commented ". . . at present I can do no better than call [them] *Pupilla* cf. *blandi* Morse, although there are manifest differences, notably that it is very small for *blandi,* and the palatal tooth is too small and does not penetrate. It is about the size of *P. sonorana* (Sterki), but is too chunky, more truncate in front, and has too small teeth for that."[4] It is hoped more collecting will provide additional specimens of this aberrant form for study.

One specimen of *Helisoma* was found. It is certainly *H. tenue* and probably variety *sinuosum* (Bonnet). I have done a considerable amount of work recently with *H. tenue* varieties, from New Mexico and Chihuahua, and have found great tendency for some specimens of a colony of *sinuosum* or *pertenue* F. C. Baker[5] to go toward *tenue* (Philippi) s. s. Dr. J. P. E. Morrison states that many lots of varieties of *H. tenue* from northern Mexico in the U. S. National Museum likewise exhibit this characteristic.[6] The *H. tenue sinuosum* (Bonnet) found at Albuquerque, New Mexico, however, is quite typical of the variety, and is illustrated as such in F. C. Baker's monograph on the Planorbidae.[7] Again, further collecting in the Chaco should make additional *Helisoma* available for study.

Unfortunately no representatives of the Physidae or Sphaeriidae were found in Chaco Canyon, since the peculiarities of members of those families are exceedingly little known in New Mexico and the Southwest.

Sincere thanks go to the many archeologists and anthropology students who helped with the Chaco collecting (and tedious sorting) of drift. To one of the former, Mr. Lloyd M. Pierson, Jr., goes special thanks. Being gifted with the collector's instincts, Mr. Pierson became a convert to field snailing and gave me much help during our University's archeological expedition to southeastern Chihuahua in August and September of 1947.

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[4] Letter, dated 13 October 1947.

[5] *H. tenue pertenue* F. C. Baker represents a change in name for the preoccupied common northern Mexican *H. tenue applanatum* (Martens). See Baker, 1941, p. 97, and Baker, 1945, p. 149.

[6] Letter, dated 26 November 1947.

[7] Baker, 1945, pl. 98, fig. 15.

In fact, he collected the only lot of *Oreohelix* found during our trip.

Mr. Gordon K. MacMillan, Dr. Wendell O. Gregg, and Dr. S. S. Berry have been kind enough to examine the Chaco material and make most of the determinations.

Chaco duplicates have been deposited in the collections of W. O. Gregg, S. S. Berry, W. J. Eyerdam, C. L. Blakeslee, M. K. Jacobson, the Academy of Natural Sciences of Philadelphia, the U. S. National Museum, the California Academy of Sciences, the University of Michigan Museum of Zoology, the Chicago Natural History Museum, the Carnegie Museum, the Museum of Comparative Zoology, and the Allan Hancock Foundation of the University of Southern California. Examples of all forms are in my collection and are available for examination by conchologists.

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THE MATING OF STENOTREMA FRATERNUM (SAY)

By GLENN R. WEBB, Ohio (P. O.), Illinois

The following notes on the copulation process of *Stenotrema fraternum* (Say) are based on the behavior of captives. Both

the typical variety and *S. f. cavum* (Pilsbry and Vanatta) from Indiana material were used in this study, but no differences in either anatomy or habits were observed between them. The source of *cavum* material supports a mixed and intergrading *fraternum-cavum* population with *cavum* tending to be dominant; this locality is a level woodland about 3 miles E.S.E. of Cumberland (Hancock Co.), Indiana, on sec. 12 of the Harvey Farm. The *fraternum* specimens were collected Dec. 30–31, 1940, about Bean Blossom Lake in Morgan-Monroe State Forest, Indiana. Specimens from both localities are preserved in the collections of the Acad. of Nat. Sciences of Philadelphia.

The courtship commences with the slow head-on approach of the amorous individuals. As soon as the animals meet, the tentacles cease swaying from side to side and remain with the tip almost stationary opposite the corresponding tentacle-tip of the other animal. Meanwhile the inferior tentacles have become "focused" on the genital pore of the mate and the animals have gradually moved so that their heads are parallel and their bodies no longer head-on in a straight line. Simultaneously with these maneuvers, the mouth and head adjacent to the inferior tentacles become constricted and pouted-out in a peculiar manner; but the rest of the head and body is unaffected. By this time usually the sex organs have become partially protruded —first appearing as a pimple-like swelling but later as a concave, lobate disk. The climax of the courtship is reached when the pouted-out mouth parts touch the protruding parts of the sex organs of the mate. When this occurs, the animals commence gnawing at the concave, central part of each other's sex organ. Often pivoting acts (in which an animal turns away and rejoins its mate after performing a complete rotation) follow these first gnawing contacts. Such pivoting may be performed by one or both animals simultaneously, and at these periods the protruding portions of the genitalia are generally retracted until the animals are again in the appropriate stage of the head-on position. Rarely courting specimens bite each other about the head when they first meet. Such incidents also induce pivoting acts.

Coitus occurs usually within a few minutes after the specimens have commenced gnawing at each other's sex organ and is discontinued when the rest of the sex organ is suddenly and

vigorously protruded.[1] The suddenness of the act renders direct observation of the coitus process impossible. However, from the data presented by mating anatomies (secured by plunging mating animals quickly into boiling water) the following conditions seem to exist:

1. The fully protruded sex organ of each animal is composed of both male and female parts borne on a common base—the male organ (penis) appearing as a cup-like body with an ejaculatory pore (EP) opening onto the rim of the cup in a fissure, and the female organ appearing as a tubular body with two orifices, a lateral and a terminal.

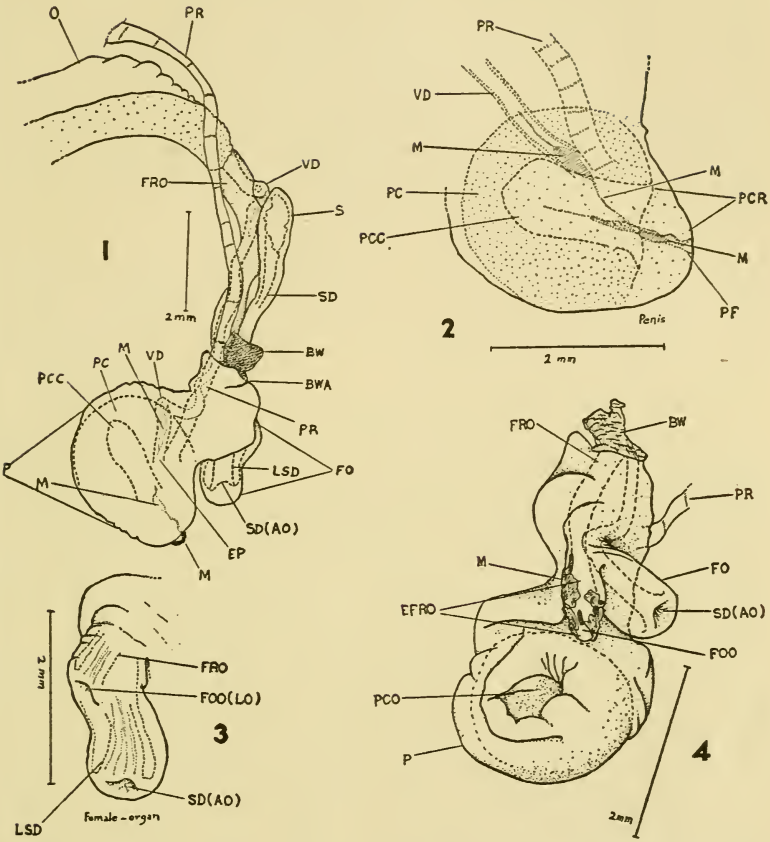
2. In many undisturbed dissections, the female organ has been found to occupy the cup of the penis so that the apical orifice (AO) of the female organ is enveloped and its lateral orifice (LO) opens on or near the rim of the penis-cup. A mass of coagulated matter often clogs, or adheres to, the lateral orifice. In one dissection, figure 4, the lateral orifice is borne at the tip of a body everted secondarily from the female organ.

3. Dissections of the female organ reveal the apical orifice to be the opening of the spermathecal duct (SD) and the lateral orifice to be the opening of the free oviduct (FOO).

4. Dissections of the penis (P) reveal the vas deferens (VD) to terminate at the site of the ejaculatory pore (EP), and the penis retractor (PR) to attach in the same area. The ejaculatory pore is within the penis-cup, seemingly on the foremost wall.

From these anatomical details, transfer probably results from a modified form of copulation wherein seminal material is deposited on the female organ. Apparently the act is accomplished by the engulfment of the female organ by the penis, or by the actual insertion of the female organ into the penis-cup, or by both insertion and engulfment. In any event, the female organ would come to occupy the same position eventually and thus would receive the discharge from the ejaculatory pore or fissure. Whether semen transfer may ever be non-reciprocal is unknown

[1] Ulrich Gerhardt (1933) has used the term "explosive" for the similar suddenness of penis eversion of limacids ("Zur Kopulation Der Limaciden I," Zeitschr. Morph. u. Okol. Tiere, 27 (3), pp. 401–450, 11 figs.).



FIGS. 1–3, *Stenotrema fraternum:* 1, Mating anatomy, showing everted and non-everted parts of sex organs. 2, Details of everted penis. 3, Details of female organs. Fig. 4, *S. f. cavum:* Everted parts of mating anatomy. Note secondary eversion of free oviduct.

as yet. In one mating anatomy of the race *fraternum*, the female organ is scarcely everted and the most of the spermathecal duct (which is expanded below a duct-like portion connecting with the spermatheca) and oviduct are not everted. Since the female organ is turned outside-in during its retraction, the formerly external parts become the lumen of the basal spermathecal duct and oviduct. Seminal material adherent to the site of the oviducal pore, or other parts of the female organ, must then be transferred into the spermathecal duct and thence subsequently into the spermatheca itself.

The entire sex act requires from less than one to more than three hours. The courtship occupies the greater part of the proceedings while coitus usually lasts less than five minutes. Often after a prolonged courtship the two amorous specimens separate and coitus does not occur at all.

The accompanying figures (inversion uncorrected) are tracings from projector images of whole mounts in balsam of mating anatomies. The parts exhibit the usual shrinkage of material so preserved, and slight distortion has occurred. Figures 1, 2, and 3 are of *S. f. fraternum* specimens from Bean Blossom Lake, Indiana (slide No. 207 of the author's collection). Figure 4 shows the exserted organs of a *S. f. cavum* specimen from near Indianapolis (slide No. 213 of the author's collection).

Explanation of abbreviations: AO, apical orifice of the female organ; BW, body wall; BWA, body wall and atrium junction line; EFRO, everted free oviduct body; EP, ejaculatory pore; FO, female organ; FOO, free oviduct orifice; FRO, free oviduct; LO, lateral orifice; LSD, lower spermathecal duct; M, matter (probably seminal); O, oviduct; P, penis; PC, penis-cup; PCC, penis-cup cavity; PCO, penis-cup orifice; PCR, penis-cup rim; PF, penis fissure; PR, penis retractor; S, spermatheca; SD, spermathecal duct; VD, vas deferens.

THE TAXONOMIC AND DISTRIBUTIONAL HISTORY OF THE FRESH-WATER MUSSEL ELLIPTIO COMPLANATUS (DILLWYN, 1817)

By MAX R. MATTESON

(Continued from page 132, vol. 61)

Distribution. The fresh-water mussel, *Elliptio complanatus,* after originating in Alabama, gradually extended its range northward, east of the Appalachian Mountains. With the ad-

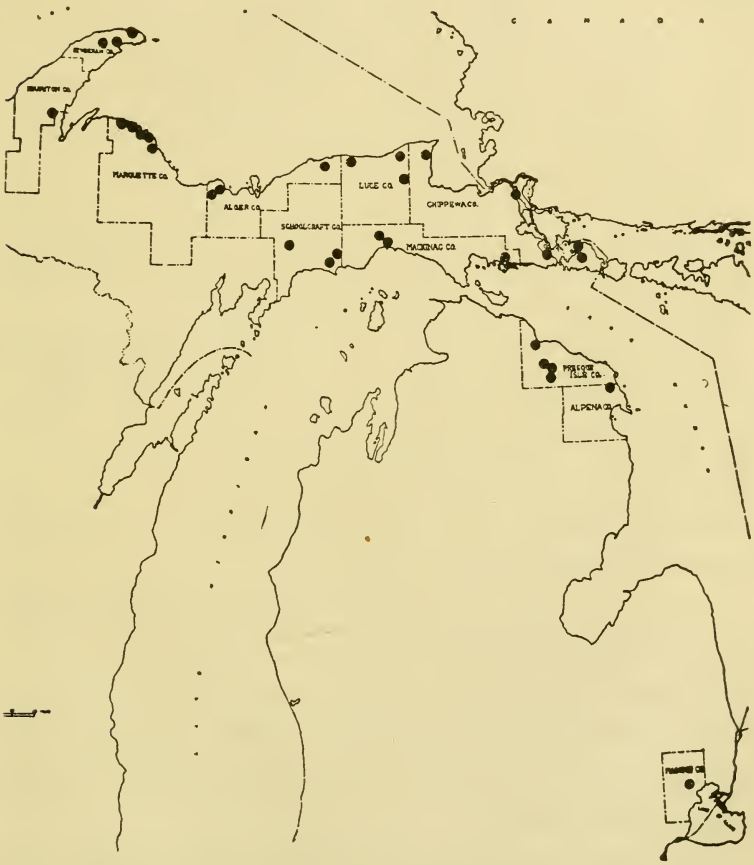


Fig. 1. Distribution of *E. complanatus* in Michigan.

vent of the glacial epoch, the northernmost boundaries of its range were pushed southward. As the ice sheet receded, it returned as far north as Cape Breton Island. At the time when Lake Erie, as it is known today, was non-existent, this mussel was able to migrate up the Mohawk River valley to Lake Ontario. From there it proceeded through the now extinct Trent River to present-day Georgian Bay. It then proceeded westward into Lake Superior (Walker, 1898). The Ocqueoc River drainage system of the Lower Peninsula of Michigan possesses it (fig. 1). Its distribution today, as plotted from records in the Division of Mollusks, Museum of Zoology, of the University of Michigan, is limited to the St. Lawrence River, Lake Ontario, Georgian Bay, Ocqueoc River drainage system, the north shore of Lake Huron, Lake Superior and the Atlantic seaboard from Cape Breton Island to northern Florida (fig. 2). Generally speaking, the range of *Elliptio complanatus* has increased little since its original entrance into Lake Superior.

Specimens have been taken from several locations on the north shore of Lake Michigan directly west of the Straits of Mackinac. This fact is evidence that the mussel is extending its range from the original boundaries at this point.

Several specimens have been collected far from the original range of *Elliptio complanatus.* One specimen in the Michigan collection was taken from the Clinton River at Mt. Clemens, Michigan. Ortmann (1924) found this species at Eaglesville, Ashtabula County, Ohio, in the Grand River. It has also been collected by Sterki (1907) in the Tuscarawas River, near New Philadelphia, Ohio. As to how these specimens reached the mentioned points remains a mystery.

SUMMARY. 1. The genus *Elliptio* Rafinesque, 1819, along with other related American genera, has been separated from the European genus *Unio* Retzius, 1788.

2. *Elliptio complanatus* (Dillwyn, 1817) is one of the most prominent members of the genus and possesses a large synonymy.

3. Because of its extensive range, there is considerable variation in this species. This fact has created confusion in dealing with it taxonomically.

4. The mussel arose in an area where stream confluence was occurring. This allowed *Elliptio complanatus* to occupy the

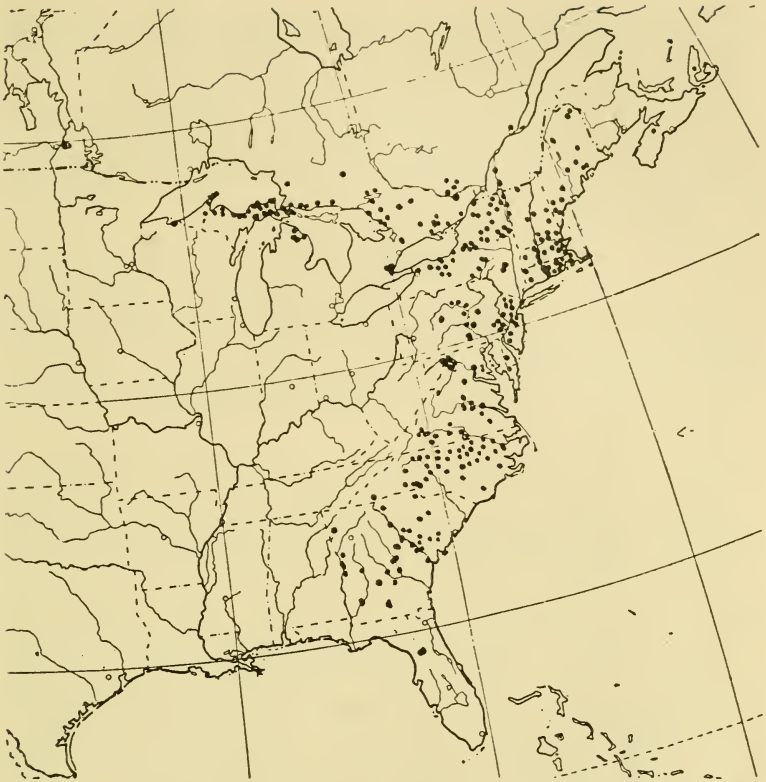


FIG. 2. Distribution of *Elliptio complanatus.*

Atlantic seaboard by entering it through the Savannah River, one of the streams involved. The northern limits of its range were later altered by glacial action.

5. It was able to enter the Great Lakes region near the end of the glacial epoch by way of the Mohawk River outlet, then connecting the Great Lakes region with the Atlantic Ocean. From Lake Ontario it entered Georgian Bay by the extinct Trent River. Since that time its range has remained almost constant.

6. Its present distribution includes the Atlantic seaboard, east of the Appalachian Mountain, from northern Florida to Cape Breton Island; Lake Ontario, Georgian Bay, and the north shore of Lake Huron; the Ocqueoc River drainage system of the

Lower Peninsula of Michigan, a small group of waters entering Lake Michigan directly west of the Straits of Mackinac; the St. Mary's River and Lake Superior.

7. The only positive evidence that this species is increasing its range at present is found in the fact that specimens may be found in a few lakes and streams connected with the north shore of Lake Michigan.

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TERRARIA OBSERVATIONS ON PROPHYSAON ANDERSONI (J. G. COOPER)

By WILLIAM MARCUS INGRAM
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The interesting western slug, *Prophysaon andersoni* (J. G. Cooper), is a member of a genus which may practice self amputation of the posterior body region. Concerning the genus *Prophysaon,* Pilsbry and Vanatta (1898) state, "Tail usually showing an oblique constriction of from the posterior third to sixth of the animal's length, marking the place where self-amputation takes place."

The writer collected seven specimens in Redwood Regional Park, Oakland (January 18, 1946), which showed no tendency to attempt self amputation of the posterior body area. These specimens were taken from beneath the sprung bark of an *Eucalyptus* tree which was in a state of wet rot at a height of 12 feet. On being transferred to terraria at Mills College, they were subjected to rather unnatural treatment in an effort to cause them to amputate the posterior body area.

After being placed in terraria on January 16 the slugs were immediately starved for 14 days. During this period, three

died without fragmentation of the posterior body region. The four survivors were then fed on a moist paper towel diet from the 15th day of captivity till the twenty-second day when they were fed lettuce which they rapidly devoured. From the twenty-third day of captivity until May 22, 1946 they were fed only on moist paper towels when another slug died; two others dying on July 16, 1946. The surviving slug was preserved on July 22 in a three percent formaldehyde solution.

Beginning May 22 until July 1, the four surviving slugs were pinched from time to time with forceps, shaken in a closed container, dropped on a wooden floor from a height of five feet, and pricked with a scalpel without throwing off the posterior body region.

These observations add data to indicate definitely that, of the members of the genus *Prophysaon, Prophysaon andersoni* does not always amputate the posterior body area when subjected to probably abnormal environmental factors or when preserved in a three percent formaldehyde solution. Concerning amputation by *P. andersoni,* Raymond (1890) and Pilsbry and Vanatta (1898) have implied that amputation of the posterior body area is not necessarily the rule. Raymond (1890) states, "In August, 1888, I collected on one occasion about a dozen examples of *Prophysaon Andersoni* J. G. Cp., near the San Jose reservior, above Lexington, Santa Clara County. While taking measurements of the living specimens, before putting them into alcohol, I noticed in several a contraction about two-thirds of the length from the head. This appeared as an indented line completely encircling the body. Upon handling the slugs to examine this phenomenon more closely, the line became deeper, and in the case of two of the specimens the tail dropped off, almost as readily as the ray of the so-called 'brittle' starfish." Pilsbry and Vanatta (1889) write, "Nearly all full grown alcoholic specimens of *P. andersoni, foliolatum* and *coeruleum* show a well defined impressed line around the tail, or occasionally the tail has actually been amputated. . . . Dissection shows that the body cavity does not extend beyond the point of excision, or but very little beyond; the remainder of the tail being occupied by very spongy vesicular connective tissue."

Hemphill (1890) has written about amputation in the closely related species *Prophysaon foliolatum* (Gould): "I have to record a peculiar habit that is quite remarkable for this class of animal. When I found the specimen, I noticed a constriction about one-third of the distance between the end of the tail and the mantle. I placed the specimen in a box with wet moss and leaves, where it remained for twenty-four hours. When I opened the box to examine the specimen, I found that I had two specimens instead of one. Upon examination of both, I found that my large slug had cut off his own tail at the place where I noticed the constriction, and I was further surprised to find the severed tail piece possessed as much vitality as the other part of the animal. The ends of both parts at the point of separation were drawn in as if they were undergoing a healing process. On account of the vitality of the tail piece, I felt greatly interested to know if a head would be produced from it, and that thus it would become a separate and distinct individual." Concerning this collection, Binney (1892) to whom Hemphill had sent the specimen wrote, "The animal on reaching me still plainly showed the point of separation from its tail. . . . The tail piece was in an advanced stage of decomposition. I have noticed the constriction towards the tail in many individuals. The edges of the cut were drawn in like the fingers of a glove, after the excision."

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NOTES ON THE FOREIGN LAND SNAILS OF LOUISIANA

By HAROLD W. HARRY

The several reports of foreign land snails in Louisiana extend back over a period of three-quarters of a century. Because these reports have been widely scattered in the literature, because the present population status of several species seems to have changed, and because the occurrence of foreign snails in some sections of the country is viewed with alarm, a review of the subject as it applies to Louisiana is here presented.

Otala vermiculata (Müller) was first cited from Louisiana by Viosca (1928), who reported it from Jackson Square, New Orleans, and said that he had been aware of its presence there over a period of ten years. He believed its introduction was intentional, since it was sold alive by an Italian delicatessen in the French Quarter. Pilsbry (1939) verified Viosca's citation and figured a shell from New Orleans. He considers it unlikely that this species has become established as a permanent resident of the United States. My collecting in Jackson Square, done at various times over the last nine years, has never revealed this species, and it may safely be stated as extinct there at present.

Otala lactea (Müller) and *Helix aperta* Born were both sold alive by an Italian delicatessen in the 900 block of Decatur St., New Orleans, in 1939. The aestivating specimens, with a thick, white epiphragm, were kept in uncovered bushel baskets in the store. In looking over specimens which I bought from the basket of *Otala lactea,* I find an occasional specimen of *O. vermiculata,* which may be recognized by the marked distinctness of the spiral bands of brown (in *O. lactea* these color bands are poorly defined, often diffuse, so that the banded appearance may be completely obliterated). During the recent war the importation of these snails ceased, but I was recently informed by the proprietor of the store that they have been imported on several occasions since, and that they are "in season" during April and May. There is no indication of their establishment in the state, though such may have happened. Pilsbry (1939) notes that *O. lactea* has been established in Georgia and Florida, in limited localities. Gammon (1943) reports the establishment

of both *O. lactea* and *Helix aperta* in California, where they cause considerable concern as pests of cultivated areas. Strecker (1935) notes that *O. vermiculata* is well established over large areas in Waco, Texas, and that *O. lactea* is likewise to be found in that city, though not as common as the former species. Jackson (1944) reports colonies of both *O. vermiculata* and *O. lactea* from Bryan, Texas. The specific distinction of these two species of shells, at present made entirely on coloration, seems doubtful.

Helix aspersa Müller is known from both New Orleans and Baton Rouge. Viosca (1928) found it in Jackson Square, but I have never taken it there (nor elsewhere in that city) in the last several years. The earliest record for New Orleans seems to be that of Tryon (1866). Featherman reported it from Baton Rouge in 1871, and Binney's Baton Rouge record of it in 1885 may be independent. It is still present in that city, though in isolated localities. I have collected it in the 900 block of America St., and several blocks close by, under rubbish in vacant lots. *Helix aspersa* seems not to have spread in Louisiana, and was known to Strecker from only two small localities at Waco, Texas. However, this species has caused much concern as a pest of cultivated areas in California, as reported by the special studies of Ingram, Gammon and others.

Bradybaena similaris (Férussac) was first reported from Orleans Parish by Goodrich (1940), under the name of *B. similaris hongkongensis* Deshayes. Haas (1945) records it a second time, as occurring in gardens in New Orleans; he considers it to be permanently established there now. I first collected it in 1939, in Jackson Square, and have found it plentiful there since, in the loose soil of the flower beds. In 1947 it was found in the St. Louis Cemetery; this was the only helicid found in those two places, during my collecting. In January, 1948, a large colony was discovered along a short portion of Dalrymple Drive, at the University Lake in Baton Rouge. This colony is established on a grassy road embankment of good though short slope, and extends along the drive for several hundred feet. Oddly enough, not a single specimen could be found on the opposite side of the road, where conditions appeared to be very similar. I had collected over this same area in the years 1939–1942, but had never before taken this snail in East Baton Rouge

Parish. It probably became established there after that time. Viosca did not report this species from Jackson Square in 1928, and Pilsbry (1939) seems to have been unaware of its presence in the United States when he published the portion of his monograph on the American land snails dealing with the Helicidae. This species, originating in southeastern Asia, has been widely distributed by commerce in the tropical and subtropical portions of the world; it is recorded from the Caribbean Islands, and was probably introduced to Louisiana from that region. A figure and brief description are given by Tryon (1887) under the genus *Helix;* Pilsbry (1894) placed in the genus *Eulota,* but later (1934) showed that this genus must be called *Bradybaena* by right of priority. An extended account of the synonymy of this species is given by Dautzenberg and Fischer (1905). The subspecies *B. similaris hongkongensis* Deshayes is distinguished by the presence of a linear stripe of maroon red on the periphery of the shell; of 24 shells collected from the Baton Rouge colony I found 18 banded and 6 non-banded specimens. The New Orleans colonies also contain both forms.

Lamellaxis gracilis (Hutton), I have found very common in Jackson Square and the St. Louis Cemetery in New Orleans; in Baton Rouge it is plentiful in the vacant lots in several blocks along the river front, south of the old Capitol Building, and at isolated places in the city. At Donaldsonville a single live specimen was taken in November, 1947, on top of the levee at the Ferry Landing. Pilsbry (1946) gives a discussion of the synonymy and distribution; according to him it was known in City Park, New Orleans, as early as 1905.

Rumina decollata (Linnaeus) has been plentiful in Jackson Square, New Orleans, during the past nine years. I have also taken it in the St. Louis Cemetery. Pilsbry (1946) gives a discussion of the synonymy and distribution, and cites it from New Orleans as early as 1906. Viosca (1928) records it again from Jackson Square, and other places in the city. He thinks it is becoming rarer, perhaps due to the improving drainage of the city. Goodrich (1940) cites it as occurring "in rural parts of the parish" (Orleans), though probably, even in this instance, it was found by his correspondent in cultivated areas. In Baton

Rouge, I have taken it in the same areas where *Lamellaxis gracilis* was found.

Limax flavus Linnaeus is found in several places in Louisiana, including Shreveport, Baton Rouge, St. Francesville, and at Norwood (East Feliciana Parish). I have never collected it in other than urban and suburban areas, and it seems not to have invaded the regions covered with natural vegetation. W. G. Binney (1885) has given a description, and a review of the synonymy and distribution.

Of the eight species of foreign land snails reported above, only five are known to be presently established in Louisiana (*Helix aspersa, Bradybaena similaris, Lamellaxis gracilis, Rumina decollata* and *Limax flavus*); *Otala vermiculata* was apparently established in Jackson Square, New Orleans, for a time (1918–1928, perhaps somewhat earlier and later) but has been unable to survive there. *Helix aperta* is not known to have established itself, though it and *Otala* are frequently brought into the state. The species of *Helix* and *Otala* were purposefully introduced, as articles of food, but the others probably have been introduced accidentally, by commerce. When a study of the snails occurring in greenhouses is made, doubtlessly several other species will be added to the list of foreign snails of the state, judging by the reports of exotic snails in other regions of the country.

In Louisiana, the species reported as now established seem limited to small areas, in urban and suburban situations. I have never taken them in natural areas, away from cities and houses. With the exception of *Limax flavus,* all the species here reported are found in cities and towns of the major trade routes. Incidentally, Goodrich (1940) reports *Polygyra texasiana* (Moricand) in Orleans Parish, and cites this as the easternmost range of the species; but Pilsbry (1940) does not list it east of Texas. In November of 1947, a thriving colony of this snail was found in Baton Rouge, in the same area as the *Rumina* and *Lamellaxis.* As it has not been taken elsewhere in the Parish, seemingly this too is a localized colony, probably accidentally imported from the west.

None of the foreign snails known from this state seems to be a pest of any great detriment to agriculture. This is in contrast with the reports of the same species in other regions (see Gam-

mon, and his bibliography). However, the almost ubiquitous *Zonitoides arboreus* (Say) has been reported as detrimental to sugar cane in Louisiana (Bartsch and Quick, 1926).

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CURRENT INTEREST IN MALACOLOGY

By RALPH W. DEXTER, Kent State University, Kent, Ohio

In recent years there has been a revival of interest in the old, fascinating study of conchology and a greatly accelerated development of the modern science of malacology. These developments have been stimulated in part by organized clubs with capable leadership, new publications, new and active shell dealers, extensive travel by men in military service, accumulation of shells sent home by service men, use of shells in therapy, a fuller realization of the importance of mollusks as items of food and as hosts for parasites, researches on commercial mollusks as steps in conservation of natural resources, and the expanding use of mollusks for experimental purposes. Malacology today probably ranks second to entomology in the field of invertebrate zoology in regard to the number of professional workers and amateurs engaged in its study.

Directories and membership lists issued during the past few years give some indication of the extent of interest in the study of mollusks. "The International Directory of Malacologists" (1) lists 580 names from the United States with notes on specialization and size of collection. Of special significance is the notation of the year when interest in shell life began for 199 of these persons. Twenty-three began before 1901, fifteen started between 1901–1910, twenty-two between 1911–1920, forty-two between 1921–1930, while a total of ninety-five, nearly as many as all the others put together, started between 1931–1940. The ranks of the older students are naturally thinned out by death and changing interest, but the students which remain active have had time to become known and therefore have a more complete representation in the directory than the recent students. While direct comparison cannot be made for these reasons, it does seem apparent that considerable interest in malacology was initiated in the 1930's. Only two are listed after 1940, but such recent additions to the field are not apt to come to the attention of an editor bringing out a directory within two years time. Probably a great many, amateurs especially, have taken up shell collecting since 1940.

"The Directory of Conchologists" (2) lists more than 750 persons from the United States with the field of interest of many indicated in a categorical manner. It also contains some 650 names of foreign conchologists. While these are not grouped by country, it is the most complete recent list of foreign students, as well as the most extensive one published for the United States. The 1947 Annual Report of the American Malacological Union (3) records but 347 members, but this is more of a professional list than that of the directories, composed very largely of those who are scholarly in their malacological interests. The recent list shows an increase of 32 over that of the preceding year, but it seems evident that many students and hobbyists have not yet been encouraged to unite with the national organization. The formation of the proposed Western Section of the Union should greatly increase the total membership and stimulate further interest in mollusks.

In "The Naturalists' Directory" (4) there are 3394 professional and amateur naturalists of all kinds listed from the United States and Canada. Of these, 146, 4.3% of the total, mention some phase of malacology as a special interest. Some of the most frequent designations with the number of each are as follows: Mollusca, 45; shells, 33; conchology, 20; malacology, 9. Others mentioned less often include the following: cephalopods, ammonites, Tertiary Mollusca, marine Mollusca, land and fresh-water shells, Pulmonata, Gastropoda, bivalves, Sphaeriidae, tree snails, physiology of mollusks, and ecology of fresh-water snails. A general review of this directory with an analysis of interest in ecology has already been published (5).

The current directory of members of the Ecological Society of America (6) gives but little information on specialties. The majority of the members are simply listed as being workers in the field of botany or zoology. While the vertebrate sciences are frequently named, entomology is the only invertebrate science given specific mention. The membership list of the Limnological Society of America (7), however, gives a more refined classification. Out of a total of 497 members, 29 (5.8%) are listed with some interest in malacology. Sixteen of these recorded Mollusca as a general field of investigation while the others specified such items as follows: fresh-water mollusca,

shellfish, Gastropoda, Sphaeriidae, Marine Borers, Ostrea, and Reproduction in Snails.

Correlated with the recent rise of interest in mollusks has been the appearance of several new journals and serial publications in the field. The most significant of these is Johnsonia (8), which was first published in 1941, and is edited by William J. Clench. This is monographic in nature, thoroughly scientific, and superbly illustrated. Four years later the same editor began another series of shorter papers entitled Occasional papers on Mollusks (9). Also in 1941, the Minutes of the Conchological Club of Southern California (10) appeared under the editorship of John Q. Burch. This paper also includes the Minutes of the Long Beach Shell Club and contains scientific reports and progress reports as well as club and personal activities. In 1942 a popular trade paper called Shell Notes (11) was first distributed by its owner, Frank Lyman. The following year another scientific journal bearing the title, Revista de la Sociedad Malacologia "Carlos de la Torre" (12), made its appearance under the direction of Carlos G. Aguayo. Mollusca (13), a popular paper issued by Paul H. Reed, appeared in 1944. A private publication of S. Stillman Berry known as Leaflets in Malacology (14) was first issued in 1946.

Of recent books which have stimulated collecting, study, and research, three might be mentioned as of special importance. Volume I of the masterpiece of Henry A. Pilsbry, "Land Mollusca of North America" (15), has already been published, with volume II in preparation. This definitive tome will hold the seat of authority for many years to come. Of interest to the service men and their friends is the section of a book on "Shells of the Pacific World" (16) by Paul Bartsch. The latest handbook which will surely further an expanding interest in collecting shells, if not of more serious study, is the recent "Field Guide to the Shells" (17) by Percy A. Morris.

It will be of great interest to learn whether the next decade will see as much activity in the collection and study of mollusks, the publication of results, and the appearance of new serial publications and books as has taken place in the past decade or two.

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INDISCRIMINATE SCATTERING OF EXOTIC MOLLUSKS

By G. D. HANNA, California Academy of Sciences

The desire of human beings to maintain pets and to transplant them and watch them thrive, is a trait which cannot be legislated out of existence. Only by the slow process of mass education concerning the dangers involved will the difficulty be eliminated. There is a tendency in many states to pass laws of protection and these, unquestionably, do just this to a certain extent. These laws and regulations are merely expressions by the public in an endeavor to protect themselves. There will be many more.

Some of the most dangerous of all pests are mollusks. Conchologists are thoroughly familiar with them yet the pages of The Nautilus have had numerous articles during recent years which contain statements of admission by the authors of having actually planted exotic species or of having advocated the planting. A need for such action is not shown or is only hinted upon, and I have no doubt that the time is not far distant when paramount need will have to be proved and doubly checked before an introduction will be permitted. Furthermore, it seems safe to prophesy that at no very distant date it will be made difficult to secure a permit to collect or maintain live mollusks at all. Amateurs and professionals alike may well take warning.

In a late number of The Nautilus in an article on *Achatina achatina* the author * admitted having allowed an egg laying individual to escape. Fortunately it was captured and, let us hope it was promptly executed. The author went on to state that the introduction of the species into Florida might be successful. Let us also hope that if this State does not already have laws forbidding such action, they will be promptly enacted.

A closely related species, *Achatina fulica,* was transplanted to some of the Pacific islands prior to or during the war by Japanese and the damage it has done is incalculable. Many beautiful islands have become barren wastes. Guam is infested and the

* Andrews, E. A. *Achatina achatina* lays its eggs. The Nautilus, Vol. 61, No. 3, Jan. 1948, pp. 95–96. This reference is not singled out for special criticism; it is merely a citation which shows the feeling of many conchologists.

species has even reached Hawaii where the greatest effort is being expended in an attempt to exterminate it. F. X. Williams is currently in Africa in an endeavor to find some natural enemy which will aid in control.

These animals are extremely prolific. Two (*A. achatina*) were once left at the Steinhart Aquarium on loan. They were kept under most rigid control and observation because they were thought to be safer there than in private hands. These two laid 246 eggs at one period. Finally the California quarantine officials killed the animals and it was found that one of them contained about 100 additional eggs. None of these were allowed to get into private hands; they were at once placed in strong alcohol or broken.

California has adequate laws to prevent the entrance of such animals but some misguided individuals fail to be impressed and sometimes elude detection.

I do not know of any records to show that conchologists have actually scattered any of the species which have become such expensive pests in California but it is not likely that they are much if any more careful than such collectors elsewhere. They might well be, however, because the state has spent many millions of dollars in efforts to exterminate certain European species of land snails. Some of these have gained such a foothold that it is useless to even try and in spite of the utmost vigilance others get through. In the only case where there is an actual historical record (*Helix aspersa*), the "food" excuse was cited, yet I have not heard of one being eaten in 25 years. The same excuse was used by the federal government years ago when it planted German carp indiscriminately in western waters, the result being that excellent native species were displaced by one which is so undesirable that it rarely is eaten.

The well known role which freshwater mollusks play as intermediate hosts for parasites of many animals, man included, scarcely calls for comment. Yet when the collector is tempted to move a snail from one stream drainage over into another he should hesitate a moment and try to give absolutely definite answers to these questions.

1. What food does this mollusk eat?
2. Which animals eat it and in what proportion?

3. Is the mollusk a carrier of parasites potentially dangerous to other animals?
4. In the new locality is there any species so desperately in need of food that this move is necessary?
5. Is the transplanter financially able to back up his judgment against losses?

Failure of individuals to answer these questions satisfactorily in the past, accounts for many of the difficulties and expenses of agriculture and aquatic biology today.

THE SPREAD AND DESTRUCTIVENESS OF THE GIANT AFRICAN SNAIL, ACHATINA FULICA *

By R. TUCKER ABBOTT

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Few snails that have been introduced by man in various parts of the world have attracted the attention of gardeners and plantation owners as much as has the giant African snail, *Achatina fulica* Férussac. The sudden appearance of snails half a foot in length, the rapidity with which the colonies increase in size, and their destructiveness to succulent plants and young sprouts have caused man to turn battle against the molluscan invaders in a dozen places around the world. The story of their arrival in various parts of the Far East and Pacific Islands has been told from time to time as the march of *Achatina* has proceeded from west Africa across half the face of the world. Alarming destruction to truck crops in the Mariana Islands and the recent accidental introduction of this snail to southern California have added a new chapter to the story. The suggestion of a recent writer, who aids and abets a flourishing colony of *Achatina achatina* in the United States, that the snails' introduction to Florida might serve some useful purpose promises to add still another headline—"Giant Snails Raze Florida Tomato Crops" or "Cubans Battle Giant Snail Visitors from the United States."

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* Published by permission of the Secretary of the Smithsonian Institution.

The menace is so real that the National Research Council, at the request of the United States Navy and Pacific Island governments, has set out to find some solution to the problem. Already, a scientist renowned for his successful fight against insect invaders of the Hawaiian Islands has been sent to the home of the achatinas in tropical Africa. His job is to learn as much as possible about the snails' habits and natural enemies. What he discovers will be used in our all-out attack on the snail in the Pacific.

The early history of achatina's march is rather obscure, although its introduction to the island of Mauritius was certainly before the year 1818. Lamarck records it from that island in 1819, but how long his specimens were in the Paris Museum collection even before this is not known. Férussac and Rang mention it several times in works appearing in the early quarter of the nineteenth century. Férussac in 1821 says that the governor of Reunion Island imported it into his gardens for a favorite young lady who had acquired a taste for snail soup which in those days was considered to be of some medicinal value. A special voyage was made to Madagascar for this snail, according to Férussac's tale.

While the well-known malacologist, Benson, was visiting his friend, Captain Barclay, in Mauritius in 1847, he became sufficiently interested in the giant snails to bring back living specimens to Bengal and release them in the back garden of the Bengal Asiatic Society. The same year, Benson introduced them to Calcutta where Captain Hutton in 1848 collected several specimens which he later introduced to Mussoori in the western Himalayas.

Since Benson's day the giant African snail has made a steady march eastward with serious outbreaks occurring in the Seychelle Islands prior to 1868—Ceylon in 1900 where young tea plants were attacked—Perak, Straits Settlements in 1927—Malaya in 1928 when thousands of young rubber plants were destroyed—Singapore gardens in 1930—a year later Southern China—Rhio Archipelago, Netherlands East Indies in 1933—Java, 1935—Palembang, Sumatra, 1936—and Siam prior to 1937. The snail has appeared from time to time in the Hawaiian Islands, but thanks to the vigilance of Dr. C. M. Cooke of the Bernice

P. Bishop Museum, introduced colonies have been stamped out each time before the situation reached the epidemic stage.

The Japanese introduced achatinas to Saipan and Tinian Islands in the Marianas for food purposes some time before 1940. Although the Japanese were very fond of *Achatina* stew, the natives did not acquire a liking for it. When American troops occupied these islands in 1945, the snails were so abundant that driving was made dangerous by slippery roads caused by hundreds of crushed snails. The author has seen as many as fifty large achatinas clinging to a small ten-foot tree on Saipan Island. Green, in 1911, reported a similar condition in Ceylon where "Two hundred and twenty-seven snails were counted . . . on the stem of a coconut-tree. The ground beneath . . . was covered an inch deep with their excreta."

In 1946, when *Pandanus* leaves were being shipped from Saipan to Guam for native handicraft, the snails soon after appeared on the outskirts of Santa Rita Village. No serious efforts were made to control the invader, and by 1947 the colony had enlarged and spread over most of the southern half of Guam. At present, a similar epidemic is raging in the Palau Islands. Okinawa was invaded some time before the last war.

United States is the most recent port of call for *Achatina,* where living adults have been found in gardens in San Pedro, California. The theory has been advanced that eggs or hibernating adults were brought in on army vehicles returned from Tinian Island soon after the war. It would, indeed, be regrettable if the snails established themselves in California's great truck farming areas. In Malaya, agriculturalists were concerned equally as much by the ability of the snail to mechanically transport common plant diseases as they were with its destructiveness to sprouting rubber plants.

Adult achatinas seem to prefer rotting vegetation, human excreta, and fallen fruit as the main part of their diet, but the younger snails take an active part in attacking succulent vegetables and the sprouts of certain economically important plants. According to Connolly (1931) there is no limestone in Ceylon, which is of almost purely granitic formation, and due doubtless to this cause the snails have developed a passion for whitewash for which they crawl up buildings in order to lap it off the

whitewashed walls, and this is now turned to account in keeping down the pest by hanging little bags of poisoned whitewash in spots where they are likely to find and eat it.

In Malaya, agriculturalists have met with considerable success in cutting down the number of snails by means of bait-balls of rice-bran mixed with poison. "Meta fuel," a patented compound metaldehyde, was used as the poisoning agent, although doubtlessly other common insecticides would serve equally well. The use of D.D.T. may possibly meet with failure, since some mollusks already tested have ingested the famous insecticide with no harmful effects.

The bibliography concerning the spread and control of *Achatina fulica* is too lengthy to include in this article, but the information is on file in the division of mollusks, United States National Museum, Washington 25, D. C. The shell is illustrated in Pilsbry's "Manual of Conchology," vol. 17, 1904, plates 36 and 37, by Green in "The Zoologist," London, 1911, pl. 2, and in the "Pomona Progress Bulletin," a California newspaper, in May, 1947. Cleaned shells may be purchased from some shell dealers, including a well-known dealer in California. We are indebted to Miss Ruth Turner who kindly sent us many locality records from the collection at the Museum of Comparative Zoology.

THE HIRASE COLLECTIONS OF MOLLUSKS

By WILLIAM J. CLENCH

Through the kindness of Dr. A. R. Cahn, I have received the following notes in regard to the two Japanese collections, made by Yoichiro Hirase and his son, Shintaro Hirase.

By far the more important collection is that of Yoichiro Hirase. This collection of mollusks was built up through the years by the elder Hirase, based mainly upon the efforts of field collectors that he had sent to many portions of the Japanese Empire. Many of the species were new, and these were described by Pilsbry and by Pilsbry and Hirase.

I quote from Dr. Cahn's letter. "The Y. Hirase collection was in the Science Museum in Ueno Park, Tokyo. Early in the war it was packed and shipped into the country somewhere. It is now en route to Ueno Park. So far as I know, it is wholly unharmed."

This is exceedingly fortunate. It is by far the most important collection of mollusks in Japan, since so much of it consists of type material.

The fate of the collection of Shintaro Hirase is not so fortunate. Again I quote from Dr. Cahn. "Here is the story, and it is a sad one. At the start of the war, Hirase [Shintaro] split his collection for safety. He gave approximately 60% of it to Research Institute for Natural Resources in Tokyo, keeping 40% of it himself. His house was completely destroyed by incendiary bombs, and his 40% was eliminated. The Institute promptly split the 60% they had, shipping about half of it (30% of the total collection) out into the country for safety. The remaining half (30% of the total collection) was retained in Tokyo, and was lost through bombing. Hence, all that is now left of the original collection is about 30%, now in the Research Institute here in Tokyo. This I have seen superficially. My guess is that the collection contains very roughly some 5000 specimens, but this is only a guess. Remember the shells are in boxes, all jumbled up, and wholly inaccessible to either sight or study. I wish I could give you a more optimistic story about it. Better make a note of the above facts, if the fate of that collection is of any historical importance, for only a few people in Tokyo know the facts. I got them from Dr. Kuronuma, a close friend of Hirase, and from Dr. Oshima, a closer friend."

It was upon this latter collection that Shintaro Hirase based his book, "A collection of Japanese Shells with Illustrations in Natural Colors" (1934).

The loss of this collection is most unfortunate. Nevertheless, its effect on Japanese malacology is not nearly so great as would have been the loss of the collection of the senior Hirase with its priceless type material.

NOTES AND NEWS

Dates of The Nautilus.—Volume 61, no. 1, pp. 1–36, pl. 1, was mailed July 14, 1947. No. 2, pp. 37–72, pls. 2–4, December 18, 1947. No. 3, pp. 73–108, pls. 5 & 6, March 2, 1948. No. 4, pp. 109–144 + i–vi, pls. 7–10, May 24, 1948.—H. B. B.

Drymaeus multilineatus osmenti, new form.—Shell similar in structural characters and size to typical *D. multilineatus,* differing by having the ground color a light orange-yellow and being devoid of any brown spiral bands. The holotype (MCZ. no. 160807) measures 21.5 × 10 mm. It was collected by William Osment on Little Pine Key, Lower Florida Keys.—W. J. Clench.

The Authorship of Elliptio complanatus.—Solander is the author of *Elliptio complanatus,* but because Simpson (1914, Cat. Naiades, p. 651) was unaware of the existence of the Portland Catalogue, he considered *E. complanatus* to date from Dillwyn's description of 1817 (Cat. of Recent Shells, p. 51), as have most subsequent authors. However, as pointed out by Iredale (1916, Proc. Mal. Soc. London **12**, p. 90) and Dall (1921, Nautilus **34**, p. 99), the Portland Catalogue is a valid publication and Solander's citation (1786, Portland Catalogue, p. 100) of Lister (1688, Historiae Conchyliorum, pl. 150, fig. 5) is an adequate description under the rules of the International Commission on Zoological Nomenclature. Therefore, Solander is the author of *Elliptio complanatus,* and the name dates from 1786. This makes the adoption of Spengler's name, *Unio violaceus,* (1793, Skriv. Nat. Selsk. **3**, p. 55) impossible. Spengler's name would become relevant only if *E. complanatus* dated from Dillwyn's description of 1817. Solander gives Maryland as the type locality of his species. Lister gives Virginia as the locality on his plate. Therefore, I hereby restrict the type locality to the Potomac River, Washington, D. C.—Richard I. Johnson.

THE NAUTILUS

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A COLLECTING TRIP IN MEXICO

By ANDREW W. SORENSON

On May seventh a party consisting of Dr. and Mrs. Earl H. Myers, John Strohbeen and the writer started in two automobiles from Pacific Grove, California for a ten day trip to Punta Penasco, Mexico. Dr. Myers is an internationally known authority on Foraminifera, who with Mrs. Myers has spent much time in the Dutch East Indies and in southern Asia, and who has travelled in most of the countries of Europe studying Foraminifera. But the Myers had not been in Mexico, and that is where John Strohbeen and the writer spend much of each winter beachcombing along the west coast from our border south to Mazatlan.

So a short trip to the nearest available place for shore collecting would serve as an introduction for them. Our good roads and millions of automobiles have made nearly every part of the United States easily accessible with the result that if one wants to study nature in its original condition he must go far afield and keep away from popular places and paved highways.

Even in Mexico they are "steadily" improving their road system and the influx of American tourists is gaining rapidly. Still both shores of the Gulf of California for its whole length from the mouth of the Colorado River to Point San Lucas on the tip of Baja California are yet the best collecting grounds for marine mollusks and crustacea to be found north of Central America. How long this will last is problematic, so we decided to visit Punta Penasco, for comparatively little work has been done there in the study of marine fauna.

It was practically inaccessible to automobiles until three years ago when the Mexican government completed a paved road to the Arizona border at Sonoyta, and Sonoyta is connected by paved road with U. S. Highway No. 80 at Gila Bend, Arizona.

From here one turns south for 44 miles to Ajo, where the large Dodge Phelps open pit copper mine is located, said to be the third largest in the United States. The mile wide pit is a wonderful sight with sixteen railroad tracks circling the enormous walls and many trains simultaneously loading or bringing ore up to the smelter.

The road continues south and soon enters "The Organ Pipe Cactus National Monument" which extends to the Mexican border where you pass through Custom. On the Mexican side you secure your tourist permit for $2.20 American money. This is good for six months, and renewable once, also for six months. The total distance from Gila Bend to Punta Penasco is about 150 miles and is an easy half-day run. Our reason for selecting Punta Penasco was due to its favorable position so near the head of the Gulf. The variation in tides is extreme, running up to nearly thirty feet in vertical distance.

In the little harbor, boats that have not anchored outside before low tide lean drunkenly against each other or lie on their sides till the incoming water rights them again, and big trucks actually drive around on the harbor bottom at low tide.

Sport fishermen from Arizona and southern California regularly come here week-ends for dependable fishing and conchologists do not have to be told that the etxreme low tides which expose as much as two miles of smooth bottom give them an unusual chance to study the molluscan fauna much better here than in places with little variation in tide levels.

A couple of previous visits had whetted our desire for making a more thorough study of the many species of mollusks to be found here. Two days run would have brought us there, but we preferred to stay overnight at Gila Bend, so as to get in on Sunday when most of the many week-end fisherman were going home, and consequently accommodations easier to get.

I will not go into detail about how we worked the various beaches of this still unspoiled place, but will confine my remarks to naming some of the more common species we found. The most interesting finds were made at La Cholla Bay some five or six miles north of Punta Penasco. Mrs. Myers and the writer followed the tide out for more than a mile and collected *Turbo fluctuosus, Melongena patula, Polinices reclusiana, Murex bi-*

color, Murex nigritus, and three different species of *Cerithium.* On the way out we came to an enormous bed of *Encope grandis* Agassiz. There were literally thousands of them living barely covered by sand. They averaged 4 to 5 inches in size.

At this stage we were joined by the other two members of the party who had been working the outer rocky point for acmaeas, tegulas, cypraeas, acanthinas, etc., and the numerous small octopi found under rocks. They were as excited at our find as we were, and they soon wandered off determined to outdo us at all costs. This they did, for soon John Strohbeen's lusty shout brought us to where they had located another huge bed of the still rarer *Meoma grandis* Gray. These two species are both echinoderms, and of about the same size, both nearly flat and covered with short black bristly spines, their chief difference being that the *Encope grandis* is somewhat thicker, has a large "keyhole" and five indentations in the margin while the *Meoma grandis* has a small round hole instead of a keyhole and five round holes near the margin. This is the first time in more than a dozen trips to the east coast of the Gulf of California that the writer has seen such beds, single live specimens only having been found, so it is no wonder that we were all pleased with our trip.

On other days the long beach connecting Punta Penasco with the rocky point that causes the shallow La Cholla Bay, which is really only a sub-bay of Bahia Adair, furnished us with three species of Oliva, namely *Oliva angulata, O. venulata* and *O. dama.* Also the long-tailed spiny *Murex elenensis, Conus regularis, Strombus gracilior, Strombus galeatus, Cancellaria cassidiformis, Eupleura muriciformis, Neritina picta,* turritellas and triforas and many species of Pelecypoda.

Of course we could not go to this popular fishing place without taking at least one fishing trip. Five of us went out with a Mexican charter boat and had a wonderful trip getting cabrillos, pintos, corbinos, sierras, sharks and even a five foot sting ray, but that is all I dare tell for fear of having it called a "fish story."

From a commercial standpoint, this little town deserves more than a passing notice. The Mexican white sea bass, called by them "Totoava," is a fish averaging some 50 pounds in weight

with individuals much heavier. It is caught here in large numbers, for the upper part of the Gulf seems to be its spawning place. They are hauled by trucks to the United States and with the large catch of shrimps furnish a good income for the rapidly growing fishing population. The town has more than doubled the last two years, and substantial buildings are going up. Their water supply came exclusively by tank trucks from a well twelve miles distant until recently when a distilling plant was built.

Being so isolated and new the town cannot take advantage of all its resources. A regular shark fishery is going on with only the livers being utilized. While we were there a truck hauled more than five tons of shark carcasses daily out on the desert for the buzzards to feed upon. A reduction plant would do well.

Time passed all too fast in this, as yet, unspoiled and primitive place, and the time for departure likewise came too fast, so home we went making plans to return there early in the fall when the summer heat is over.

NEW SUBSPECIES OF HELICOSTYLA FROM MINDORO, AND OF POLYGYRA FROM FLORIDA

By RALPH W. JACKSON

Helicostyla florida mesai, new subspecies

Shell imperforate, solid, rather broadly ovate. Nucleus and early postnuclear whorls are white. Beginning with the third whorl, a white thread-like band appears under the suture and as it approaches the aperture it widens and takes on a creamy tint. Directly under this band is a brown band which also increases in width and darkness of color with each whorl. After the postnuclear whorls the green color appears and this becomes darker as the aperture is approached; the base and the area behind the peristome is a very dark olive green. There is a wide dark columellar area, occupying one-half of the parietal wall. The entire peristome for an area of 3 mm. is brown. The aperture is oblique, broadly oval.

The type no. 184032 ANSP. has 5.5 whorls and is one of four collected by Pedro de Mesa at Bulalacao, southern Mindoro. Length 42 mm.; greater diameter 32 mm.; lesser diameter 28.5

mm. Three other specimens from Bulalacao (in coll. R. W. Jackson) measure: length, 40.5, 36, 39; greater diameter, 34, 32, 32; lesser diameter, 30.5, 27, 27 mm.

Mr. de Mesa also found this subspecies at San José and three specimens from there measure: length, 44.5, 39, 43 mm.; greater diameter, 36.5, 35, 35 mm.; lesser diameter, 32, 30, 31 mm.

This striking race of *H. florida* comes from Southern Mindoro, and differs from all other described forms by its large size, dark green color and brown peristome. Figure will appear in the January NAUTILUS.

POLYGYRA POSTELLIANA HAUSMANI, new subspecies

Shell perforate, slightly convex; after the initial smooth stage of the embryonic shell, the surface is rib-striate above and below with some short deciduous hairs. The oral obstructions are strongly developed with the outer part of the lip sharply bent back in the middle of the peripheral region; the parietal tooth is channeled and enters rather deeply; the outer lip tooth is prominently placed near edge, not deeply immersed.

Height 3.8 mm.; diameter 6.8 mm.; 5 whorls.

The type (184045 ANSP.) was collected along the highway between Perry and Cross City, Florida by Mr. Frank Hausman, for whom the subspecies is named.

This shell differs from *postelliana,* as in the subspecies *subclausa* and *peninsulae,* by the strong development of the oral obstructions and narrow apertural orifice. From *subclausa* it differs by its smaller size and by having the outer lip tooth very much less deeply placed; the parietal tooth enters less deeply. From *peninsulae* it differs in having a rib-striate base and by having the lip tooth not immersed as far. From both subspecies it differs in having short deciduous hairs.

FIVE NEW YARMOUTHIAN PLANORBID SNAILS

BY A. BYRON LEONARD
Department of Zoology, The University of Kansas

The summer field season of 1947 brought to an advanced stage several years' study of the molluscan fauna associated with the Pleistocene deposits which contain the Pearlette volcanic ash

lentils. It has been shown (Frye, Swineford, and Leonard, 1948), on evidence based in part on the distinctive qualities of the molluscan fauna, that the deposits in question, which are known from an area extending from northwestern Iowa and southeastern South Dakota across Nebraska, Kansas, northwestern Oklahoma to northwestern Texas, are of Yarmouthian age. As now known, this molluscan fauna contains approximately 65 species, of which several are undescribed. Descriptions of five new planorbid snails are given here; a complete description of the fauna will appear in a later publication.

PLANORBULA NEBRASCENSIS, new species, Plate 2, A, B.

Type: Catalogue number 5048, University of Kansas Museum of Natural History.

Horizon and type locality: Yarmouthian; 6 mi. SE Santee, Knox County, Nebraska.

Diagnosis: Shell small for the genus, whorls 4, tightly coiled, roundly angulate above, acutely angulate below, plane on umbilical surface; umbilicus narrowly infundibuliform, exhibiting all the whorls, but the inferior angle revealed only on last two volutions; peristome semilunate, except angulate below; a conspicuous crest a short distance behind peristome.

Description of holotype: Shell small for the genus, whorls 4, tightly coiled, obtusely angulate above, acutely angulate below, plane on umbilical surface; umbilicus narrowly infundibuliform, exhibiting all volutions to nucleus, but exposing inferior angles of last two volutions only; spire depressed to nucleus; body whorl deflected downward near aperture, the latter wider than high, semilunate, except angulate below; lip without varix, continuous across parietal wall; a high, rounded crest a short distance behind lip; lamellae 6, disposed as in *Planorbula wheatleyi,* except sinuosity of principal parietal lamella less pronounced; sculpture of fine, obliquely transverse striations, beginning on nuclear whorls, becoming somewhat coarser on succeeding volutions. Greater diameter, 5.6 mm.; lesser diameter, 4.6 mm.; height, 2.4 mm.

Remarks: P. nebrascensis is apparently related to *wheatleyi,* which it resembles. The species is known from a few examples at the type locality, and from a small series from deposits in Lyon County, Iowa, which place is 2 mi. E of Canton, South Dakota.

PLANORBULA VULCANTA, new species, Plate 2, C, D.

Type: Catalogue number 5049, University of Kansas Museum of Natural History.

Horizon and type locality: Yarmouthian; 4 mi. W Navarre, Dickinson County, Kansas.

Diagnosis: Shell small for the genus, whorls 4½, tightly coiled, rounded above and peripherally, angulate below, plane on umbilical surface; body whorl expanded near aperture, deflected downward one-half width of preceding whorl; spire depressed toward nucleus; peristome wider than high, semilunate, except angulate below; lip flared, thickened, continuous across parietal wall, and with low crest a short distance behind; lamellae 6, disposed as in *Planorbula armigera,* except principal parietal lamella truncate behind.

Description of holotype: Shell small for the genus, whorls 4½, tightly coiled, rounded above and peripherally, angulate below, plane on umbilical surface; body whorl expanded near aperture, and deflected downward one-half width of preceding whorl; spire depressed toward nucleus; umbilicus narrowly infundibuliform, one-half diameter of shell, exhibiting inferior angle of all volutions to nucleus; peristome wider than high, semilunate, except angulate below; lip flared, thickened, continuous across parietal wall, with low crest a short distance behind; lamellae 6, disposed as in *P. armigera,* except principal parietal lamella truncate behind as well as in front; nucleus of 1½ whorls, minutely punctate, remaining whorls embellished with fine, obliquely transverse striations, interspersed with irregularly disposed, coarser growth lines. Greater diameter, 6.25 mm.; lesser diameter, 5.2 mm.; height, 2.5 mm.

Remarks: Planorbula vulcanata bears some resemblance to *wheatleyi,* but lacks the conspicuous varix on the lip, and the crest behind the lip is much less well-developed; the principal parietal lamella is less sinuous, and is truncate at either end. *P. vulcanata* is totally unlike *P. armigera,* except in the general arrangement of the internal lamellae, but the roundness of the whorls of *armigera* is one of the most striking differences. In *P. crassilabris,* the umbilicus is wider, the umbilical surface of the whorls more rounded, and the angulation on the inferior surface of the whorls is less pronounced than in *vulcanta.*

P. vulcanata is known from the type locality, where it forms a conspicuous element of the molluscan fauna, and from de-

posits situated 10 mi. W, 1 mi. N, Minneapolis, Ottawa County, Kansas. At the type locality this species occurs both above and below the volcanic ash lentil.

PLANORBULA VULCANATA OCCIDENTALIS, new subspecies, Plate 2, E, F.

Type: Catalogue number 5050, University of Kansas Museum of Natural History.

Horizon and type locality: Yarmouthian; 13 mi. E, ½ mi. S, Minneola, Clark County, Kansas.

Diagnosis: Shell of moderate size for the genus, 4½ to 5 whorls, body whorl enlarging, and deflected downward near aperture; whorls obtusely angulate to rounded above, body whorl angulate below; spire depressed toward nucleus, umbilicus broadly infundibuliform, exhibiting all volutions to nucleus, widening rapidly from penultimate whorl; lip simple, without crest; lamellae disposed as in *P. v. vulcanata,* except principal parietal lamella less abruptly truncate behind.

Description of holotype: Shell of moderate size for the genus, whorls 4½, enlarging regularly, except body whorl expanded and deflected downward toward aperture; whorls rounded to subangulate above, body whorl angulate below; spire depressed toward nucleus, umbilicus broadly infundibuliform, expanding rapidly below penultimate whorl; all volutions visible, above and below; lip simple, continuous; aperture semilunate, except angulate below, about as wide as high; lamellae 6, disposed as in *vulcanata,* principal parietal lamella sinuous, but less abruptly truncate behind; sculpture of fine, obliquely transverse striations, beginning on nucleus, becoming slightly coarser on succeeding volutions. Greater diameter, 6.75 mm.; lesser diameter, 5.75 mm.; height, 2.1 mm.

Remarks: The generally greater diameter, greater width of umbilicus, less acutely angled whorls, and less abrupt truncation of the principal parietal lamella readily distinguish most examples of *P. v. occidentalis* from *vulcanata.* However, about 10 per cent of the shells from localities in southwestern Kansas grade toward typical *vulcanata,* or cannot be distinguished from it. *P. v. occidentalis* is known from four localities in southwestern Kansas.

GYRAULUS LABIATUS, new species, Plate 2, G, H.

Type: Catalogue number 5051, University of Kansas Museum of Natural History.

Horizon and type locality: Yarmouthian; ¼ mi. NW Gate, Beaver County, Oklahoma.

Diagnosis: Shell large for the genus, whorls 4, not flattened above nor below, except terminal half of body whorl above; whorls increasing regularly in size; first two whorls depressed below level of later volutions; base widely concave, exhibiting all volutions; sculpture of fine to coarse, obliquely transverse growth lines, often crowded into irregularly spaced ridges; aperture ovate, not deflected downward, superior margin produced beyond inferior margin; peristome continuous across parietal wall with no thinning. The deeply incised suture, the roundness and number of the whorls, the absence of downward deflection of the body whorl, and the lip across the parietal wall are the principal diagnostic features of this species.

Description of holotype: Shell large, robust, ultradextral, depressed; suture deeply incised; periphery rounded; sculpture of fine, obliquely transverse growth lines beginning above the nucleus, increasing in coarseness toward the body whorl, often coalesced into thickened ridges; nucleus small, punctately sculptured; whorls 4, enlarging regularly and rapidly, but without conspicuous enlargement of the body whorl; peristome flared near aperture, somewhat depressed above; spire depressed, base broadly concave; all volutions visible above and below; aperture ovate, wider than high, slightly flattened above, the superior margin produced considerably beyond the inferior margin; lip simple, thickened, and continuous across parietal wall. Greater diameter, 6.4 mm.; lesser diameter, 5.2 mm.; height, 1.6 mm.; diameter of aperture, 1.6 mm.; height of aperture, 1.4 mm.

Remarks: G. labiatus seems most closely related to *G. circumstriatus,* from which it may be distinguished by its smaller number of whorls, the flared aperture, the lack of revolving lines, and the continuous peristome; *labiatus* may be distinguished from *G. arcticus* by its larger size, absence of spiral lines, punctately sculptured nucleus, lack of downward deflection of the body whorl near the aperture, and the continuous peristome. The species is known from fifteen localities, distributed from northwestern Texas to northwestern Iowa.

MENETUS PEARLETTEI, new species, Plate 2, I, J.

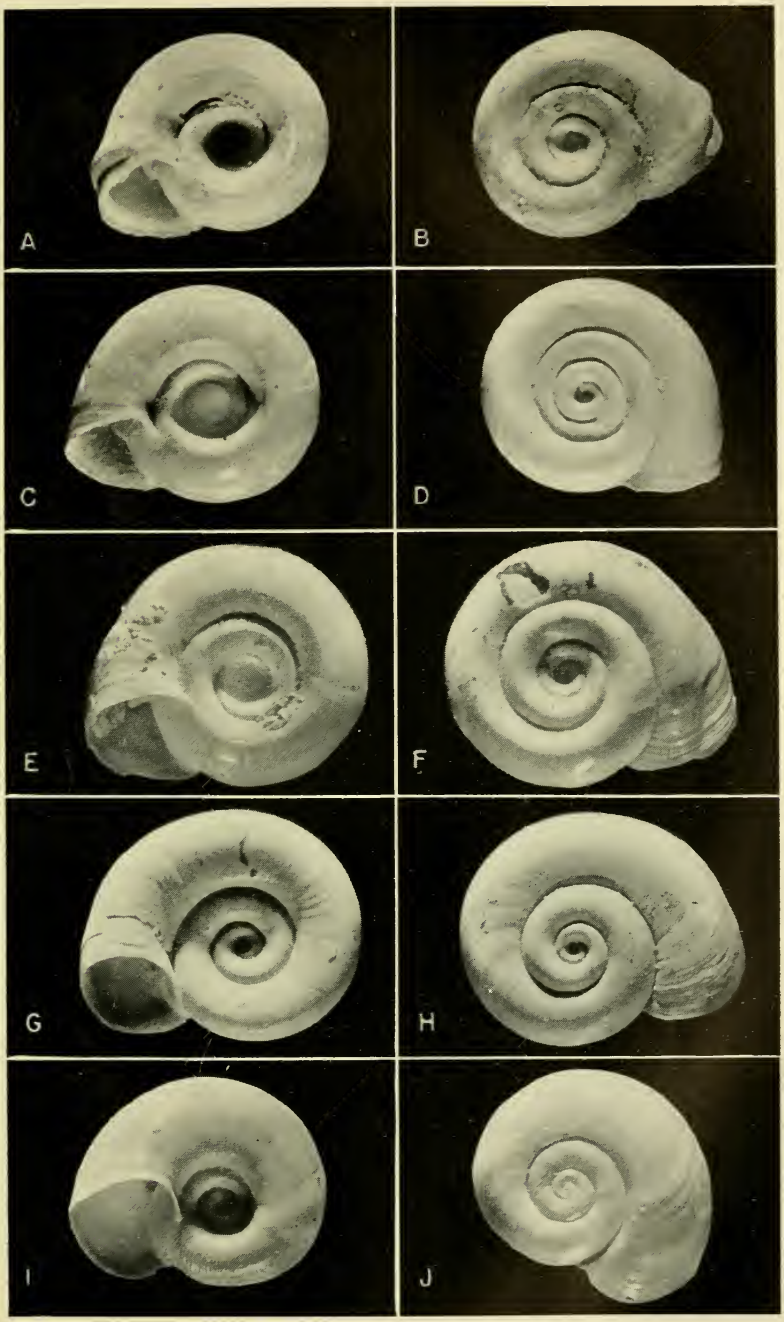
Type: Catalogue number 5052, University of Kansas Museum of Natural History.

Horizon and type locality: Yarmouthian; 4 mi. W. Navarre, Dickinson County, Kansas.

Diagnosis: Shell of moderate size for the genus, ultradextral, depressed, whorls 4, increasing regularly in size toward the aperture; spire not elevated; umbilicus shallow, diameter slightly less than half lesser diameter of shell; periphery carinate; whorls slightly convex above, rounded below; sculpture of fine, closely crowded, obliquely transverse growth lines, sometimes coalesced into coarser ridges; aperture trianguloid, the superior margin of the peristome produced beyond the inferior margin.

Description of holotype: Shell ultradextral, depressed, whorls 4, increasing regularly in size toward the aperture; spire neither elevated nor depressed; umbilicus shallow, diameter slightly less than half the lesser diameter of shell, exhibiting all the volutions; whorls rounded below, especially near border of umbilicus, slightly convex above; periphery roundly carinate, not "pinched" as in *M. kansasensis;* aperture trianguloid, peristome slightly flared, continuous across parietal wall, the superior margin produced beyond the inferior margin; nuclear whorls punctate and sparsely striate, remaining whorls with sculpture of fine, closely crowded, obliquely transverse, raised lines, giving the surface of the shell a silky texture, rarely coalesced into coarser ridges. Greater diameter, 5.75 mm.; lesser diameter, 4.75 mm.; height, 1.5 mm.

Remarks: M. pearlettei stands in an intermediate position, both in time and in evolutionary development, between *M. kansasensis,* common in Aftonian deposits in southwestern Kansas, and *M. coloradensis* which is living in the front range of the Rocky Mountains. *M. pearlettei* does not reach the maximum size of *M. kansasensis,* the whorls are more rounded, and *pearlettei* lacks the "pinched" periphery, the spiral ridges, and conspicuous transverse ridges of the Aftonian species; *pearlettei* differs from *coloradensis* by its larger size, rounded whorls, and by the lack of coarse transverse striations and "pinched" periphery. The species is known from ten localities, distributed from northwestern Texas to northwestern Iowa.



Leonard: Yarmouthian Planorbid Snails

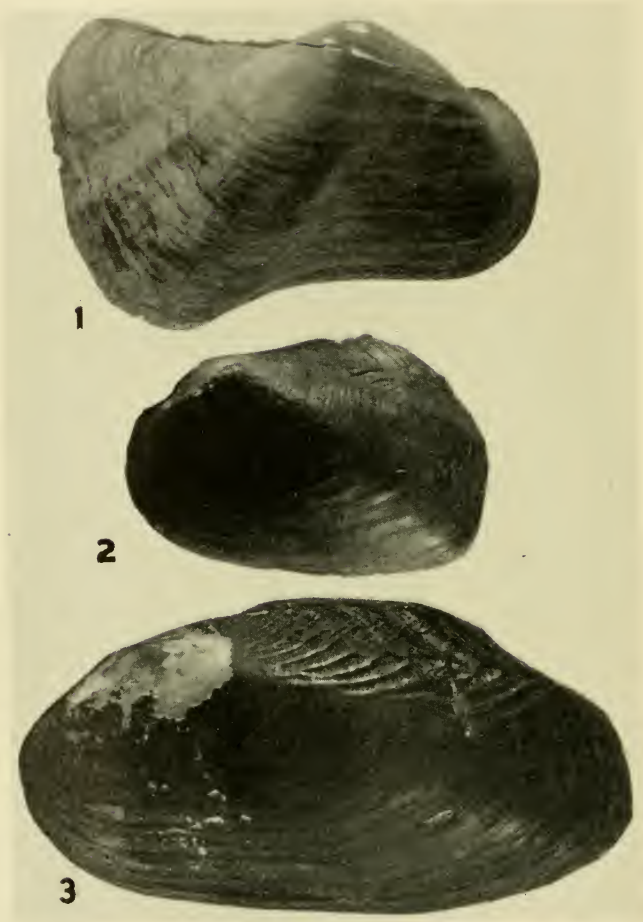


FIG. 1. Hyridella fannyae Johnson

FIG. 2. Pseudodon walpolei Hanley

FIG. 3. Pseudodon resupinatus Von Martens

REFERENCE TO LITERATURE

1948. FRYE, JOHN C., SWINEFORD, ADA and LEONARD A. BYRON. Correlation of Pleistocene deposits of the central Great Plains with the glacial section. Jour. Geol., 56:6 (in press).

EXPLANATION OF FIGURES. PLATE 2

All figures enlarged × 5.5; photographs by the author

A. *Planorbula nebrascensis,* holotype; umbilical view; B, spiral view. Six mi. SE Santee, Knox County, Nebraska.
C. *Planorbula vulcanata,* holotype; umbilical view; D, spiral view. Four mi. W Navarre, Dickinson County, Kansas.
E. *Planorbula vulcanata occidentalis,* holotype; umbilical view; F, spiral view. Thirteen mi. E, ½ mi. S. Minneola, Clark County, Kansas.
G. *Gyraulus labiatus,* holotype; umbilical view; H, spiral view. One-fourth mi. NW Gate, Beaver County, Oklahoma.
I. *Menetus pearlettei,* holotype; umbilical view; J, spiral view. Four mi. W Navarre, Dickinson County, Kansas.

A NEW NAIAD FROM DUTCH NEW GUINEA

BY RICHARD I. JOHNSON

In 1936 Mr. P. T. L. Putnam of Boston presented two specimens of Unionidae to the Museum of Comparative Zoölogy that he had collected at a locality in Southern Dutch New Guinea during the summer of 1926. One of these specimens proved to be *Hyridella anodontaeformis* Tapp.-Can., but the other specimen seems to represent an undescribed species.

HYRIDELLA FANNYAE, new species, Plate 3, fig. 1

Description.—Shell reaching at least 65 mm. (2½ inches). Outline subquadrate, valves much inflated. Anterior end regularly rounded, a bit produced and subangulate above. Posterior end truncated. Ventral margin incurved. Posterior slope very slightly compressed; dorsal margin straight, forming an acute angle with the posterior slope. Posterior ridge extremely full and rounded causing a notable swelling in the post-basal region. Above the posterior ridge is another very slight ridge. Hinge ligament not prominent. Beaks slightly forward of the center and moderately inflated, (their sculpture corroded away). Sur-

face of the shell marked with growth lines; periostracum dull ashy over a dull greenish brown base. Left valve with one long, straight, low pseudocardinal and two long straight laterals, all of which are parallel to the hinge line. Right valve with two pseudocardinals and one lateral tooth. Beak cavities shallow, without muscle scars. Anterior adductor muscle scars well impressed; posterior muscle scars not noticeable. Pallial line visible anteriorly only. Nacre yellowish in the beak cavities, becoming bluish-white and iridescent toward the margins.

Length, 65 mm.; height, 36 mm.; width, 38 mm.

Types: Holotype, Museum of Comparative Zoölogy No. 160663, Merauke, Marco River, Southern Dutch New Guinea. Collected by P. T. L. Putnam during the summer of 1926.

Range: Known only from the type locality.

Remarks: Hyridella fannyae may be distinguished from the other members of the genus by the remarkable development of the posterior ridge and the consequent swelling of the postbasal region. The hinge and the color of the periostracum and nacre are similar to those of *Hyridella andontaeformis* Tapp.-Can.

This species is appropriately named for Miss Fanny Day Farwell of Lake Forest, Illinois.

LECTOTYPES FOR TWO SPECIES OF ASIATIC UNIONIDAE IN THE GENUS PSEUDODON

By RICHARD I. JOHNSON

As neither *Pseudodon walpolei* Hanley nor *P. resupinatus* von Martens was figured when described, and as there are cotypes of both species in the Museum of Comparative Zoölogy, it has been thought advisable to create lectotypes for them and thereby fix their identity. These lectotypes substantiate the subsequent descriptions and figures made by Haas in the Conchylien-Cabinet.

Pseudodon walpolei (Hanley) Plate 2, fig. 2

Monocondylaea walpolei Hanley, 1871, Proc. Zool. Soc. London, p. 587 (Sarawak, Borneo); Simpson, 1900, Proc. United States Nat. Mus. 22, p. 840 [Merely listed as an unfigured species].

Alasmidonta walpolei Hanley, Issel, 1874, Ann. Mus. Civico, Genoa 6, p. 477.

Pseudodon walpolei Hanley, Haas, 1913, Conchylien-Cabinet (2) 9, pt. 2, sec. 2, pl. 41, figs. 5–7 [No description]; Simpson, 1914, Descriptive Catalogue of the Naiades, Detroit, Michigan 3, p. 1096; Haas, 1924, Abhandlungen Senckenbergischen Naturforschenden Gesell. 38, p. 139.

Description: Shell reaching at least 64 mm. (2½ inches); thin though strong. Outline subrhomboidal, with the anterior end quite narrow in front. Valves not much inflated. Anterior end regularly rounded and subangulate above; posterior end subtruncated. Ventral margin almost imperceptibly incurved. Posterior slope slightly compressed and a little alate at the upper posterior angle. The lower and middle portions of the posterior slope are irregularly and noticeable plicate; the upper portion is smooth to the ligament. Dorsal margin straight, forming a more or less distinct angle with the somewhat irregular posterior slope. Posterior ridge full and rounded, ending in a blunt point at the base of the shell; above it is another somewhat fainter ridge. Hinge ligament prominent. Beaks well forward of the center, moderately elevated but not inflated, their sculpture consisting of a number of small heavy bars. Surface of the shell smooth, rather dark brown and dull posteriorly. Each valve has a single, small, rounded and slightly elevated cardinal tooth. Lateral teeth absent. Beak cavities shallow, containing several small muscle scars. Anterior adductor muscle scars distinct but not deep; posterior adductor muscle scars scarcely visible. Pallial line barely visible. Nacre yellowish near the beaks, becoming bluish-white and iridescent toward the margins.

Hanley, 1871, p. 587): Length 64, Height 38 mm., Sarawak, Borneo.
(Simpson, 1914, p. 1096): Length 55, Height 32, Width 19 mm., Sarawak, Borneo.
Lectotype: Length 44, Height 26 mm., Width 17 mm., Sarawak, Borneo.

Types: Hanley mentions that the specimen on which he based the description of *P. walpolei* was in his private collection. After Hanley's death the collection went "to Crewe Hanley, who gave some types to the British Museum; [the] rest [were] sold to Harvey of Houndsditch, who held them in 1906."[1]

[1] Sherborn, C. D., Where is the . . . Collection? Cambridge, England, 1940, p. 65.

Fortunately, Robert F. Geale, an English shell dealer, to whom Hanley was indebted for the species, sent one of the types to John G. Anthony. This specimen is here selected as lectotype, Museum of Comparative Zoölogy No. 175577. The type locality is Sarawak, Borneo.

Distribution: Known only from the type locality.

Remarks: Although the lectotype is considerably smaller than Hanley's specimen, it agrees with the original description, the figures of Haas (1913, pl. 41, figs. 5–7), and the subsequent description made by Simpson (1914, p. 1096).

Frierson (1909, Nautilus 22, p. 106) mentions that he received specimens from Sowerby and Fulton, a firm of English shell dealers, under the name of *P. walpolei.* Their beak sculpture was "much like that of the cristarias, being heavy bars, more or less parallel with the growth lines." This observation is confirmed by the lectotype, even though its beaks are quite corroded.

Pseudodon resupinatus von Martens, Plate 3, fig. 3

Pseudodon resupinatus von Martens, 1902, Nach. Deutschen Malak. Gesell. 34, p. 131 (Than-Moi, Tonkin); Simpson, 1914, Descriptive Catalogue of the Naiades, Detroit, Michigan 3, p. 1090; Haas, 1913, Conchylien-Cabinet (2) 9, pt. 2, sec. 2, pl. 39, figs. 2–6 [No description]; Haas, 1920, Ibid., p. 310.

Description: Shell reaching over 80 mm. (3¼ inches); moderately thick and strong. Outline oblong. Valves not much inflated. Anterior end regularly rounded; posterior end produced and sub-biangulate. Ventral margin straight or slightly sinuate. Posterior slope very slightly compressed, sculptured with more or less subdivided, radiating folds which curve and ascend toward the dorsal and ventral margins. Dorsal margin slightly curved, meeting the slightly concave posterior slope in just a trace of an angle. Posterior ridge full and rounded, ending in a more or less distinct biangulation. Hinge ligament prominent. Beaks located at the anterior ⅕th of the shell, not elevated or inflated, their sculpture consisting of about nine fine undulations which are broken anteriorly or possessed of a sinus. Surface of the shell smooth except for the posterior slope, rather shiny brownish-black; yellowish-green when young. Each valve has a single thick, blunt, elevated pseudo-cardinal tooth. Laterals absent. Beak cavities shallow, containing two small muscle scars. Anterior adductor and accessory scars deep; posterior ad-

ductor muscle scars scarcely visible. Pallial line barely visible. Nacre bluish-white and somewhat iridescent.

(Haas, 1920, p. 311) : Length 80, height 40, width 26 mm., Than-Hoi, Tonkin.
Lectotype: Length 73, height 38, width 22 mm., Than-Hoi, Tonkin.
Paratype: Length 41, height 22, width 10 mm., Than-Hoi, Tonkin.

Types: Von Martens did not select a holotype for this species, nor did he say where his types were deposited, though they may be in the British Museum or the Berlin Museum. There is a type of this species in the Museum of Comparative Zoölogy, the measurements of which are identical with those given by Von Martens in the original description; it may well be the specimen on which the description was based. This specimen is here selected as lectotype, Museum of Comparative Zoölogy No. 167671. There is also a paratype MCZ No. 167672 which consists of one valve of a young specimen. The type locality is Than-Hoi, Tonkin, French Indo-China.

Distribution: Known only from the type locality.

Remarks: Haas (1913, p. 39, figs. 2–6) figured *P. resupinatus,* but as all of his specimens were topotypes, none of his illustrations could be considered a type figure. Frierson (1911, Nautilus 24, p. 97) notes the beak sculptures of this species.

Literature Cited

Haas, F., 1910–1920, Die Unioniden. Conchylien-Cabinet by Martini and Chemnitz (2) 9, pt. 2, sec. 2.
Hanley, S., 1871, Description of a New Species of *Monocondylaea.* Proceedings of the Zoological Society of London, p. 587.
Simpson, C. T., 1914, A Descriptive Catalogue of the Naiades, Detroit, Michigan.

OREGONIAN OLIVELLAS

By D. S. and E. W. Gifford

In July, 1948, a brief collecting trip on the Oregon and Washington coasts yielded series of *Olivella biplicata* Sowerby from three places in Oregon: Bandon, Coos County, above latitude

43° north; Newport, Lincoln County, above latitude 44°30′ north; and Seaside, Clatsop County, at latitude 46° north. A search of the beach at Kalaloch, Jefferson County, Washington, about latitude 47°30′ north, proved fruitless, although Keen lists 49° as the northern limit for the species.[1] Besides these three series, we had collected at Port Orford, Curry County, Oregon, above latitude 42°30′ north, July, 1941, a series which we described in our "Color Variation in Olivella biplicata in Various Localities."[2]

In addition to our four series just enumerated, we have two lots from Miss Miriam Shepard. One is a small series collected in July, 1923, at Agate Beach, about three miles north of Newport. The other is more extensive and comes from Netarts Sandspit, Netarts Bay, Tillamook County, Oregon, above 45° north latitude, collected July 20, 1947.

At Seaside, on July 9th, we found two adult *Olivella pycna* Berry, apparently the northernmost record for this species; the previous northern record was a single adult from Port Orford, which we took in July, 1941. All three of these Oregonian examples lack the brown spot at the base of the columella, which is so frequently seen in Californian specimens. We had hoped, in vain, that we might find *Olivella pedroana* Conrad (or *baetica* Carpenter) littorally, since it occurs in abundance farther north, as for example at Sitka, Alaska.

The population of *Olivella biplicata* comprised adults at Bandon and Newport, except for a few half-grown individuals. At Seaside, however, 47 out of a total of 107 individuals were young, ten millimeters or less in length. Why there were young at Seaside and none at Bandon and Newport is an unanswered question.

The series from Netarts, presented to us by Miss Shepard, totals 132. (Some additional ones had been sent by us to the California Academy of Sciences.) It comprises mostly large adults, many of which have a "sponge" growth bordered by a rust-colored area on the underside. The growth suggests that

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[1] A. Myra Keen, An Abridged Check List and Bibliography of West North American Marine Mollusca, p. 43, 1937.

[2] The Nautilus, vol. 56, pp. 43–48, 1942.

on many of our Bolinas, California, adults, which was identified as a species of *Cliona* by Professor Bruce L. Clark.[3]

Whitish or albinistic specimens were rare. We obtained one at Seaside, two at Bandon. None was pure white throughout and none showed any trace of orange. Each had the upper third of the main whorl pure white, the lower two-thirds veiled with pale purplish gray.

From Newport came two pathological individuals. One has a callus above the suture of the main whorl, extending from the lip back along the suture, and suggesting on a small scale the similar callus in many species of *Oliva*. The other has a low raised band parallel to the main suture and extending around on to the second whorl at the top of the lip. At the lip the band is four millimeters wide and is situated three millimeters below the suture. On the second whorl, above the lip, it diminishes to three millimeters in width. Inside, a depression corresponds with the raised band, just as though it had been pushed up as the shell was formed. This peculiarity was not noted as the shells were cleaned, so we missed the opportunity of examining the soft parts. A few shells had traces of orange, usually on the columellar sides of the aperture, sometimes on the callus, sometimes below it.

In the following table showing color variation, the term "normal color" refers to the usual grays and browns prevalent in the bulk of *Olivella biplicata* wherever collected. This has been described by us in earlier papers.

Color Variation in *Olivella biplicata* in Oregon

Locality	Total	No orange in aperture	No orange: normal color	No orange: "albino"
Port Orford	533	550	549	1
Bandon	348	329	327	2
Newport	237	215	215	0
Agate Beach	8	7	7	0
Netarts Bay	132	128	128	0
Seaside	107	103	102	1
Total	1385	1332	1328	4

[3] D. S. and E. W. Gifford, Color Variation in *Olivella biplicata*, The Nautilus, vol. 55, pp. 10–12, 1941.

	Orange in aperture	Orange: normal color	Orange: "albino"	Total "albino"
Port Orford	3	3	0	1
Bandon	19	19	0	2
Newport	22	22	0	0
Agate Beach	1	1	0	0
Netarts Bay	4	4	0	0
Seaside	4	4	0	1
Total	53	53	0	4

Range of variation in shape in *Olivella biplicata* is shown by the following millimeter measurements and indices of adults. The indices are obtained by dividing the greatest diameter by the length. Low indices indicate slenderness, high indices the opposite.

Port Orford: 27 × 14, index 52; 27 × 12, index 44.
Bandon: 22.4 × 12.6, index 56; 25 × 11.3, index 45.
Newport: 25.3 × 14.5, index 57; 27 × 13.2, index 49.
Netarts: 24.9 × 13.9, index 56; 28.5 × 13.2, index 46.
Seaside: 22.5 × 11.8, index 52; 22.1 × 10.5, index 48.

GROWTH OF YOUNG STROPHOCHEILUS OBLONGUS

By E. A. ANDREWS

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The very large tropical American land snail, *Strophocheilus oblongus,* occurs in Jamaica, B. W. I., about Kingston and westward, having been introduced probably in connection with sugarcane. In 1932 some dozens were collected near "Maryfield" in a suburb of Kingston, formerly a sugar plantation.

Brought to Baltimore, Maryland, they were kept in large packing boxes with earth and limestone kept moist enough to germinate the large circular Jamaica bean, "pony eye." They were fed lettuce and cucumber, and kept outdoors in summer and in a very hot room in winter. Coming out to feed at night, the snails were found by day buried in the earth and retracted, but

when taken out they expanded and crawled in daylight and were then so insensitive to handling that we inferred they had been used to freedom from attacks. Some shells showed large healed-over linear scars, as if the shell had been cut by some gardening tool.

Eggs were laid both in 1933 and 1934. These eggs were found two to four inches deep in the earth, often two near together.

Each egg was a very large white object with rough brittle calcareous shell easily fractured. The shell was made up of pyramids rounded externally but papillated internally so that the inner face was rougher than the outer. Measurements of 23 eggs gave a range of 20–29, but most were 26–27 (all dimensions are stated in millimeters). Thus the egg is from a quarter to a third of the length of the adult since measurements of 12 large shells were lengths of 94, 93, 93, 92, 89, 87, 84, 82, for those with thickened lip, and 77, 73, 72, 60, for those with thin lip. The eggs were somewhat elongated, as 20 × 16 and 24 × 12. Their weights ran from 2400 to 5450 milligrams. The egg shell held from 3–4 cc. of albumen very similar to that of the hen egg, and an embryo of a few millimeters that grew to fill the entire space. This embryo had a temporary massive, flat, incurved, parenchymatous and vascular expansion of the foot, the podocyst, which for a time exceeded all the rest of the animal in length.

Most of the eggs failed to hatch, and many were overgrown with mold. The embryos developed slowly so that after two months one placed on the surface and accidentally cracked let out a young snail that crawled a few inches and made a pit in the earth into which it fitted itself. This young snail weighed 3490 and its exceedingly thin and fragile shell of 4½ whorls was 27 by 18 mm. in maximum dimensions. The operture of its shell was 19 by 15 mm. It had the same habits as the adult and showed the same lack of response to handling.

This was about Christmas time. In three months it added only 1 mm. to length and 1 to width of its shell, but in 1½ months in spring the shell increased 2 mm. in length and 5 in width and then within a month added 8½ mm. length and 4 width. In two and one-half summer months the shell length

increased 24 mm. and width 11. Then growth slowed down so that in one and one-half autumn months only 4½ mm. was added to length and 3 in width. In 4 and one-half cold months there was little or no increase in length and but 1 mm. in diameter, as measured. However, in 4 and one-half months with the second spring the shell increased by 18 mm. in length and 4 in width and in three summer months 12 mm. were added in length and 5 in width. In three months of its third winter nothing was added, and the snail died, probably from neglect and exposure to cold though the earth was not frozen. In less than two years this snail had grown from dimensions of 27 by 18 mm. to 93.5 by 52 and from 4½ whorls to 6, being thus large enough to be adult, yet while it had colored enamel over the columella the thickened aperture edge had not been completed, though the mantle was seen as if forming it, before death. Also the weight of the shell when empty was 23,800 milligrams which exceeds some adult shells. This snail at hatching weighed with its thin shell 3490 and in 8 months 40,000 milligrams, in 10 months 52,000 but in winter fell off to 43,000, yet three months later 69,000 and with 3 more summer months 91,000, which is adult weight.

Two other young were found buried in the earth at the end of May, 1933, each with thin shell of 3½ whorls. Crawling on a table they readily fell off as if having no experience of heights. The larger shell had a healed injury as if it had fallen upon the edge of a glass plate. In crawling they showed the peculiar sense organs of the upper lip as very extensile and retractile, hand- or foot-like protrusions, one right, one left, each with about eleven "toes" grading down from the biggest outer to the little inner toe. The shells measured 24 by 19 and 23½ by 20 mm. After 2½ months they weighed 19,000 and 14,000 milligrams. The smaller doubled its weight in one and a half months more, and the larger more than doubled its weight in that time. The smaller died when less than half the dimensions of an adult but the larger attained full length of some adults, that is 92 by 52, before dying when less than two years old.

These three young were kept together and measured and weighed on the same date; they all showed the same rapid growth to adult dimensions within two years. When all the

measurements of lengths, widths and weights were charted as curves with months as ordinates it was striking that all nine curves agreed in that in winter months they rose slowly while in summer months they rose very sharply, to flatten off or even fall in each succeeding winter period.

We conclude that *Strophocheilus oblongus* can readily be kept alive in confinement and produce eggs at least for two years. The embryo, with large podocyst, requires months to develop while using up much albumen, and hatches with adult form and three to four whorls of the thin shell. Within two years it increases from three to four times in length and width, and more than twenty-five times in weight with a shell lacking little of the most perfected adult. Increase is very rapid in summer and slow in winter when there may be even a loss in weight. This marked slowing of growth in winter may have been due to neglect to supply adequate food and to dryness of air rather than to temperature alone, as that was at times up to 28° C. In Jamaica one might expect the dry season would be less favorable to growth than the wet season, and possibly these snails have a tendency to become less active at seasons.

August 31, 1948.

NEOGENE CYPRAEACEA FROM CHIBA PREFECTURE, JAPAN

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Introduction

The senior writer, in the course of compiling a check list of Japanese Tertiary marine molluscs, found it necessary to check the stratigraphic position of the boundary between Pliocene and Pleistocene. The area selected for this study is in the central part of the Bôsô Peninsula where the most complete sequence, least affected by unconformities, is believed to be. During the course of geological investigation of this sequence by the writers and student-assistant Mr. Kohei Nomura, many new species of

molluscs were found which must be described before discussion of the problem of the Pliocene-Pleistocene boundary is attempted.

This first report describes fossil Cypraeacea from the Neogene formations of the Bôsô Peninsula. Former records of fossil Cypraeacea from this area are limited to lists without figures; species names used in such lists afford little indication of the species to which they would now be assigned because of recent revisions in the taxonomy of this group.

The geological age of the Kiwada, Otadai, Sakahata and Hasumi formations, from which the species described below were collected, is a matter of controversy. Some authors consider the entire sequence to be Pliocene, while others consider the first two to be Miocene and the last two to be Pliocene. The present writers prefer tentatively at present to regard the Kiwada, Otadai and possibly the lower half of the Sakahata as Miocene.

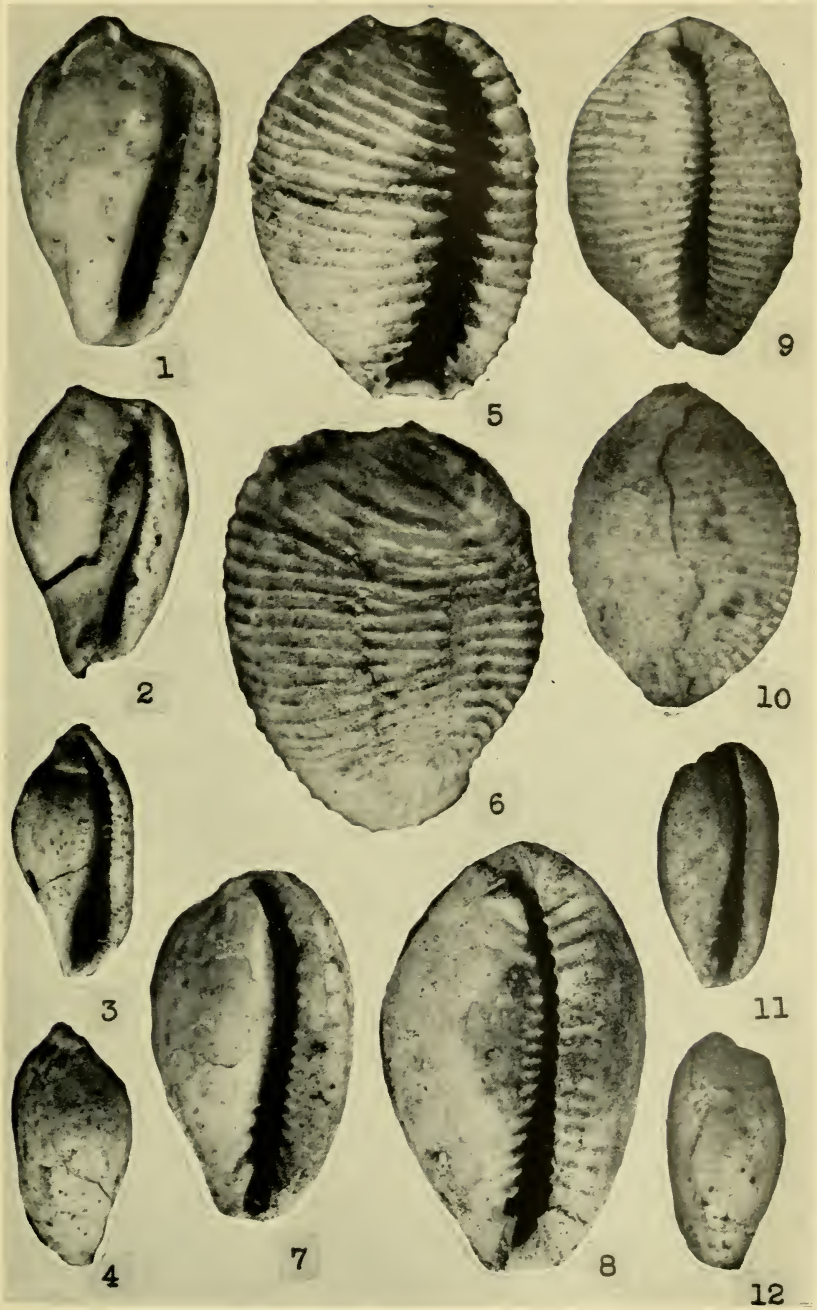
This paper forms part of a project initiated by Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, for the purpose of assembling paleontologic data applicable to solution of stratigraphic problems encountered in the search for oil in Japan.

ACKNOWLEDGMENTS are due to the following: To Lt. Colonel Hubert G. Schenck, Chief of Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, and Professor of Stanford University, California, under whose supervision the problem of the Pliocene-Pleistocene boundary is being studied, for his continued encouragement and supervision; to Professor S. Hanzawa of the Institute of Geology and Paleontology, Tohoku University, Sendai, where the work was done, for reading the manuscript and offering advice concerning it; to Messrs. K. Nomura and K. Kumagai, both of Tohoku University, for their help in many ways; to Mr. L. W. Stach, Petroleum Branch, Natural Resources Section, for editing the manuscript.

Description of Species

PRIMOVULA (PRIMOVULA) ATRACTINA Hatai and Nisiyama, n. sp., Plate 4, figures 3, 4.

Shell fusiform, rather thick and glassy, length along axis about twice the lateral diameter; posterior and anterior ends



Hatai and Nishiyama: Neogene Cypraeacea

pointed and about equally produced. Outer lip thickened outside and within, retracted at both ends, indistinctly angular near the posterior end, and armed with about 21 unequal, not very strong teeth; grooves between teeth extend to middle of face of lip; columella with strong callus (funiculum) near posterior end. Aperture narrow and wider anteriorly, curved more or less more sharply behind than in front. Dimensions of the holotype: length along axis 12 mm., lateral diameter 6 mm., dorso-ventral diameter 5 mm.

Type locality and formation: East cliff of the Yôrô-Gawa, east of Iwaibara, Oikawa-Mura, Isumi-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°13′41″, E. long. 140°10′37″. IGPS (= Institute of Geology and Paleontology, Tohoku University, Sendai) Coll. Cat. No. 72641 (holotype), 72634 (paratype). Top sand of the Kiwada formation (F. Ueda, 1930, p. 251).

Remarks: This species is closely related to *Primovula* (*Primovula*) *rhodia* (A. Adams) (Adams, 1854, pl. 28, fig. 8), a Recent species of Central and Western Japan, but can be distinguished from that species by its thicker shell, more thickened outer lip and especially by the wider aperture.

TRIVIROSTRA PYRINULA Hatai and Nisiyama, n. sp., Plate 4, figures 9, 10.

Shell small, ovate, moderately inflated, maximum inflation a little behind the median line; spire indicated merely by a slight bulge near the posterior extremity of aperture. Dorsal groove narrow and shallow, obsolete at extremity. Medial portion sculptured with 10 to 11 narrow ridges, continuous across the dorsal groove; ridges on posterior and anterior slopes gradually converging until they came almost parallel to axis; posteriorly they extend directly over the spire bulge; number of ridges increases towards margin by intercalation. Aperture narrow, slightly expanded anteriorly, curved more sharply behind than in front. Outer lip thickened, inner margin of labrum rounded and serrated with about 28 ridges, ridges on inner lip about 22 in number. Fossula rather shallow. Posterior extremity of aperture emarginate, posteriorly narrow and oblique. Dimensions of holotype: Length along axis 7.6 mm., lateral diameter 5.4 mm., dorso-ventral diameter 4.8 mm.

Type locality and formation: East cliff of the Yôrô-Gawa, east of Iwaibara, Oikawa-Mura, Isumi-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°13′41″, E. long. 140°10′37″. IGPS Coll. Cat. No. 72642

(holotype), 72635 (paratype). Top sand of the Kiwada formation.

Other localities: Railroad cutting about 400 m. north of Takamizu, Matsuoka-Mura, Kimitsu-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°14′26″, E. long. 140°05′08″ Base of the Hasumi formation (K. Sakakura, 1935, p. 699).

Remarks: Trivirostra pyrinula is closely related to *T. oryza* (Lamarck) (Lamarck, 1810, p. 104; Kiener, 1843, pl. 52, fig. 2), a Southeastern Asiatic species, but is less globular and less slender, only slightly spired, and has a greater number of spire ridges; the dorsal groove is also narrower and shallower compared to that species.

PSEUDOTRIVIA PLERES Hatai and Nisiyama, n. sp., Plate 4, figures 5, 6.

Shell rather large, shortly spired, globosely ovate with rounded base and rather finely ribbed. Dorsal groove indicated by a narrow smooth area from which ribs diverge in every direction; medial portion sculptured with 10–12 narrow ridges normal to the line, and gradually converging on posterior and anterior slopes and becoming nearly parallel to line; posteriorly they extend directly over the spire. Numbers of ridges somewhat increased towards margin by intercalation. On ventral side, the spire ridges are oblique and extend into the aperture, where they decrease in number and become coarser. Aperture rather narrow and slightly wider anteriorly, curved more sharply behind than in front. Outer lip thickened outside, strongly ribbed transversely with about 20 ridges, forming labial teeth on the inner margin, retracted anteriorly. Inner lip with 16 ridges and a very small callus projection above. Extremity of aperture emarginate. Fossula rather shallow, dentition continued across it. Dimensions of holotype: length along axis 20 mm., lateral diameter 14.5 mm., dorso-ventral diameter 12 mm.

Type locality and formation: East cliff of the Yôrô-Gawa, east of Iwaibara, Oikawa-Mura, Isumi-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°13′41″, E. long. 140°10′37″. IGPS Coll. Cat. No. 72643 (holotype), 72639 (paratype). Top sand of the Kiwada formation.

Remarks: This species closely resembles *Pseudotrivia eos* (Roberts) (Roberts, 1913, p. 99, pl. 7, figs. 10, 11), a Recent species of Central Japan, but differs from that species by the

narrower smooth dorsal groove, fewer spiral ridges, less globular shell and by the smaller size of the shell.

PROTERATO (SULCERATO) CALLOSA NOMURAI Hatai and Nisiyama, n. subsp., Plate 4, Figure 1.

Shell small, ovate-conic, rather ventricose, abruptly rounded to the slightly elevated spire, tapering rapidly to a straight and truncated anterior extremity. Sculpture none, the whole shell being covered with enamel; spire short, obtusely tapering. Protoconch small and rounded; spire-whorls small; body-whorl large, rather ventricose, contracted anteriorly. Sculpture hidden by enamel. Aperture narrow, sublinear, slightly oblique. Outer lip sharply angulated at shoulder, linear, thickened and rounded, externally margined and serrated along the inner margin by about 21 short ridges. Inner lip with about 9 short and slender ridges wider apart anteriorly; three in front produced into oblique and somewhat irregular ridges that simulate columellar folds. Fossula obsolete. Body constricted anteriorly into an ill-defined canal, squarely truncated or obscurely emarginate at its extremity. Dimensions of holotype: length along axis 7.2 mm., lateral diameter 4 mm., dorso-ventral diameter 4.3 mm.

Type locality and formation: East cliff of the Yôrô-Gawa, east of Iwaibara, Oikawa-Mura, Isumi-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°13′41″, E. long. 140°10′37″. IGPS Coll. Cat. No. 72644 (holotype), 72636 (paratype). Top sand of the Kiwada formation.

Other localities: Roadside cutting at the curve south of Tsutsumori, Oikawa-Mura, Isumi-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°13′16″, E. long. 140°09′32″. Lower part of the Sakahata formation (K. Sakakura, 1935, p. 694).

Remarks: This new subspecies is not so broad nor so globose as the typical *callosa* (Adams and Reeve) (Adams and Reeve, 1850, pl. 10, fig. 32; Sowerby, 1859, figs. 35–37), and the aperture is broader and the outer lip narrower compared with that species. The subspecific name is given in honor of the late Dr. Sitihei Nomura, an eminent paleontologist of Japan.

PROTERATO (SULCERATO) CALLOSA UEDAI Hatai and Nisiyama, n. subsp., Plate 4, figure 2.

This subspecies is distinguishable from typical *P. callosa* by not being so broad nor so globose, and the aperture is broader

with a narrower outer lip. The outer lip is evenly and sharply angulated at the shoulder, so that the posterior part of the aperture sharply curves to the posterior outlet. Dimensions of the holotype: length along axis 6.4 mm., lateral diameter 3.8 mm., dorsal-ventral diameter 3.3 mm.

Type locality and formation: Roadside cutting immediately northeast of the Post-office at Kotadai, Oikawa-Mura, Isumi-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°14′16″, E. long. 140°10′20″. IGPS Coll. Cat. No. 72645 (holotype). Lower part of the Otadai formation (F. Ueda, 1933, p. 799).

Remarks: The subspecific name is given in honor of Mr. Fusao Ueda, who undertook extensive studies on the geology of the Bôsô Peninsula.

PALMADUSTA (PURPURADUSTA?) FUSANA Hatai and Nisiyama, n. sp., Plate 4, figure 7.

Shell pyriform, rather thick, with moderately inflated test, maximum height a little behind the median line, making posterior slope a little steeper than the anterior. Oral surface a little inflated, asymmetric, the curvature of left side being stronger than that of the right, aperture a little nearer to the right than to the left side. Spire concealed with very heavy enamel, which extends to sides. External surface smooth, original coloration indistinct. Callus on outside of outer lip forms an obtuse and arcuate angle continuous anteriorly with prominent callus ridge on right side of anterior extremity and accompanied by shallow, transverse excavation. Aperture narrow, rather straight, almost parallel-sided; teeth on outer lip about 18, moderately strong, slightly extending to base; those on inner lip numbering 17, rather weak and obscure at middle. Anterior extremity produced, the margins nearly parallel, ending with a nodular callus; posterior extremity moderate, also with callus deposition. Fossula rather moderate, bearing about 4 transversely elongate teeth on its inner border. Terminal ridge long and oblique. Dimensions of holotype: length along axis 16.6 mm., lateral diameter 9.8 mm., dorso-ventral diameter 8.7 mm.

Type locality and formation: Small cliff just below the road, about 1.1 Km. northeast of the junction of the two roads at Tsujimori, Mishima-Mura, Kimitsu-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°13′30″, E. long. 140°01′59″. IGPS Coll. Cat. No. 72646 (holotype). Upper part of the Sakahata formation.

Remarks: In shape and size, this new species closely resembles *Palmadusta* (*Purpuradusta*) *japonica* Schilder (Schilder, 1931, p. 67, 68), a Recent species of Central and Western Japan, but it is easily distinguished from that species by its slender shell, more contracted anterior part, narrower aperture and larger number of labial teeth. *Palmadusta* (*Palmadusta*) *artuffeli* (Jousseaume) (Jousseaume, 1876, p. 81), a species from Central and Western Japan, is also similar to the present one in shape, but the more contracted anterior part of the shell, narrower aperture and smaller number of labial teeth serve to distinguish *P. fusana* from that species.

Fusa, from where the specific name is taken, is an ancient name for Bôsô Peninsula.

PALMADUSTA (PURPURADUSTA) OLIGODON Hatai and Nisiyama, n. sp., Plate 4, figures 11, 12.

Shell small, rather thin, elongately ovate in outline, moderately inflated, posterior extremity much produced, anteriorly truncated. Oral surface asymmetric, base inflated, aperture nearer to right side than to the left. Spire raised, concealed with enamel which extends around sides. External surface smooth. Outer lip produced posteriorly and somewhat constricted anteriorly. Aperture rather broad, posteriorly broadened and curved; teeth on the outer lip about 16 moderately strong, hardly extending over the base; columellar teeth 17 in number, weak, obscure at the middle and marked on the left border of aperture. Fossula rather narrow and shallow, bearing about 3 transversely elongate teeth on its inner border. Terminal ridge remote from the anterior columellar teeth, rather long and oblique. Dimensions of holotype: length along axis 11 mm., lateral diameter 5 mm., dorso-ventral diameter 4 mm.

Type locality and formation: Cliff of the Koito-Gawa, about 250 meters east of the Temple at Nishi-Higasa, Akimoto-Mura, Kimitsu-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°13′29″, E. long. 140°00′16.4″. IGPS Coll. Cat. No. 25296 (holotype). Middle part of the Sakahata formation.

Remarks: In shape and size, this new species is closely related to *Palmadusta* (*Purpuradusta*) *microdon* (Gray) (Gray, 1828, p. 71; Reeve, 1846, sp. 139), a Recent species of Southern Japan and the India Ocean, but can easily be distinguished from that

species by the much broader aperture and smaller number of labial teeth.

Erosaria (Ravitrona) subrostrata Hatai and Nisiyama, n. sp., Plate 4, figure 8.

Shell ovate, rather thick, with moderately inflated whorls, the maximum height a little behind the median line, both extremities produced, somewhat rostrate. Oral surface inflated, asymmetric, the curvature of the left side much stronger than that of the right, aperture a little nearer to the right than to the left side. Spire raised, but concealed with heavy enamel which extends around the sides. Lateral pittings rather shallow and small, developed along the margins from anterior extremity to posterior extremity over the right side. Aperture narrow, a little curved anteriorly and posteriorly, labial teeth somewhat constricted anteriorly; teeth on the outer lip about 18, moderately strong and extending about halfway over the base; columellar teeth 15 in number, slender but distinct throughout. Anterior extremity produced, ending with nodular callus; posterior extremity also produced, with heavy callus deposition. Fossula broad, bearing about 5 transversely elongate teeth on its inner border. Columellar sulcus smooth. Terminal ridge not so remote from the anterior columellar teeth, but rather long and oblique. Dimensions of the holotype: length along axis 29.5 mm., lateral diameter 18 mm., dorso-ventral diameter 14 mm.

Type locality and formation: Cliff of the Koito-Gawa, about 250 meters east of the Temple at Nishi-Higasa, Akimoto-Mura, Kimitsu-Gun, Chiba-Ken. Otaki sheet, N. lat. 35°13′29″, E. long. 140°00′16.4″. IGPS Coll. Cat. No. 25294 (holotype). Middle part of the Sakahata formation.

Remarks: This species closely resembles *Erosaria* (*Ravitrona*) *labrolineata* (Gaskoin) (Gaskoin, 1849, p. 97; Sowerby, 1870, pl. 25, fig. 231), a Recent species of the Japanese Seas and the Indian Ocean, but is distinguishable from that species by its larger and more produced extremities, and also by the narrower aperture. In shape and size, this new species is also close to *Erosaria* (*Ravitrona*) *boivinii* (Kiener) (Kiener, 1843, pl. 18, fig. 2; Kiener, 1845, p. 66), a Recent species of Central and Western Japan, but is distinguishable from that species by its more produced extremities and narrower aperture.

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EXPLANATION OF PLATE 4.

Fig. 1. *Proterato callosa nomurai* Hatai and Nisiyama, × 6.
Fig. 2. *Proterato callosa uedai* Hatai and Nisiyama, × 6.
Figs. 3, 4. *Primovula atractina* Hatai and Nisiyama, × 3.
Figs. 5, 6. *Pseudotrivia pleres* Hatai and Nisiyama, × 3, fig. 5, paratype; fig. 6, holotype.
Fig. 7. *Palmadusta fusana* Hatai and Nisiyama, × 3.
Fig. 8. *Erosaria subrostrata* Hatai and Nisiyama, × 2.
Figs. 9, 10. *Trivirostra pyrinula* Hatai and Nisiyama, × 6.
Figs. 11, 12. *Palmadusta oligodon* Hatai and Nisiyama, × 3.

BIOLOGY, TAXONOMY, AND NOMENCLATURE

BY PAUL BARTSCH

In devoting a lifetime of effort to our chosen field, I have met with a number of problems not covered by the usual approach of nomenclature and taxonomy.

When I began my study of the family Pyramidellidae a half century ago and prepared the manuscript for the monograph on the "West American Pyramidellid Mollusks" I was sorely puzzled what valuation should be assigned to the various groups —natural assemblages of species.

Discussing this problem with Dr. Dall, who had agreed to become joint author of this effort and serve as a check to a possibly over-enthusiastic novice, we decided to recognize four genera, *Pyramidella, Turbonilla, Odostomia* and *Murchisonella,* and align the various natural groups as subgenera under them. Doing so, Dr. Dall believed we would avoid the criticism of having created too many genera. (A fear to be criticized seems always to be lurking in the minds of our molluscan students which *now* appears to me the greatest deterrent to real clean progress.)

I yielded to the doctor chiefly because *Odostomia* (*Chrysallida*) *virginalis* D.&B. was so enormously variable as far as sculptural characters are concerned that one might consider some individuals as properly placed under the subgenera *Evalina* or *Evalea.*

Turbonilla (*Pyrgiscus*) *tenuicula* (Gould) was another puzzling species.

Later I found Pyramidellids in the Lower San Pedro Series which were equally variable in that horizon, and it appears that out of that mutating complex several fixed forms have emerged and established themselves in the Upper San Pedro Series. (I have not yet published my MS. on these forms.)

When I monographed the New England Pyramidellids I found another mutating form, *Turbonilla* (*Pyrgiscus*) *vinae* B. These mutating forms have characters which when once known easily enable one to recognize the species. It is interesting to note that such mutuating forms seem always more abundant and more widely distributed than the stable, fixed species. Mutating forms appear in many widely unrelated groups of mollusks; for example, *Helicostyla* (*Prochilus*) *virgata* Jay from the Island of Mindoro, Philippines, is very variable.

Goniobasis virginica (Gmelin) our common East American species is very interesting. Above the Fall Line uniform sized individuals are found which are smooth and usually have a color band, while in the reaches of the lower freshwater tidal area we have a uniform sized multilirate form *Goniobasis virginica multilineata* (Say). At the meeting of these two areas we have a most variable mutating complex, forms differing enormously in size and varying in sculpture from smooth to spirally lirate and even axially ribbed or marked by varying combinations of these characters.

It was this enormous variability that caused Hannibal to lump almost all the *Goniobasis* under *Goniobasis virginica* (Gmel.). The seeking for an explanation and solution of the problem connected with *Goniobasis* mutation eventually drove the poor fellow to the mad house. Another man who went off at a tangent was Dr. Sinitsin whose study of the intermediate host of the liver fluke of our cattle uncovered in our southwestern states a mutating mollusk *Stagnicola bulimoides techella* (Haldeman). Using the usually accepted anatomic characters for superspecific designation he created new subfamilies, new genera, and species, basing them on his dissection of individuals of this mutating complex. Refusal of the Department of Agriculture's Zoological Division to accept his manuscript for publication

caused him to resign his position in that institution, which resulted in a tragic aftermath.

My Cerion breeding on the Florida Keys (1911–1948) has thrown some light upon the problem of molluscan mutation, and I hope next year to revisit my families on the Florida Keys and to prepare a summary report upon these experiments. So far they point to two things:

1. Changed environment *per se* appears to produce no measureable changes in the species experimented with.
2. Hybridization (*C. incanum* Binn. x *C. viaregis* B., also *C. incanum* x *C. casablancae* B.) has caused enormously variable progeny (mutations) after the second generation.

This definitely points to an explanation for the probable cause of the other mutations referred to above. Here too we have a decided efflorescence in numbers which is in agreement with the other cases alluded to. In *Cerion* hybrids, changes in form, sculpture, and coloration are combined with equally variable anatomic structures. In one extreme individual the reproductive system was doubled.

We have in the wild state without human assistance similar mutating hybrids; for example, *Cerion tridentata* Pilsbry and Vanatta x *Cerion peracuta* Torre. Where these two species meet on Playa de Muerto on the north coast of Havana Province, Cuba, they mutate. On Little Cayman Island there are two colonies of *Cerion nana* Maynard. Where these colonies each meet an undescribed species of *Cerion*, similar mutating results are present.

These and many additional observations lead me to conclude that hybridization in mollusks produces mutations and that these seem more prolific than stable species and become more widely spread. Furthermore, that when these are isolated in small colonies as are, for example, the Cerions along South Bight, Andros Island, Bahamas, where every little ridge separated by a swale extending away from this channel has a colony of Cerions whose members have fixed characters that readily distinguish them from adjacent or other colonies. In other words,

they have undergone fixation and become species, meeting my five point formula: Hybridization—mutation—isolation—fixation—speciation.

Now for an application of the above biologic features to taxonomy. For many years I have been interested in the family Urocoptidae. I published my first paper in 1906.[1] To this I have added from time to time as material became available. Dr. De la Torre and I have about completed our monograph of the Cuban members of the family.

Recently a suggestion has been made to lump a number of mainland superspecific groups, since it has been found that in Arizona certain species are very mutable as far as internal lamination is concerned. These in their range of variation combine lamellar characters that appear constant for groups of Mexican species which also by other shell characters appear supraspecifically related. I am wondering if here we are not also dealing with a mutating complex which has not yet undergone fixation, and would it not serve a better purpose to place an * against the name of these forms, placing them in the group to which the rest of their characters ally them, calling attention that the lamellar characters in them are unstable, rather than lumping all the other supraspecific groups that have constant fixed lamellar features that fall within the range of these mutating forms under a common designation.

WILLIAM HENRY FLUCK, 1870–1948

By RUTH D. TURNER

Many missionaries have made important contributions to science by collecting and observing the fauna and flora about their mission stations. Among these was the Reverend William Henry Fluck who was stationed for four years at Wounta Haulover, Nicaragua, and who while there made an extensive collection of the mollusks of the Mosquito Coast area.

William H. Fluck was born in Philadelphia, Pennsylvania, on February 22, 1870. He was graduated from Moravian College, Bethlehem, Pennsylvania, in 1894, and the Moravian Theological

[1] The Urocoptid Mollusks from the Mainland of America in the Collection of the United States National Museum.

Seminary in 1896. Later, in preparation for his life as a missionary, he took up medicine at the Hahnemann Hospital in Philadelphia. During his boyhood and college days he collected shells locally and frequently visited the dock area to obtain shells that might be found on the hulls of the ships that had come in from the tropics. He carried on correspondence and exchanges with collectors throughout the country and often visited the Academy of Natural Sciences at Philadelphia. Consequently he was versed in the ways of malacologists before he left for Nicaragua.

The Reverend Fluck was one of the early collectors to visit Nicaragua and he sent back quantities of valuable material to the Smithsonian Institution, the Academy of Natural Sciences at Philadelphia, the Boston Society of Natural History and others throughout the country. Several species have been named in his honor and, though he wrote several articles, mostly on collecting on the Mosquito Coast, he described only two forms, one of which was from Nicaragua. These were *Strombus pugilis nicaraguensis* Fluck (Nautilus 19, p. 32) and *Valvata tricarinata bakeri* Fluck (Nautilus 46, p. 20), a form which he had found in quantity in Oneida Lake, New York.

Returning from Nicaragua Reverend Fluck took his M.A. degree at Moravian College and later taught Natural History there for about ten years while holding a pastorate in Bethlehem. He was a charter member of the American Malacological Union.

After his retirement from the ministry in 1938 Reverend Fluck made his home in Newfane, Vermont and later moved to Brattleboro, Vermont where he died on April 17, 1948.

Following is a list of the papers written by William H. Fluck.

1900, December. Shell Collecting on the Mosquito Coast. Nautilus 14, no. 8, p. 94.

1901, August. Extract from a letter by W. H. Fluck on Shell Collecting on the Mosquito Coast. Nautilus 15, no. 4, p. 48.

1905–1906. Shell Collecting on the Mosquito Coast of Nicaragua, Parts I–VI. Nautilus 19, nos. 1, pp. 8–12; no. 2, pp. 16–19; no. 3, pp. 32–34; no. 5, pp. 55–57; no. 7, pp. 78–80; Nautilus 20, no. 1, pp. 1–4.

1932, July. *Valvata simplex* Gould. Nautilus 46, pp. 19–22.

1943, January, February. Abnormalities in *Helis* (*Alabastrina*) *tingitana* Paladilhe, and *Mesodon exoletus* Binney. Nautilus 56, pp. 104–105.

NOTES AND NEWS

HELMINTHOGLYPTA NICKLINIANA EXTENDING NORTHWARD.—Recently the writer was collecting land molluska amid the redwood groves in the vicinity of Miranda, Humboldt County, California. While taking a short cut across a portion of the bar of the Eel River (South Fork), a small colony of *Helminthoglypta* was noted amid the short grass and debris left by high water. Closer search resulted in the collecting of a few adult and immature specimens, from out of the mass of nettles, blackberries, willow, and debris. The writer at once noted that the animal was distinct from local examples of the *Helminthoglypta arrosa* complex, and later examination with a hand lens brought out the difference more clearly. Specimens were immediately sent to Mr. and Mrs. E. P. Chace who identified the snails. Later identification by Dr. Gregg confirmed the variety. The result was an extension to the north of the range of the *Helminthoglypta nickliniana anachoreta* (W. G. Binney).

Upper Clear Lake, Lake County, California is the closest published locality of this snail. The Miranda locality is approximately ninety miles northward in an air line. In order to reach the Miranda locality from Clear Lake, the snail would have to cross several small ranges of mountains, follow devious winding creeks and rivers, and finally locate a suitable habitat. Therefore the ancestors of this colony must have traveled a good many miles.—R. R. TALMADGE, Eureka, California.

MR. J. R. LE B. TOMLIN of St. Leonards-on-Sea, England, has recently resigned from the editorship of the Journal of Conchology, a position he has held with distinction for over 40 years. Besides editing this publication, Mr. Tomlin has contributed many original papers on mollusks, not only to the Journal of Conchology, but to many other publications as well.—W. J. CLENCH.

THE DISCOVERY OF ARION CIRCUMSCRIPTUS JOHNSTON AT URBANA, ILLINOIS.—A colony of the slug *Arion circumscriptus* Johnston has been discovered at Urbana, Illinois. It is believed to be the first record from the state. The first specimen which I identified was captured on April 19, 1948. Residents of the neighborhood remember seeing similar slugs at least five years

ago, and perhaps earlier. Thus far I have found *Arion* only in the city block bounded by Orchard Street, Iowa Avenue, Douglas Street, and Indiana Avenue. It is seemingly absent from all the adjacent blocks. In the yards where it is found, it is quite numerous, especially during wet weather, when many specimens may be found under stones, bricks, and boards. On July 10, I discovered a specimen one inch deep in undisturbed sod. My specimens have two well-defined lateral bands. The identification was verified by examination of the genitalia. Several examples have been given to the Illionis State Natural History Survey.—Ross Taylor Bell.

Zonitoides arboreus (Say) in Nevada.—In Dr. Pilsbry's recent monograph of Land Mollusca of North America, vol. II, p. 481, under distribution of *Z. arboreus,* I note, "All states except Nevada." I took *Zonitoides arboreus* (Say) in southern Nevada on April 21, 1935. It was found beneath moist dead leaves in a small aspen grove on the southeastern slope opposite the head of Cabin Canyon, which is near Bunkerville in Clark County. Directly above the grove was Wiregrass Spring and a small dry stream bed led from the spring to the aspen grove. This locality, as I now remember it, was directly north of Virgin Peak. Associated with *Z. arboreus* were *Euconulus fulvus alaskensis* (Pils.), *Retinella indentata paucilirata* (Morelet), *Vallonia cyclophorella* Sterki, and *Cionella lubrica* (Müller).—W. O. Gregg.

PUBLICATIONS RECEIVED

A zoogeographical study of the land snails of Ontario. By John Oughton. University of Toronto Studies, Biological Series, no. 57, pp. 126, 2 tables and 86 distributional maps, 1948. This is not a handbook on the land snail fauna of Ontario, but as the title indicates, a study of distribution only. The species are not described or figured. Critical remarks are given and a small text-figure map indicates the known as well as the probable distribution for each species in Ontario. The total land snail fauna is given as 88 species and subspecies and in addition 8 included that are questionable.—W. J. Clench.

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A NEW FLORIDA SPECIES OF THE TECTIBRANCH GENUS PLEUROBRANCHUS

By R. TUCKER ABBOTT

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In the winter of 1947 a number of Opisthobranchs were collected in Biscayne Bay, Florida, by Mr. F. M. Bayer of the United States National Museum and Miss Harding Boehme, a graduate student at the University of Miami. Among the living and preserved specimens sent to the United States National Museum for identification was a species of *Pleurobranchus* which appears to be undescribed.

An unusual amount of confusion has existed in the definition of the various genera of the subfamily Pleurobranchinae. The genera *Gymnotoplax* Pilsbry, 1896, *Berthella* Blainville, 1825, and *Bouvieria* Vayssière, 1896, are sufficiently distinct to have escaped much change, but other groups such as *Oscaniella* Bergh, 1897, *Oscanius* Gray, 1847, *Susania* Gray, 1857, and *Pleurobranchopsis* Verrill, 1900, have been variously used as subgenera under the genus *Pleurobranchus* Cuvier, 1805, or raised to generic standing by different authors. No two workers seem to have treated these groups alike, and it is likely that this is due to the rather nebulous generic characters. Until living material of most of the species has been carefully examined by one person, the group will remain in a state of flux.

The new Florida species is closest in general characters to the type species of *Susania* (*testudinaria* Philippi, 1844, = *testudinarius* Cantraine, 1835). At present, we are considering *Susania* as a subgenus of *Pleurobranchus*.

PLEUROBRANCHUS (SUSANIA) ATLANTICUS new species. (Plate 5, figs. 1–10.)

Body.—The body of the animal when alive and crawling on a flat surface is elliptical to elongate, slightly flattened, from

40 to 50 mm. in length and 20 to 22 mm. in width. Specimens in alcohol contract to about two thirds their natural size. Mantle slightly larger than the foot, with an undulated, thin border and with a deep, rounded sinus in front. The size and depth of the sinus can be changed at will by the animal. In preserved material the sinus is moderately shallow. The dorsal surface of the mantle (dorsum) is covered with numerous small, rounded tubercles which are largest on the central and anterior region. Towards the margins, the tubercles are reduced to small round warts. Color of dorsum a yellowish orange with irregular splotches of deep maroon-brown. The largest tubercles are a translucent pale orange with a dark chocolate ring around the base. Some tubercles are capped with chalk-white pigment. Other smaller tubercles are entirely chalk-white. The foot is elliptical in shape, and moderately crenulated along its lateral edges. The anterior edge possesses a deep mucus groove, bounded above by a small skin flap which is deeply notched in the center. Color of foot a translucent, pale yellowish orange. The dorsal surface of the edge of the foot is uneven, but without warts, and is speckled with groups of orange dustings and chalk-white dots. A well marked pedal gland is visible at the posterior end of the foot in some preserved specimens.

Head.—The frontal veil is relatively small, trapezoidal in shape, with the anterior edge slightly rounded and slightly extended laterally (fig. 3). The lateral edges of the veil are deeply grooved as shown in the cross-sectional figure 5. Dorsal surface orange-yellow with irregular blotches of maroon-brown. Underside a pale yellowish orange. The mouth is located under the veil at its juncture with the head. The two rhinophores arise from the dorsal surface of the head a few millimeters in front of the two small black eyes. In living animals the rhinophores project up through the sinus in the dorsum and are about 4 mm. in length. Each rhinophore is actually a rolled up plate, with one margin overlapping the other. The exhalent opening is on the side of the head well below the eye. Color is a translucent orange brown. In life, the rhinophores palpitate and are contracted at will on stimulation.

Ctenidium.—The branchial plume lies on the right side of the body in the space between the overhanging edge of the mantle and the foot, usually completely concealed from top view, but plainly visible from the side. When fully expanded, it measures slightly less than one half the length of the body, but may be contracted to one third of its natural size. The posterior or distal third of the plume is free from the body wall. The rachis or primary lamella bears on its dorsal surface two rows of 20–22 swollen nodules opposite which are located the

secondary lamellae or pinnules. Each of the 40 or so pinnules is a miniature replica of the large plume itself, and is similarly nodulose and bears on each side about 15 tertiary lamellae. The tertiary lamellae bear, in turn, about 5–10 extremely small and simple quatenary lamellae. Between the secondary lamellae, and on the main rachis, there are occasionally 2 to 5 minor or dwarfed pinnules. The plume is of a pale yellowish color, with a heavy dusting of orange on the upper surfaces. Secondary lamellae often marked with a few chalk-white dots.

Shell.—Shell (see fig. 8) small, length 40 mm., width 2.4 mm.; only one tenth the total length of the animal. Auriculiform to semi-quadrate in outline, calcareous, and quite flat with only a slight convexity to the large last whorl. Spire very short with only 1½ whorls. The concentric lines of growth very coarse and irregularly spaced. Color of shell in life a yellowish white with a faint rosy tint. A light reddish brown band runs diagonally across the inside of the shell from the spire to the outer and lower edge. A broad thin, transparent, hyaline sheath borders the shell. The shell is embedded under the dorsum about one third the distance from the anterior end of the animal.

Mandibles.—The labial armature consists of a pair of oblong, flat mandibles of a rich golden brown color. Each mandible is made up of closely set chitinous platelets arranged in approximately 80 transverse rows with each row containing about 35 platelets. Each platelet is somewhat trapezoidal in shape, with the anterior end bearing a large pointed tooth, on either side of which may be 2 to 6 denticles. Variations in the denticles are figured in figure 10a-d.

Radula.—The radula consists of about 75 transverse rows of simple, unciform, strongly hooked teeth. Each row contains about 380 teeth, those nearest the center being shorter, stouter and more strongly hooked (fig. 9a) than those towards the outside which are longer, more slender and almost straight. The formula is 190, 0, 190.

Genitalia.—The external genitalia are located on the right side of the body a little anterior to the ctenidium. The penis and female orifices are surrounded by a common, elaborately folded flesh cup. The verge is anterior to the oviduct orifice which in turn is anterior to the opening of the nidamental-albumen gland. The fleshy arms of the genital cup are illustrated in figure 6. The excretory organ of Bojanus is large and bean-shaped and opens to the outside by means of an oval slit (the prebranchial opening) in the integument between the ctenidium and the genital cup.

Type locality.—Soldier Key, Biscayne Bay, Florida. F. M. Bayer, collector. February 22, 1948.

Types.—Holotype U.S.N.M. No. 574352; four paratypes: U.S.N.M. No. 574342 (four other specimens were destroyed in the course of examination). A paratype shell has been deposited in the Academy of Natural Science of Philadelphia, No. 184350, and the Museum of Comparative Zoölogy at Harvard College, No. 165951.

Ecology.—The following remarks have been kindly supplied by the collector, Frederick M. Bayer:

"The first specimens of this species were collected in the spring of 1946 at Soldier Key in Biscayne Bay. Yet it appears to be not uncommon, and is probably abundant in similar stations throughout the Florida Keys. It is particularly common in the shallow waters surrounding the small islands in the Soldier Key area. At low tide, great stretches of the bay's floor between the islands are exposed or covered only by a few inches of water. These flats are thickly overgrown with the low branching coral, *Porites porites* and its varieties. An integral part of the flats are massive clumps of the alga, *Halimeda*, and patches of the flowering plant, *Thalassia*, called Turtle-grass. This species of *Pleurobranchus* seems to prefer the lower strata of the *Porites* colonies where the zooids are dead. There the mollusks may be seen commonly in pairs during the spring months engaged in depositing their large, translucent, gelatinous egg masses. They may be seen less often among the large clumps of *Halimeda*. On one occasion, at the Ragged Keys, we found very few *Pleurobranchus* despite the presence of a luxuriant growth of *Porites*. Near here, in a small sandy patch, we turned over a water-logged board to find nearly a dozen specimens clinging to its under surface. Apparently, this species is not entirely dependent upon the presence of *Porites*. Although many dredge hauls were made in nearby waters of one to two fathoms in depth, no specimens were taken although some coral and *Halimeda* were present. It is apparent that the ecological niche inhabited by this mollusk is rather restricted, and it is not remarkable that it should have escaped notice despite more or less intensive investigations in the Miami area."

Remarks: In the Western Atlantic, the closest ally to *Pleurobranchus* (*Susania*) *atlanticus* is *P.* (*S.*) *areolatus* Mörch 1863

from the Lesser Antilles. From Mörch's original description, it appears that the dorsum of *areolatus* is more coarsely patterned with raised areas of oblong hexagons instead of the pointed low tubercles found in *atlanticus*. The shell of *areolatus* differs in having a relatively larger spire and a more flaring last whorl. The color of the shell in *areolatus* is chestnut becoming whitish towards the periphery, while in *atlanticus* it is yellowish white with a rosy brown diagonal band. The cup-like fleshy folds around the genitalia found in *atlanticus* are very much reduced in *areolatus*. The shell of *Pleurobranchus lacteus* Dall and Simpson 1901 is quite similar to that of *atlanticus*. However, in the former it is a pure milky white as is the animal itself and possesses a thick glazed layer on the inside of the shell. The shell of *atlanticus* is not as elongate, is considerably more rugose, and is opaque with only a slight sheen on the inside.

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EXPLANATION OF PLATE, PLEUROBRANCHUS (SUSANIA) ATLANTICUS

FIG. 1. Dorsal and slightly lateral view of animal crawling on flat surface. × 2. (Photo by F. M. Bayer.)

FIG. 2. Right lateral view of living animal. an, anus; ge, genital cup; pl, gill plume or ctenidium; rh, rhinophore; sh, position of shell under dorsum. × 1½.

FIG. 3. Underside of animal. pe, posterior pedal gland; si, sinus or sulcus at anterior end of mantle; ve, velum. × 1½.

FIG. 4. Lateral view of right rhinophore. po, posterior orifice; ey, eye. × 4.

FIG. 5. Cross-sectional view of velum to show lateral mucus grooves. × 5.

FIG. 6. Genitalia. fl, skin flaps of the genitalial cup; hd, hermaphroditic duct; nd, nidamental-albumen gland; or, female orifice; pr, prostate; sp, spermotheca; vd, vas deferens; vg, vagina and oviduct. × 25.

FIG. 7. Dorsal view of anterior end of ctenidium showing nodulated rachis and secondary lamella or pinnule. × 20.

FIG. 8. Shell showing (hy) hyaline sheath. × 25.

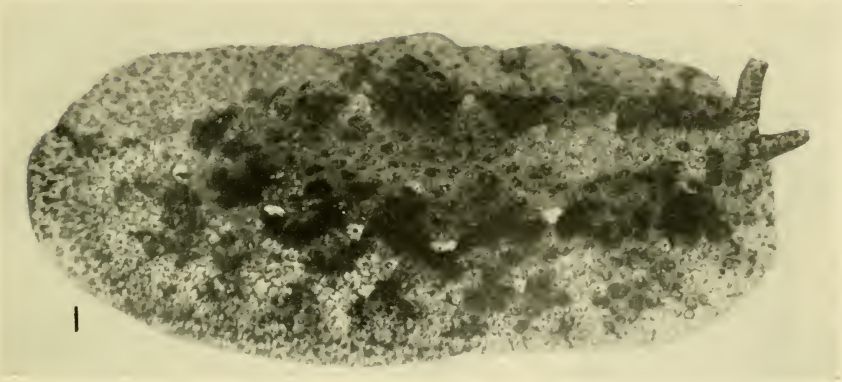
FIG. 9. Radula. a, lateral tooth nearest center; b and c, intermediate laterals; d, 190th or outermost lateral.

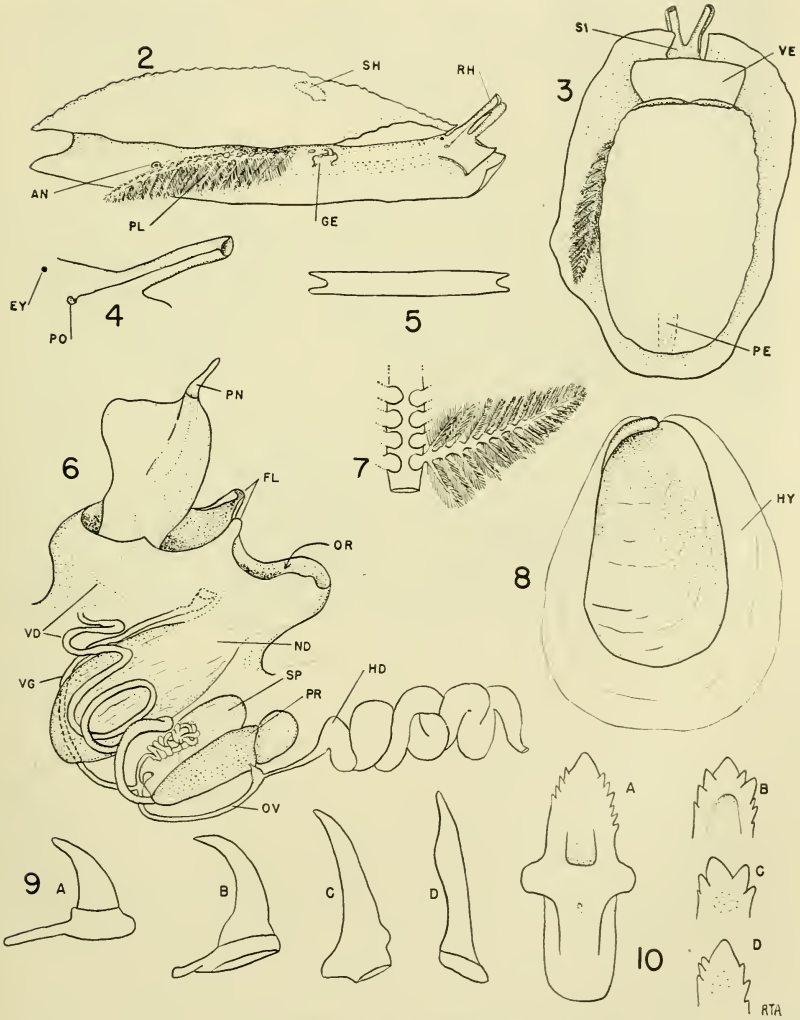
FIG. 10. Mandibles. a, well developed platelet; b, c and d, variations in dentition in more posteriorly placed platelets. (Enlargements approximate. Drawings by the author.)

IN PINAR DEL RIO, A COLLECTING TRIP

BY MORRIS K. JACOBSON

Not far from the matchless valley of Viñales, a little to the southeast, lies the village of Luis Lazo (or San Carlos) at the foot of the Sierra de San Carlos, an area not quite so well known to conchologists and hence somewhat less explored for shells than Viñales. Past this village and tapping the area runs the road from Pinar del Río City to Guane. This road, on the way to Guane from Luis Lazo, runs past localities like the Estrechura, Ensenada de Las Angustiás (or Sijú), Sierra de Los Acostas, Mal Paso, Punta de la Sierra, Tenería, La Muralla, the Cueve Oscura of Portales, the Sierra de Guane and Paso Real, several of them type localities for many of the species and subspecies described by Torre and Bartsch. (Proceedings United States National Museum, Volumes 85 and 89, and United States National Museum Bulletin 181.) From the town of





Pleurobranchus atlanticus.

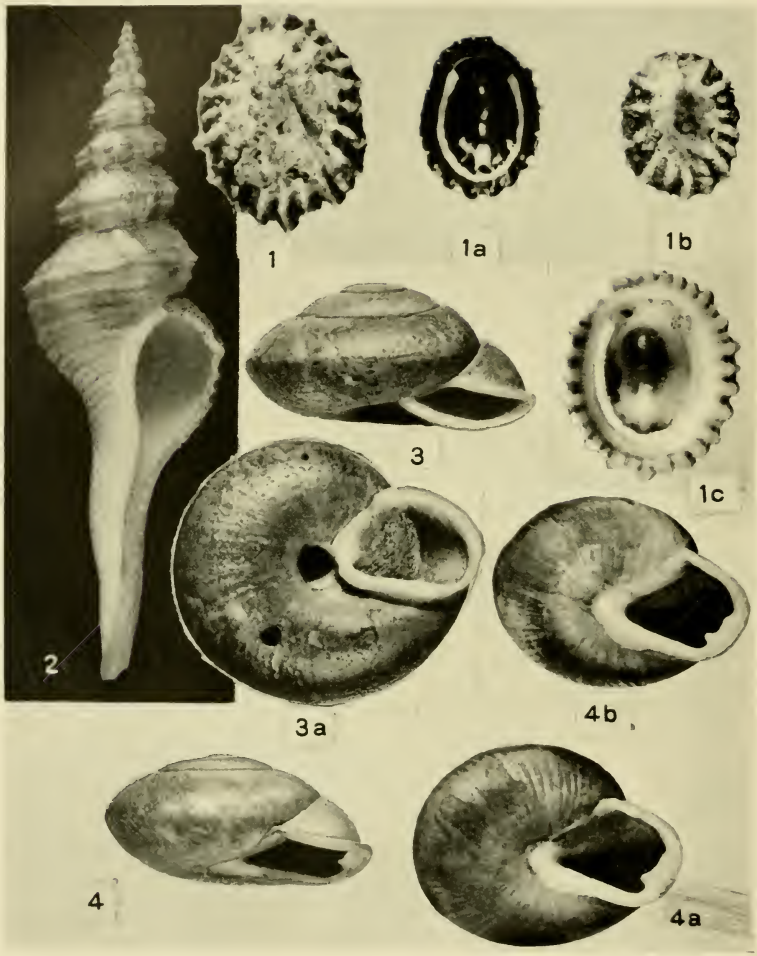


FIG. 1–1c, *Acmaea langfordi* Schwengel, type (fig. 1) and paratypes × 2. FIG. 2, *Fusinus spectrum* (Ad. & Rve.) FIG. 3, 3a, *Isomeria anodonta* Pils. FIG. 4, 4a, *Isomeria anestia* Pils., type; fig. 4b, paratype.

Guane there is a road, still in the process of being paved, to Mendoza (or Paso Real). From Luis Lazo to Pinar del Río the road passes the Sumidero, and a branch road to the Matahambre mines takes one to Isabel María and Cabezas and the Sierra del Quemado. Near Luis Lazo village lies the well known Portrero de Luis Lazo, also known as the Valle de San Carlos, a large flat area entirely enclosed by steep-sided mogotes and sierras, watered by the Cuyaguateje River and its branches, the Arroyo Mal Nombre and the Arroyo las Fuentes, and crowned in its center by a vast and lonely mogote. In this Valle are the localities Las Vírgenes, Las Fuentes, el Resolladero and el Junco (cf. maps Proc. U. S. N. M., vol. 85, pp. 218, 224, 294, etc.). The entire area described above was the site of a collecting trip undertaken by Oscar Alcalde Ledón of Cienfuegos and myself during the week December 26, 1947 to January 2, 1948.

This area is by no means virgin territory conchologically speaking. Among well known collectors in this area are to be mentioned first and foremost, of course, the indefatigable Dr. Carlos de la Torre and our own Dr. Paul Bartsch, whose three volumes mentioned above were to be the bible of our little excursion. In addition must be mentioned names like Wright, Dominguez, Arango, Bermudez, Barrera, d'Alté Welch, Lowe and Hand, Jaume and Aguayo and undoubtedly many others. In all we visited 34 localities in seven general areas, namely: at Isabel María 8 localities, at Luis Lazo 6, in the Valle de San Carlos 6, region west of Luis Lazo 4, in the region of Sumidero 2, the area between Luis Lazo and Guane 5, and around Guane and Mendoza 3. Although in almost all cases we felt ourselves under the pressure of time and hence forced to omit many other desirable stations, our chief regret was our failure to visit, because of erroneous local information, the well known Sierra de Guane.

I met Alcalde at the airport Rancho Boyeros on December 26. Since we knew each other only through a lengthy correspondence, never having seen even a picture of each other, we identified ourselves by—not big red roses worn in our lapels—but large shells clutched manfully in upraised hands, I holding a large naiad (*Lampsilis ovata* from the Illinois and Michigan Canal at Chanahon, Illinois, for those who insist on exact data)

and Alcalde a fine large *Liguus fasciatus*. We thus made ourselves known to each other with very little difficulty and, picking up the entomologist Señor Manuel Barro at the Hotel Montserrat, took a bus (gua gua) immediately for Pinar del Rio. The events of the rest of the day remain in my mind as a brilliant, vastly colorful confusion. The overwhelming impressions of Cuba—the country I had longed to visit since I can first remember—the slurred, barely intelligible vernacular, the hurried change from bus to bus, all serve to leave only a most vivid impression of palm trees, heat in December, strangler figs on the side of the Central Highway, roast whole pigs sold at wayside stands (muy sabroso!), Havana gleaming whitely in the distance and picturesque bohíos, the palm thatched huts of the peasantry. We raced through the rich countryside with only short stops at bustling little towns, alike as beads on a string, Guira, Alquizar, Artemisa, Las Manguas, Candelería, etc., good collecting localities many of them. I remember definitely however that that night we slept in the Hotel Comercio in Pinar. For myself it was hardly sleep, rather a grand sweep of rioting, undigested impressions. We were up at 4:30 for a trip to that mecca Viñales, picture postcards come alive! We picked up our guide Juan Gallardo and travelled, always by open sided bus, to Isabel María, and here, at the foot of the slope of Juan Alonso of the Sierra del Quemado, I collected my first Cuban snails, a number of urocoptids clinging vigorously to a dry limestone ledge. Here too I experienced my first *diente de perro*, dog-tooth rock surface (gives a secure foothold for rubber soled boots) and turned up my first live black widow spider. Here too were the echoing caves, the saucy lizards, the "date pits" of the hidden *hutía*. Barbour's incomparable "Naturalist in Cuba" was coming alive before my very eyes!

By the time we descended from the steep slopes of Juan Alonso I realized that our collecting of live material would not be good during the dry season. I was to collect specimens by the hundreds, by the thousands, but the thrill of seeing a rock covered with ambulating beauties would be denied me. How thickly rocks can be so covered was made abundantly clear by the myriads of whorls of dried snail droppings (snail chips?). However, as it turned out, I was not to be completely disap-

pointed. At Las Vírgenes in the Valle de San Carlos we collected live Eutrochatellas and Chondropometes by the score; at the mogotes near Tenería we actually had to chase specimens of *Chondropometes* (*Chondrothyroma*) *sagebieni disjunctum* T. & B., a snail far livelier than anything I have ever seen in our country; and on the very last day of our trip, at the town of Mendoza, I filled little boxes with the beautiful urocoptid known as *Callonia ellioti* Crosse. Of course, we collected many live specimens in other places, but never in such large numbers as at these three stations.

Land operculates have a habit that is disconcerting even startling to one who has never collected them alive before. Up to now, whenever I approached a snail clinging to a vertical surface, I knew the prey was mine, because the animal would obligingly withdraw its head and pull the shell all the tighter to its holdfast. Not so the annularids. Let them but get an inkling that you are near and they pop into their shells and drop like plummets, leaving a small spot of moisture behind. I wish I could show them that this is really not a very good habit —their shells are fragile and fracture badly when they hit, as they mostly do, a hard limestone surface. Or else they fall with considerable force into a crevice where, securely wedged, they die a lingering death and make it practically impossible for anyone to free them in one piece. A corollary of this habit is the extreme timidity of such operculates. An inoperculate like *Zachrysia* or *Cepolis* or even *Liguus* will in a short time after capture stick out its head to survey the situation. But with annularids an unconscionably long time will pass before they venture even to loosen the tight fit of the operculum, and any sort of light shock to the container causes them to pull back in again, tight as a stone.

However, the experience gained as a collector in the temperate zones is not without value in Cuba. Aside from the rock faces and the foot of boulders, we collected shells on leaves and branches of trees, including *Cepolis* and a few *Liguus,* under most rocks and under sprung bark. Farcimens were usually found buried in wet, rotted leaves on the ground, but they were not infrequently taken clinging to sticks and fallen tree trunks, especially in dark and humid situation. In little pockets in the

rough surfaced limestone, under accumulated decaying leaves, we found *Rhytidothyra* and *Annularops,* and clinging to dry rock faces Helicinas like *Viana* and *Eutrochatella.* The latter were frequently covered with a fine layer of pulverized, hardened limestone, and at the mogotes near Tenería this cover took the shape of a many pointed star, the points extending beyond the outer edge of the true shell. How the animal manages to attach this cover is a mystery.

To return to our journey. That night we ate with a Cuban tobacco farmer, a *guajiro* as he is here termed, in his little thatched bohío. The food, stewed chicken and white rice, was tasty enough, but I found that sudden whiffs of live pig running around in the kitchen did little to improve my appetite. Here I ate my first malanga, the root of our familiar garden plant, the elephant ear, and boniato, a white potato that has the flavor of sweet potato. We slept in the tobacco curing house, now unused. There was a sow and her litter not far from where I had hung my hammock, and she continued instructing her children all night long. Barro had a cold and kept telling Alcalde all about it. We were in the midst of a Cuban cold spell and the weather was uncomfortably chilly. When my blanket covered my top side, my underneath froze through the thin hammock, underneath and my top froze, wrapt up and I was cold all over. However, this was the only really uncomfortable night we spent.

The next day, December 28, Barro left us for Havana to nurse a bad case of grippe. We had our breakfast, a demitasse called here *café solo,* put some boniatos in our pockets and set off to collect at several mogotes in the vicinity, namely that of Juan Alonso, the large mogote near the cemetery of Cabezas and a few more on the finca of Señor Hernandez, who invited us in, served us coffee, and told us of other collectors who had visited his *batey.* His son accompanied us on a small trip we took and collected quite as enthusiastically as any of us, although, he confessed, to him there were only two kinds of snails, the big and the small. He was delighted when we showed him a tiny Eutrochatella; this was not *grande,* not even *chico,* it was *chirriquitico,* or really wee bit tiny.

In the afternoon we took the bus to Luis Lazo where we spent

the next three days at the house of Señor Carballo, a friend of the renowned Don Carlos. He was a very old man, skin as thin as paper, all the veins clearly showing, and in build very tall and thin. But his posture was upright and his deportment that of a grandee of old Spain. He entertained Alcalde—his Spanish was too fast for me—with tales of old Cuba and his adventures as a soldier of the king in the far off Philippines. He referred to this period of his life as the time when he was defending the "patria," meaning Spain of course and not Republican Cuba. When we left he referred to us in his visitors book as "intrepid naturalists, boldly surging thru the fields of Cuba in search of her natural wonders" or something like that. We were quite embarrassed, but signed nevertheless.

Here we slept in beds, hard but warm, and except for poor food (after all, one can make only so many different dishes from beans and rice even though the beans do vary in color from day to day) we had a pleasant enough stay. On December 29 we made the long round of the Valle de San Carlos collecting in all the areas mentioned by Torre and Bartsch. On rocks in the Cuyaguateje River we found hosts of *Hemisinus* (*Hemisinus*) *cubanianus* (d'Orbigny) and *Hemisinus* (*Potamanax*) *brevis* (d'Orbigny), both species freely mingling. The only other fresh water shells we took, aside from a large *Ancylus* in a little intermittent pond at Isabel Maria, were the small naiads *Nephronaias gundlachi* (Dunker). Our best find at Luis Lazo turned out to be a *Rhytidothyra* which we found in the Hoyo de La Guataca on the southeast slope of the Sierra de San Carlos, and which Alcalde subsequently described as new (Revista Sociedad Malacológica "Carlos de La Torre" 6:4). But we did *not* find, not even in semifossil condition, the unique *Chondrothyra* (*Hendersonoma*) *percrassa* "Wright" Pfeiffer (cf. Proc. U.S.N.M., vol. 85, pl. 15, fig. 6).

The region here is quite spectacular, the outstanding feature being the characteristic limestone blocks, some being no bigger than good sized barns, others vast mountains. Here, in these steep, soaring mogotes and sierras of Pinar del Rio we find the Cuban tropics. Endlessly twining vines, gray trunked palm trees, curious lizards, insects and butterflies, the cries of colorful birds and hosts of magnificent snails—a region that differs

not very much today from the time of Columbus. The lowland jungle has for the most part disappeared, the fauna and flora on the inaccessible, sharply cut limestone cliffs remain largely unchanged. When I think of Luis Lazo I see in my mind's eye a grey, green clad soaring cliff, slowly wheeling buzzards over its peaks, and hear the high sweet cry of the Cuban nightingale. At the foot of these cliffs there is a stretch of spiny, vine-covered, almost impenetrable underbrush, the Cuban manigua. Forcing our way through this thicket, we reach the ringing, sharp toothed limestone and carefully mount to the cave fretted upper portions. These mogotes are at times so narrow that large holes have been torn right through them, showing beyond other palm covered scenes that move majestically past like a magic peep show. This is especially true as one passes the cliffs at the Cueva Oscura at Portales. These mogotes so much resemble cliffs rising from the sea that a projection of flat land into their sides is known as an *ensenada,* the word for bay.

Aside from falls there are no real dangers in these cliffs, though there are many unpleasant features, chiefly vicious wasps (active only in the summer), the acid spitting *mancoperro* (a huge millipede) and great numbers of spiny, thorny bushes: tocino, chichicate, ortiguilla, espuela de caballero and many cactus-like plants. Finally one must not fail to mention the *ormiga brava* or wild ant, a little fellow that stings like a needle. However he leaves no itch or burn; when he lets go the pain vanishes.

In the entire area about Luis Lazo we collected *Chondropometes* (*Chondrothyroma*) *magnum magnum* T. & B. but are not satisfied that we were able to find the subspecies *signae* and *elisabethae;* and *Chondrothyretes barbouri barbouri* T. & B. whose subspecies *itineraria* we found at Cabezas. The typical *barbouri* varies from light yellow and orange in the Ensenada de Las Angustias to uniformly dark ones in the Estrechura, although most localities show series from light to dark. In several stations near the finca "Sabanas Llanas" there is a large proportion of forms showing dark spots arranged in spiral bands. The most interesting snail at all localities is *Cepolis* (*Jeanneretia*) *parraiana* d'Orb. with its numerous unnamed

varieties. Of this Aguayo and Jaume say (Católogo Moluscos de Cuba no. 98): ". . . a polymorphic species which includes a good number of varieties or forms and perhaps distinct subspecies." This very interesting group is now in the process of being monographed by Dr. Carlos de la Torre. Together with this *Cepolis* we sometimes found *C. subtussulcata torrei* Clench & Aguayo, with the curious depression at its base. In addition we found almost everywhere *Proserpina depressa* d'Orb., *Rhytidothyra bilabiata aurantiaca* T. & B., Vianas chiefly of the species *regina subunguiculata* (Poey), *Emoda* of the species *percrassa* and *sagraiana,* Urocoptes, Zachrysias Farcimens, dead *Liguus* and *Oleacina.* (A complete list of shells and details about all stations will appear in a subsequent paper.) Many of the Zachrysias were found with a neat hole broken out of the second whorl, the handiwork of a preying bird.

At the Estrechura we found *Chondropometes* (*Chondrothyroma*) *eximium malleatum* T. & B. and at the Ensenada de las Angustias the subspecies *angusticulum* T. & B. And finally almost everywhere we found the ubiquitous *Subulina octona* (Bruguière) and occasionally in dead leaves small numbers of *Pichardiella.*

On December 31 we visited two localities at the Sumidero, and among other things took some more *Farcimen superbum superbum* T. & B., but whether we collected the subspecies *itineraria* T. & B. we are not at all sure. Here we also took *Chondrothyra* (*Plicathyra*) *crassa* T. & B.

That afternoon we left for Guane, a typical Cuban country town, rough streets, high narrow sidewalks, horses and mules everywhere, a few rather dilapidated taxis, a once a week movie house and a neglected church. Before turning in that evening we visited the Sierra Paso Real and collected large numbers of the characteristic *Chondrothyretes gundlachi gundlachi* T. & B. and *Chondropometes* (*Chondrothyroma*) *sagebieni sagebieni* T. & B. The next day was the busiest day of all. Sending Juan Gallardo to go collecting at the Mogote de Xila at km. 14 of the Pinar to Guane Highway (where he found *Turrithyra hamlini xilaensis* T. & B.), Alcalde and I visited in turn the Punta de la Sierra—for *Chondropometes* (*Chondrothyroma*) *sagebieni disjunctum* T. & B. and *Chondrothyretes gundlachi deviata* T. &

B.; the Cueva Oscura of Portales—for *Chondropometes* (*Chondrothyroma*) *sagebieni portalense* T. & B.; and the mogotes between Tenería and La Muralla—for *Chondropometes* (*Chondrothyroma*) *sagebieni parvum* T. & B., all of which shells we found in satisfying quantity. Both at Tenería and Punta de la Sierra we collected large numbers of *Obeliscus* (*Liobasis*) *paradoxus* Arango, which we first took for a urocoptid, and which made us quite excited.

January 2 was my last day. We took a morning trip by taxi to Mendoza where we found those matchless *Callonia* mentioned above as well as *Chondropometes* (*Chondrothyroma*) *sagebieni mendozense* T. & B. In a little creek not far from the hill we took what we think is *Pomacea paludosa* form *garciae* Richards. That same day we returned by bus to Pinar del Rio and early next morning were on our way to Havana. And that very evening at 10 I landed at La Guardia Airport in a chilly New York that was even then struggling to free itself from the effects of the greatest snowfall in its history, in less than five hours from heat of Havana to the ice of New York!

NATURAL HISTORY OBSERVATIONS ON PHILOMYCUS CAROLINIANUS (BOSC)

By WILLIAM MARCUS INGRAM

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The included observations were made from June 12 to August 17, 1948, while the writer held an ecological fellowship on the Edmund Niles Huyck Preserve, Rensselaerville, Albany County, New York.[1] The preserve consists of between 500 and 600 acres and has twenty-six plant communities as aptly described by Odum (1943). Evidence indicates that the climax forest of

[1] Gratitude is expressed to the officers of the Edmund Niles Huyck Preserve and to the following individuals who did everything possible to further this work: Dr. Sherman C. Bishop of the University of Rochester who was often the writer's field companion; Dr. William J. Hamilton, Jr., of Cornell University, and Mr. James Murphy of Albany and Rensselaerville, New York.

the preserve is beech-hemlock association or hemlock consociation or both intermixed, Odum (1943). Of the various plant communities the beech-hemlock forest was by far the most fruitful in collecting *Philomycus carolinianus* (Bosc.). Slugs never were found in abandoned fields or in association with human habitation.

The general diurnal activity and arboreal tendencies of this native slug have been reported by Ingram (1941) for the Edmund Niles Huyck Preserve when he held an earlier fellowship in 1940. The natural history data included here will supplement that already published for this slug on the preserve and will add to that which has been incidentally published in taxonomic discussions of the species, i.e., Baker (1902) (1939), and Pilsbry (1948). Special consideration is given to a listing of the fungus food of this slug and to its general habitat.

General Habitat.—It is known that this slug has arboreal tendencies, Baker (1902), Ingram (1941), Pilsbry (1948). It is especially abundant in Beech-Hemlock stands, generally tending to avoid logs and trees of the hemlock and to especially favor a beech tree or beech log association. Contrary to written reports it is active throughout all hours of the day, whether the sun is clouded over or is shining brightly, Clapp (1920), Pilsbry (1948). Favored collecting times are those after a rain which brings forth the slugs from their resting retreats. After wet periods this slug is typically found crawling up beach trees to heights estimated at 60 feet; those at a 12 to 20 foot level can be collected easily by means of a pole, for as they are boosted from their hold by the pole they can be caught as they fall towards the ground. Some fifteen have been gathered in five minutes at a height of from 12 to 20 feet from a single beech through the use of a pole. After rains, for every slug collected on the ground five were taken from beech trees. During summer collecting it was not uncommon to find as many as from 2 to 6 individuals under the sprung bark of a beech log or under the sprung bark of a yellow birch log.

In the area under consideration this slug is not solitary in habit, evidence indicating that Baker's (1902) statement, "Solitary in habit," is not a representative remark, Baker (1939) having very likely realized this when he later wrote concern-

ing *P. carolinianus,* "A single large prostrate tree trunk may contain as many as 20 specimens of this species, often many sizes and ages from young to mature." Clapp (1920) reports nine specimens from a log crack that was 7 inches long by 2 inches wide. On the preserve 2 to 3 individuals on 11 different occasions have been collected from under the caps of a single mushroom feeding on the gills and stalk in bright daylight. Often from 4 to 5 individuals have been gathered from branch cavities that were formed when branches fell on beeches. In one instance 7 individuals were collected from the top of a wet rot beech stump exposed to the sun at 11 o'clock in the morning of a bright day feeding together on several clumps of the coral mushroom group, *Clavaria* (*stricta* (*?*)). Clapp (1920) states that the feeding of this slug is done at night and rarely will one find them feeding on the under surface of a fungus in daylight. Another collection to indicate that the species may be gregarious was made from a dead beech stump on which a Peleated Woodpecker had worked; here 7 individuals were taken from deep within the holes made by the bird, three individuals being clustered in one hole and two holes providing shelter for two slugs apiece.

Of the 19 species of land mollusks thus far reported from this preserve by Ingram (1946), this one is perhaps most easily found because of the tenacious slime tracks that it leaves wherever it has been. One can easily observe slime tracks on beeches up to heights of from 40 to 60 feet; too, tracks on logs and around mushrooms if followed usually reveal this slug or less commonly the large white-lipped wood snail, *Triodopsis albolabris* (Say).

Feeding and Food.—General statements have appeared in the literature from time to time indicating that land mollusks are not in direct competition with each other for a food supply, Boycott (1934), Williams (1936). In studying the fungus food of *P. carolinianus* indication is that this slug is in direct competition with at least two other mollusks for a food supply and with several species of beetles, and with rodents.

Three unidentified species of Staphylinidae, one Scarabidae, and one Silphidae were observed commonly feeding on fungi, the plants that form the bulk of the food supply of *P. carolini-*

anus. The observed snail competitors for the slug's food supply were *Triodopsis albolabris* (Say) and *Zonitoides arboreus* (Say). Another native slug, *Pallifera dorsalis* (Binney), was observed only once feeding on a mushroom that *P. carolinianus* feed upon, although it was commonly observed feeding on the under surface of shelf fungi, *Fomes* sp., a fungus that *P. carolinianus* was not observed to feed on. Aside from these specifically listed animals tooth marks on mushrooms also indicated that rodents likewise compete for a food supply with the slug.

Radular marks on beech bark indicate that *P. carolinianus* feeds on alga, *Protococcus* (?), that is very commonly associated with the beech tree. To confirm such field observations beech bark with a luxuriant growth of the alga was peeled from a tree and brought into the laboratory and housed in terraria with slugs. No other potential food was placed with the slugs; after three days radular tracks were found on the bark where the algae had been scraped off to be used as food. Green scats that were abundantly dropped by the slugs likewise indicated that the bark algae had been used as food, for only cream-white and light brown scats had been deposited by the slugs from their mushroom diet prior to their feeding on *Protococcus* (?).

In feeding on mushrooms individuals varied in habit of attack on their food supply. Stems of mushrooms were observed with slugs cutting canoe-shapped troughs into them. Caps of mushrooms were observed with slugs at rest on the upper surface filing away at the outer surface of the cap, and often slugs were collected under the caps feeding on the gills. In terraria when mushrooms of the genus *Boletus* without gills were proffered as food it was observed that holes were filed into the under surface of the caps just large enough to accommodate the anterior end of the slug as it ate its way inward. In feeding on *Boletus* the lower surface of the cap was fed upon most commonly, although radular work was observed on the dorsal surface of the cap where the common procedure was to scrape off the outer mycelial covering.

The fungus food of *P. carolinianus* seems to be quite varied based on field observations; such observations indicate that no single species of mushrooms seems to be preferred. It is realized of course that different conclusions might be obtained with

selection tests in laboratory feedings. However, under natural conditions feeding on mushroom fungi in general seems to be adapted to those commonly available in forest stands where the slug abounds without any special species being sought out. The list of fungi on which *P. carolinianus* feeds is based on identifications made by the writer based on Krieger (1935), and follows: *Amanita muscaria* (L.), *Boletus* (2 sps.), *Armillaria mellea* (Vahl) Quél., *Collybia* sp., *Pleurotus sapidus* (Schulz) Quél., *Hydnum caput-ursi* Fr., *Clavaria stricta* (Pers.) Fr., *Marasmius* sp., *Polyporus sulphureus* (Bull.) Fr., and *Cantharellus* sp. Only fungi on which slugs were observed feeding in the field are included in this list. Radular marks observed on other mushrooms indicate that many more species are fed upon by this slug and might be added to this list; however none are included in the list that slugs were not seen to feed on.

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SOME SNAIL RECORDS FROM SOUTHEASTERN OHIO

By CHARLES B. WURTZ

During August and September of 1941 I took a one man expedition into domestic fields. Starting in Pittsburgh, Pa., the route embraced northwestern West Virginia, southeastern Ohio and northeastern Kentucky. Since then I have written concerning both the Kentucky snails collected (Nautilus, 58: 125–128, 1945) and the West Virginia snails collected (Nautilus, 61: 80–89, 1948). This latter paper also included other West Virginia material collected at various times.

Feeling that the best one can do is emulate the eminent, e.g., Pearl Buck of literary fame, I decided to complete the writing and thus compose my trilogy. This, therefore, concludes the work of this particular field trip.

This part of the trip was more abbreviated than that of the other two states as I spent only two days (August 30 and 31) collecting from seven counties in Ohio. Naturally this is reflected in the amount of material collected. The memories of the trip itself have become somewhat dulled, and I discover, as does everyone, that field notes which appear comprehensive at the moment are but tantalizing after a few years.

Transportation consisted of a one-half ton truck fitted with a bed-roll, one-burner kerosene stove and other paraphernalia. It was the type of truck that allowed me to lock the doors and leave the keys inside. After this happens one must walk a mile or so to the nearest farm to borrow a piece of balin' wire that can be maneuvered through a small slit left open at the top of the window. There is a very scenic mile between Hocking and Athens in Ohio!

I entered Washington County, Ohio, from Parkersburg, W. Va., and was so impressed by my own mobility that I went right on to Athens County. My first stop was at Athens. This locality is in the Kanawha Section of the Appalachian Plateaus. Here I had an opportunity to meet Dr. Geir of Ohio University. He went out of his way to come to the University buildings to meet me, bringing with him some snails from his backyard.

After being shown around the Biology Department by Dr. Geir I drove west and collected at the west end of the town along Rt. 50.

The snails from Athens County include *Stenotrema hirsutum* (Say) Geir!, *Triodopsis tridentata* (Say), a single specimen of *Triodopsis albolabris* (Say) which lacked the parietal tooth, *Haplotrema concavum* (Say), *Mesomphix inornatus* (Say) and *Anguispira alternata* (Say).

Forging westward I next collected in Vinton County. This locality was a roadside park, Hooper Park, about ten miles east of McArthur along Rt. 50. Like Athens this locale is in the Kanawha Section of the Appalachian Plateaus. Five species were taken here. These were: *Stenotrema hirsutum* (Say), *Triodopsis tridentata* (Say), *Haplotrema concavum* (Say), *Ventridens intertextus* (Binney) and *Zonitoides arboreus* (Say). The *H. concavum* was taken while feeding on *S. hirsutum.* Reference is made to this in the above mentioned paper on Kentucky where two other such incidents are discussed. This small collection represents the time it takes for an engine ten years old to reduce itself from a temperature of 212° F. to one more commensurate with efficient operation.

Continuing on my way I reached Chillicothe in Ross County just before the telegraph office closed. Here I learned that a congratulatory message on the occasion of a father's birthday should not include such Latin phrases as "Pax vobiscum." It strains the relationship between the telegraph operator and the sender. Such things breed dissension.

After an uneventful night beside a filling station the expedition bore southwesterly. Two miles out of Chillicothe, at Slate Mills along Rt. 50, I made another small collection. This locality is on the border between the Kanawha Section of the Appalachian Plateaus and the Till Plains of the Central Lowland Province. (I followed this border to Adams County.) At this point my field notes read, "This seems to be the best time of the year to get immature polygyrids. I see far more immature forms than I do mature forms." Here I took *Stenotrema fraternum* (Say), *Mesodon inflectus* (Say), *Triodopsis tridentata* (Say), *T. denotata* (Fér.), *Haplotrema concavum* (Say), *Zonitoides arboreus* (Say) and *Discus patulus* (Desh.).

With persistence I coaxed my vehicle to Cynthiana in Pike County where I collected *Stenotrema fraternum* (Say), *Mesodon inflectus* (Say), *Ventridens ligera* (Say) and *Anguispira alternata* (Say).

The next stop was at Butler Springs Park in Highland County. This was another roadside park along Rt. 41. (The roadside parks that are found in Ohio are a real boon to motoring humanity.) Here I collected *Triodopsis tridentata* (Say), *T. albolabris* (Say), which lacked the parietal tooth and *Ventridens intertextus* (Binney).

Beyond this point I passed over the border into the Lexington Plain of the Interior Low Plateaus Province. The first stop in this physiographic section was in Adams County at McClanahan's farm two miles south of West Union. Here I collected a nice series of *Anguispira alternata* (Say) in which the larger specimens have a blunt peripheral carina and are higher than is typical of the species. They resemble the form *A. a. eriensis* (Clapp) in this respect. Other species collected were: *Stenotrema fraternum* (Say), *Mesodon thyroidus* (Say), *Triodopsis tridentata* (Say), *Haplotrema concavum* (Say), *Gastrocopta armifera* (Say) and *Pupoides albilabris* (C. B. Ad.).

The last stop in the state was in Brown County at Ellsberry. The snails that were collected here all came from grass which had been piled beneath a honey locust. This was the largest collection made in the state on this trip. Of particular interest among the species collected was a series of *Triodopsis tridentata discoidea* (Pils.). Like the other reported localities for the occurrence of *T. t. discoidea* this locality is in the valley of the Ohio River itself. This is an eastward extension of the known range of the subspecies which has been found from Cincinnati (type locality) westward along the Ohio River Valley to the Mississippi River. (Cf. Pilsbry, Land Moll. of N. Amer., Vol. 1, Pt. 2: 799, 1940.) Other species collected were *Stenotrema fraternum* (Say), *Mesodon thyroidus* (Say), *M. mitchellianus* (Lea), *M. pennsylvanicus* (Green), *M. appressus* (Say), *M. inflectus* (Say), *Triodopsis albolabris* (Say) which lacked the parietal tooth, *Haplotrema concavum* (Say), *Ventridens ligera* (Say), *Anguispira alternata* (Say) which were similar to those from Adams County, *Gastrocopta armifera* (Say) and *Pupoides albilabris* (C. B. Ad.).

MOLLUSCA OF THE EASTERN BASIN OF THE CHACO RIVER, NEW MEXICO

By ROBERT J. DRAKE

Department of Anthropology, University of New Mexico

An assemblage of land and freshwater shells has been obtained from the drift of the eastern tongue of the Chaco River, at Pueblo Bonito, Chaco Canyon National Monument, San Juan County, New Mexico. Collections were made in October of 1946, and April, June, July, August and October of 1947, in conjunction with archeological survey and excavation programs of the Department of Anthropology of the University of New Mexico. Most of the collection was made during the University Anthropology Field Session in the summer of 1947.

This collection of fifteen forms is significant in that the dead shells had lived in the enclosed basin of the eastern tongue of the river. Biotic provinces are represented in this area by the Upper Sonoran Life Zone (4000/5000 to 7000/8000 feet), and Dice's Navahonian Province, the latter a more geographic biome. The Continental Divide is at the eastern edge of the basin from 7500 to 8000 feet elevation. The source of the eastern tongue of the Chaco is (at ca. 7500 feet elevation) about 45 miles from Pueblo Bonito, and this large ruin is at ca. 6000 feet.[1]

The climate of the eastern tongue of the Chaco is normally cold desert, bordering on steppe (BWkfw, near BSkfw, following the Koeppen system of climatic determination). Seven or eight years out of ten are apparently desert years in precipitation. The mean average per year for rain is 8.18 inches. Adjoining mesas bordering the canyon are probably steppe as the canyon only lacks an average of one inch more rain a year to be entirely steppe.[2]

The rainy season for the area is from July to September. The Chaco is intermittent, flowing during the last of the rainy

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[1] Fisher, Reginald G., 1934, University of New Mexico Bulletin, Archaeological Series, Vol. 3, no. 1, p. 19. Some geographic factors that influenced the ancient populations of the Chaco Canyon.

[2] Brand, Donald D., Florence M. Hawley, Frank C. Hibben, *et al.*, 1937, University of New Mexico Bulletin, Anthropological Series, Vol. 2, no. 2, pp. 44, 45. Tseh So, a small house ruin, Chaco Canyon, New Mexico.

seasons, and following springtimes, when the high mountain snow deposits are melting. Some of the drift is at various levels, probably representing deposition when the raging torrent was higher or lower according to the amount of water concentrated in the arroyo normally from rain or during flash floods. As with drift I have collected from the Rio Grande and Rio Puerco systems in New Mexico, the Uncompahgre, Slate, and Gunnison systems in Colorado, and the Florido and Concho systems in Chihuahua, shells in concentrated deposits of rejectamenta apparently represent colonies of one form or fairly homogenous groupings of several landshell forms. Pupillidae and Vallonidae have been especially noticed in this respect.

Dead landshells of forms from the Chaco drift were observed on surfaces of ruins and anthills in the canyon and in dry clumps of vegetation at springs and seeps on the rimming mesas.

The vegetation of the canyon floor is mostly piñon pine, juniper, and shrubs (sagebrush, cacti, yucca, greasewood, rabbitbrush, and shadscale). Alder, cottonwood, walnut, and box elder grow inside canyons.

In the higher altitudes are found western yellow (or ponderosa) pin, spruce, oak, serviceberries, wild rose, occasional sagebrush and rabbitbrush, and very abundant herbs and grasses.[3]

Fifteen forms of gastropods discovered in the basin of the eastern tongue of the Chaco River are:

Gastrocopta pellucida hordeacella (Pilsbry)
Hawaiia minuscula (A. Binney)
Hawaiia minuscula alachuana Dall
Pupilla cf. *blandi* Morse
Pupilla hebes (Ancey)
Pupoides hordeacus (Gabb)
Pupoides albilabris (C.B.Ad.)
Succinea grosvenorii Lea
Vallonia cyclophorella Ancey
Vallonia gracilicosta Reinhardt
Vertigo ovata (Say)
Fossaria parva (Lea)
Gyraulus circumstriatus (Tryon)
Helisoma tenue cf. *sinuosum* (Bonnet)
Stagnicola bulimoides cockerelli (Pilsbry and Ferriss).

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[3] Elmore, Francis H., 1943. University of New Mexico Monograph Series, Vol. 1, no. 7, pp. 10, 11. Ethnobotany of the Navajo.

Pupilla cf. *blandi* Morse is represented by only two specimens. They were sent, in September of 1947, to Dr. S. S. Berry, Redlands, California, who examined them and commented: ". . . at present I can do no better than call [them] *Pupilla* cf. *blandi* Morse, although there are manifest differences, notably that it is very small for *blandi*, and the palatal tooth is too small and does not penetrate. It is about the size of *P. sonorana* (Sterki), but is too chunky, more truncate in front, and has too small teeth for that."[4] It is hoped more collecting will provide additional specimens of this aberrant form for study.

One specimen of *Helisoma* was found. It is certainly *tenue* and probably variety *sinuosum* (Bonnet). I have done a considerable amount of work recently with *H. tenue* and varieties, from New Mexico and Chihuahua, and have found great tendency for some specimens of a colony of *sinuosum* or *pertenue* F. C. Baker[5] to go toward *tenue* (Philippi) s. s. Dr. J. P. E. Morrison states that many lots of varieties of *H. tenue* from northern Mexico in the U. S. National Museum likewise exhibit this characteristic.[6] The *H. tenue sinuosum* (Bonnet) found at Albuquerque, New Mexico, however, is quite typical of the variety, and is illustrated as such in F. C. Baker's monograph on the Planorbidae.[7] Again, further collecting in the Chaco should make additional *Helisoma* available for study.

It is unfortunate that no representatives of the Physidae or Sphaeriidae were found in Chaco Canyon, as the peculiarities of members of those families are exceedingly little known in New Mexico and the Southwest.

Sincere thanks go to the many archeologists and anthropology students who helped with the Chaco collecting (and tedious sorting) of drift. To one of the former, Mr. Lloyd M. Pierson, Jr., goes special thanks. Being gifted with the collector's instinct, Mr. Pierson became a convert to field snailing and gave me much help during our University's archeological expedition to south-

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[4] Letter, dated 13 October, 1947.

[5] *H. tenue pertenue* F. C. Baker represents a change in name for the preoccupied common northern Mexican *P. tenuis applanatus* Martens. Baker, Frank, C., 1945, The Molluscan Family Planorbidae, p. 149.

[6] Letter, dated 26 November, 1947.

[7] Baker, 1945, The Molluscan Family Planorbidae, pl. 98, fig. 15.

eastern Chihuahua in August and September of 1947. In fact, he collected the only lot of *Oreohelix* found during our trip.

Mr. Gordon K. MacMillan, Dr. Wendell O. Gregg, and Dr. S. S. Berry have been kind enough to examine the Chaco material and make most of the determinations.

Chaco duplicates have been deposited in the collections of W. O. Gregg, S. S. Berry, W. J. Eyerdam, C. L. Blakeslee, M. K. Jacobson, the Academy of Natural Sciences of Philadelphia, the U. S. National Museum, the California Academy of Sciences, the University of Michigan Museum of Zoology, the Chicago Natural History Museum, the Carnegie Museum, the Museum of Comparative Zoology, and the Allan Hancock Foundation of the University of Southern California. Examples of all forms are in my collection and are available for examination by conchologists.

A NEW JAPANESE LIMPET

By JEANNE S. SCHWENGEL

Acmaea langfordi n. sp. Plate 6, figs. 1, 1a–1c.

Shell small, oblong-ovate, elevated, apex near the front third. Surface dull, greyish white, having 14 to 18 slightly noduled, heavy ribs which extend into points beyond the margin. There are shorter ribs between these, beginning at the denticulated margin and disappearing before they reach the apex. The more adult shells are completely covered with calcareous growth, which more or less obscures the sculpture between the ribs, which consists of very strong, irregular growth lines, especially evident in the younger specimens. The interior ranges from a creamy tint to a dark brown, with the central callus either well defined with a line of brown, or entirely dark brown. The inner margin is marked with brown spots between the ribs, which are indented.

Length 14 mm., width 10.8 mm., altitude 5 mm. Paratype.

Length 12-1/2 mm., width 10-1/2 mm., altitude 4-1/2 mm. Type.

Length 10 mm., width 8 mm., altitude 4 mm. Paratype.

The Type A.N.S.P. No. 185109, and Paratype No. 185110

were collected at Chikura, Japan, in 1935, by Daniel B. Langford, for whom the shell is named.

This shell somewhat resembles *Acmaea heroldi* Dunker. It is somewhat narrower, the ribs are much heavier and it has no bluish cast in the interior, but is consistently of the brown tones. It resembles more *Acmaea corticata* Hutton, of New Zealand, though it is a heavier and darker shell.

NOTES ON THE POLYGYRIDAE OF NORTHERN ARKANSAS

By LESLIE HUBRICHT

During 1942 the author made two trips to Calico Rock, Arkansas and vicinity to collect *Polygyra peregrina* and *Mesodon clenchi* which were then known only from that locality. This paper is a report on the more interesting species found plus a few records from earlier trips into northern Arkansas.

POLYGYRA PEREGRINA Rehder

Izard Co.: bluffs, just south of Calico Rock; talus (recent), 4 miles south of Calico Rock. Stone Co.: talus (Pleistocene), north of Sylamore. Marion Co.: Stair Bluff, opposite Buffalo; bluff along Crooked Creek, 1.7 miles north of Rea Valley.

Found living in large numbers under rocks on talus slopes at the bases of limestone or dolomitic bluffs.

STENOTREMA BLANDIANUM (Pilsbry)

Izard Co.: talus (recent), 4 miles south of Calico Rock. Stone Co.: talus (Pleistocene), north of Sylamore. Marion Co.: bluff along Crooked Creek, 1.7 miles north of Rea Valley.

This species had not previously been reported from Arkansas.

MESODON CLENCHI (Rehder)

I did not find this species at Calico Rock. In 1936, I saw what at the time I thought were fragments of *Allogona profunda,* in the talus north of Sylamore, Stone Co., but which were undoubtedly this species. Later, near Greenville, Wayne Co., Missouri, I found and later lost a single shell that was possibly this species.

MESODON EDENTATUS (Sampson)

Izard Co.: talus (recent), 4 miles south of Calico Rock. Marion Co.: Stair Bluff, opposite Buffalo. Newton Co.: ravine, 12 miles south of Jasper.

Dr. Pilsbry in his "Land Mollusca of North America" treats this species as a variety of *M. inflectus*. However, at the first two localities cited above the two species occur together and *M. edentatus* can be readily separated not only by its smaller teeth but by its much larger size.

TRIODOPSIS OBSTRICTA OCCIDENTALIS (Pilsbry & Ferriss)

Stone Co.: talus (Pleistocene), north of Sylamore.

NEW SPECIES OF ISOMERIA AND HELICINA

BY H. A. PILSBRY

ISOMERIA ANESTIA, new species. Plate 6, figs. 4, 4a, 4b.

The shell is rather solid, imperforate, depressed, biconvex, with bluntly subangular periphery. Color uniform brown (the shade uncertain, as all seen are "dead" shells). The whorls are weakly convex, of slow increase, behind the aperture the last is about equal in width to the penult whorl; it descends rather steeply in front and is contracted a little behind the peristome. The first 1½ whorls are smooth; following whorls have rather coarse and low retractively radial wrinkles, and a very minute sculpture of close, wavy wrinkles (sometimes cut by a few irregular, short impressed spiral lines). The oblique aperture is somewhat trapezoidal, the peristome reflected and a little recurved at the edge, the upper and basal margins nearly straight and parallel, the outer margin regularly curved, and on its inner face bearing a long but rather low tooth, which is higher at the lower end and slopes to the low upward end (or in some specimens the middle part is concave, forming a double tooth, fig. 4b). The parietal callus is thin and toothless.

Height 18 mm., diameters 35.5 and 29.3 mm., barely 5 whorls. Type.

Height 17.3 mm., diameters 33 and 28 mm., 4.8 whorls.

Peru? Type and paratypes 184497 ANSP.; others of the same lot are No. 112 Museo Historia Natural, Lima, without known locality or collector.

This species is quite different from all others known to me, by the shape of the tooth within the outer margin of the peristome. The micro-sculpture is also characteristic. It should be recognized easily by these characters when found again; otherwise I would not describe unlocalized specimens.

ISOMERIA ANODONTA, new species. Plate 6, fig. 3, 3a.

The shell is somewhat depressed with angular periphery, rather solid, dark brown. The spire is rather strongly convex, of very slowly increasing whorls, the last abruptly descending in front and with angular periphery, the angle nearly disappearing near the aperture. The base is convex, with deep, cylindric umbilicus, which becomes wider in the last half turn; measured behind the lip its width is contained about six times in the diameter. The aperture is strongly oblique, somewhat trapezoidal. Peristome rather narrow, light brown, reflected, its face convex, toothless, the margins remote, connected by a straight, thickened parietal callus.

Height 21 mm., diameters 39.5 and 33 mm.; 4¾ whorls.

Chaupo, at 6000 ft. elevation, province of Jaen, Department of Cajamarca. Type 165202 ANSP., collected by M. A. Carriker, 1933.

As the type is a "dead" shell, somewhat corroded by weathering, the minute sculpture, if any, cannot be made out. It appears to be nearly smooth. It does not seem to be nearly related to *I. continua* (Pfr.) or to any of the other toothless species of *Isomeria*.

HELICINA ACOBAMBENSIS, new species.

The shell is white with scattered streaks and dots of gray on the last 2½ whorls; the height about 62 percent of the diameter, the spire conic with slightly projecting apex, the rounded last whorl weakly angular at periphery, base convex. Sculpture of faint growth lines, and above the periphery there are fine spiral striae. The oblique aperture is semicircular; the peristome slightly expanding, thickened within, with a projecting angle at the junction with the columellar margin. The axial callus is rather large and quite thick.

Height 3.65 mm., diameter 5.9 mm.; 4⅓ whorls.

Acobamba, north of Tarma, Peru, 3900 meters elevation. Type 180003 ANSP.

This species has a more convex base than *H. psorica* Morelet, and the aperture is of quite different shape.

HELICINA CHIONEA, new species.

The shell is white with a few inconspicuous streaks or small spots of gray, solid and strong, the height about 70 percent of the diameter, the spire conic, apex a trifle projecting, the periphery narrowly rounded or indistinctly subangular, base convex. Sculpture of indistinct lines of growth and traces of impressed spirals, chiefly on the upper surface of last whorl (or in some specimens such spirals are not visible); there is also some weak malleation. The oblique aperture is widely semicircular. Peristome expanded outwardly and at base, with the face built forward, strongly thickened, rounded or quite bluntly angular where it joins the columellar margin. Axial callus roughened, small but thick.

Height 5.3 mm., diameter 7.5 mm.; 4⅓ whorls.

Mejorada, near Huancayo, Peru, 2600 meters elevation. Type and paratype 180005 ANSP.

This species is somewhat larger than *H. acobambensis,* with far thicker lip and less spiral sculpture.

HELICINA HUACAPISTANA, new species.

The shell is cartridge buff with nearly white apex, moderately solid, the height nearly three-fourths of the diameter, the spire conic, periphery bluntly angular, the base convex. Whorls 4½, very weakly convex. Sculpture of fine, weak wrinkles of growth, with well impressed spaced spiral grooves on the upper surface, about six above the periphery on the last whorl, and much finer numerous spirals over much of the base, but not extending to the center. The oblique aperture is rather wide, the peristome reflected, thickened within and on the convex face, which is slightly lighter in tint than the outside of the shell. The axial callus is white, rather small. Parietal callus thin and transparent.

Height 6.7 mm., diameter 9.2 mm.

Huacapistana, Peru, at 1800 meters. Type 180004 ANSP.

NOTES AND NEWS

FUSINUS SPECTRUM (Adams & Reeve), A NEW RECORD FOR THE GULF OF MEXICO.—This beautiful shell, illustrated on Plate 6, fig. 2, was recently presented to the Academy of Natural Sci-

ences by Pearl M. Lane, in memory of Sidney Hunter, of Pass-a-Grille. It was collected by Dewey Pastrikos, a diver, about twenty-five miles off Tarpon Springs, Florida.—JEANNE S. SCHWENGEL.

THE COLLECTION OF THE MARQUIS DE MONTEROSATO.—This famous collection was purchased about 1927 by V. Beltrani of Palermo, Sicily, who had also a very fine world-wide collection. After the death of Beltrani, the Monterosato-Beltrani collection was purchased by the Municipality of Rome and is now deposited in the Zoological Museum of Rome. It was moved from Palermo to Rome during the early years of the war, under the supervision of Dr. Giovanni Giorgi who is now in charge of this very important collection. The Marquis de Monterosato was one of the foremost Italian paleontologists and had built up a very large collection of mollusks, both recent and fossil. An obituary of the Marquis de Monterosato and a list of his publications were published by H. Crosse in the Journal de Conchyliologie, 1928, 72, pp. 69–73.—W. J. CLENCH.

THE LOST TYPE OF OBOVARIA DEPYGIS (CONRAD).—In the American Journal of Conchology (1866, 2, p. 107, pl. 10, fig. 1) Conrad described *Obovaria depygis* from the Harpeth River, Tennessee. This species was founded on a single specimen in the collection of W. H. DeCamp of Grand Rapids, Michigan. DeCamp's collection went to the Grand Rapids Public Museum, which was in turn given to the University of Michigan and the Museum of Comparative Zoölogy, Cambridge, Massachusetts. The Museum of Comparative Zoölogy is in possession of DeCamp's original label which says: "Type specimen and only one found by me." Unfortunately, the specimen was not with the label; therefore an example from the type locality will have to be selected as a neotype by a subsequent author.—RICHARD I. JOHNSON.

NOTE ON THE NOMENCLATURE OF TWO MARINE GASTROPODS FROM THE GALAPAGOS ISLANDS.—During the course of work dealing with tropical West American mollusks we have noticed that the combination of names *Pleurotoma bicolor* Sowerby (Proc. Zool. Soc. London for 1833, p. 135, issued April 16, 1834. "Found under stones at Panama, and dredged from a sandy

floor at a depth of eight fathoms at the Gallapagos Islands.''—Reeve, Conch. Icon., Vol. 1, *Pleurotoma,* 1843, species 40, pl. 6, fig. 40) had already been used for a Mediterranean species by Risso (*Pleurotoma bicolor* Risso, Hist. Nat. l'Europ. Mérid., Vol. 4, 1826, p. 214). The name *Monilispira ochsneri* is here proposed for *Pleurotoma bicolor* Sowerby, 1834, and is based upon a new type (Holotype, No. 9426, height, 16.5 mm., maximum diameter, 6.4 mm., and Paratypes Nos. 9427, 9427a, Calif. Acad. Sci. Dept. Paleo. Type Coll.) from Chatham Island, Galapagos Islands, collected by W. H. Ochsner, 1906.

It seems desirable to call attention to the fact that *Drillia roseobasis* Pilsbry & Vanatta (Proc. Washington Acad. Sci., Vol. 4, September 30, 1902, p. 558, pl. 35, fig. 2. ''From Tagus Cove, Albemarle'') was later renamed *Pleurotoma roseotincta* by Dall (Proc. U. S. Nat. Mus., Vol. 54, No. 2238, April 5, 1918, p. 333), due to an earlier *Pleurotoma* (*Drillia*) *roseobasis* E. A. Smith (Ann. & Mag. Nat. Hist., Ser. 6, Vol. 2, No. 10, October, 1888, p. 301. ''Hab.—?''). The name *roseotincta* being preoccupied, the new name *Pleurotoma testudinis* was given by Pilsbry & Vanatta (Nautilus, 36: 132. 1923). *Pleurotoma albicostata* Sowerby (Proc. Zool. Soc. London for 1833, p. 135, issued April 16, 1834. ''Hab. ad Insulas Gallapagos.'' ''A very elegant small species, found in fine coral sand at a depth of six fathoms.''—Reeve, Conch. Icon., Vol. 1, *Pleurotoma,* 1843, sp. 62, pl. 8, fig. 62), from the Galapagos Islands, was described as possessing sculpture and coloration similar to that of the species described by Pilsbry & Vanatta.—L. G. Hertlein and A. M. Strong.

Drillia roseobasis (= *Pleurotoma testudinis* P. & V.) and Pleurotoma albicostata (Sowerby).—The definitions of these snails seem to differ so much that their specific identity is doubtful. The former is strongly compressed around the upper part of the last whorl while Reeve's figure of *albicostata* shows no trace of compression there. The shape of the aperture differs, as it is much narrower anteriorly in *roseobasis* than in *albicostata.* The latter is a larger and narrower shell, measuring, length 0.9, width 0.3 inch (about 22.5 × 7.5 mm.), of 9 whorls, while *roseobasis* (*testudinis*) with 10 whorls measures, length 13.5 × 5.2 mm. These differences may be thought to be

individual variation of one species, but although their coloration is similar, I think that further collections are needed to demonstrate the identity suggested in the preceding note.—H. A. PILSBRY.

DIRECTORY OF CONCHOLOGISTS: We wish to make our annual list of persons and institutions interested in the collection or study of mollusks as complete and with as few errors as possible. Former editions have listed many with the most casual of interests. It has been our custom heretofore simply to mail out the directory on approval to those whom we think it might interest. Next year we propose to mail *only* to those who have ordered it. There is no obligation to order a copy of the directory, but in any event we wish to put your correct name and address with your special interests on our list. We will continue our plan of following each name with the numbers based on the following table, but you are invited to give us your special interests if not fully covered by this table.

1, Worldwide sea shells. 2, Pacific coast shells. 3, Atlantic coast shells. 4, land shells. 5, fresh water shells. 6, buy shells. 7, sell shells. 8, exchange shells. 9, buy books. 10, field collecting. 11, marine life in general. 12, fossil shells.

The booklet is announced for delivery in January at $1.50. Those wishing a copy are asked to register and order it now as we plan to print only a few more than the orders on file.—JOHN Q. BURCH, 4206 Halldale Ave., Los Angeles 37, Calif.

CYLINDRONENIA, A NEW SUBGENUS OF NENIA.—Gehäuse immer dekolliert, mit mehr oder weniger niedrigen Umgängen, letzter Umgang wenig verschmälert, nur schwach halsartig ausgezogen. Basis mit 2 schwachen Kielen oder gerundet. Naht wenig eingetieft, teilweise wellig oder krenuliert. Spirallamelle meist von aussen seitlich in den hintern Teil der Oberlamelle einlaufend. Unterlamelle bei vertikalem Einblick in die Mündung grossenteils sichtbar, schräg bogig oder S-förmig aufsteigend. Clausilium am Ende mehr oder weniger scharf zugespitzt, mit der Spitze in die Lücke zwischen den enden von Lunella und Subcolumellaris eingreifend. Schalen oberfläche glanzlos, wie weissgrau bereift, mit dichtstehenden, sehr feinen flachen Rippenstreifchen besetzt. Genotypus: *Clausilia maranhonensis* Albers.—P. EHRMANN, MS.

MONTEREY MOLLUSCA: CORRECTIONS.—*Turbonilla* (*Bartschella*) *bartschi* Smith & Gordon, Proc. California Academy of Sciences, 4th ser., vol. 26, no. 8, Dec. 15, 1948, pp. 222–223, pl. 24, fig. 13, being preoccupied by *T.* (*Careliopsis*) *bartschi* Aguayo & Rehder, Mem. Soc. Cubana Hist. Nat., vol. 9, 1936, p. 267, pl. 24, fig. 7, from La Chorrera, Habana, Cuba, the former species may take the new name *T.* (*Bartschella*) *bartschiana* Smith & Gordon. We are indebted to Dr. L. G. Hertlein for calling our attention to the fact that our species name is a homonym, as originally used.

Dr. A. Myra Keen has pointed out that *Retusa* (*Sulcularia*) *montereyensis* Smith & Gordon, described on pp. 217–218, pl. 3, fig. 11 of the same paper, should be cited as *Sulcoretusa montereyensis* (Smith & Gordon). As *Sulcularia* Dall, 1921 (USNM Bull. 112, pp. 61, 202) is a homonym of *Sulcularia* Rafinesque, 1831, Burch has proposed the genus name *Sulcoretusa* as a replacement, which we accept as valid. For a discussion of the applicable taxonymy, see Proc. Conch. Club of Southern California (John Q. Burch, editor), Minutes, No. 47, p. 16, April, 1945. We appreciate the opportunity of making these corrections.—ALLYN G. SMITH & MACKENZIE GORDON, JR.

AESTIVATION IN HELMINTHOGLYPTA TRASKII PHLYCTAENA (BARTSCH).—One active *Helminthoglypta traskii phlyctaena* (Bartsch) was collected in September of 1947 in Ventura, Ventura County, California. The snail was placed in a penny match box in Ventura and was carried in a watch pocket up the coast to Oakland, California. During the trip the snail formed two epiphragms and aestivated. The snail was placed in a desk drawer and was observed from time to time to November, 1948. At no time did it come out of aestivation; on November 20, 1948, the snail was placed in a terrarium with lettuce. No apparent effort was made to break out of the epiphragm for three days, and I thought that the snail had died. However, on the fourth day, the snail broke the epiphragm after a year of aestivation and fed weakly on the available lettuce. It made no effort to leave the food supply for four days after emerging; it laid on the lettuce with the body limp and extended. On the fifth day after breaking the epiphragm, the

feeding snail gained strength and crawled at random about the terrarium.—WILLIAM MARCUS INGRAM.

PUBLICATIONS RECEIVED

THE MOLLUSCA OF THE NIAGARA FRONTIER REGION, by Imogene C. S. Robertson and Clifford L. Blakeslee. (Bull. Buffalo Soc. Nat. Sci., vol. 19, no. 3, xi + 191 pp., 18 plates, text figures and map.) The area covered by this handbook is the region within about fifty miles of Buffalo, nearly all within the St. Lawrence drainage, but comprising also the headwaters of some streams of the Mississippi system. Two hundred and thirty-eight species and subspecies are considered, but this includes a number of doubtful records not verified by the authors, and others of uncertain standing. Even with these eliminated, the number is remarkable for that latitude, being far beyond any area of similar size in New England or eastern Pennsylvania. The species are all described and nearly all illustrated on 18 handsome plates. Chapters on where and how to collect and on collecting sites in the region are given; that on collecting sites of the present time will be of permanent value to all future collectors in the region. The volume concludes with a history of the Conchological Section of the Buffalo Society by Mrs. Robertson. It was organized by Elizabeth Letson (afterward Dr. Elizabeth Letson Bryan) in 1897, and is still going strong. In malacology, where the information on mollusks of any locality is scattered through many volumes, such handbooks as this are of great utility in introducing an absorbing subject for pastime or study.—H. A. P.

THE WEST INDIAN MARINE SHELLS, by H. Krebs (1864). Republication by W. J. Clench, C. G. Aguayo and R. D. Turner; with remarks, a portrait, and a brief account of the life of H. Krebs. (Extracted from Revista de la Soc. Malac. "Carlos de la Torre"). Krebs' work is a very rare publication. There are copies in the Museum of Comparative Zoology and the National Museum, which came from Thomas Bland, and Robert Swift's copy in the Academy of Natural Sciences, which contains an autograph letter of gift from Krebs. It would be

interesting to hear whether any others are in American libraries. It is valuable for the many records, especially those from the Virgin Islands and southward, which this reprint will make generally available.—H. A. P.

SHELLS AND SHELL COLLECTING. By the Long Beach Shell Club, Long Beach, California. This is a collection of about 25 papers by members and friends of the club, covering many sides of their zoological and collecting activities. It includes a history of the club by Julia Ellen Rogers, and an account of the geology of Deadmans Island by Effie M. Clark, among other interesting articles. Edited by Mrs. Mary Bormann.—H. A. P.

THE MARINE MOLLUSKS AND BRACHIOPODS OF MONTEREY BAY, CALIFORNIA, AND VICINITY. By Allyn G. Smith and Mackenzie Gordon, Jr. (Proc. Cal. Acad. Sci. 26, pp. 147–245, 2 plates, 1948). Mollusk collecting in Monterey Bay goes back to 1774, and since 1835, when Thomas Nuttall collected there, a long list of collecting expeditions and conchologists visited that famous locality, down to the present day. An account of these is followed by information on the physical features of the region, and the species of commercial importance (that on the abalone fishery being especially interesting). The checklist of species contains no less than 732 species and subspecies of known occurrence,—a remarkably large number for a temperate fauna, and reasons are given for regarding 80 other recorded species (listed in square brackets) as of doubtful occurrence. Eighteen species are described as new and figured.

The nomenclature as a rule is brought well up to date, but we object to the use of *Purpura* Martyn (p. 188), and *Volvulella* Newton (p. 179), an unlawful change of *Volvula*.

This census of mollusks of a region classic in California conchology gives evidence of a great deal of careful study. It is an important addition to the molluscan literature of the West Coast.—H. A. P.

FOSSIL AND LIVING PUPILLIDAE IN KANSAS, by Dorothea S. Franzen and A. Byron Leonard. (University of Kansas Science Bulletin, vol. 31, no. 15. 1947.) 100 pp., 6 plates, 15 figs. in text, mapping distribution. In this critical study the five genera and 33 species and subspecies now known from the

state are described and figured, and their geographic and geologic distribution and ecologic relations are discussed. Two genera *Pupilla* and *Columella,* and 18 species are known in Kansas only as Pliocene to Pleistocene fossils. *Gastrocopta rexroadensis* and *G. paracristata* from the Blancan formation (uppermost Pliocene or later) of Meade Co. and *G. anteridens* from the Laverne formation (Lower Pliocene) are described as new. There is a pronounced faunal break between the Blancan and the Lower Pleistocene Meade formations. Two forms of *Gastrocopta procera* (*G. p. mcclungi* and *G. p. sterkiana*), which have formerly been admitted as subspecies, were found to intergrade so fully in many places that they are relegated to synonymy. *Pupoides hordaceus* (Gabb) is reported living in Reno Co. and Upper Pleistocene in Meade Co., a very considerable extension of its range.—H. A. P.

Procedure in Taxonomy, including a reprint, in translation, of the International Code of Zoölogical Nomenclature, with titles of and notes on the Opinions rendered to the present date (1907 to 1947). By Edward J. Schenk and John H. McMasters, 1936, Revised edition enlarged and in part rewritten by A. Myra Keen and Siemon William Muller, 1948. Stanford University Press, Stanford, California. $2.50. Everyone whose work is concerned with genera and species will have frequent use for this handbook of taxonomic methods. Being fully indexed, it simplifies the solution of many a perplexing problem in nomenclature. It is a most useful manual of the subject for the expert, and a well-nigh indispensible guide for the beginner in systematic zoölogy.—H. A. P.

THE AMERICAN MALACOLOGICAL UNION

The fifteenth annual meeting of the American Malacological Union will be held at the University of Miami, Miami, Florida, June 16 to 19 inclusive. The University dormitories will be available at moderate rates which will be announced later. There will be collecting trips on shore and by boat from the Marine Laboratory under the direction of Dr. F. G. Walton Smith, Director of the Laboratory.

Please send titles of papers and approximate time required to the Secretary, Mrs. Harold R. Robertson, 136 Buffum Street, Buffalo 10, N. Y.

THE NAUTILUS

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A NEW SPECIES OF OREOHELIX, SUBGENUS RADIOCENTRUM, FROM SOUTHEASTERN CHIHUAHUA

By ROBERT J. DRAKE

Department of Anthropology, University of New Mexico

During August and September of 1947, it was my fortune to be a member of the University of New Mexico Department of Anthropology archeological expedition to the river valleys and desert bolsons of southeastern Chihuahua. Although the purpose of the expedition was primarily to discover artifacts and to make a survey of sites of early man, I had much opportunity to collect recent shells. Through the help of the director and members of the expedition, over 100 lots of non-marine mollusks were added to my collection.

Interesting variation and ecological data, and new distribution records for the area are in evidence. There is one new species, the *Oreohelix* here described, and there are several probably new Urocoptidae, all apparently *Holospira*. As time permits, I am preparing this material for publication and distributing duplicates to those institutions and conchologists especially interested in the non-marine Mollusca of Mexico.

A short résumé of the archeological results of the expedition has been published elsewhere by the director.[1] During April of 1948, and during extreme drought conditions, I returned to the region to attempt to find live specimens of the new *Oreohelix*. In this I was unsuccessful, but was fortunate in obtaining living *Succinea* and many pond forms not secured alive in 1947.[2] During the last week in November of 1948, six of us

[1] Reiter, 1948: 273.

[2] A short epistle account of this trip appeared in *Minutes* of the Conchological Club of Southern California, No. 80: 4–5, May–June, 1948.

from the department of anthropology, and all members of the 1947 expedition, again returned to southeastern Chihuahua for a quick archeological survey; mainly to rework early man sites in the bolsons. No *Oreohelix,* alive or dead, were found, but excellent dead series of what might be topotypes of the several probably new urocoptids were obtained. The time of the last 1948 trip was also very dry.

The 1947 and 1948 University of New Mexico expeditions were under the direction of Dr. Paul Reiter, professor in the department of anthropology, to whom thanks are given for his coöperation with my conchological interests. Thanks also go to the student members of the 1947 and 1948 expeditions for their help in collecting. The photographing of the holotype and descriptional paratype of the new *Oreohelix* by Mr. Boyd Wettlaufer, anthropology student of the University of New Mexico, is gratefully acknowledged. Dr. Henry A. Pilsbry very kindly provided photographs of his recent two new species of *Oreohelix* from Chihuahua as well as page proof of his 1948 paper describing them. Further work in the very near future has been planned for investigating the archeology, biology, conchology, and other geographical factors of Chihuahua and other states of northern Mexico by faculty members and some students of the universities of New Mexico and Texas.

OREOHELIX (RADIOCENTRUM) ALMOLOYA, **new species.** Pl. 8.

Holotype: Relatively small for genus and a little under average size for subgenus. Lenticular, flattened above, moderately convex below. Umbilicus wide, contained in the diameter of the shell about five times. Whorls 5, pinched-out with pronounced keel, flattened, and extremely carinate—carination en chevron. Aperture sub-triangular and standing at an angle of about forty-five degrees with the vertical axis of the shell. Apical whorl having embryonic rib sculpture which abruptly gives way to less oblique but still slanting striations. Size: height, 5 mm.; diameter, 14 mm. The species is named after the small mountain range including the type locality, the Sierra de Almoloya. The holotype (A. N. S. P. No. 185106) was collected on 19 August 1947 by Lloyd M. Pierson, Jr. Even though the rainy season was on, no live snails were found at the type locality. The type lot was accompanied by an unknown *Holospira* and *Bulimulus dealbatus ragsdalei* Pilsbry.

Type locality: Rocky cacti and bush covered hillside in the steep foothills of the Sierra de Almoloya within a five-mile radius northwest of Cueva Diablo. This "Cave of the Devil" is a limestone sink located two miles due northwest from the small village of Salaices, Distrito Jiménez, Chihuahua. Salaices lies southwest toward Parral approximately 19 miles from Jiménez, at about Lat. 105°02′50″, W., Long. 27° N. A newly paved highway skirts the southern hills of the Sierra de Almoloya a few hundred feet south of Cueva Diablo. An unchecked altimeter reading at the floor of Cueva Diablo, in November of 1948, gave an elevation of 100 feet less than 1 mile above sea level. The type locality is several hundred feet higher than the general elevation of Cueva Diablo.

Paratypes: The descriptional paratype (pl. 8) is conically higher than the holotype and slightly more compactly coiled and a bit smaller. Otherwise, it is very close to the holotype—as are all the paratypes. Only nineteen bones of *Oreohelix almoloya* were collected with the holotype. These paratypes have been distributed as follows: Wendell O. Gregg Collection, 4319; Ernest J. Roscoe Collection, 238; S. Stillman Berry Collection, 14500; California Academy of Sciences Department of Paleontology, 32590; U. S. National Museum Division of Mollusks, 590513; Carnegie Museum Section of Recent Invertebrates, 62.39826; Drake Molluscan Collection, 629; and Academy of Natural Sciences of Philadelphia, 185107.

Discussion: *Oreohelix almoloya* exhibits strong shell shape and sculptural affinity to two other described *Radiocentrum: Oreohelix chiricahuana* Pilsbry and especially *O. chiricahuana percarinata* Pilsbry and Ferriss, both southern Arizona forms.[3] It is generally flatter than *O. chiricahuana percarinata* but exhibits the same degree of keeling on the periphery of the body whorl. The keel is as fully pronounced as that of *Oreohelix handi* Pilsbry and Ferriss,[4] from Nevada, which is of the *O. yavapai* group and therefore not a *Radiocentrum.* In the specimens of *almoloya* available for study at this time, there is no evidence that the species has any cuticular appendages, as some other species of *Radiocentrum* have. Both previously

[3] See Pilsbry, 1939: 548, 551–552.

[4] See Pilsbry, *loc. cit.:* 534–535.

described species of *Oreohelix* from Chihuahua, *O. caenosa* Pilsbry and *O. labrenana* Pilsbry, have cuticle.

Without any animal material available, the apical ribbing and general shell shape and size, with the geographical locality, is sufficient to locate *Oreohelix almoloya* in the subgenus *Radiocentrum.* When live and preserved specimens are available, the subgenus characteristics of club-shaped penis and equality in length of penis and epiphallus will probably be present.[5]

All *Oreohelix* from Mexico described have proven to be of the subgenus *Radiocentrum.* Recently H. A. Pilsbry described *Oreohelix caenosa* and *O. labrenana* from northwestern Chihuahua, from material he collected in 1935.[6] This brings the total number of *Radiocentrum,* counting the present new species, to eight. Five, with their varieties, are found in California, Arizona and New Mexico. The other three are Chihuahuan. As Pilsbry predicted in 1939, other radiocentrums will undoubtedly be found in northern Mexico, especially in Sonora and Chihuahua; and, I think, perhaps even in the mountains of northern Durango.

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Reiter, Paul. 1948. The Southwest. American Antiquity, Vol. 13, No. 3, Notes and News. Menasha.

[5] See discussion of the subgenus *Radiocentum* in Pilsbry, 1939: 540.

[6] Pilsbry, 1948: 198–199.

THREE NEW SOUTH AMERICAN LAND SNAILS (STROPHOCHEILUS, THAUMASTUS, DRYMAEUS)

By JOSEPH C. BEQUAERT

Museum of Comparative Zoology, Cambridge, Mass.

STROPHOCHEILUS (MEGALOBULIMUS) LEUCOSTOMA WEYRAUCHI, **new subspecies.** Plate 7, figs. 1–4.

Averaging smaller and in proportion wider at the body-whorl and in the spire than typical *S. leucostoma* (Sowerby). Regularly ovate in outline, widest slightly below mid-length. Spire short, with rather wide and blunt summit; penultimate whorl decidedly broader and shorter than in most *leucostoma* of the nominate race. Body-whorl about six-sevenths of the total length in front view (50 mm. long in the holotype), more obese than usual. Sculpture as in the typical race, the nepionic riblets of the same type. Vertical folds of body-whorl somewhat coarser and less regular; in one of the paratypes (Fig. 2) these folds are cut at the periphery by three widely spaced engraved lines and the upper third of the body-whorl is irregularly malleate, apparently abnormal features, as the holotype and the other 7 paratypes show no trace of them. Fine granulation present on the spire, very weak or almost lacking on the body-whorl. Color of fresh specimens as in the nominate race, the coarser folds of the body-whorl white.

Measurements (in mm.). Holotype, M. C. Z. No. 166295: 5 whorls; length, 58.5; width in front view, 35.5; width in profile, 29; length of aperture, 35; width of aperture, 19. Plate 7, fig. 1.

Corresponding measurements of 4 paratypes. (a) Ac. N. Sc. Phila. No. 183974: 5 whorls; 65.5, 38, 30.5, 40.5, 21, Plate 7, fig. 2. (b) 5 whorls; 59.5, 35, 30, 35.5, 19. (c) 5 whorls; 57, 35.5, 28, 35.5, 18. (d) 5 whorls; 56.5, 36.5, 29.5, 35, 18.5.

PERU: Holotype M. C. Z. No. 166295, 3 paratypes M. C. Z. No. 166296, and 4 paratypes Mus. Nat. Hist. Lima, without more precise locality, received from Dr. W. Weyrauch. One paratype, Ac. N. Sci. Phila. No. 183974, obtained by Dr. H. A. Pilsbry in Cusco, but exact locality unknown.

This new race differs from typical *S. leucostoma* in the average small size, the very rounded summit, the short spire and the relatively wider penultimate whorl. These differences appear to be of no more than subspecific value, particularly as in a

large lot of typical *leucostoma* recently collected by Dr. W. Weyrauch at Santa Ana, in the Urubamba Valley, between 3000 and 3500 ft., some specimens (Fig. 5) have a rather broad penultimate whorl, although the spire is more raised and more pointed than in *weyrauchi*.

THAUMASTUS (SCHOLVIENIA) ARGENTINUS, **new species.** Plate 7, fig. 6.

Closely related to *T. weyrauchi* Pilsbry (1944, The Nautilus, vol. 57, p. 121, Pl. 11, figs. 2–2*a*), from Peru, of which I have compared several topotypes. Shell elongate turriculate, slender, regularly tapering to the very obtuse apex, narrowly rimate, fairly solid, but light and translucent. Dark mahogany-brown, with a narrow white spiral band a very short distance below the suture and on the body-whorl a pair of broader white spiral bands at the periphery, of which the upper one only is visible on the earlier whorls above the suture. Umbilical area entirely dark. Shape and sculpture of apical (nepionic) whorls as in *T. weyrauchi,* but the vertical striae on the lower half of the body-whorl finer and more wavy. Later whorls very slightly convex, separated by narrow, shallow sutures. Spire about three-eighths of total length in front view, more broadly conical than in *T. weyrauchi,* the third and fourth whorls being wider in proportion to the height. Aperture oval, shaped as in *T. weyrauchi,* but the upper flattened portion of the columellar margin shorter and narrower, reflexed over the narrow slit-like umbilical rimation. Outer lip barely thickened, very narrowly expanded. Columella, peristome and very thin parietal callus white.

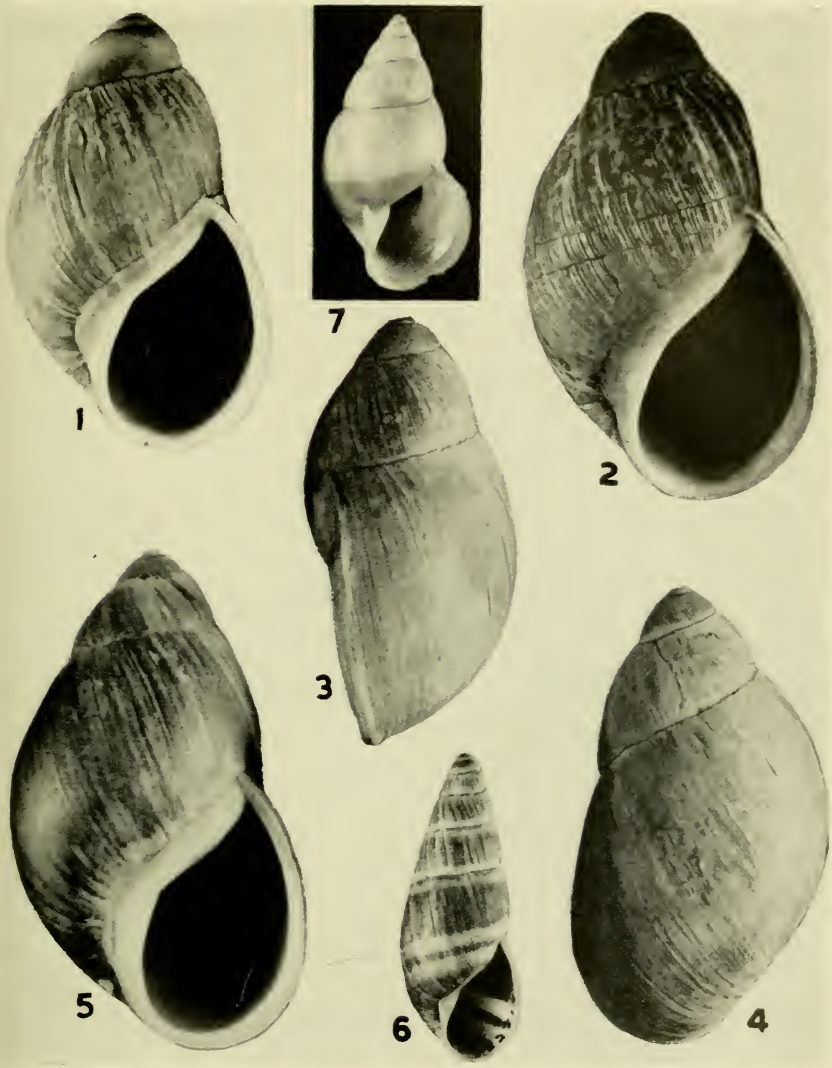
Measurements (in mm.) Holotype M. C. Z. No. 132313: 6½ whorls; length, 40.2; width in front view, 15.5; length of aperture, 16.5; width of aperture, 9.

ARGENTINA: Holotype M. C. Z. No. 132313, Hacienda Ducous, 15 kilom. N. of Pique, Dept. Saavedra, Prov. Buenos Aires (W. J. Eyerdam).

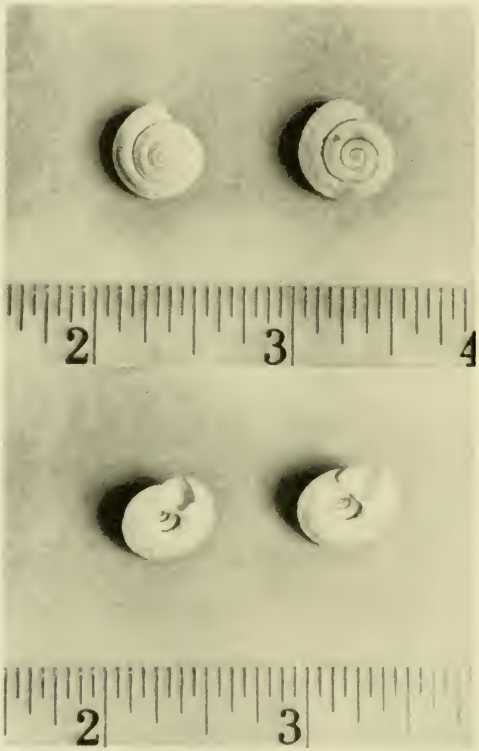
The relatively broader whorls of the spire, the different shape of the upper columellar area and the narrow, slit-like umbilicus seem to warrant giving this shell specific status, rather than subordinating it as a subspecies to *T. weyrauchi.*

DRYMAEUS (DRYMAEUS) FAIRCHILDI, **new species.** Plate 7, fig. 7.

Shell lengthened ovate-conic, thin, rather fragile, translucent, deeply rimate. Dirty white, also at apex and at base, with



FIGS. 1–4. *Strophocheilus leucostoma weyrauchi* J. Bequaert: 1, holotype; 2, 3, and 4, paratypes. FIG. 5. *Strophocheilus leucostoma* (Sowerby), typical race. Santa Ana, Peru. FIG. 6. *Thaumastus argentinus* J. Bequaert, holotype. FIG. 7. *Drymaeus fairchildi* J. Bequaert, holotype. All natural size.



Orcohelix (*Radiocentrum*) *almologa* Drake. Scales show inches.

chalky-white streaks and on the penultimate whorl with faint traces of darkened vertical areas. Inside of aperture, outer lip, columella and parietal wall white. Nepionic 1½ whorls with the regular pitted or grated microsculpture typical of *Drymaeus;* following whorls smooth and glossy to the naked eye, under the lens with very fine growth-striae, cut by numerous microscopic, slightly wavy, incised spiral lines, also below the periphery where the growth-striae are somewhat stronger; a few weak malleations on the body-whorl. Spire about two-thirds of total height in front view, straightly conic, with slightly convex whorls, and narrow, shallow, even, not crenulate sutures. Body-whorl somewhat more convex, not swollen nor flattened at the base, rounded over the terminal half, weakly and bluntly angular at the periphery over the first half. Aperture vertical, semi-circular, trumpet-like, nearly half the total length of the shell; peristome broadly expanded, flaring and slightly reflexed, the outer edge regularly curved, thin, fragile. Columella strongly curved, almost twisted above, with a broad flattened upper area set off by a deep curved depression from the parietal wall; outer columellar margin straight. Umbilicus a narrow, flattened, deep and partly perforate rimation behind the columellar flattened area.

Measurements (in mm). Holotype M. C. Z. No. 175763: 6½ whorls; length, 35.4; width in front view, 20.4; length of aperture, 18.3; width of aperture, 11.

Republic of Panama: Holotype M. C. Z. No. 175763, El Valle, Coclé Prov., June 16, 1940 (Graham B. Fairchild).

D. fairchildi belongs in the typical section of the genus, where it seems to be most closely related to *D. lattrei,* which is similar in texture and sculpture, and sometimes also in color, but lacks the broad flattened columella of *fairchildi* and has also a more elongate aperture and a different umbilicus. *D. expansus,* of which a race was described from Panama (*D. e. balboa* Pilsbry), has much the same shape, but has a different texture and shape of columella and umbilical area, in addition to being more strongly vertically striate. Among the Central American species, *D. fairchildi* also resembles *D. zhorquinensis,* but this has a different aperture, lacks the blunt peripheral angulation of part of the body-whorl, and is moreover said to be without spiral striae.

THE VARIATION OF BANDING IN CEPAEA

By PROF. DR. F. A. SCHILDER

University of Halle, Germany [1]

The European *Cepaea hortensis* and *C. nemoralis* have spread over the North Eastern part of the U. S. only; nevertheless, even American conchologists may be interested in the variability of these shells, concerning the five dark spiral bands, which will be designated, in the present paper, by the letters a, b, c, d, e from the suture of the last whorl to the umbilicus. Confluent bands will be connected by – , while absent bands will be replaced by a point.

Theoretically, there are 89 combinations, if every dark band can become absent, and every pair of adjacent bands can become confluent. Following Taylor's Monograph on the Land Mollusca of the British Islands (1910–1911), all these 89 varieties have been observed in *C. nemoralis,* but 60 only in *C. hortensis.* I doubt, however, whether several unprobable combinations really do exist: thus, for instance, in *C. nemoralis* the varieties . b–c . . and . . c–d . may be the common . . c . . with an extremely broad central band (see Archiv f. Mollusk. 67: 144, 1935).

The relative frequency of varieties is quite different, and each species exhibits especially frequent varieties. This interesting fact may be shown by the following table, which is the result of studies on almost thirty thousand shells collected at about two hundred localities of Europe from Scandinavia to the Alps, and from France to Vienna. The left column indicates the number of *C. hortensis,* the right of *C. nemoralis,* each expressed in pro mille of examined shells; the signs indicate: 0 = less than ¼ of a promille; o = 1 or 2 specimens only among the sum of all populations; – = not represented among the writer's shells; X = not yet observed at all, following Taylor's monograph.

When valuing every present band by 1, and every connection of a pair of bands also by 1, these varieties will be classified in 10 classes from 0 (no band) to 9 (5 confluent bands). The diagram shows the varieties observed among the writer's shells,

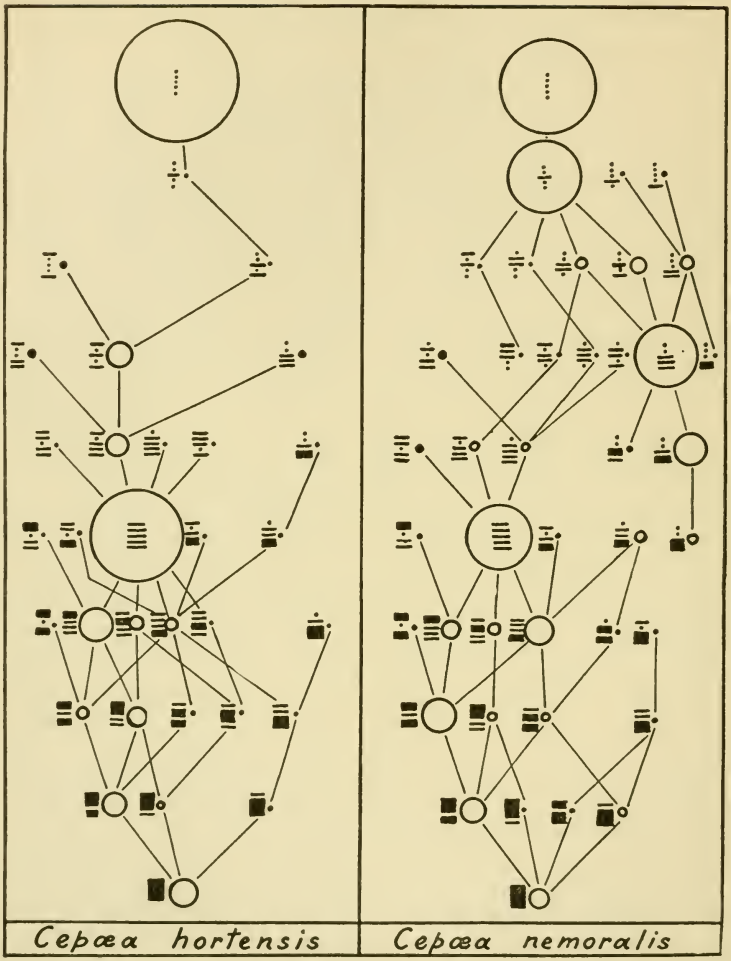
[1] Submitted by William Marcus Ingram.

TABLE

. . . . .	534	323	a b c d .	–	–	a–b–c . .	X	–
a	–	–	a b c . e	0	–	. b–c–d .	X	–
. b . . .	–	–	a b . d e	1/2	2	. . c–d–e	X	2
. . c . .	0	186	a . c d e	11	10	a–b c d e	32	12
. . . d .	–	1/2	. b c d e	1/2	9	a b–c d e	12	6
. . . . e	–	1/2	a–b c . .	–	–	a b c–d e	0	–
a b . . .	–	–	a–b . d .	–	–	a b c d–e	5	25
a . c . .	–	1	a–b . . e	X	–	a–b–c d .	X	–
a . . d .	–	–	a b–c . .	–	–	a–b–c . e	X	–
a . . . e	1	–	. b–c d .	X	–	a–b c–d .	X	–
. b c . .	–	1	. b–c . e	X	–	a–b . d–e	0	o
. b . d .	X	–	a . c–d .	X	–	a b–c–d .	X	–
. b . . e	X	–	. b c–d .	X	–	. b–c–d e	X	–
. . c d .	–	5	. . c–d e	X	1/2	. b–c d–e	–	1/2
. . c . e	0	10	a . . d–e	–	–	a . c–d–e	X	o
. . . d e	–	7	. b . d–e	X	–	. b c–d–e	0	–
a b c . .	–	o	. . c d–e	o	34	a–b–c d e	11	3
a b . d .	–	–	a b c d e	318	141	a–b c–d e	–	–
a b . . e	–	–	a–b c d .	X	–	a–b c d–e	6	33
a . c d .	–	1/2	a–b c . e	–	–	a b–c–d e	0	–
a . c . e	18	–	a–b . d e	o	1/2	a b–c d–e	1/2	4
a . . d e	1	–	a b–c d .	X	–	a b c–d–e	0	0
. b c d .	–	0	a b–c . e	–	–	a–b–c–d .	X	–
. b c . e	X	1/2	. b–c d e	X	–	. b–c–d–e	–	–
. b . d e	–	1	a b c–d .	X	–	a–b–c–d e	3	0
. . c d e	1	134	a . c–d e	X	–	a–b–c d–e	19	23
a–b . . .	X	–	. b c–d e	X	–	a–b c–d–e	–	1/2
. b–c . .	–	–	a b . d–e	0	–	a b–c–d–e	o	2
. . c–d .	X	–	a . c d–e	0	0	a–b–c–d–e	24	17
. . . d–e	–	1/2	. b c d–e	o	5			

arranged according to these 10 classes: varieties which often occur together on the same locality, and which differ by presence or absence of only *one* band *or* by only *one* confluence of adjacent bands, have been connected by a line. The size of the circles indicates the frequency.

One will observe that the most frequent varieties differ by more than one degree of banding, as these centers are separated by far less common intermediate varieties (in *C. nemoralis* the bandless and the unizonate variety also must be regarded as separate, as intermediate shells with a narrow and pale band c are very rare). Some of these more frequent centers of variation have been proved hereditary by Arnold Lang (Zürich) 45 years ago; therefore they may be called subspecies,



viz.: in *C. hortensis* . . . . . (*unicolor* Moq.), a . e . d . e (*moulinsia* Moq.), a b c d e (*hortensis* Müll.) and a–b–c–d–e (*coalita* Moq.), in *C. nemoralis* . . . . . (*concolor* Pic.), . . c . . (*cincta* Shep.), . . c d e (*trifasciata* Pic.), a b c d e (*nemoralis* Linn.) and a–b . d–e (*poiretia* Moq.). The other varieties, however, even those as frequent as a–b c d e in *hortensis* or . . c d–e in *nemoralis*, are individual modifications of these subspecies, caused by chance or environment.

The various populations greatly differ in percentage of these subspecies, according to the genes introduced by the few individuals which colonized the locality first; there is, however, a distinct prevalence of certain subspecies in some districts, e.g., *C. hortensis unicolor* predominates in Austria near Vienna, whereas *hortensis hortensis* predominates in Southern Bohemia. Besides, other regional pecularities may be observed, especially concerning the colour of the body whorl and of the lip, as well as the general size: thus, for instance, bandless *C. nemoralis* are far more frequently reddish to brownish than zonate shells, and among more than thousand *C. hortensis* from Doksy in Czechoslovakia I observed 22 per cent bandless, red shells with brown lips and 78 per cent five banded, yellow ones with white lips, but there was no specimen exhibiting another combination of these three characters!

Such statistical studies need further research; it could be supported by American malacologists publishing similar exact data on the *Cepaea* observed in restricted localities, which should not extend more than hundred meters in each direction.

SOME EDIBLE MOLLUSKS OF KAUAI, HAWAIIAN ISLANDS

By ALISON KAY

For the past several years, the writer has been interested in obtaining data on mollusks which are used for food by the residents of Kauai, Hawaiian Islands. The information has been obtained by personal communication and observation with residents and on personal experience of some twelve years. Markets have not been checked to find what native mollusks are brought in for sale, nor has the literature referring to use of mollusks in the Hawaiian Islands been investigated.

Among the shells most commonly found on the reefs are the cowries, the Cypraeidae. They are consumed by Hawaiians, Japanese, and Filipinos. The Hawaiians refer to cowries in general as "leho," and the mollusks are always prepared by boiling. This is the only method of cooking used by the Ha-

waiians, who, however, occasionally will eat the mollusk raw. The large tiger cowry (*C. tigris* Linnaeus) is collected by the Hawaiians who, after boiling the shell, remove the animal to consume it. The humpback cowry (*C. mauritania* Linnaeus) is used more frequently than the tiger cowry by the Hawaiians. Among the smaller varieties of cowries which are used is the snakehead cowry (*C. caputserpentis* Linnaeus), which is referred to as "alea-alea."

The tiger cowry is also used by the Japanese, who throw the live shell on hot coals to roast. Cooked in this manner, the cowry tastes very much like an oyster. The humpback cowry is also cooked in this way by the Japanese.

The tiger cowry is used principally by the Filipinos, however. The animal is hooked outside the shell and dried in place. The dried animal is then fried for the meal.

Shells of the family Neritidae are used for food by the Hawaiians, the Portuguese, and the Japanese. The small *Nerita picea* Recluz is called "pipipi" by the Hawaiians, who boil it and pick the animal out with a pin or sharp stick. The larger *Nerita polita* Linnaeus is referred to as "kupee." It is very meaty, and only a few are needed to make a meal. It is collected only at night. The Portuguese both boil and fry this mollusk.

Of the limpets, Phenacolepididae, the shell which the Hawaiians call "opihi" is the shell most commonly eaten in the Islands today. It is used by all races, eaten either boiled or raw. The opihi is almost a necessity at every luau or feast, and the Japanese plantation laborers consume the mollusks with their rice. The opihi is usually gathered by women who roam the reefs at low tide, carrying old table knives or screwdrivers to pry the shells from the rocks. Opihis form an important part of the diet of most of the Hawaiian families living near the shore, and often those from the plantation camps spend their Sundays collecting the mollusks. The Portuguese are also fond of them.

Other univalves which are collected for consumption are the trumpet shells (*Cymatium tritonis* Linnaeus), the partridge tuns (*Tonna perdix* Linnaeus), and the large helmet shells (*Cassidae*). The partridge tuns are used by the Hawaiians and

Filipinos; the trumpets by the Hawaiians and Japanese; and the helmets by all three races.

The large helmet shells, some of which weigh from five to ten pounds, are used principally by the Filipinos, for whom they are collected commercially. The shell is hung up, and when the animal extends its body, a cord is tied close to the shell so that the animal can't retreat into its shell. The animals are dried before being cooked. The Filipinos season the mollusk with tamarind, ginger, and tomatoes; and they use both the broth and meat.

Generally cone shells (Conidae) are not used, because there are several poisonous varieties. However, a few families of Hawaiians on Kauai are known to occasionally collect the large *Conus millepunctatus* Lamarck for food. It is not often used because the large shell is prized as an ornament, and the only way in which the animal can be reached is by breaking the shell.

Bivalves in the Hawaiian Islands are not too popular as food. However, the Pearl Harbor oyster (*Pinctada galtsoffi* Bartsch), and a white clam (*Tellina rugosa*) are occasionally collected. The rock oyster (*Spondylus hawaiensis* Dall, Bartsch, Rehder), referred to as "pana-pana-puhi," is dug out of its shell with a chisel and then boiled.

The Hawaiians on Kauai use practically all the varieties of mollusks found on the reefs. Often the animals are mixed together in one pot and boiled. Because there are not many specimens of any one species except for the *Nerita* and the limpets, a meal of mixed mollusks is often consumed.

SOME LAND AND FRESHWATER MOLLUSKS FROM THE COASTAL REGION OF VIRGINIA AND NORTH AND SOUTH CAROLINA

By HARALD A. REHDER [1]

Our knowledge of the molluscan fauna of the coastal plain area, from Virginia to northern Florida—and indeed all the

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

way to Louisiana—is still very fragmentary, as a glance at the distribution records given in Pilsbry's recently published "Land Mollusca of North America" will show.

This present list is intended as a contribution to filling in some of these gaps, and to spur other collectors to investigate the land and freshwater shells of this area. This is a region which, though not rich from a malacological viewpoint, offers some fascinating problems in the zoögeography of the mollusks, and will undoubtedly reward the collector with some interesting discoveries. My colleague, Dr. J. P. E. Morrison, was kind enough to check the identifications in certain critical groups. The specimens were gathered by Mrs. Rehder and myself during a trip in the fall of 1946.

Virginia Beach, Princess Anne County, Virginia: Under old boards, bricks, and debris, not far from beach.

Ventridens ligera (Say). Common. This species is apparently rare in the coastal region. The only previous published records that we have noted for this faunal area are for Wilmington and Lake Waccamaw in North Carolina. There are several other lots in the U. S. National Museum collection from Surrey County, Virginia.

Mesodon thyroidus (Say) form *bucculenta* (Gould). Common.

Triodopsis tridentata juxtidens (Pilsbry). Fairly common.

Near North Landing River, Norfolk County, Virginia: Among stones along the edge of a small stream at the junction of State Routes 190 and 165.

Ventridens cerinoideus (Anthony). Fairly common. This substantiates the record for this species for Norfolk County given by W. G. Binney (Pilsbry, Land Mollusca of North Amercia, vol. 2, pt. 1, 1946, p. 452). We have also collected it along the James River, in Isle of Wright County, Virginia, near Rescue, 25 miles northwest of Norfolk.

Near Northwest, Norfolk County, Virginia: In Northwest River, on stones and plants along edge near bridge on State Route 170.

Amnicola limosa (Say). Fairly common.

Pseudosuccinea columella (Say). Rather common; small form.

Physa heterostropha Say. Two young specimens.

Musculium truncatum Lindsley. Two specimens.

Ferrissia (*Laevapex*) *fusca eugrapta* Pilsbry. Two specimens.

Succinea avara Say. One specimen found on the muddy bank.

South of Moyock, Currituck County, North Carolina: Along edge of creek, on State Route 170.

Retinella (*Glyphyalinia*) *indentata paucilirata* (Morelet). This is a new northern record for this species in the coastal plain area. One specimen.

Stenotrema hirsutum (Say). Fairly common.

Haplotrema concavum (Say). Two specimens.

Kill Devil Hill, Dare County, North Carolina: In leaf mulch around base of shrubbery at the foot of the Wright Memorial.

Triodopsis hopetonensis (Shuttleworth). Fairly common.

5½ miles south of Elizabeth City, Pasquotank County, North Carolina: Under bark of fallen logs in small clearing along Route 17.

Zonitoides arboreus (Say). One specimen.

Philomycus carolinianus (Bosc). Two specimens.

Edenton, Chowan County, North Carolina: Among stones, bricks, etc., along sea wall bordering Albemarle Sound.

Ventridens cerinoideus (Anthony). Two specimens.

Mesodon thyroidus (Say). Rather common.

Triodopsis hopetonensis obsoleta (Pilsbry). Two specimens. A northward extension of the range of this form.

Stenotrema hirsutum (Say). Common.

Haplotrema concavum (Say). Common.

Near Washington, Beaufort County, North Carolina: Under logs and debris along edge of Tar River.

Quickella (*Mediappendix*) *vagans* (Pilsbry). One specimen of this little-collected species, filling in part of the gap between the New Jersey records and that for Lake Waccamaw, North

Carolina cited by Pilsbry (op. cit., vol. 2, pt. 2, 1948, p. 844).

Ventridens cerinoideus (Anthony). Two specimens.

Retinella (*Glyphyalinia*) *indentata paucilirata* (Morelet). Rather common.

Polygyra postelliana carolina Pilsbry. Fairly common. This is almost sixty miles further north than the previously northernmost record for this subspecies.

Mesodon thyroidus (Say) form *bucculenta* (Gould). One specimen.

Triodopsis hopetonensis obsoleta (Pilsbry). Common.

Wilmington, New Hanover County, North Carolina: Under boards in back yard of residence of A. H. Harriss, Dock Street.

Zonitoides arboreus (Say). Three specimens.

Anguispira alternata fergusoni (Bland). Fairly common.

Triodopsis hopetonensis (Shuttleworth). Common.

Arion circumscriptus Johnston. Nine specimens. A new southern record for this species.

Greenfield Pond, Wilmington, North Carolina: Along sandy shore.

Campeloma rufum (Haldeman). Common.

Wrightsville Beach, New Hanover County, North Carolina: Under boards and in surrounding grass.

Succinea campestris Say. Three specimens.

Triodopsis hopetonensis (Shuttleworth). Fairly common.

Lake Waccamaw, Columbus County, North Carolina: Under logs and boards at settlement on north shore. The freshwater specimens were found along the sandy shore of the lake.

Campeloma rufum (Haldeman). Five specimens.

Ventridens cerinoideus (Anthony). Three specimens.

Mesodon thyroidus (Say) form *bucculenta* (Gould). Fairly common.

Triodopsis soelneri (J. B. Henderson). Common.

Triodopsis (*Neohelix*) *albolabris* (Say). One specimen.

Lampsilis ochraceus (Say). Fairly common.

Elliptio complanatus quadrilaterus (Lea). Also fairly common.

Myrtle Beach, Horry County, South Carolina: Under boards and around planks near boardwalk.

Succinea campestris Say. Common.

Euglandina rosea Fer. One young living specimen. This is a new record for this species, about 130 miles farther north than the previous record (Yemassee, Beaufort County, South Carolina).

Mesodon thyroidus (Say). Very common.

Triodopsis hopetonensis (Shuttleworth). Common.

Gastrocopta pentodon (Say). Two specimens.

Pupoides albilabris (C. B. Adams). Fairly common.

Hawaiia minuscula (Binney). Common. These last three species were all found together under only three pieces of board.

Myrtle Beach, Horry County, South Carolina: At outlet of small pond, near Ocean Forest Hotel.

Pseudosuccinea columella (Say). One specimen.

Helisoma anceps (Menke). Fairly common.

Helisoma trivolvis (Say). Two specimens.

Physa pomilia Conrad. Common. The identification is somewhat uncertain.

Ventridens cerinoideus (Anthony). Not uncommon.

Helicodiscus parallelus (Say). One specimen.

Between Myrtle Beach and Little River, Horry County, South Carolina: Under fallen leaves and near fallen logs.

Ventridens cerinoideus (Anthony). Five specimens.

Zonitoides arboreus (Say). One specimen.

Helicodiscus parallelus (Say). One specimen.

Anguispira alternata fergusoni (Bland). One specimen.

Mesodon thyroidus (Say). One specimen.

Triodopsis fallax (Say). One specimen.

Near Myrtle Beach, Horry County, South Carolina: In and near creek flowing into Midway Swash, at Myrtle Beach State Park, on Route 17. The land shells were found around fallen logs.

Pseudosuccinea columella (Say). Common.

Physa species. Common.

Ventridens cerinoideus (Anthony). One specimen.

Ventridens ligera (Say). One small specimen that is rather depressed and thin and may be referable to Pilsbry's form *stonei*, known from New Castle County, Delaware, and from near Wilmington, North Carolina. A new coastal region record for this species.

Ventridens intertextus (Binney). One specimen, also representing a new record for the coastal area.

Mesodon thyroidus (Say). Two specimens.

Triodopsis fallax (Say). One specimen. This and the specimen recorded from the preceding locality are referable to the form that Pilsbry (1939–40, p. 811) describes from Brunswick, New Hanover, and Bladen Counties, North Carolina. Further collections in this region may show that this is a good geographic race, worthy of a subspecific name.

Haplotrema concavum (Say). One young specimen.

Between Homewood and Bayboro, Horry County, South Carolina: In small pool on State Route 701.

Physa pomilia Conrad. One specimen.

Brookgreen Gardens, Georgetown County, South Carolina: Under fallen leaves, and on bank of small stream.

Oxyloma effusa (Shuttleworth). One specimen.

Ventridens cerinoideus (Anthony). Fairly common.

Triodopsis hopetonensis (Shuttleworth). Two specimens.

Haplotrema concavum (Say). One specimen.

NOTES ON THE DISTRIBUTION OF SOME TERRESTRIAL GASTROPODS IN WESTERN PUERTO RICO

By N. T. MATTOX

Miami University, Oxford, Ohio

The most comprehensive survey of the land mollusks of Puerto Rico is that made by van der Schalie.[1] Many workers have published various notes on the distribution of different

[1] van der Schalie, Henry, 1948. The land and fresh-water mollusks of Puerto Rico. Misc. Publ. Mus. of Zool., Univ. Mich. No. 70.

species in Puerto Rico, but none give the complete coverage presented by van der Schalie. During the years 1946 to August, 1948, the writer was privileged to work at the College of Agriculture and Mechanic Arts at Mayaguez, Puerto Rico. From this point various collecting trips were taken into areas not well covered by van der Schalie and others. The present paper deals with a listing of localities not previously given for a number of species; primarily in the western end of the island.

The localities representing new distribution records for some species are as follows: Mayaguez: on the coastal plain of mid-western end of the island. Maricao: in the mountains about 15 miles east of Mayaguez. Lares: in mountains about 20 miles northeast of Mayaguez. Corsica: on coastal plain about 10 miles north of Mayaguez. Guanica: on southwestern coastal plain in a very arid area. Rio Abajo: north-central mountain range about 10 miles northwest of Utuado. Cerro de Punta: the highest point on the island, 4400 ft., in the Toro Negro National Forest, about 5 miles south of Jayuya, in a rain forest. El Yunque: in mountain rain forest, about 25 miles southeast of San Juan.

A listing of the new distribution records, with localities, is here given.

Helicina phasianella "Sowerby" Pfeiffer, at El Yunque. Not previously reported from central mountains.

Lucidella umbonata (Shuttleworth) at Mayaguez, Maricao, Rio Abajo, Cerro de Punta, Lares and El Yunque. Previously reported from northern and southern coastal plains.

Megalomastoma croceum, form *maricao* Clench, at Cerro de Punta.

Succinea hyalina Shuttleworth, at Maricao.

Zonitoides arboreus (Say) at Cerro de Punta.

Lamellaxis unilamellatus (D'Orbigny) at Mayaguez.

Varicella calderoni H. B. Baker, at Cerro de Punta.

Laevaricella playa H. B. Baker, at Rio Abajo.

Austroselenites concolor (Férussac) at Cerro de Punta.

Austroselenites alticola H. B. Baker, at Cerro de Punta.

Mcleania darlingtoni Bequaert and Clench, at Cerro de Punta.

Platysuccinea portoricensis (Shuttleworth) at Maricao, and Cerro de Punta.

Pleurodonte carocolla (Linnaeus) at Maricao, Cerro de Punta and Rio Abajo.

Polydontes acutangula (Burrow) at Cerro de Punta.

Cepolis boriquenae H. B. Baker, at Lares.

Gaeotis nigrolineata Shuttleworth, on leaves of the mountain palm at Cerro de Punta.

Macroceramus microdon (Pfeiffer) at Guanica.

The specimens represented here were kindly determined by Dr. Henry van der Schalie, for which the writer is grateful. The specimens are in the collection of the Biology Department at the College of Agriculture and Mechanic Arts at Mayaguez, Puerto Rico.

SOME SNAIL RECORDS FROM THE QUETICO PROVINCIAL PARK OF ONTARIO

By R. G. LINDEBORG [1]

During the summer of 1935 the author and R. V. Drexler traveled by canoe through the Quetico Provincial Park and adjoining regions of southwestern Ontario. Snails were collected from a limited number of locations but it is felt important to report them because the snail fauna of this interesting area is not well known. I appreciate the help of the late F. C. Baker for checking the identifications.

The region is located in the eastern portion of the Rainy River district and the western part of the Thunder Bay region, all within the Hudson Bay drainage system. The trip started at Ely, Minnesota, and described a large figure eight with the most northerly point at Savanne, Ontario. A short itinerary of the trip may aid in locating the collecting stations. The following lakes were visited in turn: from Basswood northeast to Agnes and Kawnipi, northwest to Russell, and north to Sturgeon and Doré; thence to Pickerel, east to French, north

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[1] Contribution No. 27 from the Department of Biological Science, Michigan State College, East Lansing, Michigan.

to Eva, east to Nydia and Elbow, north to Crooked and Mercutio, east to Bedivere and up the North Arm to Lac des Mille Lacs, the most northerly lake visited. From the southeast end of Mille Lac we traveled south through Kashabowie, southwest through Upper Shebandowan, Burchell and Snodgrass; then down the Wawiag River turning south just inside the park boundary to Mack Lake. From Mack we returned to the Wawiag and continued southwest to Kawa Bay of Kawnipi and retraced our course almost to Shelley, finally turning south to Cairn, Sark, Keefer, Kahshahpiwi to end the journey in Ranger Bay of Basswood Lake. All of the names used are taken from the Quetico Sheet No. 52B, of the National Topographic Series, of the Canadian Department of Interior dated August 1931.

List of Land Snails

Deroceras gracile. The southernmost island in Lake Louisa on damp moss at the base of a cliff; on an island in the north end of Agnes Lake found crawling on a dead mouse; also near Russell Lake under a half-decayed poplar log.

Pallifera dorsalis. A single specimen, near Mack Lake, from the moss on a tree trunk after a rain.

Anguispira alternata. Between Lakes Agnes and Louisa under a rotten log.

Cochlicopa lubrica. Two localities near the south end of Mack Lake, under logs and on a moss bank.

Columella edentula. South end of Mack Lake, under a log.

Discus cronkhitei. West shore of Agnes; the south shore of Kawnipi (Long Island); the north island in McKenzie Bay of Kawnipi; near Russell; and in three locations near Mack Lake. Specimens were collected on moss banks, under logs, and from moss on a tree trunk after a rain.

Euconulus fulvus. South shore of Kawnipi (Long Island); the north island in McKenzie Bay of Kawnipi; south and north ends of Mack Lake. Collected mostly under logs but also from moss on trees after a rain.

Retinella binneyana. East shore of Agnes; south shore of Kawnipi (Long Island); north island of McKenzie Bay of Kawnipi; two locations near the south end and one near the

north end of Mack Lake. Found mainly under logs and stumps and once from moss on a tree trunk and on ferns after a rain.

Striatura milium. South shore of Kawnipi (Long Island) under decaying logs.

Strobilops labyrinthica. West shore of Agnes and Russell Lakes; two localities near the south end and one near the north end of Mack Lake. Found under logs and on tree moss after a rain.

Succinea ovalis. West shore of Agnes under decomposing logs.

Vertigo modesta. South shore of Kawnipi (Long Island); near Russell and Mack Lakes. All found under logs.

Vitrina limpida. A single specimen was taken near Russell Lake on a moss bank.

Zonitoides arboreus. Probably the most abundant snail in this area. Collections were made on an island in Louisa; east and west sides of Agnes; on an island in McKenzie Bay of Kawnipi; near Russell Lake; and in three localities near Mack Lake. Their habitats are mainly under decaying logs and stumps, but were also found on damp moss including *Sphagnum* in a bog at the south end of Mack Lake. Ants and these snails were seldom found under the same logs.

Zoögenetes harpa. An island in McKenzie Bay of Kawnipi; near Russell; and in three places near Mack Lake. All were taken under logs except at Mack Lake where a few were collected on tree moss after a rain.

List of Water Snails

Sphaerium fallax. Mack Lake on a muddy bottom.

Pisidium sp. Creek at the south end of Mack Lake; also in a dry, temporary stream bottom apparently estivating.

Amnicola limosa porata. Northeast arm of Mercutio from submerged vegetation.

Stagnicola caperata. A single specimen was found in a dry, temporary stream bottom near Mack Lake.

Stagnicola lanceata. A small lake between the North Arm of Bedivere and Mille Lac, on submerged rocks.

Helisoma anceps royalense. South shore of Kawnipi (Long

Island); a little unnamed lake north of the north end of McKenzie Bay of Kawnipi, on rocks.

Helisoma campanulatum var. South shore of Kawnipi (Long Island) on rocks; northeast arm of Mercutio from submerged vegetation.

Gyraulus deflectus. A single specimen, in a creek at the south end of Mack Lake.

Ferrissia parallela. A small lake north of the north end of McKenzie Bay of Kawnipi from submerged roots; and from the underside of lily pads in the south end of Mack Lake.

Physa gyrina. North end of McKenzie Bay of Kawnipi from submerged rocks; northeast arm of Mercutio from vegetation; a small lake between the North Arm of Bedivere and Mille Lac from rocks.

Aplexa hypnorum. A small creek at the south end, and in a dry, temporary stream bottom at the north end of Mack Lake.

FEEDING OF ARIOLIMAX COLUMBIANUS (GOULD) ON THE CALIFORNIA BAY FRUIT

By WILLIAM MARCUS INGRAM and CADET HAND

Mills College, California

Little is known of the specific food of land mollusks, especially those of Western North America. The writers present the following data on a food item that is apparently important to the giant western slug, *Ariolimax columbianus* (Gould). Observations were first made in the field and later in the laboratory.

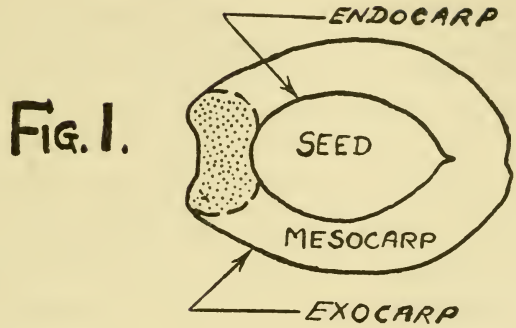
The California bay, *Umbellularia californica* Nutt., in areas where it is associated with the coastal redwood, *Sequoia sempervirens* Endl., bears fruit from approximately October through March. Locally this corresponds with a large part of the very active period of *A. columbianus* which becomes relatively inactive through most of dry season, seeking shelter in earth crevices, beneath large stones in dry streambeds, under grass, and under roots, Ingram and Adolph (1943). The fruit of the California bay is a typical drupe (Fig. 1) of about an inch in

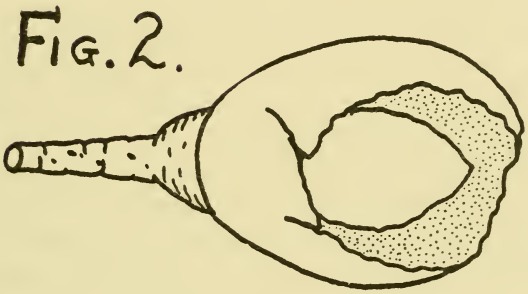
diameter. It consists of a thin, tough outer membranous coat, the exocarp, under which occurs the fleshy mesocarp. The seed of this drupe is single and about one half inch in diameter and is covered by a hard coat, the endocarp. The drupe is borne on a stalk, the peduncle. The writers will show that this fruit, specifically the mesocarp, is an important food item of this giant western slug, and that due to the action of birds and small mammals the availability of this food is greatly increased.

Dall (1913) in a note on the feeding of *Ariolimax columbianus* (Gould) stated that in Marin County, California, this slug was known to feed on the bay fruit, attacking the fallen drupes by the end which was attached to the stem. He further stated that the slugs ate out the pulp between skin and kernel for about half the surface of the fruit without breaking the rind. This information was later quoted by Pilsbry (1948). Ingram (1942) observed this slug under natural conditions feeding on poison oak, *Toxicodendron diversilobum* Torr. and Gray. Ingram and Peterson (1947) conducted controlled laboratory feeding experiments with this slug but did not provide bay fruit.

Two redwood-bay tree associations in Oakland, Alameda County, California, were studied. One area was a highland area in Redwood Park, the other being a lowland area in the Montclair region. In the former area the bay fruit is initially fed upon by the California jay, *Aphelocoma californica* subsp., and to a lesser extent by one or more rodents. Collections of the bay fruits may be found in the nests of a rodent, *Neotoma* sp., a wood rat. The bird and the rodent feed only on the seed and discard the fleshy part of the fruit after the seed has been removed (see Fig. 2). In the second association studied the jay and rodent are missing for the most part and the majority of the fruits fall to the ground in the unopened condition.

In the field several interesting observations were made. Fruits which had fallen to the ground in the unopened condition are not attacked by slugs unless the peduncle falls off. This observation was verified many times in the laboratory by placing whole drupes in aquaria with slugs. If, however, the peduncle is removed the slug immediately attacks the fruit. The slug enters the fruit from the peduncle end and files away the mesocarp at this area. The exocarp apparently is too tough for the





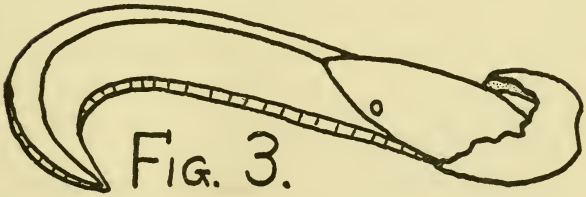


FIG. 1, Longitudinal section through fruit to show penetration area of slugs (stippling), at peduncle with seed in place. FIG. 2, Fruit opened and seed removed; white area indicates portion of fruit occupied by seed. Broken area allows slug to enter to feed on mesocarp. FIG. 3, Position of slug in feeding on mesocarp area of fruit. A young slug is diagrammed.

slug's radula, but the mesocarp when it is exposed is easily removed. Progress by the slug into the drupe is blocked, however, as soon as it reaches the hard endocarp covering of the seed. The slug is able, therefore, to remove only about 10 percent of the mesocarp of fruits which have lost their peduncle (see Fig. 1). A second observation concerns fruits which have been opened by birds or rodents and have the seeds removed. In the field slugs were found with the head thrust within an opened fruit feeding on the fleshy mesocarp (see Fig. 3). In the laboratory whole drupes were cut in half, the seed removed, and placed in terraria with slugs. In an hour the slugs in each case had completely removed all of the mesocarp leaving the exocarp as a thin membranous sack. In opening a drupe a bird destroys about 30 to 40 percent of the mesocarp but this leaves at least 60 percent of the mesocarp which is all available to the slug. The feeding action of the bird or rodent then, in removing the seed for its own food, makes available at least 60 percent of each drupe for the slug.

It would appear then that in an area such as the bay-sequoia association in Montclair that a large percent of the available food supply of bay fruits is being denied the slugs due to the absence of birds and rodents. In a small random sample in the Montclair area 21 bay drupes were collected in 15 minutes. Of the 21 fruits only one had been opened (by a rodent) and 20 were whole. Of the 20 whole fruits, 15 had been attacked by slugs at the peduncle end and the usual small amount of mesocarp had been removed. It would seem clear then that a large potential food supply of bay drupes is not available in this area due to the lack of birds and rodents.

In the Redwood Park area another random sample of bay fruits was taken. In one half hour 73 fruits were collected. Of the 73 fruits, 40 had had their seeds removed by birds, 12 by mammals, and 8 were intact. Thirteen fruits were in such a state of advanced decay that no data could be gathered from them. Of the 60 fruits from which data could be obtained 15 fruits showed signs of slug feeding, 8 had the mesocarp almost completely devoured, and 7 had at least 50 percent of the meso-

carp devoured. Of the 8 intact fruits 2 had missing peduncles and these had had the mesocarp cut away as far as the seed would allow. It appears then that in this area where birds and rodents are actively feeding on the seeds of the bay drupe there is potentially a much greater food supply available to *Ariolimax columbianus* than in areas where the involved vertebrates are missing.

If we assume a situation where birds or mammals never feed on the bay fruit, and this situation appears to be nearly realized in the Montclair area where the association studied is in a ravine between two well settled areas, we see the slug only utilizes 10 percent of the bay fruit (when the peduncle is removed). On the other hand in an area such as Redwood Park, a relatively undisturbed area, we see that a large proportion of the bay fruits are used as food by jays and rodents. The opening and subsequent destruction of up to 40 percent of the fruit by the vertebrate leaves about 60 percent of each fruit available to the slug, and this is actually a 5-fold increase in available food. That the mesocarp of the bay fruit is an important part of the slugs diet can be seen from the large numbers of fruits actually found in the field which show signs of slugs feeding on them.

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SOME LAND AND FRESHWATER MOLLUSKS FROM GUATEMALA

By FRITZ HAAS

Curator of Lower Invertebrates, Chicago Natural History Museum

The Chicago Natural History Museum Guatemala Expedition of 1948 had the collecting of mammals and insects as its principal aims, but the museum's entomologists, Assistant Curator Rupert L. Wenzel and Mr. Rodger D. Mitchell, nevertheless paid some attention to the collecting of land mollusks. The entomological collecting technique used enabled them to obtain many small and minute forms, which are still so little known in tropical countries. Though no new species were discovered, each new locality helps to clarify the range of the species. The species obtained are listed below according to their localities.

Guatemala City.

Drymaeus (*Drymaeus*) *jonasi* (Pfeiffer). April 22, 1948; elevation 4900 ft. In a barranca north of the Parque Minerva.

La Jolla Grande, Finca Montserrat, on the Northwest slope of the Volcan de Fuego, Municipio Yepocapa, Dept. Chimaltenango.

Opeas (*Opeas*) *gracile* (Hutton). May 2, 1948; elevation 5600 ft. Under decaying banana stalk.

Finca Panajabal, Municipio Yepocapa, Dept. Chimaltenango.

Aperostoma (*Neocyclotus*) *dysoni ambiguum* (Martens). May 8, 1948; elevation 3500 ft. Under decaying banana stalk.

Finca Recreo, Municipio Yepocapa, Dept. Chimaltenango.

Subulina (*Subulina*) *cylindrella* (Morelet). May 11, 1948; elevation 4400 ft. Under bark.

Yepocapa, Municipio Yepocapa, Dept. Chimaltenango.

Drymaeus (*Drymaeus*) *jonasi* (Pfeiffer). May 12, 1948; elevation 4800 ft. On bank of dry ravine.

Subulina (*Subulina*) *cylindrella* (Morelet). May 15, 1948; elevation 4800 ft. Under log.

Leptinaria (*Leptinaria*) sp. April 23, 1948; elevation 4800 ft. Beating of cut branch trap.

Habroconus (*Ernstia*) *elegantulus* (Pilsbry). May 1, 1948; elevation 4800 ft. Sweeping bushes.

Helicina (*Helicina*) *tenuis* Pfeiffer. April 27, 1948; elevation 4800 ft. Beating trees in forest.

Radiodiscus hermanni (Pfeiffer). April 24, 1948; elevation 4800 ft. Beating of cut branch trap.

Aplexa (*Stenophysa*) *elata* (Gould). April 28, 1948; elevation 4800 ft. On stems of plants at river edge near Finca Sants Isabel.

Finca Montserrat, West slope of the volcano Acatenango, Municipio Yepocapa, Dept. Chimaltenango.

Streptostyla (*Chersomitra*) *sololensis* Crosse & Fischer. June 1, 1948; elevation 6900 ft.

Zonitoides (*Zonitellus*) *arboreus* (Say). May 17, 1948; elevation 6700 ft. May 18, 1948; elevation 7500 ft.

Habroconus (*Ernstia*) *elegantulus* (Pilsbry). May 18, 1948; elevation 7500 ft. May 2, 1948; elevation 5700 ft.

Averellia (*Trichodiscina*) *pressula* (Morelet). May 18, 1948; elevation 7500 ft.

Lanquin, Dept. Alta Vera Paz.

Opeas (*Opeas*) *gracile* (Hutton). June 7, 1948; elevation 1000 ft. Under palm log.

Carychium exiguum mexicanum Pilsbry. June 9, 1948; elevation 1000 ft. From leaf mould.

Annularia (*Annularis*) *rigidula* (Morelet). June 3, 1948; elevation 1000 ft. On edge of Cahabon River.

Finca San Rafael, Dept. Sacatepequez.

Drymaeus (*Drymaeus*) *jonasi* (Pfeiffer). July 1, 1948; elevation 6900 ft.

Streptostyla (*Chersomitra*) *sololensis* Crosse & Fischer. July 1, 1948; elevation 6900 ft.

Streptostyla (*Chersomitra*) *bocourti* Crosse & Fischer. July 1948; elevation 6900 ft.

Habroconus (*Ernstia*) *elegantulus* (Pilsbry). June 22, 1948; elevation 6900 ft. June 28, 1948; elevation 6900 ft. Sweeping at edge of woods.

Zapote, Dept. Escuintla.

Drymaeus (*Drymaeus*) *liliacinus* (Férussac). July 10–20, 1948; elevation 2400 ft.

Subulina (*Subulina*) *cylindrella* (Morelet). July 7, 1948; elevation 4000 ft.

Averellia (*Trichodiscina*) *coactiliata* (Deshayes). July 12, 1948; elevation 2400 ft. Under bark.

Habroconus (*Ernstia*) *elegantulus* (Pilsbry). July 7, 1948; elevation 4000 ft.

Santa Clara, valley in the interior of the Sierra de las Minas, North of Cabañas, Dept. Zacapa.

Drymaeus (*Drymaeus*) *sulphureus* (Pfeiffer). August 14, 1948; elevation 6500 ft. On leaf.

Zonitoides (*Zonitellus*) *arboreus* (Say). August 5, 1948; elevation 5500 ft. Under bark.

Helicina (*Helicina*) *tenuis* Pfeiffer. August 10, 1948; elevation 5500 ft.

Finca San Victor, Dept. Escuintla.

Aperostoma (*Neocyclotus*) *dysoni ambiguum* (Martens). September 9–11, 1948; elevation 600 ft.

SOME OBSERVATIONS ON HALIOTIDAE (ABALONES) AND THEIR WORLD DISTRIBUTION

By ANDREW SORENSEN

Of all the primitive mollusks, *Haliotis* ranks as one of the very earliest. It has come down through the ages practically unchanged and it is still going strong.

The evidence of its age is found in the fossil beds of the earth's crust. In California alone the Cretaceous of San Diego County, the Miocene of Los Angeles, Santa Barbara and San Luis Obispo counties and the Pliocene of Los Angeles County have all furnished many specimens resembling present day *H. rufescens, fulgens* and *corrugata.*

Their age is evident and the huge deposits in the early day kitchen-middens show their continued presence and availability as food for prehistoric man.

They continued to prosper and spread, and they were found in vast numbers along our West Coast until modern man came along and he is rapidly causing their depletion.

Our fossil beds are replete with many forms of mollusks that no longer are found in the living state. Some of them are well developed and apparently were perfectly fitted for their environments and still they perished. Some like the ammonites developed a peculiar form and grew to enormous size. They were of spiral shape and occasionally grew to the size of cart wheels. They spread over nearly all North America and Europe before becoming extinct.

Only a few illustrations need to be given, but so many failures make one wonder what natural advantages the Haliotidae had that enabled them to escape their enemies and outlive their contemporaries, for life in the wild is a series of struggles and only the fittest survive.

Haliotis is a gastropod or univalve in that it has but one valve or shell, but this shell is entirely unlike the ordinary gastropod or snail-like mollusk. Instead of a more or less rounded shell of many whorls in which the animal lives, *Haliotis* lives in a shell with the general appearance of an inverted slightly oval saucer. This heavy flattish shell gives room for a large body with a huge muscular "foot" firmly attached to the shell.

In case of danger, the foot immediately contracts and pulls the shell down tight, thus completely covering the animal. Besides that, the suction of the foot on the rock on which the animal sits is so great that a chisel is needed to remove it unless the chisel is quickly slipped under the shell before the animal has a chance to clamp down. There is a story of a Chinaman being drowned by the incoming tide when his hand was held fast by an abalone he had tried to pull off with his bare hand.

Its shell is thick and hard and the ordinary predators such as *Polinices* and *Murex,* which raise such havoc among the bivalves, have little effect on it.

However it is beset by a small bivalve, *Pholadidea parva,* which burrows into the shell. But the pholad rarely penetrates because the haliotis simply deposits more nacre inside the shell at the threatened opening, thus forming the beautiful blister pearls.

Its food supply is assured, since it is a vegetarian, for algae

grow on the rocks from the shoreline out to as deep as light will penetrate effectively, around a hundred feet.

Having thus shown their ability to survive for ages, one would naturally expect that they had spread over the whole world where conditions were favorable, but such is not the case. While there are long stretches of rocky beaches where the haliotises are plentiful there are also similar places, apparently as favorable, where not an abalone can be found. For instance from Alaska south to the tip of Baja, California, many species are found in quantities while there is record of only one specimen, a *Haliotis fulgens,* ever having been taken on the east coast of Baja, California. Nor have any others been taken in the whole Gulf of California, with its otherwise teeming molluskan life, nor along the west Mexican and Central American coast all the way down to Panama. Both the east and west coasts of South America and the east coast of North America are also without *Haliotis.*

They seem to thrive the best in temperate waters. The largest live on the California coast, the next biggest on the Japanese Islands, South Australia, New Zealand and South Africa. The South and Central Pacific and parts of the Indian Ocean show the greatest number of small species, but no large ones such as are found both north and south of them.

Having had plenty time to spread all over, there must be a good reason for its not having done so and such reason is none too obvious. But let us do some speculating. As is generally known, the larvae of mollusks are free swimming upon being hatched from the egg, but there may be some exceptions. We are not at all sure that the *Haliotis* larvae are free swimming and even if they are for a while the time must be very brief. I have seen an old shell on which there were a number of young abalones, some of them but slightly more than one millimeter in greatest length and yet they showed the beginning of the shell. These shells were brought to the Monterey wharf by Delbert Riviae, a commercial diver, and Paul Bonnot, with the California Fish and Game Commission. In 1940 Mr. Bonnot wrote about these small abalones and I quote: "At the apex of the small shells taken at Carmel Bay, the larval shell is plainly visible (see Fig. 79). It has the appearance of a U-

shaped worm tube and may indicate that the larva as well as the adult is a creeping bottom form.'' If Bonnot is right that the larva, like the adult, is a bottom creeping form, and I believe he is right, then we have the solution to their limited distribution. Only free swimming forms can take advantage of ocean currents or surface winds to transport them to distant continents or isolated islands over the great ocean depths, and therefore the young abalones must remain where they are hatched or perish.

Species of *Haliotis* have a number of local names. On our west coast, they are known as abalones. In the east they are generally spoken of as sea-ears; in England as ormers and in Australia as mutton fish.

They are much sought after as food on account of their delicious flavor and it is this quality which is mainly responsible for their rapid depletion. California law gives some protection to four species in that the sports fishermen may in the open season take only a limited number and of minimum size and the commercial fishermen must keep outside of twenty feet depth. He operates out to one hundred or a hundred and twenty feet using the most efficient deep sea diving gear and suits. No wonder our coast is being rapidly depleted of this valuable mollusk.

Beginning with Alaska, we have the *Haliotis kamschatkana* Jonas and from there as we proceed south we have *H. cracherodi* Leach; *H. wallalensis* Stearns; *H. rufescens* Swainson; *H. assimilis* Dall; *H. aulaca* Bartsch; *H. corrugata* Gray; *H. sorenseni* Bartsch; *H. fulgens* Phillippi; *H. rufescens hattorii* Bartsch; *H. californiensis* Swainson; *H. rosea* Orcutt, *H. holzneri* Hemphill; *H. fulgens turverii* Bartsch. Their territories are not exclusive as they overlap considerably but mainly they are found in the order given, south to the tip of Baja, California.

In Japan, Hirase gives as the chief one, *Haliotis gigantea* Gmelin and two subspecies named by Reeve. Also *H. japonica* Reeve; *H. varia* Linne; *H. planata* Sowerby; *H. ovina* Gmelin and *H. asinea* Linne.

The latter, *Haliotis asinea* Linne, is also widely distributed throughout the Central Pacific and it is well known in North Australia, New Guinea and the Philippines. Its peculiar long

narrow shape similar to the ears of the well-known four-legged animal probably is responsible for its name. In South Australia, we again find *Haliotis* up to six inches or over in size. *Haliotis albicans* Quoy and Gaimard, *H. naevosa* Martyn, *H. roei* Gray, and a number of others. In New Zealand is found the most beautiful of any *Haliotis,* the *H. iris* Martyn.

On the Samoan, the Fiji and other Pacific Islands, there are dozens of small peculiar marked *Haliotis* as there also are in the Indian Ocean. Near the Cape of Good Hope is found the only large African one, *Haliotis midae* Gmelin, and two small species, *H. sanguinea* Hanby and *H. parva* Linne.

In Europe, the Channel Islands and the Bay of Biscay support *H. tuberculata* and the Mediterranean has *Haliotis lamellosa* and a still smaller one.

In defiance of all that has been said about no *Haliotis* in the West Atlantic, there is record of an extremely small one, only eleven millimeters in length, being dredged near Key West, Florida, in 1869 and another one in the same place in 1913. They are named *Haliotis pourtalesii* Dall.

The more than fifty species of *Haliotis* in the writer's collection vary greatly in size, in shape, and in beauty. The smallest is about half an inch while the largest is ten and five-eighths inches long and weighs more than five pounds.

NOTES AND NEWS

Epitonium (Cirsotrema) pilsbryi.—The name of this species was misspelled *"pilsbry"* by typographical error, Nautilus, volume 54, No. 2, page 62. It appears advisable to change it to read *pilsbryi,* as originally written.—Thomas L. McGinty.

Dissentoma, the embryonic stage of Cymatium martinianum (Orb.).—The examination of immature stages of this common *Cymatium* shows that *Dissentoma prima* (Nautilus, 59: 59) is the stage immediately succeeding the smooth, brown embryonic stage. This determination was suggested by Mr. T. L. McGinty and confirmed by examination of his series of all ages. —H. A. Pilsbry.

THE NEW YORK SHELL CLUB.—This new organization, devoted to the study of conchology and malacology, was founded on January 30th, 1949, in New York City. Membership is open to all interested in the subjects. The club has held two meetings. Several most interesting and instructive papers were read. Field trips are contemplated in the spring and fall. The president is Mr. Morris Jacobson. Those interested in the club can obtain further information by writing the secretary-treasurer, Dr. WALTER H. JACOBS, 124 West 93rd Street, New York, N. Y.

HELICOSTYLA FLORIDA MESAI.—Dr. Harald A. Rehder has just advised me that this subspecies that I described in the October NAUTILUS, had been previously described by Dr. Bartsch in the Proceedings of the Biological Society of Washington, "A new subspecies of *Helicostyla florida* from Mindoro, Philippine Islands" (vol. 59, p. 179). I was unaware of this publication and regret making a useless name in literature. According to Dr. Rehder, Dr. Bartsch described the shell in December of 1946 from material that I sent to the National Museum. He was ungrateful, to say the least, in not sending me a copy of the paper or even mentioning my name in it.—RALPH W. JACKSON.

DR. GEORGE H. CLAPP.—Died March 29, 1949, in Sewickley, Pa. Dr. Clapp, who was 90 at his death, was interested in shells for a long time, and his collection of more than 15,000 was given to the Carnegie Museum in Pittsburgh, Pa. Further notice will follow.—C. B. WURTZ.

PUBLICATIONS RECEIVED

THE LAND AND FRESH-WATER MOLLUSKS OF PUERTO RICO. By Henry van der Schalie. Misc. Pub. Mus. Zool. Univ. Mich., no. 70; 134 pp., 14 pls.; 68 text figs. and maps. 1948.—This valuable study will be of great assistance to all students of Puerto Rican inland mollusks. The clear artificial keys and Grace Eager's beautiful drawings should make identification easy, even without detailed descriptions. However, the figures of small species, such as *Yunquea denselirata,* are not enlarged enough to show the characteristic sculptures. An excellent fea-

ture is the presentation of many distribution maps, but these would be more useful, though less personal, if all known records had been included. Statistical studies of *Megalomastoma croceum, Obeliscus terebraster, Polydontes lima* and others are given. The work closes with a very interesting treatment of physiographic features in relation to local distribution, and a careful discussion of the broader zoögeographic relations.

Because of its importance as a handbook for future students, attention is called to the following lapses. "*Lamellaxis unilamellata*" (p. 55) should read *Leptinaria unilamellata;*[1] it is the type species of a distinct (and prior) genus. The family references of the related genera are confused: *Cecilioides* and *Opeas* belong in the "Ferussaciidae" (p. 51), and *Lamellaxis, Leptinaria* and *Obeliscus* go in the "Subulinidae" (p. 56), if these "families" are separated from the African "Achatinidae" (p. 57).[2] "*Varicella terebraeformis*" (p. 63) should be called *V. sulculosa* (Sh.); since the two names appeared simultaneously, the relative "priority" depends on the action of the first reviser[3] who made them synonymous. "*Microconus*" (p. 70, last line of quotation: "*Mcleania* . . . .") should read *Miroconus;*[4] *Microconus* (cf. p. 71) is of course a very distinct genus.[4] Incidentally, the inclusion of these Thysanophorinae in the "Polygyridae" is still dubious.[5] The discussion of *Macroceramus microdon* omits "two southern records given," and the incomplete quotation (p. 96, 1st paragraph) about *M. m. shuttleworthi* (Martens?) Pilsbry only applies to shells from near the southern coast: "Penuelas" (Martens), west of Rio Loco, Cerro Capron (near Guanica) and near Tallaboa (often much larger and bluish in color). Those from the northern side, as collected (map 62) and figured (pl. 7; contrast with figs. quoted from Pilsbry), are very similar to typical *M. microdon,* as are also those from Los Peñones (quoted in 2nd paragraph). F. C. Baker[6] called the 3 species cited under

[1] 1945, Naut., vol. 58, p. 91.

[2] Cf. Thiele, 1931, Handb. System. Weichtierk. I, p. 558.

[3] 1941, Naut., vol. 55, p. 28.

[4] 1927, Proc. ANSP. 79, pp. 236, 238. My apologies for the too close similarity.

[5] 1940, Naut., vol. 54, pp. 55, 56.

[6] 1945, The molluscan family Planorbidae, pp. 502, 118, 490, respectively.

Planorbis (p. 105): *Tropicorbis schrammi, Drepanotrema lucidum* and *D. cimex* (Moricand); he did not mention all synonyms but probably identified *Planorbis terverianus* Orb. (p. 103) with his *T. havanensis* (Pfr.). Instead of *T. decipiens* (p. 104), *P. circumlineatus* may have been *T. pallidus* (C. B. Adams),[7] which has similar spirals when young, and might occur in P. R. Both forms attain far larger sizes (type diameters over 9 mm.) than Schalie's dimensions (p. 100) or figure. —H. Burrington Baker.

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[7] 1848, Proc. Boston Soc. N. H., vol. 2, p. 102. Cf. 1930, Occ. Papers Mus. Zool. Univ. Mich., no. 210, p. 47.

[1] 1917, vol. 30, p. 144.

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THE NAUTILUS

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EDITORS AND PUBLISHERS
HENRY A. PILSBRY, Curator of the Department of Mollusca,
Academy of Natural Sciences, Philadelphia 3
H. BURRINGTON BAKER, Professor of Zoology,
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