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THE NAUTILUS.

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RIVER BARRIERS TO AQUATIC ANIMALS.

BY CALVIN GOODRICH.

Contending that the genus was purely a creek form, Dr. James Lewis [1] questioned the existence of *Goniobasis* in the Holston river. Tryon,[2] with little waste of good-nature, retorted that Dr. Lewis was in no position to know about this, since the information upon which the assertion was based had to do with only twenty-five miles of the Holston.

Dr. Lewis seems to have glimpsed a fact in the distributional history of *Goniobasis*, but not all of the fact. The genus does exist in parts of the Holston, but it is where creek conditions obtain or river conditions are no more than beginning. It ceases to live in the true river. The twenty-five miles which had been painstakingly explored by Lewis's correspondent were apparently below the line of creek characteristics, within the barrier across which *Goniobasis* of the region could not go.

Dr. Paul Bartsch,[3] describing the restrictions which the sediment-laden Missouri places upon the distribution of the *Unionidæ*, remarks: "We have, therefore, the curious condi-

1 *Amer. Jour. of Conchol.*, vol. vi, p. 216.

2 *Ibid.*, vol. vii, p. 86.

3 *Nautilus*, Dec., 1916.

tion of a river forming a barrier to aquatic animals.'' It may be of interest to recite similar instances as they apply to *Goniobasis*.

Say's *G. semicarinata* lives in streams upon both sides of the Ohio river. It does not, I am convinced, inhabit the river itself. Shells that one may identify as *semicarinata* have been sent out from Cincinnati, and it has been assumed that the material came from the Ohio. The collection of the University of Cincinnati leads me to believe that the shells were taken, not in the Ohio, but in the Little Miami river and in Mill creek, close at hand. A barrier is plainly indicated by the difference in the species on the two sides, the *semicarinata* of the Kentucky streams being smaller, darker, the carinæ less pronounced, than in Ohio and Indiana streams.

In the Blue river of southern Indiana, Daniels found a *Goniobasis* that Pilsbry described under the name *indianensis*. So far as the records show, the race is confined to that stream. In Hardin county, Ill., the streams of which are tributary to the Ohio, occurs a plicate *Goniobasis* which is identified as *costifera* Hald. In Pigeon creek at Evansville, Ind., I found a species of the genus which, if not new, is exceedingly rare in collections. It has no counterpart in streams explored elsewhere in Indiana and in Ohio and, so far as I know, in Kentucky and Illinois. To the list of isolated races of the region can be added *G. eliminata* Anth. In all these instances, the Ohio river has acted as a barrier, preventing the interbreeding of the races of one species, permitting the development of small, distinct races, acting as a wall between the interdistribution of the *Goniobases* of the Licking, Kentucky and Salt rivers on one part and of the Green river *Goniobases* on another.

Goniobasis depygis Say is recorded as from the Falls of the Ohio. I have collected there three times and never found specimens of the genus. None appears in the Daniels collection, and in a large sending from this locality to Dr. Bryant Walker, from Billups, there were no *Goniobases*. My own suspicion is that *depygis* is a *Lithasia* as surely as is the *G. louisvillensis* of Lea.

The characteristic *Goniobasis* of the upper Wabash river is *livescens* Menke, a species which, with the possible exception of *virginica* Gmel., is the most adaptive of all members of the genus. It appears as far down the river as Logansport. But somewhere below that point the conditions become inimical. It does not occur in the extensive collections made by Daniels in the Wabash at Lafayette. A small depauperate form was taken by Hinkley under stones at the "Chains" in Posey county, and he reports it also from Mt. Carmel, higher up the river. Its relationship is with *livescens*. We have here the case of a fairly robust species that has been isolated by river conditions but which, by reason of its adaptiveness, has been able to plant struggling colonies in an unfavorable environment, the colonies developing subspecific characters.

This isolating effect of river conditions is compactly illustrated at Big Stone Gap, Virginia. In a collection from the south fork of Powell river at this point — made without discriminating among species—*Pleurocera unciale* Hald., a river form, was exceedingly abundant; *G. simplex* Say, a race of the creeks, was rare. In the north fork of the Powell, a smaller stream about a mile away, nearly 16 percent of the *Pleuroceridæ* were *simplex*, the rest *unciale*. In a brook tributary to the south fork, 78 percent of the specimens taken were *simplex*, 22 percent *unciale*. Near Arthur, Claiborne county, Tenn., the Powell seemed to contain no *Goniobases*. Conditions were suitable in the brook at Big Stone Gap. The genus survived, but under difficulties in the north fork of the Powell. The struggle was all but over in the south fork and, farther down stream, the isolation had been made complete.

The inhospitable nature of the true river to most species of *Goniobasis* may again be indicated by a quotation from a letter from Herbert H. Smith to Dr. Walker in November, 1909, writing while collecting at the Muscle (Mussel) Shoals of the Tennessee. "It is remarkable," Mr. Smith says, "that we have found no *Goniobasis* in the river except a few creek forms evidently washed in. The predominating genus is *Pleurocera*."

A great many forms of *Goniobasis* occur in east Tennessee.

Yet of all the species and in spite of their seemingly great powers for existing under such harsh conditions as those of flood, shifting stream bed and chemical erosion, none seems to have been able to survive the river conditions of the middle Tennessee. Not one, present study appears to show, has rounded Walden Ridge and become located in the streams of central Tennessee or of Alabama. Nor, the literature to the contrary, is there clear evidence that *Goniobases* characteristic of central Tennessee thrive east of the mountains.

A NEW CHITON FROM SOUTHERN BRAZIL.

BY W. H. DALL.

Among some shells sent for identification by Dr. Florentino Felippone of Montevideo is a chiton with quite unique sculpture, and a combination of characters which does not admit of its being placed in any of the subdivisions which have hitherto been proposed in the restricted group of Chitonidæ. I therefore suggest for it the following designation.

TYPHLOCHITON.

Chiton without dorsal eyes, the end valves with numerous slits, the intermediate valves with one slit on each side; the insertion plates externally grooved; the eaves not spongy; the gill rows long but not extending to either head or tail, the margin of the sinus entire.

Type:

Typhlochiton felipponei n. sp.

Chiton with brownish velvety girdle with rare minute, short, silvery spicules sparsely irregularly distributed; gills about 25 on each side with the ends of the series separated by a marked vacant space from both head and tail; valves rather acutely ridged and medially posteriorly produced; the anterior valve with ten, the intermediate valves with one slit on each side, the tail valve with 12 slits; the eaves pale blue and not spongy; the insertion plates are radially sharply grooved but the distal margins remain practically entire; sutural plates narrow, the sinus shallow with entire margin; a brown streak on each side of it internally but the rest of the interior white; external sculpture of the intermediate valves with lateral areas but no defined jugal tract; the surface microscopically reticulate with, on the central and pleural tracts, rather sparse slender bluish beaded longitudinal threads on a brownish ground, about 15 threads on each side with wider interspaces; lateral areas with two to four similar threads of which not more than two run the whole length of the area, the others being irregularly broken up and short; the anterior valve with about 20 similar threads, tending to pairs; the posterior valve with a feeble subcentral mucro, in front of which it is threaded like the pleural tracts, behind it there are about a dozen sparse feeble radial threads. There are no eyes or visible sense organs on the surface of the valves. Length of specimen (after soaking) 23; breadth 16; height 8 mm. U. S. Nat. Mus. Cat. no. 333091.

WHAT IS THE TYPE OF ANCYLASTRUM BOURGUIGNAT?

BY BRYANT WALKER.

In a paper recently published in the Proceedings of the Malacological Society (XIV, 1920, p. 86), Messrs. Kennard and Woodward, after stating that in their opinion the type of *Ancylus* of Geoffrey was the *Patella lacustris* of Linné, and that as that species is the type of Beck's *Acroloxus*, the latter consequently becomes a synonym of *Ancylus s. s.*, suggest that as *fluviatilis* Müll. must be placed in a distinct genus, "recourse must be had to the subgeneric name of *Ancylastrum*, proposed by Bourguignat in 1853 and that name must now be raised to generic rank."

Assuming that the premises of the authors are correct, which is by no means free from doubt, the question is at once raised as to whether *Ancylastrum* Bgt. can properly be used for the group typified by the European *fluviatilis* Müll.

If so, it is evident that the Tasmanian species represented by *Ancylus cumingianus* Bgt., which are generically distinct from the European group of *fluviatilis,* will have to be known by another name.

As the establishment of the proper type of *Ancylastrum* thus becomes of very considerable importance in the classification of the *Ancylidæ,* and as I have not been able to agree with the position taken by the authors of this paper, it seems proper to state the reasons that have influenced my decision of the question before their suggestion has been generally accepted.

STATEMENT OF FACTS.

Ancylastrum was first proposed by Bourguignat in the Journal de Conchyliologie, IV, p. 63. This number of the Journal is dated February 15, 1853. His paper is entitled "Notice sur le genre *Ancylus,* suivie d'un catalogue synonymique des especes de ce genre." Only the preliminary part, the "Notice", was published at this time. On p. 63 the author defines his new "S. G. *Ancylastrum,*" but neither names a type nor lists any species that he would include in it.

In the next number of the Journal, issued May 1, 1853, in a paper, which is entitled "Catalogue des especes du genre *Ancylus,* 2e Article," Bourguignat published a complete catalogue of all of the species of the genus then known to him. Under the caption "ANCYLASTRUM" (p. 170) the first species mentioned is *Ancylus cumingianus* Bgt., which he states "is the type of the section *Ancylastrum,*" and remarks that "Cette magnifique espece, remarkable par l'excessive deviation de son sommet, contourné sur lui-meme, habite la terre de Van Diemen, dans la Nouvelle Hollande." He further states that he regrets that he is unable to give the diagnosis of this and certain other new species from the Cumingian collection for the reason that he had promised Mr. Cuming that they should appear first in the Proceedings of the Zoological Society of London. He then proceeds with his catalogue, which shows that he included all of the known *Ancyli* in *Ancylastrum* except those having the apex directed to the left side.

On July 12, 1853, Bourguignat's paper was presented to the Zoological Society and was published on July 25, 1854. The *A. cumingianus* was fully described in this paper on p. 91 and beautifully figured. And the author again states that it is the type of his section *Ancylastrum*.

In 1864 Bourguignat (Mal. Algerie, II, pp. 188-9) repeated his diagnosis of *Ancylastrum*, citing *A. simplex* Buch. (= *fluviatilis*) and *A. cumingianus* as examples.

In 1881 Fischer in his Manual cited *fluviatilis* as an example of *Ancylastrum*. Clessin in his monograph in the Conchylien Cabinet (1882) gave *fluviatilis* as the type of *Ancylastrum*, and in this has been followed by Tryon, Germain and practically all of the recent European writers.

Hedley (Prac. Mal. Soc., I, 1895, p. 118) was the first to call attention to the fact that Bourguignat had designated *cumingianus* as the type of *Ancylastrum*.

ARGUMENT.

The publication of Bourguignat's paper in 1853 in two distinct parts with an interval of nearly three months must be considered as two separate publications.

If so, it follows:—

I. That *Ancylastrum* in the first instance was a genus published not only without any specified type, but also without any accompanying list of species. It therefore comes within the ruling of Opinion 46 of the International Commission on the "Status of Genera for which No Species was Distinctly Named in the Original Publication," and consequently contained all of the species of the world which would come under the generic description as originally published. And the generic type could be designated by the first subsequent author dealing with the subject.

II. That the subsequent publication of Bourguignat's catalogue was not a part of the original publication and that consequently the subsequent designation of the type was not restricted to the species listed in that catalogue.

This does away with the criticism that the designation of *cumingianus* in the catalogue of 1853 was ineffective because it had not then been described and was therefore simply a nude name.

If there is any question as to this position, it may be well claimed that the characterization of *cumingianus* in the catalogue of 1853, taken with the subgeneric diagnosis of *Ancylastrum* given by Bourguignat, was sufficient to identify the species, even though he refrained from giving a formal description of it at that time. His remarks give an "unmistakable picture, which applies to no other form yet known." The only other known species of that group, *A. irvinæ* Petterd, is quite different in the manner of the enrollment of the persistent spire, which has practically no lateral twist at all.

III. No other species having in the meantime been designated as the type, it follows that Bourguignat's second designation of *cumingianus* in the P. Z. S. as the type of his section, *cumingianus* having then been formally described, was fully operative, even though that of 1853 was insufficient.

IV. When later it was discovered that *cumingianus* was generically distinct from the European *Ancyli, Ancylastrum*, of which it was the type by designation, necessarily followed its type and became the name of the new genus.

The argument of Kennard and Woodward, as I gather from several letters from Mr. Kennard, is substantially as follows:

I. "It is clear that *Ancylastrum* Bourg. is really a synonym of *Ancylus s. s.* of authors. Bourguignat in 1853 when he used the word type did not use it in the modern sense and had no idea that it was generically distinct from the forms with which he associated it."

The reply to this is that under the Code the original diagnosis "cuts very little ice". The generic name follows the type regardless of the specifications of the original diagnosis. Very many of the ancient genera now in accepted use have wandered far from the specifications of the original author.

II. "Bourguignat never intended to separate *cumingianus* from the rest and he uses the word type in a different sense. He meant example, a very different thing. The present idea of "type" is quite a modern one and when the older men used it they meant example."

The answer to that is that Bourguignat twice explicitly stated that *cumingianus* was the type of *Ancylastrum*. I cannot see how we can go behind his positive statement and argue that he meant something else. The fact that in 1864 he mentions *cumingianus* and *fluviatilis* as "examples" of *Ancylastrum* has no bearing on the validity or intention of his original designation. If this can be done, all of the older designations of typical species can be overthrown.

III. That when *cumingianus* was designated as the type in 1853 it had not been described and therefore could not be so used.

This has been answered by my paragraph II.

CONCLUSION.

Ancylus cumingianus Bgt. is the type of *Ancylastrum* by designation and consequently that name cannot be used for the European group typified by *A. fluviatilis* Müll.

ANCULOSAE NORTH OF THE ALABAMA DRAINAGE.

BY CALVIN GOODRICH.

Work upon the Alabama drainage Anculosæ collected by Herbert H. Smith, compelled a more or less thorough study of the species and forms which occur in other parts of the country. I submit the impressions and conclusions for what they are worth, realizing that a painstaking examination might greatly modify my present views.

Group of *Anculosa carinata* (Brug.).

1—A. CARINATA (Brug.), 1792.

Synonyms: *Paludina dissimilis* Say, 1819; *Anculotus nigrescens* Conrad, 1834; *Anculotus monodontoides* Conrad, 1834; *Anculotus dentatus* Couthouy, 1839; *Anculosa carinata* Lea, 1841; *Anculosa dentata* Lea, 1841; *Anculosa variabilis* Lea, 1841; *Anculotus carinatus* DeKay, 1843; *Anculotus trivittata* DeKay, 1843.

Some of these may deserve recognition as local races.

1*a*—A. CARINATA NICKLINIANA Lea, 1841.

Tryon's insistence to the contrary (Monograph of the Streptomatidæ, p. 395), this is an *Anculosa.* I think the reason for Tryon's error may lie in the fact that a dwarf form of *Goniobasis virginica* Gmel. was in his day distributed as *nickliniana.* I have specimens from the type locality which were sent to me by Mr. Robert Patterson of Chase City, Va. Their generic position cannot be questioned.

2—A. CORPULENTA Anth., 1860.

3—A. CANALIFERA Anth., 1860.

4—A. DILATATA Conrad, 1834.

Synonyms: *Anculotus rogersi* Conrad, 1834; *Melania inflata* Lea, 1838; *Anculotus kirtlandianus* Anth., 1840; *Leptoxis rapæformis* Hald., 1843(?) (on the authority of Tryon); *Anculotus carinatus* Anth., 1860.

5—A. ORNATA Anth., 1860.

This is a form with Atlantic drainage antecedents which, like *dilatata*, has crossed over into a western drainage. So far as I know, it is confined to the Hiawassee of the Tennessee.

Group of *Anculosa trilineata* Say.

1—A. TRILINEATA Say, 1829.

Synonym: *Melania viridis* Lea, 1841.

2—A. COSTATA Anth., 1840.

Synonym: *Melania occidentalis* Lea, 1841.

3—A. VIRGATA Lea, 1841.

A distinct species, quite different from *subglobosa* Say where Tryon placed it.

4—A. MINOR Hinkley, 1912.

5—A. ARKANSENSIS Hinkley, 1915.

Group of *Anculosa prærosa* Say.

1—A. PRÆROSA Say, 1824.

Synonyms: *Melania cruentata* Menke, 1828; *Melania angulosa* Menke, 1830; *Anculotus angulatus* Conrad, 1834; *Melanopsis neritiformis* Deshayes, 1838; *Melania cincinnatiensis* Lea, 1838.

2—A. TINTINNABULUM Lea, 1834.

3—A. TRYONI Lewis, 1870.

4—A. PINGUIS Lea, 1852.

5—A. TROOSTIANA Lea, 1841.

6—A. PLANISPIRA Anth., 1854.

The figure given of this species by Tryon suggests a variant very common among the *prærosa* of the Holston and Cumberland rivers. The Green river material mentioned in Tryon is *Lithasia obovata* Say with the spire worn away.

7—A. LEWISII Lea, 1861.

8—A. VIRIDULA Anth., 1860.

Cited from Tennessee. It suggests some of the forms taken by *A. picta* Conrad in the Alabama river. Tryon links it with *kirtlandianus* Anth. of the *carinata* group.

9—A. UMBILICATUS Wetherby, 1876.

10—A. HARPETHENSIS Pilsbry, 1896.

11—A. SUBGLOBOSA Say, 1825.

Synonym: *Melania globula* Lea, 1841.

12—A. GIBBOSA Lea, 1841.

A form from Abram's creek, Blount county, Tenn., is the only one I have seen which consistently corresponds with the description of this species.

13—A. LITTORINA Hald., 1840.

Synonym: *Melania pilula* Lea, 1841.

It seems to me to be of significance that this species, recorded from the Holston river, does not appear in the extensive collections of Mrs. Andrews and Professor Wetherby. Aberrant specimens of *virgata* agree with the description except in the matter of size. It may be suspected that *littorina* is a form of *subglobosa* varying in a similar manner.

The entire *prærosa* group is something of a confusion. Particularly in the smaller rivers and creeks of central Tennessee does it take peculiar aspects which may or may not deserve differentiation from the parent stock. In the Elk river are forms ranging from undeniable *prærosa* to *subglobosa*. The same thing is true of the Duck river. *A. pinguis* is in the Caney Fork of the Cumberland river, but typical *prærosa* is there also, and I have not had means of learning whether *pinguis* is a true local race or represents specimens selected from sendings of species previously named. The suspicion holds good against *troostiana* and *lewisii*. The only *subglobosa* outside of southeastern Virginia and eastern Tennessee that may not be challenged as variants of *prærosa* comes from Lookout creek, a tributary of the Tennessee river in northern Alabama. There is still a great deal to be learned about the forms of middle Tennessee.

THE HELICOID GROUP DISCULELLA PILSBRY.

BY T. D. A. COCKERELL.

Lowe gave the name *Placentula* to a small group of Madeiran Helices, typified by *H. maderensis* Wood. This shell, in general form and coloration, resembles the *H. polymorpha* group (*Discula* Lowe), but is easily distinguished by the lack of the surface sculpture of elongate pustuliform granules, the round aperture (hence the synonym *H. cyclostoma* Menke) and strictly continuous peristome. Eight species are referred to *Disculella* by Pilsbry, and a ninth must now be added:

Geomitra (Disculella) cenourensis n. sp.

Shell with max. diam. 7.2 to 9.5 mm., with the form of *G. dealbata* Lwe., to which it is nearly related, but dark reddish-brown, varying to whitish, with the surface *dull*, above and below, minutely granular, not very conspicuously striate; aperture round, the peristome continuous, livid brown. The umbilicus is rounder than in *dealbata;* in the latter species it is distinctly contracted, and therefore not round. In the dull surface the shell resembles *G. (Spirorbula) depauperata*, but it differs by the wider umbilical region, with much more of the penultimate whorl showing. In the form of the umbilical region it resembles *G. (Disculella) fictilis* Lwe., but it is considerably larger than *fictilis* and lacks the glistening surface. The animal is pellucid whitish.

I found this abundantly on Cenouras Island, off the east side of Porto Santo, January, 1921. The snails of this small island have not previously been collected, so far as I can learn. The island is barren, with a scanty vegetation consisting of *Microstigma maderensis (Matthiola maderensis* Lowe), *Lotus*, etc. I could not find any ants or millipedes. The same plants and the same general conditions are found on the Ilheo de Nordeste, a short distance away, yet the snail faunas of these two islets are very different. Nordeste possesses a fine *Leptaxis (forensis* Woll.), and swarms with a *Discula (gomesiana* Paiva). On Cenouras I found no *Discula*, except a single dead and broken *G. cheiranthicola* (Lowe), which, as Mr. A. C. de Noronha suggests, may have been brought by a bird. On Nordeste we found a small variety of *G. (Caseolus) abjecta* (Lwe.) in some numbers, but the shells were all dead.

The group *Disculella* contains rather discordant elements. *G. leptoticta* (Lwe.) of Madeira, and the related *G. micromphala* (Lwe.) of the Desertas stand apart, having a granulated surface, small umbilicus, no keel, and peristome not strictly continuous. They should, I think, be transferred to *Caseolus*. *G. spirulina* n. n. (*Helix spirorbis* Lowe, 1852, not Linné, 1758) is the smallest of the series, and *G. compar* (Lwe.) is easily known by the elegant ribbing.

I recently received *G. micromphala* from the Southern Deserta (Bugio), collected by Mr. C. B. Cossart. According to Paiva, *spirulina* and *leptosticta* also occur there, but several of Paiva's Bugio records are improbable and in need of confirmation. Mr. Cossart's collection from Bugio (1921) consists of the following forms:

Plebecula vulgata saxipotens (Woll.). Six.

P. punctulata avellana (Lowe). Common.

Geomitra micromphala (Lowe). Six.

G. polymorpha poromphala (Lowe). The most abundant shell.

G. coronula (Lowe). Two examples of this beautiful little species.

G. actinophora descendens (Woll.). This form can only be segregated on average characters, I think. Three were found.

OREOHELIX MACULATA, NEW SPECIES.

BY JUNIUS HENDERSON.

In 1917 I collected several species of *Oreohelix* in abundance in Shell Creek Canyon and White Creek Canyon, northern Wyoming. The first-mentioned canyon is the type locality of *O. pygmaea* Pilsbry, and the other, near by, is the only other recorded locality for that species. Supposing that I was at the type locality of *pygmaea*, and misled by the size and shape of the smallest species of *Oreohelix* I found there, the specimens were labeled *pygmaea* in the field and so designated in the field notes. Apparently they were not reexamined upon returning to Boulder, but were unfortunately placed in a drawer and published as *pygmaea* (NAUTILUS, XXVII, pp. 45-46), and specimens have since been distributed in exchange to several conchologists and institutions under that name. A few days ago I examined a few of them with a lens, just after looking at some true *pygmaea*, and at once saw that they bear no very close resemblance to that form or to any other described *Oreohelix*. Indeed, the difference may be readily seen without a lens. An examination of the records in comparison with the latest map of the region also shows that the *pygmaea* localities are several miles farther up both canyons than our 1917 stations, and none of the material found in 1917 is *pygmaea*.

OREOHELIX MACULATA, new species.

Shell below medium size for the genus, spire elevated, whorls $5\frac{1}{2}$, with convex periphery, somewhat flattened above near the suture, resulting in a deeply impressed suture, convex below. Embryonic whorls dark brown in most examples, at first nearly smooth, with very fine growth-lines crossed by microscopic spiral lines, which, at about the beginning of the third whorl, develop into beaded ribs easily detected with a low-power lens. The last two whorls of the shell bear numerous rather strong, rude, blunt, irregular ribs, parallel with the growth-lines, crossed by about equally numerous rude spiral ribs, this sculpture being especially well developed on the base of the last whorl. This sort of sculpture is typical of the *depressa-cooperi* group, as distinguished from the sharp-ribbed *haydeni* group, but the sculpture is very much stronger in *maculata* than is usual in either *depressa* or *cooperi*, and the two latter are smoother below than at the periphery and above, while in *maculata* the opposite is true. Aperture rounded, outer and inner lips approaching. Umbilicus deep and narrow. Color exceedingly variable, a large number seen collectively appearing quite dark because of a preponderance of brown. The great majority of examples have irregular, poorly defined light brown patches on a white ground color, particularly noticeable under a lens, with usually one spiral band or more of the same color above the periphery and stronger bands of darker brown, varying in width and number, just below the periphery and on the base. A few albinos were found, without intergradation to the typical color, as is also true of *O. cooperi obscura* at the same locality. A considerable number of examples are almost entirely dark brown, but, except in a very few specimens, there is a wide, conspicuous lighter band at or just above the periphery of the melanistic shells, which shows just above the suture on the spires.

Type, width, 14 mm.; height, 11.5 mm. Univ. Colo. Mus.

Cotype No. 1, width, 13.5 mm.; height, 10.8 mm. Univ. Colo. Mus.

Cotype No. 2, width, 14 mm.; height, 11 mm. Univ. Colo. Mus.

Cotype No. 3, width, 12.8 mm.; height, 10.6 mm. Univ. Colo. Mus.

Cotype No. 4, width, 13 mm.; height, 10.8 mm. Univ. Colo. Mus.

Cotype No. 5, width, 13.5 mm.; height, 12 mm. Univ. Colo. Mus.

Cotype No. 6, width, 14 mm.; height, 10.8 mm. A. N. S. Phila.

No. 5 is a melanistic example with no light band.

GLOCHIDIA IN SURFACE TOWINGS.

BY H. W. CLARK AND SAMUEL STEIN.

In their article on "Reproduction and Parasitism in the Unionidæ," by LeFevre and Curtis (Journ. of Experimental Zoology, Vol. IX, No. 1, p. 98), under the caption, "Behavior and Reactions of Glochidia," occurs the following statement: "At the time of spawning the glochidia, already free from the egg-membranes and more or less loosely held together in slimy strings, are discharged at irregular intervals through the exhalent siphon. Being heavier than water, they sink rapidly to the bottom, coming to rest with the outer surface of the shell directed downward and the valves gaping widely apart." The belief was formerly general that they "swim" about by rapidly opening and closing the valves, after the manner of Pecten, and in spite of frequent denials by Schierholz ('88), Latter ('91) and others, the same statement is still occasionally encountered. In the recent volume on Mollusca in the Treatise on Zoology, edited by Lankester, this inexcusable error is represented. "The glochidia," we are again informed, "swim actively by clapping together the valves of the shell" (p. 250). They are, on the contrary, as is now well known, entirely incapable of locomotion and remain in the spot where they happen to fall, and that "The glochidia remain in this helpless situation until they die, unless they happen to come in contact with the host on which they pass through the post-embryonic development as parasites.'' The same statement occurs in the ''Studies on the Reproduction and Artificial Propagation of Freshwater Mussels'' by the same authors in the Bulletin of the U. S. Bureau of Fisheries, Vol. XXX (Document No. 756, page 152).

The occurrence of glochidia in plankton is noted and commented on in some fullness of detail by Kofoid in his report on the Plankton of the Illinois River, Part 2, page 287, where, under the heading ''Lamellibranchiata'' he remarks: ''This group is represented in the plankton by the larval stages or glochidia of the *Unionidæ*, which form an important part of the bottom fauna of the stream and its tributaries.'' Among those mentioned as occurring in the plankton are *Anodonta corpulenta* Cooper, glochidia ''referred with some uncertainty'' to *Lampsilis anodontoides*, and glochidia presumably belonging to *Arcidens confragosus*.

Kofoid's remarks concerning the abundance, numbers and percentage of occurrence, temperature relations and seasonal distribution, as well as his remarks on identification of the glochidia encountered, preceding as it does the strenuous attempts at description and identification of glochidia and ascertainment of breeding seasons of different species of mussels later entered into with such avidity in behalf of mussel propagation, form one of the most fascinating episodes in scientific research. His discussion is unfortunately too long to quote in a brief article like that intended here, but too interestingly precious to be missed by anyone studying the history of mussel propagation.

Peremptorily dismissing the temptation to quote remarks illuminating other but what would anciently be called impertinent phases of the subject here, it only remains to remark that what is really the one pertinent query, that of the relation of the glochidia to the surface, is left in doubt. The wording of the one introductory sentence quoted, doubtless perfectly clear when written, develops an ambiguity which increases with a growing interest in glochidia rather than mussel. Kofoid took his plankton by means of a pump, and at all depths, from near the bottom to the surface. He may, therefore, have obtained his glochidia anywhere between those extremes of depth.

During the spring and summer of 1920, in an attempt to ascertain the relation, quantitatively and qualitatively, between the river, the reservoir and the various ponds of the Fisheries Biological Station at Fairport, Iowa, occasional surface towings were made with a fine bolting-cloth net in all the places mentioned. On April 12, ten short hauls were made at the surface of the Reservoir near its outlet, in about 12 feet of water. In the portion of the haul examined (in most cases, especially where a considerable amount of material was taken, only a small portion, usually about one-tenth, was examined carefully) a glochidium of the Anodonta type, probably that of *Anodonta corpulenta*, was taken. It was at first supposed that it was dead, but four hours after capture it was observed to snap its valves.

On July 3, the river, which was high and muddy, showed a slightly greenish cast, suggesting an abundance of plankton. Accordingly several short draws, almost dips, were taken at 11:15 a. m. from the end of the pier, from the surface in shallow water near shore. One glochidium, provisionally identified as that of *Lampsilis anodontoides*, and 12 shorter, rounder, probably of some species of *Quadrula*, were taken. On July 29 a towing was taken in water a considerable distance from shore, from a boat and in the current. Only a small amount of the material — mostly silt — was examined; but in the part scrutinized was found a glochidium.

On July 30, the townet was held under the edge of the mass of water coming up from the river and falling in an inverted bowl-shaped mass from the vertical inlet pipe, where it enters the Reservoir. The net was held here only about 3 minutes, and naturally strained only a small portion of the water falling from the pipe—hardly a hundredth part. A good deal of material, chiefly detritus, was obtained and only a small amount of this examined; but in this small amount was obtained 8 glochidia of the Lampsilis type.

On August 14, twenty-five liters of water was dipped from the surface out in the river in fairly deep water and in the channel. In the part examined one very minute glochidium was taken.

On August 19, in taking a surface towing by dragging the townet from a boat going down stream from a bar above the station, and in fairly deep water, three glochidia were captured.

To sum the matter up, there was not a single collection of surface plankton taken from the river in which there was not one or more glochidia, and indeed, until the river became low and calm, permitting the development of plankton organisms, the glochidia usually outnumbered any other organism; the river, except during the conditions above mentioned, being remarkedly plankton-poor. In every instance, too, where examined repeatedly and at long enough intervals, the glochidia proved themselves alive by a feeble snapping of their valves. The flapping of the valves was always too feeble and too widely separated in time intervals to be effective as a means of locomotion. It may, of course, have been much more vigorous and frequent for a time after first discharged, but there is no probability that it could ever have resulted in swimming."

On the assumption that the glochidia lie on the bottom where discharged, and there die unless they become attached to a fish, one of the most important advantages served by parasitism is that of dissemination. In the light of the observations recorded above, it becomes evident that distribution down stream is common and that perhaps many, if not most, natural infections take place some distance from and below the place of discharge. The importance of parasitism as regards dispersal is therefore confined chiefly to up-stream migration, although of course dispersal in other directions is greatly assisted and accelerated by means of the fish.

The surface-floating habit of glochidia explains also the occurrence of *Anodonta imbecillis*, a species which is capable of developing without parasitism, in floating crates, the bottoms of which are considerably above the level of the bottom of the river, as has happened in crates moored at Fairport, Iowa, and at New Boston, Ill.

Fisheries Biological Station, Fairport, Iowa.

FLORIDA WEST COAST LIGUUS.

BY CHARLES TORREY SIMPSON.

In the April, 1921, number of the NAUTILUS, Mr. M. G. Miller states that Capt. W. D. Collier, long a resident of Key Marco, brought tree snails from Middle Cape Sable and "planted" them at Caxambas, Goodland Point, and Marco, all on Key Marco. This was done forty-eight years ago and there were no *Liguus* snails on Marco previous to this, but they multiplied and spread rapidly.

As a matter of fact there have been found no less than four subspecies of *Liguus* belonging to two species, and one species of *Oxystyla* in the Marco region and for some forty miles southeast of it. *Liguus fasciatus roseatus* has been found on Marco Key, Horr's Island, near it, at Gomez Old Place, ten miles southeast, at Caxambas, and at Chokoloskee farther down the coast. The form of *Liguus* which I have called *lineolatus* has been found at several places on Marco Key, Horr's Island, Gomez Old Place, Russell's Key, Turner's River, Caxambas and Chokoloskee. *Liguus fasciatus castaneozonatus* has been found at Rabbit Key, just below Chokoloskee, and on the island of the latter name, but nowhere to the northwest of these places, so far as I know. *Liguus crenatus marmoratus*, the "black snail", was obtained by Mr. Clarence B. Moore, who got it from a Mr. C. G. McKinney from land which he cleared somewhere near Chokoloskee, according to Pilsbry in his "Study of the Liguus of Florida," page 453. Some five years ago I visited Chokoloskee and was taken by a resident to the island where he said the black snails which Mr. Moore obtained were found. The hammock had been cleared but diligent search brought to light some fragments and three dead, badly-faded specimens, one of which is *marmoratus*, I believe. *Oxystyla floridensis* has been found at Chokoloskee, its northernmost limit, Pavillion Key and Seminole Point.

Now then, what I would like to know is if Capt. Collier brought all these forms of *Liguus* and *Oxystyla* from Middle Cape Sable and distributed them in the various localities on the west coast I have mentioned. Forms of most of them have actually been found on the Middle Cape, the *Oxystyla, Liguus fasciatus roasatus, L. castaneozonatus, L. crenatus marmoratus,* and a couple of other forms of *crenatus* which it seems he did not bring, or if he did they never became established. How did it come that the *Oxystyla* only is found as far north as Chokoloskee, that *castaneozonatus* is only known from this locality and Rabbit Key? Why did he carry *marmoratus* to a key four miles from Chokoloskee and not put it on the trees of the latter island — why didn't he take all the forms and plant them on Marco Key?

As a matter of fact I have never found any snail on Middle Cape Sable which is really very close to any of these upper west coast forms. The *castaneozonatus* are a little differently marked; the *marmoratus* I have from there is of a different pattern from the Chokoloskee shells and something like a single dead specimen I obtained on Key Vaca. I never found during several visits to the Middle Cape anything that could certainly be referred to *lineolatus.* While Capt. Collier may have brought tree snails from Middle Cape Sable and planted them on or around Marco, it is doubtless true that several forms of *Liguus* and the great *Oxystyla* crossed from the Upper Florida Keys to the southwest coast of the mainland of Florida over a now destroyed land bridge, that this migration was probably made many thousands of years ago and that they reached the Chokoloskee, Marco region after the aborigines had built and abandoned the shell mounds, that they made part of their migrations to the region of their most northern distribution from island to island by water, on the trees they lived on.

This subject of the geographical distribution of the Liguus and Oxystylas in Florida and the manner in which they migrate will be discussed later in a separate paper. As to the blue tree snails of the southwest coast, I obtained several of them from residents of Chokoloskee. These were *Oxystyla floridensis* pure and simple, and they had been boiled in water containing a little indigo. We made a number of specimens of this new species aboard the boat in the same way and they were just as nice as those sold by the natives. This receipt is absolutely free to anyone desiring to make new species.

NEW FORMS OF PLEISTOCENE MOLLUSKS FROM ILLINOIS.

BY FRANK C. BAKER.*

A recent examination of Pleistocene material from Grundy County, Illinois, submitted by Mr. Harold E. Culver, of the Illinois State Geological Survey, reveals several new forms of mollusks which seem to need recognition. Upwards of twenty species and varieties occur in the marl deposit, which is post-Wisconsin in age.

AMNICOLA LUSTRICA GELIDA n. var.

Shell differing from *lustrica* in being narrower, with more convex whorls, more deeply impressed sutures, a smaller, rounder aperture, the lip of which is usually thickened within. There are six full whorls in adult individuals.

Length, 4.25; diameter, 2.25; aperture length, 1.25; width, 1.0 mm. Topotype, Collection Museum of Natural History, U. of I., No. P926.

Length, 4.50; diameter, 2.30; aperture length, 1.40; width, 1.0 mm. Paratype. Museum No. P927.

Length, 4.0; diameter, 2.50; aperture length, 1.50; width, 1.10 mm. Paratype. Museum No. P927.

Types from near Morris, Grundy County, Illinois, in marl deposit.

This small Amnicola is one of the most abundant species in Pleistocene deposits, and seems to be widely distributed,

* Contribution from the Museum of Natural History, University of Illinois, No. 16.

occurring in Ohio as well as in the known Illinois localities, Chicago, Joliet, and Grundy County. In a previous paper (Journ. Geol., XXVIII, p. 448, 1920) it was listed as *Amnicola lustrica* variety, its differentiation having been suggested by Dr. Pilsbry. It is so markedly different from *lustrica* as found recently, and as represented in some marl deposits, that a name seems very necessary.

Three forms of *Amnicola* related to *lustrica* have come under the writer's observation. The typical form, wide, with moderately convex whorls and a large body whorl; this is in the collection of the Museum from Milwaukee, Wis. (30th Street); a wide form like the type but with thickened lip and solid shell; specimens of this form have been seen from Randolph County, Indiana; and the form herein described, which is narrower and more scalariform than the type. These all represent, probably, different types of environments. The likeness of *gelida* to *Amnicola oneida* Pilsbry, from Oneida Lake, N. Y. (NAUTILUS, XXXI, p. 46, 1917) is striking, and suggests that *oneida* may be the recent manifestation of the fossil form. It will be remembered that the old Rome outlet, in use for the discharge of the waters of the Great Lakes, was by way of Oneida Lake, and western species had easy access to this waterway.

AMNICOLA LEIGHTONI Baker.

This recently described Pleistocene Amnicola (NAUTILUS, XXXIII, p. 125, 1920) also occurred in the Grundy County material. The shells are more variable in Illinois than in the type locality in Logan County, Ohio, the spire being long or short and the body whorl varying greatly in obeseness. Continued study of this species in comparison with the Maine species (*winkleyi*) lead the writer to consider the fossil form as a distinct species, as indicated above.

VALVATA TRICARINATA Say.

This common species is most abundant in nearly all lacustrine and fluviatile deposits of the Pleistocene period. Like the recent shells, it varies greatly in the carinate condition of the shell. On the whole, the fossil individuals appear to be more variable than the recent forms. The variations in carination have been recognized to some extent and names have been applied to the most striking of these variations. Seven combinations are apparently possible. These are indicated in the following table:

Tricarinate	*tricarinata* Say.
Middle carina absent	*perconfusa* Walker.
Upper and lower carinæ absent	*unicarinata* DeKay.
Lower carina absent	*basalis* Vanatta.
Middle and upper carina absent	*infracarinata* Vanatta.
Middle and lower carina absent	*supracarinata* Baker.
All carinæ absent	*simplex* Gould.

Valvata tricarinata supracarinata n. var.

Shell differing from the other described varieties of the tricarinate series in lacking the carina on the periphery and base. Otherwise similar. Length, 3.5; width, 4.5; aperture length, 2.0; width, 1.8 mm. Topotype, Collection Museum of Natural History, U. of I., No. P928. Type locality, near Morris, Grundy County, Illinois.

This variation is apparently rare, as but four specimens were found in sorting several hundred *tricarinata*. In the deposit under study (Grundy County) the *perconfusa* form was in much greater abundance, followed by the *tricarinata* form. See Nautilus, XV, p. 124; XXXI, p. 36; XXVIII, pp. 104, 105, for descriptions of the other variations of this polymorphic species.

SOME CENTRAL AMERICAN SPECIES OF NAIDES, BELONGING OR ALLIED TO THE GENUS ELLIPTIO.

BY A. E. ORTMANN, PH. D.

Frierson (Nautil. 27. '13, p. 14) has described a new species as *Unio* (*Nephronaias*) *ortmanni*, and says that it " is clearly placed in the *Nephronaias* division by its evident near kinship to *melleus* Lea and to *persulcatus* Lea ".

Later (NAUTIL. 31.' 17 p. 47) he distinguishes as *Nephronaias* (s. s.) a group of species, containing *plicatulus*, *persulcatus*, *melleus*, *dysoni*, *ortmanni*, *ravistellus* etc., of which he says that the anatomy resembles that of *Elliptio*, but that it "differs from *Elliptio* in its sulcated disk, in its beak sculpture etc." But it should be remembered that only the anatomy of *ortmanni* was known.

My own determination of the genus *Nephronaias* (Ann. Carn. Mus. 8. '12 p. 326) rested upon the examination of the soft parts of *N. sapotalensis* (Lea), which surely is a *Lampsiline* shell; but I have pointed out that it is all important to determine the position of the *type species* of the genus, *Unio plicatulus* Charpentier. Frierson now assumes, from the characters of the shell, that *plicatulus* has the same anatomical structure as *ortmanni*. This may be correct, but has not been demonstrated; but if correct, the name *Nephronaias* becomes either a synonym of *Elliptio*, or a subgenus of it, or a genus closely allied to it.

In view of the great deficiency in our knowledge of the Mexican and Central American species, I prefer, for the present, to leave those species, which have *Elliptio*-structure, in the genus *Elliptio*. Of the following forms, the anatomy is more or less known to me.

ELLIPTIO ORTMANNI (Frierson) (l. c.).

Specimens, cotypes, from Rio Conchins, Quirigua, Guatemala, have been investigated, collected Febr. 4 and 6, 1913.

Frierson (l. c., p. 15) has already indicated the essential features of the anatomy of this species. It should be added, that the anal opening has crenulations, the branchial papillae; that the mantle connection between anal and supraanal is moderate (in most of my specimens torn by rough handling); that the posterior margins of the palpi are connected for about half of their length. The inner lamina of the inner gills is free from the abdominal sac, except at its anterior end. The marsupium is in the outer gills, placentae are present, sublanceolate, not very solid. Marsupium moderately swollen, its edge remaining sharp, when charged. *Glochidium* subcircular, L. 0.23, H. 0.22 mm. Color of soft parts (in alcohol) pale. Male and female shells indistinguishable. The breeding season seems to fall in the winter months of the northern hemisphere.

Elliptio calamitarum (Morelet) (?).

This species has been mentioned incidentally by Frierson (l. c., p. 15) from Rio Blanco, near Livingston, Guatemala, collected Febr. 18, '13, but there is some doubt about the identification; in a recent letter, Frierson thinks that this is *U. dysoni* Lea. I do not want to express an opinion; the specimens investigated by me belong to the same lot, and they have absolutely the *same structure of the soft parts as E. ortmanni.* Also the *glochidia* have the same shape and dimensions: L. 0.23, H. 0.22 mm. The breeding season also is in winter (glochidia in February).

Elliptio yzabalensis (Crosse & Fischer) (Simpson Descript. Catal. '14, p. 276).

Two specimens, with soft parts, have been sent by A. A. Hinkley, collected Jan. 6, '17, in Saja River, Guatemala (tributary to Rio Dulce, below Lake Yzabal). Both are females, and are gravid, but have not yet formed glochidia.

Frierson thinks that these specimens might be a new species, but they agree, in my opinion, quite well with Simpson's description of *yzabalensis*, and very well with v. Martens' figures (Biol. Centr. Amer. Moll. 1900, p. 507, pl. 39, f. 9–11), and in my identification I rely chiefly on 10 and 11 of these figures. Their chief character is the great height of the shell as compared with the length. One of my specimens has white, the other has purple nacre.

The *anatomy* is identical with that of *E. ortmanni* and *calamitarum* in every particular. Of course, the glochidia have not been observed.

There is no question that the three above species are closely allied to each other, both in anatomy and shell characters (sulcated epidermis), and I should not be astonished if finally they turn out to be forms of one and the same species.

Elliptio ravistellus (Morelet). (*Nephronaias rav.* Simpson, '14, p. 283).

Specimens from Lake Yzabal, at Jocolo, Guatemala, are at hand, collected by A. A. Hinkley in January, 1914. Among them are 1 male, and 3 females with soft parts; one of the females is gravid, but has only eggs, no glochidia. Seven others from Lake Yzabal were collected January 9, 1917; among them 1 male, and 6 gravid females, three of them with glochidia.

The identification is undoubtedly correct, and has been made chiefly according to v. Martens (Biol. Centr. Amer. Moll. 1900, p. 516, pl. 38 f. 2). The color of the nacre, in my specimens, varies from white through lead color and pinkish to dull purple. The breeding season seems to be similar to that of the preceding species (eggs and glochidia in January).

The *anatomy* resembles that of *E. ortmanni*,, but the posterior margins of the palpi are connected at their bases only, and remarkably enough, the inner lamina of the inner gills, in all specimens before me, is free from the abdominal sac *only for about one-half of the length of the latter* (or very slightly more), while it is connected with it in the anterior half (or slightly less). This is a rather unusual condition in American *Unioninae.* Of course, in this case, this character cannot be regarded as essential, before a larger number of Central American shells have been investigated.

Gills, marsupium, and placentae of the *Elliptio*-type. *Glochidia* absolutely identical with those of *E. ortmanni* and *calamitarum:* L. 0.23, H. 0.22 mm. Color of soft parts (in alcohol) pale, with black pigment in the region of the branchial, anal, and supraanal openings.

NOTES.

Dr. Paul Bartsch spent part of May and June in the Bahamas and Florida, continuing his studies of *Cerion.*

Dr. C. Montague Cooke, who has been working on the anatomy of Hawaiian land snails at the Academy of Natural Sciences of Philadelphia for the past nine months, has returned to Honolulu. He expects to resume his studies in Philadelphia next September.

Prof. T. D. A. Cockerell, of the University of Colorado, returned from England early in July, stopping at New York, Philadelphia and Washington on his way to Colorado.

Mr. Frank C. Baker, curator of the Museum of Natural History, University of Illinois, will spend the summer in Wisconsin, continuing his study of the molluscan fauna under the auspices of the Wisconsin Geological and Natural History Survey.

Dr. Fred Baker has joined an expedition for work on the fauna of Lower California.

Oil Injuring Oysters. — A suit for $200,000 has been brought against the Mexican Petroleum Corporation for damages done to some of the oyster beds of Narragansett Bay. The question of sewage has also entered largely into the discussion. The oyster industry of the bay began to decline in 1914 and has steadily deteriorated ever since. Prof. T. C. Nelson of Rutgers College, and biologist of the Shell Fish Commission of New Jersey, said that oil was responsible for the death of the oyster "sets" in 1916 and 1917. There seems to be a general complaint that oil and sewage is gradually destroying the marine life of our bays and harbors. During the winter even marine birds, such as the little auks, were brought to the museum with their feathers thoroughly saturated and discolored by oil. C. W. J.

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COLLECTING MOLLUSKS ON A BEAM-TRAWLER.

BY A. B. FULLER.

Collecting mollusks on a beam-trawler while not an ideal way to collect, is nevertheless interesting. These vessels are about 135 feet long, 22 feet beam, tonnage about 150, and run by steam. August 6, 1920, found me on one of these steel boats bound for the Georges Bank. Our first set was made about 118 miles southeast of the Boston light in about 45 fathoms, inside of the Georges Bank proper. The trawl consists of a sweep net about 90 feet wide and 9 feet deep, held apart and in position by two heavy oak doors about three feet by seven feet, shod with heavy iron on one long side. This makes it ride upright and prevents it from wearing as it drags on the bottom. These doors act as kites to the net, as it were, one at each end of the opening, and each hung by a chain bridle to a steel cable. The cables are attached to steam winches which work simultaneously in lowering and pulling in the net. A heavy rope cable about three inches in diameter stretches from door to door and drags on the bottom, acting as a ground line to which the lower edge of the net is fastened. In the center of the net is a large pocket of coarse meshes, but smaller than the meshes of the net proper. This is called the "cod end," and is protected by a blanket of heavy double-meshed netting, so that in dragging on the bottom it will not snag and tear. A portion of the "cod end" is pursed and tied with a special knot; when the bag is hoisted aboard full of fish a pull on the knot opens the purse and the fish are dumped upon the deck.

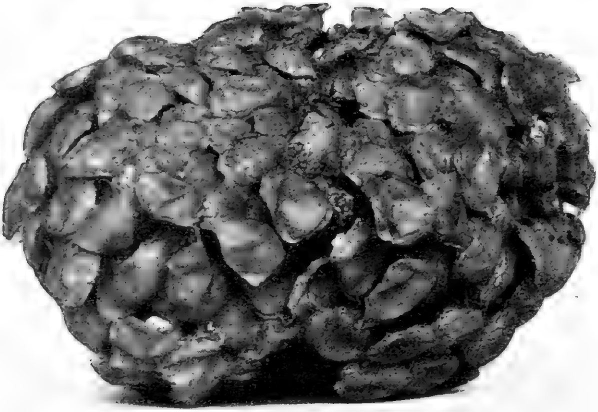
The net is "fished" two hours at a time, and the time consumed in hauling, dumping and resetting is very short. The fish are then cleaned and are often all on the ice in the hold in about thirty minutes after being taken from the water. Three to four thousand pounds of good fish at a haul was fair fishing and about the average. Most of the fishing is in water ranging from 30 to 50 fathoms, in a zigzag course across the grounds. The net sweeps nearly everything before it of any size and all goes back into the "cod end." The collection that is dumped upon the deck is therefore miscellaneous in character. From two to three tons of mixed fish, sponges, mollusks and other invertebrates is quite a sight to a collector. Large monk fish, skates, cod, haddock, hake, red snapper, halibut, flounders and sculpins, comprise the principal fish. Owing to the large mesh the majority of the mollusks pass through, leaving only the very large ones or a few of the smaller ones entangled in the net.

Each haul presented three chances to collect. First, when the net comes up; a few minutes of hasty inspection brought to light some fine nudibranchs (*Dendronotus frondosus*) and many little hermit crabs bearing various species of shells and a few very minute shells (*Cingula carinata*) imbedded in the strands of the ground line. Second, the fish are sorted by sluicing them down the deck with a stream of water, the men pushing the refuse fish along with pitch forks and picking out the good ones as this procession goes by, the shells, etc., may be snatched up and not much passes by without being seen. *Pecten magellanicus* Gmel. were sometimes very common, at other times missing. *Cyprina islandica* Linn., *Modiolus modiolus* Linn., *Buccinum undatum* Linn., *Chrysodomus decemcostatus* Say, *Colus stimpsoni* Mörch., *Polinices heros* Say, and the rare *P. levicula* Verr., were taken in this way, and all varied greatly in numbers according to bottom conditions. Some of the *Buccinum* and *Chrysodomus* were unusually large. Attached to some of the *Pecten* were the egg-capsules of *Chrysodomus decemcostatus*, called by the fishermen "sea corn." These were described and figured by Mr. Charles W. Johnson, "Occasional Papers," Vol. 5, pp. 1–4. pl. 1, 1921, Boston Society of Natural History. I am indebted to the Society for the cut illustrating these capsules. The third method of collecting is from the fish stomachs as the men were cleaning the fish; I was often able to get a bucket full of material from the haddock, later washing and sifting out the shells, wrapping them in cheese cloth and throwing them into a can of formaline. Sometimes the contents consisted mostly of small crustacea mixed with sand, with but few shells. The cod produced but little in the mollusk line except fragments of *Cyprina* and *Modiolus*, which they had evidently been able to crush. There were also pieces of large gasteropods, probably *Buccinum* and *Chrysodomus*. Crabs, however, seemed to be the main food of the cod. Sometimes the net would come up plastered with large starfish, then it would be a yellow sponge (*Desmacidon palmata*) that the fishermen call "boxing gloves," from their resemblance; another haul would show large numbers of ascidians, the "sea lemons," or the "stemmed sea peaches" (*Pyura*). Many times the net was filled with hydroids, known to the fishermen as "moss," clusters of long rubbery worm-tubes, dubbed by the men "macaroni," as it resembles that product, was very plentiful in one place. Thus the men would say, "we are on the boxing gloves," or on the moss, or in the lemons, or in the macaroni, as the case might be.

The following is a list of species obtained from the fish stomachs, with the exception of *Polypus arcticus*. For their determination I am indebted to Mr. Charles W. Johnson.

Nucula proxima truncula Dall.
Nucula tenuis Montg.
Leda tenuisulcata Couth.
Yoldia limatula Say.
Pecten magellanicus Gmel. (young).
Anomia aculeata Müll.
Anomia simplex Orb.
Modiolus modiolus L. (fragments).
Musculus substriatus Gray.
Musculus corrugatus Stimp.

Crenella glandula Totten.
Periploma leanum Conr.
Thracia truncata Migh. & Ads.
Cyprina islandica L. (young).
Astarte portlandica Migh.
Cardium pinnulatum Conr.
Macoma calcarca Gmel. (young).
Ensis directus Conr. (fragments).
Siliqua costata Say (fragments).
Spisula polynyma Stimp. (young).
Saxicava arctica L.
Solariella obscura Couth.
Odostomia sulcosa Migh.
Epitonium groenlandicum Perry.
Epitonium costulatum Migh. & Ads.
Natica clausa Brod. & Sowb.
Polinices heros Say (young).
Polinices triseriata Say.
Polinices immaculata Totten.
Polinices groenlandica Möll.
Velutina undata Brown.
Crepidula plana Say.
Cingula carinata Migh. & Ads.
Turritellopsis acicula Stimp.
Aporrhais occidentalis Beck (young).
Alectrion trivittata Say.
Anachis avara similis Rav.
Buccinum undatum L. (young).
Chrysodomus 10-costatus Say (young).
Colus stimpsonii Mörch. (young).
Colus pygmaeus Gld.
Bela scalaris Möll.
Bela harpularia Couth.
Bela pleurotomaria Couth.
Bela bicarinata Couth.
Retusa pertenuis Migh.
Retusa gouldii Couth.
Cylichna alba Brown.
Polypus arcticus Prosch.



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1. EGG-CAPSULES OF BUCCINUM UNDATUM L.
2. EGG-CAPSULES OF CHRYSODOMUS 10-COSTATA SAY.

EGG-CAPSULES OF BUCCINUM UNDATUM L.*

BY OLOF O. NYANDER.

The interesting paper on "Egg-capsules of the Ten-ribbed Whelk," by Charles W. Johnson (Occasional Papers, Boston Soc. Nat. History, Vol. 5, pp. 1–4, pl. 1, May, 1921), brings to mind a collecting trip which in this connection may prove of interest.

In the summer of 1906 I spent one month collecting Silurian fossils in Cabscook Bay from Eastport to Whiting, Maine, and as my work was mostly in the tidal zone I could not help but observe the common marine shells while collecting fossils at Broad Cove, near Eastport, where the average tide is about 22 feet. Shackford Head is at the west of the cove and near to the deep water; there is an isolated rock outcrop just above low water. In a part of this rock sheltered from the sun and among the rock weeds was hanging a large bunch of *Buccinum undatum* egg-capsules, and three large specimens were depositing their eggs in different parts of the bunch, which was 6 inches long, nearly 3 inches broad and 2 inches high. As this mass of eggs was hanging free about 5 or 6 feet above low-water mark, the observation was perfect. I took the shells and the egg-capsules which are now in my collection. This large egg-cluster must have been the nest of many individuals, as I think they only deposit a few eggs at a time and sometimes only one. During my collecting trip I found many eggs of *B. undatum* deposited on the rocks, on the rock weeds and on dead shells, ranging from one single capsule to 25 and probably sometimes a hundred or more. See Plate I, fig. 1.

I have always been interested in the eggs of shells, and at Newport, R. I., I collected, between 1886–92, many of the egg-capsules of *Busycon carica* and *B. canaliculatum*, as they are very common on the east shore of the island. When collecting at Lake Worth, Florida, in March, 1892, I found some very large

* The editors are indebted to the Boston Society of Natural History for the use of the cut illustrating this and the article by Mr. A. B. Fuller.

strings of egg-capsules of *Busycon perversum;* one in my collection is 27 inches long and full of young shells. On this same string are attached seven capsules of *Fasciolaria distans* full of young shells.

EPIPHRAGMOPHORA FIDELIS (GRAY) NEAR SAN FRANCISCO BAY?

BY G. DALLAS HANNA.

Several years ago Edson (THE NAUTILUS, XXV, 18, 1911) gave a list of land mollusks which he found at the high headland called San Mateo Point in San Francisco Bay. He there questioned the former record by Gifford (THE NAUTILUS, XIV, p. 144, 1901) of the above species at that locality. Button (THE NAUTILUS, XXV, 59, 1911) suggested that the specimens were perhaps exotic, having been brought to that locality in the oyster traffic which took place between Puget Sound and San Francisco Bay some years before. This was followed by Gifford (*op. cit.*, p. 60) again, who stated that he was not only positive of his identification but that he had collected the species there a second time, in 1910.

The locality is so far from the usual range of this northern species that the record seemed to warrant investigation on the ground. So far as available records show it has not been taken south of Cape Mendocino, Humboldt County, California.

The point on the bay referred to is known as Cayote Point on many maps. It is a hill of Jurassic chert about 100 feet high which projects into the bay about 18 miles south of San Francisco. A roadway leads to it across a salt marsh from Burlingame. It consists of about 300 acres, not one and one half as stated by Edson, densely wooded with eucalyptus. A few Monterey cypresses and pines have been planted here and there. The soil is very dry. The point is an island in so far as land snails are concerned. Under present conditions they could not reach the place of their own accord.

It happened that in August 1921 fire swept through the forest and consumed all leaves, sticks, grasses and underbrush, leaving only the bare ground. Among the ashes are the charred remains of the snails that lived there, literally thousands of them. It takes a fire such as this to bring to one's attention the enormous abundance of snails at some localities. Many of the specimens are badly burned but there would be no difficulty in recognizing forms so distinct as *Ephragmophora fidelis* and *arrosa*. Of all the many thousands which I saw on August 28th, 1921 every one except three belonged to the latter species. The exceptions belonged to the *E. californiensis* complex, doubtless the same as Edson recorded as *E. nickliniana*. A small strip of ground aroung the northeast side was left unburned and this was also searched without success for *E. fidelis*.

E. arrosa here is exceptionally abundant. Some 200 specimens were picked up incidentally during the search. Considerable variation is noted in this large series. Some approximate the size and shape of *fidelis* and the umbilicus is occasionally almost closed as in that form. Moreover, numerous shells are very dark as compared with the usual *arrosa*. But in no case is the coloration and banding of *fidelis* approached, and the surface sculpture in all specimens is positively that of *arrosa*.

It must therefore be said that Gifford's record cannot be confirmed. If *E. fidelis* existed on San Mateo Point it was a very small and inconspicuous colony which has now apparently disappeared. It will be an interesting study in the distribution of mollusks to learn how long it will take the several species to repopulate the area from the small number of specimens left living.

Ariolimax californicus Cooper was found living on the Point. It should be added to the list given by Edson.

Museum, California Academy of Sciences.

SOME LAND SNAILS OF SHASTA COUNTY, CALIFORNIA.

BY S. STILLMAN BERRY.

During an automobile trip through northern California and Oregon in the summer of 1920, that industrious collector, Allyn G. Smith, managed to find time to stop by the way long enough to unearth a few snails. Of particular interest is a small series of specimens taken as chance gave opportunity in Shasta County, still almost a virgin field for the Californian malacologist.

Along a stream band near the highway, about two miles south of Weed, occurred a number of species, the following list of which furnishes strange reading for California. The proportion of eastern, or, rather, boreal types is particularly noteworthy. A note is made of the number of specimens taken as furnishing some indication of the probable relative abundance of the species.

Euconulus fulvus (Müller) (alaskensis Pilsbry ?), 8.
Zonitoides arborea (Say), 3.
Polita hammonis (Ström), 5.
Polita binneyana (Morse), 2.
Vitrina alaskana Dall, 1.
Polygyra sierrana n. sp., 31.
Gonyodiscus cronkhitei (Newcomb), 25.
Cochlicopa lubrica (Müller), 4.
Succinea avara Say, 9.

A description of the new *Polygyra* is appended below.

Polygyra sierrana new species (plate II, figs. 1–2).

Description: Shell small, conical, thin. Growth lines numerous and strong enough almost to resemble fine ribbing under a lens. Embryonic whorls at first almost smooth, then finely radially wrinkled, the periostracum soon showing a system of dot-like papillae, bearing minute periostracal hairs over most of the surface of the shell. Spire moderately low, slightly convex, with impressed sutures. Whorls about 5½. Body whorl with a suggestion of an angle at the shoulder, and a deep, abrupt constriction just back of the peristome, the base moderately swollen; slightly decending in front. Lip light brown, thickened and reflected, but not very wide; narrowed below the pillar, then very slightly flaring again. Umbilicus small but distinct; contained about eleven to fourteen times in the diameter of the shell. Lip sometimes with a slight extra thickening at base, otherwise without evidence of teeth, although a small, whitish, narrowly crescentic parietal tooth is sometimes developed. Color close to Verona brown of Ridgway's nomenclature.

Dimensions:

	Type.	*Paratype.*	*Paratype.*
	mm.	mm.	mm.
Greater diameter	9.0	9.0	8.4
Lesser diameter	7.7	7.7	7.4
Height	5.7	5.8	5.2
Diameter of umbilicus	0.8	0.7	0.6
Number of whorls	$5\frac{2}{3}$	$5\frac{1}{2}$	$5\frac{1}{4}$

Type: Cat. No. 5087 of the writer's collection. Paratypes have been deposited in the collections of the California Academy of Sciences, and the Academy of Natural Sciences of Philadelphia, as well as the private collection of Allyn C. Smith (Cat. No. 2236).

Type Locality: Two miles north of Weed, Shasta County, California; Allyn G. Smith, August 10, 1920; 22 adult specimens, 9 juvenals.

Remarks: From the evidently nearly allied *loricata* the present species differs in its larger size and more simple toothing of the aperture. In some ways it more nearly resembles *germana*, but again is larger, has a much less tumid body whorl and differs strongly in being distinctly umbilicate. From *columbiana* it differs in its compactness and smaller size, but it is nevertheless not very unlike this species on a greatly reduced scale.

I have a small series of a similar but rather thinner-shelled and more depressed race of *Polygyra*, collected in the high Sierras of central California between Glenbrook and Al Tahoe, by Mr. E. P. Chace in 1919. The differences are not great, however, and they are apparently referable to the same species as the Shasta County form.

Near La Moine Mr. Smith collected a considerable series of a peculiar race of *Polygyra columbiana* (Lea) which seems sufficiently characteristic to be described. The ground was very dry and no other species were taken there, but the Polygyras were found almost in the water, under sticks and stones.

Polygyra columbiana shasta new subspecies (Plate II, figs, 3–4).

Description: Shell of moderate size, conic, thin; *smooth*, except for the numerous and fairly strong incremental lines, which, however, become much weaker on the base; surface *polished and lustrous*, especially on the base. Embryonic whorls, where not eroded, at first rather rudely radially wrinkled, but, at least after the first half turn, *strongly, coarsely papillose*, as well. Spire low, almost straight sided except toward the summit; sutures well impressed. Whorls usually $5\frac{3}{4}$ to 6. Body whorl subangulate at the shoulder, but becoming more rounded as the aperture is approached; slightly decending and rather abruptly constricted just back of the peristome, the base moderately swollen and rounded. Lip whitish or stained a very light brown; thickened and reflexed but not very wide; obscurely angled and narrowed below the pillar, which is somewhat reflexed over the narrow but permeable umbilicus; lip often showing a slight extra thickening on the base, but aperture otherwise without denticles save for an occasional specimen showing the merest trace of a parietal tooth. Color of body whorl fairly near tawny olive, deepening to snuff brown or Saccardo's umber on the earlier whorls.

Measurements:

	Type.	*Paratype.*	*Paratype.*	*Paratype.*
	mm.	mm.	mm.	mm.
Greater diameter	14.0	13.5	13.3	12.7
Lesser diameter	12.0	11.4	11.3	10.6
Height	9.0	8.2	8.7	8.0
Diameter of umbilicus	1.0	1.1	1.0	0.8
Number of whorls	6	$5\frac{1}{2}$	$5\frac{3}{4}$	$5\frac{3}{4}$

Type: Cat. No. 5089 of the writer's collection. Paratypes have been deposited in the collections of the California Academy of Sciences, Academy of Natural Sciences of Philadelphia, and Leland Stanford Junior University, as well as the private collection of Allyn G. Smith.

Type Locality: La Moine, Shasta County, California; Allyn G. Smith, August 1921; 25 adult specimens.

Remarks: Although I have been gathering material of *Polygyra columbiana* for several years, with a view to possible monographic treatment of the species, I am still uncertain how far it will be wise to go in giving taxonomic recognition to the innumerable weakly differentiated races of this widespread snail.

The present form is, however, not like anything which has been seen by me heretofore. Its warm brown color, smooth, polished surface, lack of any sort of persistent periostracal fringings, and narrow, though permeable umbilicus, are features serving to set it quite distinctly apart.

EXPLANATION OF FIGURES.

Fig. 1, 2.—*Polygyra sierrana* n. sp. Type, from near Weed, Shasta County, California; x 3.

Fig. 3, 4.—*Polygyra columbiana shasta* n. subsp. Type from La Moine, Shasta County, California; x 2.

MISCELLANEOUS NOTES ON LAND MOLLUSCA OF THE MADEIRA IS.

BY T. D. A. COCKERELL.

Though Porto Santo is the home of so many endemic snails, there still seems to be room for aliens from Europe. *Cochlicella acuta* is abundant in certain spots north of Villa Baleira. *Helix pisana* swarms everywhere. In a spring in the valley of the Serra do Dentro I found specimens of a small Hydrobiid, which Dr. Pilsbry has kindly identified as *Pseudamnicola similis* (Drap.). This species was already known from Madeira, but is the first record of a freshwater shell from Porto Santo.

In 1848 (Proc. Zool. Soc. Lond., p. 110) Pfeiffer described some shells from the Cuming collection, including a species *Helix calcarea,* collected by Count Vargas in Porto Santo. This shell has since been ignored; Wollaston does not mention it. Pfeiffer subsequently listed it as a fossil. In the British Museum I found the type specimen. Mr. Tomlin, to whom I showed it, recognized Pfeiffer's writing on the label underneath the slab. It is a recent shell, and is a form of *Helix pisana,* white without bands. The name *calcarea* cannot be used even in a varietal sense, as there is an earlier *H. calcarea* Born.

Also in the British Museum, from the Cuming collection are five specimens of *Vitrea miguelina* (Pfeiffer), said to be

* Plate II will appear in next issue.

from Madeira. They are only 11 mm. diameter, but Azores specimens in the Norman collection are 14 mm. The species seems to me to be the European *V. lucida.* Probably the Cuming specimens did not come from the Madeira group, as the Cumingian localities are very unreliable. I found in the Cuming collection five other Helicoids labeled as from Madeira, but all known from quite other places and, with one exception, very distinct from anything in the Madeiran fauna. The exception is *Pyramidula retexta* Shuttl., a Canarian shell resembling *P. semiplicata* (Pfr.) in appearance, but brown all over, not mottled. It must be a rare species, as Wollaston had not seen a specimen.

In the Norman collection is a subfossil *Helix ustulata* Lowe, said to be from Madeira (Rev. B. Watson). It is genuine *ustulata,* but is from the Salvages, as shown by the rest of Watson's series in the possession of Mr. Tomlin.

Punctum pygmæum and *Vitrea crystallina* have been recorded as fossil in the Pleistocene beds at Canical, Madeira, on the authority of Boog Watson. Mr. J. R. LeB. Tomlin has Watson's specimens, and was so kind as to lend them to me for examination. Both species appear to be correctly named, though the *V. crystallina* is a single very immature shell. I do not believe, however, that they are fossil. Such shells are easily carried by the wind over the sand hills, and thus mixed with the fossils. No other collectors have been able to find these species in the Canical beds.

MOLLUSCA OF PISGAH FOREST, NORTH CAROLINA.

BY MINA L. WINSLOW.

The material on which the following list is based was collected for the Museum of Zoology, University of Michigan, during a part of the months of July and August, 1916. The Pisgah Forest region was approached by rail from Asheville to Brevard, thence by wagon to Pisgah Forest station, and by log railroad about seventeen miles northwest along the

Davidson River and Lookingglass Creek. Headquarters were made in the Schenck cabin in the Pink Beds at bench-mark 3278. The cabin was loaned through the kindness of the United States Forestry Service, and is so located that it forms a convenient base for work in the Pink Beds and the south-east slopes of the Pisgah Ridge. The valley called the Pink Beds is wide, covered with a dense growth of rhododendron and laurel (whence the name), and lies in Transylvania County between the Pisgah Ridge and mountains to the south. It is all a part of the drainage basin of the French Broad River. Asheville lies about thirty miles northeast and Waynesville a somewhat shorter distance northwest.

It should be remarked here that an exceptionally heavy and continuous rainfall delayed arrival and interfered with field work, reducing the actual time spent in the field to a mere fraction of the expected amount. Living was complicated by the isolation of the community, due to flooding and landslips, so that supplies could not come in and communication was cut off for almost three weeks.

The mountains are heavily timbered, with an occasional "bald" at the top. In some places the trees have been thinned by lumbering operations which have been supervised to such an extent that the forest has been left in good condition. In the valley and along the creeks rhododendrons and laurel grow densely. Chestnut and oak are the prevailing trees, with intermixture of many others, such as whitewood, maple, beech, and so forth, with an occasional pine.

There seemed to be a decided aversion for chestnut wood on the part of the snails. Oak forests were the more favored habitats, the woods of Rich Mountain, a long flat-topped hill, yielding the greatest variety of snails. *Gastrodonta elliotti* was found everywhere, and a small *Zonitoides arboreus* was fairly abundant. Of the larger shells, *Polygyra andrewsi normalis* was the common form, and often showed a decided rosy tint. The ten specimens of *Omphalina cuprea polita* are all small, possibly immature, and no others were taken. The lack of lime in this granite country may account in part for the scarcity of mollusks and the extreme fragility of most of the larger shells.

The writer is indebted to Mr. G. H. Clapp for identifications and notes on material submitted to him. All the mollusks listed are in the Museum of Zoology, Catalog Nos. 10331 to 10463 inclusive.

LIST OF SPECIES WITH NOTES ON HABITAT.

Polygyra albolabris (Say). Rich Mountain, Pigeon Gap Trail, Pink Beds. On the ground, on dead wood, on white oak and maple trees as high as twelve feet from the ground. 6 specimens.

Polygyra andrewsae normalis Pilsbry. Pigeon Gap Trail, Wagon Gap Trail, Asheville Road at about 4000 ft. altitude. Crawling on the ground, on dead leaves; along the road, under boards on a saw-dust pile, on maple and oak trees as high as twelve feet from the ground, on a clay bank along the road. 40 specimens.

Polygyra christyi (Bland). Pink Beds, Bennett Gap Road, Rich Mountain. In woods on a north slope, on the ground, on dead wood. 4 specimens.

Polygyra clarkii (Lea). Rich Mountain, south of the Pink Beds, Davidson River. In decayed log, on clay bank along log railroad, in river débris. 3 specimens.

Polygyra hirsuta altispira Pilsbry. Rich Mountain, Bennett Gap Road, Wagon Gap Trail, Pink Beds. Under oak logs, in forest débris, under old beech log. The species seems to prefer dark habitats, under rather than on logs and stumps. 21 specimens.

Polygyra wheatleyi (Bland). Pink Beds, Chubb Gap Trail, Pigeon Gap Trail, Rich Mountain, Wagon Gap Trail. On the ground above a spring, near a brook, on dead wood and in débris. 8 specimens.

Polygyra rugeli (Shuttleworth). Pink Beds. One specimen only, taken in woods on a north slope.

Polygyra zaleta (Binney). Pigeon Gap Trail. One specimen only, taken on leaves along the trail.

Circinaria concava (Say). Asheville Road, Rich Mountain, Pink Beds. On clay bank beside the road, on leaves on the ground. 4 specimens.

Omphalina cuprea polita Pilsbry. Pink Beds, Bennett Gap Road, Asheville Road at about 4000 ft. altitude. Under dead wood near a creek, in forest débris, under stones near a spring, under rotten wood in rhododendron thicket. 10 specimens.

Mesomphix rugeli (W. G. Binney). Pink Beds. Along the log railroad. 1 specimen.

Mesomphix andrewsae Pilsbry. Pink Beds. In decayed wood and débris in the rhododendron and laurel tangle. 2 specimens.

Vitrea carolinensis Cockerell. Asheville Road at about 4000 ft. altitude, Davidson River débris, Bennett Gap Road. In débris above the road, and along the river. 4 specimens.

Vitrea cryptomphala Clapp. Pigeon Gap Trail. Under a stone. 2 specimens.

Vitrea indentata (Say). Pink Beds, Bennett Gap Road, Asheville Road, Rich Mountain, Davidson River débris. In leaves and forest débris, under a stone near a creek, under stones and débris beside a spring, under dead oak log. 8 specimens.

Vitrea lamellidens Pilsbry. Pink Beds. Under moss on a beech stump. 1 specimen.

Vitrea multidentata? (Binney). Débris from Davidson River. 5 specimens.

Vitrea sculptilis (Bland). Débris from Davidson River. 1 specimen.

Vitrinizonites latissimus Lewis. Bennett Gap Road, Pink Beds, Asheville Road. Under stones and in débris near a spring, on dead leaves near a brook, in débris. 14 specimens.

Zonitoides arborea (Say). Rich Mountain, Bennett Gap Road, Asheville Road, Davidson River débris. On rotten wood, abundant under bark on a decayed stump as high as ten feet from the ground, on an oak log. The shells from the high stump are smaller than normal, and have "*very fine* impressed radial lines" (Clapp). 50+ specimens.

Gastrodonta elliotti (Redfield). Pigeon Gap Trail, Pink Beds, Rich Mountain, Asheville Road, Bennett Gap Road. Under and in rotten wood in the open woods and in the rhododendron-laurel thickets, under moss on a beech stump, in débris of Davidson River, under stones, and under a mossy rock wet with spring water. 100+ specimens.

Gastrodonta interna (Say). Pink Beds, Rich Mountain, Bennett Gap Road. In rotten stump, in charred wood, among chips. 10 specimens.

Gastrodonta gularis (Say). Pigeon Gap Trail, Bennett Gap Road, Asheville Road at about 4000 ft. altitude, Rich Mountain, Pink Beds. Under stones beside a spring, under logs and stones, in forest débris. 13 specimens.

Gastrodonta intertexta (W. G. Binney). Rich Mountain, Bennett Gap Road. In decaying wood (beech and birch), and in forest débris. 4 specimens.

Helicodiscus fimbriatus? Wetherby. Rich Mountain. Under an old oak log. Two imperfect specimens, not fully grown.

Philomycus carolinianus (Bosc.). Bennett Gap Road, near Avery Creek, Pink Beds, Rich Mountain, Pigeon Gap Trail. Under a stone near the road, on a stone at a spring, under boards and beech and oak logs, under moss and bark of stumps and trees, under mossy rock, on saw-dust heap. 16 specimens.

NOTES ON THE GENUS ACTEOCINA, GRAY.

BY A. M. STRONG.

Dr. Dall in his new "Summary of Marine Shell-bearing Mollusks of the Northwest Coast of America" (Bull. U. S. Nat. Mus., No. 112, p. 61) lists seven species of the Genus *Acteocina* (formerly known as *Tornatina*), described by the early workers on West Coast shells, and adds one new species. The ranges given in the Bulletin would seem to add confusion to an already badly confused situation. The following table shows the ranges given by the different authors:

Acteocina	Dall[1]	Gould[2]	Cooper[3]	Arnold[4]	Pilsbry[5]
A. culcitella Gld.	Kodiak Island to Puget Sound	Santa Barbara (Col. Jewett)	Monterey to San Diego	Living Monterey to San Diego	Santa Barbara San Pedro
A. cerealis Gld.	(A. cutcitella, Junior)	Santa Barbara (Col. Jewett)	Monterey to San Diego	Living Monterey to San Diego	Vancouver to San Diego
A. eximia Bd.	Kodiak Island to Puget Sound	. . .	. . .	Living Vancouver to San Diego	Vancouver Island
A. inculta Gld.	Monterey to Gulf of Calif.	San Diego	San Diego	. . .	San Diego Monterey
A. infrequens C. B. Ad.	SantaMonica, Cal. to Panama	. . .	. . .	. . .	Panama Mazatlan
A. carinata Cpr.	San Diego to Gulf of Calif.	. . .	. . .	. . .	Mazatlan San Diego
A. planata Cpr.	San Diego	. . .	. . .	. . .	. . .
A. smirna Dall.	San Diego to San Salvador	. . .	. . .	. . .	. . .

To this should be added Packard's Molluscan Fauna from San Francisco Bay (Univ. of Cal. Pub., Vol. 14, 1918, p. 345), in which *A. cerealis* Gould is listed and the statement made that this is the furthest north that this southern species has been found. Also Zetek's late list of Panama Shells (La Revista Nueva, Tomo V, p. 521) in which *A. carinata* Cpr. is the only member of the genus given.

Most if not all of the species given in this genus are found living on the bottom of shallow bays. It does not seem possible that the different species could have the extreme ranges indicated by the different authors. In citing localities they have quoted largely from other writers, and the correctness

[1] List of West Coast Shells, Bull. U. S. Nat Mus., No. 112, pp. 61–202.

[2] Otia conchologica, pp. 184–185.

[3] Catalogue of West North American Shells, Bull. Cal. State Min. Bur.

[4] Paleontology of San Pedro, Memoirs Cal. Acad. of Sci., Vol. 3, p. 189.

[5] Manual of Conchology, Vol. 15, p. 187.

of the range depends largely on the accuracy with which the identifications were made. The type localities give an idea of the probable range. They are given as follows:

A. eximia (Baird),	Vancouver Isalnd
A. culcitella (Gould),	Santa Barbara
A. cerealis (Gould),	Santa Barbara
A. inculta (Gould),	San Diego
A. planata (Cpr.),	San Diego
A. smirna Dall,	San Diego
A. carinata (Cpr.),	Mazaltan
A. infrequens (C. B. Ad.),	Panama

It does not seem reasonable that *A. culticella* Gould would be found at Kodiak Island in the Arctics, or that *A. infrequens* C. B. Ad. would be found at Santa Monica, California. *A. carinata* Cpr. looks equally out of place in Zetek's list.

All these species are comparatively little known, and the differences seem to be small. The confusion in range would seem most probably to be caused by a failure to secure a correct identification. The following comparative notes are taken from the above listed authors:

Gould. *Bulla (Akera) culcitella.* "*B. tenuis* Adams is the only species approaching this. Some of its characters bring it close in alliance with the genus *Tornatina.*"

Bulla (Tornatina) cerealis. "In form and size it is scarcely to be distinguished from *B. gracilis* A. Ad., which is transversely striated. In terms, it agrees with B. *infrequens* C. B. Ad., but Prof. Adams himself considers it a different species."

Arnold. *Tornatina cerealis* Gld. "Distinguished from *T. culcitella* by more angular whorls, mammillated apex, more keeled upper edge of whorl and smaller size."

Tornatina eximia Baird. "Resembles *T. culcitella,* but has a whorl narrowed anteriorly, a spire depressed nearly to the rim of the body whorl, a narrower aperture and less prominent plait on columella."

Pilsbry. *Tornatina carinata* Cpr. "Resembles *T. infrequens* C. B. Ad. more than *T. cerealis* Gld."

These notes would indicate a close similarity between at least several of the species, but a distinction between *culcitella* and *cerealis* which would make Dr. Dall's statement that the latter is a junior form of the former to seem very doubtful.

One species of *Acteocina* is occasionally found on the mud flats of southern California bays in considerable numbers. The shells average about 4 mm in length and are of the characteristic shape of the genus, but the rather flat apex is always more or less eroded and pitted. These have been identified as *A. inculta* Gld. The description of this species calls for an ivory-white shell. As found by the writer, they are colored to varying extents with a brownish ferruginous stain. These are found traveling just under the surface of the mud and their presence is shown by a trail very similar to that of a small *Olivella.* Like the Olivellas, a large number are always found traveling together.

Associated with the last few specimens of a quite different and slightly larger species are sometimes found. Under a hand-glass the brownish surface is seen to be covered with very fine, slightly undulating spiral lines. The shoulders of the whorls are sharply keeled, so that in looking down on the apex the suture has the appearance of a deep spiral groove. The shores of a large tide pool just inside the entrance to Newport Bay has furnished Southern California collectors with a considerable number of specimens of a large *Acteocina* which has always been classed as *A. culcitella* Gld. These vary from 10 to 20 mm. in length but otherwise are very similar to the previously mentioned form. The microscopic brown spiral lines are quite distinct on the under side of the shell next to the aperture, but on the opposite side are very faint, leaving the shell almost white. It is quite probable that the color has been worn off the portion of the shell which is not protected by the mantle of the animal when burrowing through the mud and sand. This may be the adult of the preceding, and the identification is not at all certain.

These notes are not written in he hopes of straightening out the seeming tangle in the ranges and identification of the different species of the genus *Acteocina,* but only to call attention to the matter. A careful comparison of the type specimens with specimens from all along the coast will be required to form any definite conclusion. It is hoped that others will be able to throw more light on the subject.

LAND SHELLS FROM PALM CANYON, CALIFORNIA, AND THE GRAND CANYON.

BY H. A. PILSBRY.

Dr. C. Montague Cooke and his son C. M. Cooke 3d, collected shells, as occasion offered, while en route westward in June, among them the following:

Micrarionta wolcottiana (Bartsch). Palm Canyon, Riverside Co., California. "Found under dead plants of one species of low-growing cactus at the mouth of the canyon, about 6 miles above Palm Springs." Small specimens, 15.5 to 21 mm. diameter, only one out of 13 exceeding 19 mm.

Sonorella coloradoensis (Stearns). Bright Angel Trail, Grand Canyon. Small, 15.3 mm. diam., like the Bass' Trail specimens.

Oreohelix s. depressa (Ckll.). "Collected along the Bright Angel Trail, from about 1000 to 3400 ft. below the rim. I found the first specimen very close to the last pine on the trail, just below the foot of the high yellow cliffs. Dead specimens were seen along the trail to just below the part of the trail called Jacob's Ladder. Unfortunately, we were with a rather large party and I had a mule that wouldn't stop. I collected six specimens, which I am sending you, and saw 15 or 20 additional along the trail."

This species has been found high on the northern side of the Canyon, but not until now on the southern side.

Oreohelix yavapai angelica P. & F. About 50 ft. below the rim, Bright Angel Trail, at "Hermit's Rest".

A RADIODISCUS FROM BOGOTA, COLOMBIA.

BY H. A. PILSBRY.

Among a few shell received by Dr. Bryant Walker from Señor H[no]. Apolinor Maria there is a species of Radiodiscus which may be defines as follows.

RADIODISCUS MARIÆ n. sp.

The shell is closely similar to *R. millecostatus*, from which it differs by the narrower umbilicus and by the perceptibly greater height of the last whorl. The sculpture is essentially similar except that the riblets are noticeably lower as seen where they pass over the periphery, and the interstitial sculpture of delicate striae parallel to the riblets and fine spiral lines, is also less distinct, though present.

Alt. 1, diam. 1.85 mm.; width of umbilicus nearly 0.5 mm. Riblets about 21 to one mm. at the periphery.

R. herrmanni (Pfr.), *R. orizabensis* (Pils.) and *R. patagonica* (Suter) differ in sculpture. I have not seen the following species, which from the descriptions appear to belong to *Radiodiscus: Helix coppingeri* and *H. magellanicus* E. A. Smith, Patagonia; *Helix corticaria, H. muscicola, H. bryophila, H. exigua, H. hypophlœa,* all of Philippi, Malak. Bl., 1856, Chile.

NOMENCLATORIAL NOTES.

BY W. H. DALL.

In 1838 Sowerby figured in the Conchological Illustrations and described in his Malacologicel Magazine an Arctic shell under the name of *Margarita acuminata*. In 1842 Mighels and Adams in the Boston Journal of Natural History identified and figured a *Margarita* from the Gulf of St. Lawrence under Sowerby's name, at the same time pointing out (as has every subsequent author) certain discrepancies between the two. Owing perhaps to the rarity of the shell, which has been well figured by Morse in Binney's Gould, no action has been taken. A comparison of the figures shows at once that the two forms are distinct. For the New England shell I propose the name of *Margarites Johnsoni*, in honor of Mr. Chas. W. Johnson, author of the valuable "List of New England Mollusca." Specimens have been collected by the Canadian *Neptune* Expedition at Port Burwell, Ungava, Hudson Bay.

Cypraea pacifica was described by J. M. Ostergaard in The Nautilus for January, 1920, p. 92, and well illustrated. I have had the opportunity of comparing a specimen with the varieties of *C. helvola* from the dump at Honolulu, to which it bears a suspicious resemblance, though apparently very distinct, but the bleaching of the specimens from this dredged material plays strange tricks with the Cypraeas. However the name is long preoccupied by Gray, in the Conchological Illustrations p. 15, pl. 7, fig. 39*, 1832. I would suggest that this interesting form, whether variety or good species be named *ostergaardi* after its discoverer.

ON THE STATUS OF CHIORAERA (GOULD)

K. P. KJERSCHOW-AGERSBORG

From the Zoological Laboratory, University of Illinois

Bergh's description of various species of Melibe (1875, *Melibe capucina*, *M. rangii;* 1880, *M. vexillifera;* 1884, *M. papillosa;* 1888, 1890, *M. ocellata;* 1902, *M. bucephala;* and 1907, *M. rosa* Rang), emphasizes the following as Melibean characteristics: "*Bulbus pharyngeus cum mandibulis ut in Phylliroides; margo masticatorius mandibulis fortiter dentatus;*" (1875) p. 362. Perhaps the only exception to this may be found in the species collected at the mouth of the Columbia River, in the State of Washington (1904), in which case, the author is not sure of the mandibles. He says: "*Bulbus pharyngeus lingua destitutus.* Die Mundröhre und der Schlundkopf scheinen sich wie sonst bei den Meliben zu verhalten; die gelblichgrauen Mandibel ganz zerbröckelt, . . ." I have previously called attention (1919, 1921) to the possibility that this species may be the same as the one described by Gould (1852), from the Puget Sound region. Not all Melibes, however, have the same characteristics as indicated by Bergh; this is shown by Alder and Hancock (1864), and substantiated by Eliot (1902). The generic characteristics as enunciated by Bergh (1875) do not necessarily hold, even though this author thinks that Hancock's (Alder and Hancock, 1864) description is incorrect. Bergh says: "Es kann kaum bezweifelt werden, dass die von Hancock untersuchte Form, mit der von mir besprochenen congenerisch. Es werden sich daher die bei dem englischen Verf. vorkommenden, von den untenstehenden abweichenden anatomischen Angaben wahrscheinlich als unrichtig erweisen," p. 363. "Besonders wird solche wohl der Fall sein, wo Hancock den Anfang des Verdauungscanals bespricht: 'The buccal organ is provided with neither tongue, jaws nor collar; it is not by any means very distinctly marked, formed as it were by a mere enlargement of the oesophagus, and having little or no increase of muscular power,' " p. 364.

But Eliot (1902) verifies Hancock's claim when he writes: "I also found Alder and Hancock's description of the internal anatomy to be correct, particularly as regards the absence of jaws. . . . Mr. Crossland and I have, . . . dissected several specimens of *Melibe fimbriata,* and in all failed to detect any trace of jaws."

Gould's *Chioraera leonina* (1852) corresponds very closely in the general anatomy to that of *Melibe fimbriata* (Ald. & Hanc., 1864); this is also true as regards the species discovered by Rang (1829) and subsequently described by Bergh (1875), as well as other Melibes described by Bergh (1863, 1871, 1875, 1880, 1884, 1888, 1890, 1902, 1904, and 1908). The only difference is on the point in regard to the mandibles. Some authors, Rang, Gould, Pease, Cooper, and Fewkes, do not touch on this point and in that way, one cannot tell whether the particular specimens with which they dealt actually had such organs. Without considering the mandibles, all the generic characteristics as set forth by the earliest writers on this type of the mollusks agree (Rang, 1829; Gould, 1852; Pease, 1860; Cooper, 1863; Alder and Hancock, 1864; De Filippi, 1867; Tapparone-Canefri, 1876; and Fewkes, 1889; as well as the numerous descriptions of Bergh, 1863-1908). The discovery of the genus *Melibe* by Rang (1829) seems to have been unknown to Gould (1852) who created a new genus (*Chioraera*) for this type. Cooper (1863) and Fewkes (1889) employed the nomenclature of Gould. The generic characteristics as enunciated by the original author for *Melibe* (Rang, 1829) are practically identical with those set forth by Gould twenty-three years later for *Chioraera*. Tryon, Jr., (1883) p. 382, without stating a reason, classifies *Chioraera* as synonym of *Melibe*. Owing to the fact that Gould, and Cooper were ignorant of the actual discovery of the genus *Melibe*, the name *Chioraera* was invented by Gould and subsequently used by Cooper. The name is, in fact, a mythical term that is related in meaning to the former; and neither, of course, is descriptive of the form to which it belongs. Bergh (1904) describing a species from the territory of Gould, Cooper, and Fewkes, does not hesitate to employ the nomenclature of Rang (1829), so similar is this form to the Melibes from other parts of the world. No other author except Bergh gives mandibles as a generic characteristic, and this feature, as stated above, is not observed by Rang (1829), Gould (1852), Pease (1860), Cooper (1863), De Filippi (1867), Tapparone-Canefri (1876), and Fewkes (1889). Although *Melibe* Rang (1829) and *Chioraera* Gould (1852) differ somewhat in shape, they are very similar in most other respects; Rang's description is as follows:

"Anim. pélagien, gélatineux, transparent et limaciforme; la tête distincte et comprenant un voile membraneux, contourné en fore d'entonnoir, garni intérieurement de cirrhes dirigés à l'extérieur, et du milieu duquel s'élève une petite trompe terminée par la bouche; tentacules au nombre de deux, situés à la base du voile, très allongés, coniques, terminés par une petite capsule, de laquelle port un organe conique et rétractile; pied aussi long que l'animal, mais extrêmement étroit, en forme de sillon; branchies formées de deux séries peu nombreuses de massues oblongues, arrondies a leur sommet, pédiculées à leur base, et recouvertes de petits tubercules; organes de la génération réunis au côté droit antérieur, anus plus en arrière.''

And Gould's description of the genus *Chioraera* reads:

'' Corpus limaciformis, caput enorme, pedunculatum, semiglobosum; paginâ ventrali discoideâ; ore longitudinali, seriebus binis cirrhorum cincto; tentaculae cephalicæ foliatæ, retractiles; lobi branchiales flabelliformi, serie unicâ utrinque ordina; foramen generativum ab anali remotum, fere dorsali.''

In his comment in the English he says:

'' This curious and hideous animal seems to belong to the family *Tritoniadae*, with which it agrees in all respects except its curious oral apparatus. (As regards the family rank, *vide* Kjerschow-Agersborg, 1919, 1921). The mouth is inferior, surrounded by a double series of long cirrhi, each of which has an independent motion. Two auriform appendages, on the back of the head, differing in no respect from the branchial expansions except in being destitute of reticulations, seem to be the true tentacles, and are retractile. The generative aperture is at the usual place on the right side, the vent being distant, near the back.''

Both *Melibe* Rang, and *Chioraera* Gould, have a series of papillæ (epinotidia) on each side dorso-laterally; a large hood, cowl, or veil; a pair of tentacles, (the so-called rhinophoria) carried on leaf-like stalks, and situated anteriodorso-laterally on the veil; the veil is fringed with at least two rows of cirrhi; and a narrow grooved foot which is blunt in front and pointed behind; the head is distinctly separated from the body, by a neck, and in each case it is very large; the gizzard is lined with a '' keratinized '' secretion of its epithelium, and this keratinized secretion is the so-called stomach-plates of Alder and Hancock, or Magenzähnen of Bergh, which protects the delicate epithelium and may also help in the mastication of the food; these two types are carnivorous; both are pelagic; and both are distinctly cladohepatic. On *a priori*, the species of the American west coast which falls within this description must be of the same genus *Melibe*. The effort, therefore, to build further on the nomenclature of Gould, as has been done by Cooper (1863), Fewkes (1889) and more recently by Dr. O'Donoghue (1921) seems to me to be indefensible, and, owing to the fact, that the genus *Melibe* may either possess mandibles (Bergh, 1875) or not, (Alder and Hancock 1864, De Filippi 1867, Tapparone-Conefri 1876, Eliot 1902), the generic description may be modified to read in part:

Bulbus pharyngeus aut cum mandibilis aut sine mandibilis; radula et lingua destitutus.

In point. of fact, Bergh (1908) pp. 94, 95, for the family *Tethymelibidae* Bergh (1892) pp. 1039-1043, after consistently having reported mandibles for each species of Melibe he described during a number of years (1875, 1880, 1884, 1888, 1890, 1892, 1902, 1904) finally admits of the following:

"Forma corporis quasi ut in Æolidiidis. Caput permagnum et cuculliforme; rhinophoria vagina magna retractilia, clavo perfoliato; tentacula nulla. Epinotidia (papillæ dorsales) colosseæ sine bursis cnidogenis. Bulbus pharyngeus rudimentarius, lingua et interdum quoque mandibulis destitutus."

In the family *Tethymelibidae* there are only two genera, *Tethys* and *Melibe*. In the genus *Melibe* he includes eleven species, but he thinks that continued examination will likely reduce this number. Among the species mentioned he includes *Chioraera leonina* (Gould) and now, (1908) emphasizes the following as Melibean characteristics:

"Corpus nonnihil compressum. Branchiæ (propriæ) nullæ. Podarium angustius. Bulbus pharyngeus solum lingua destitutus."

It is thus seen that he admits, in spite of his controversy with Hancock, that: *the tongue and sometimes also the mandibles are entirely lacking.*

None of the authors, (Gould, Cooper and Fewkes) who have not employed the nomenclature of Rang for this type, have described mandibles, and O'Donoghue, (1921) states definitely: "The radula and jaws or any representatives of such structures are entirely absent."

The reasons set forth by Dr. O'Donoghue for disagreeing with Bergh's classification are to my mind not warrantable. This author, in fact, compares it with *Tethys* Linnæus, with which it disagrees in several respects, and he uses this as a reason for placing it in the genus created by Gould. Neither Cooper nor Fewkes made an intensive study of the type, which is evident from their description; a careful study of Gould's *Chioraera,* I think, will bring out sufficient reasons to merge it with *Melibe* as indicated by Tryon, Jr., (1883) and Bergh (1908). And as shown in my work on the morphology of *Melibe* (*s. Chioraera*) *leonina* (Gould), now in press, the general characteristics as well as the structure of *Chioraera leonina* Gould, correspond in many details with those of the Melibes of Rang, Pease, Bergh, *et al.* For this reason I have adopted, and indeed used in previous writings (1919, 1921) the name as indicated by Tryon, Jr., and by Bergh, and also suggested to me by my friend, Professor Trevor Kincaid, viz., *Melibe leonina. Chioraera leonina* (Gould) stands as synonym of this. The correctness of this classification may be verified by comparing the descriptions of Rang, Alder and Hancock, Gould, Pease, Eliot, Bergh, and Kjerschow-Agersborg, *et al.*

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ON THE GENERIC POSITION OF ANCYLUS FLUVIATILIS MULLER

BY BRYANT WALKER

IN discussing the availability of *Ancylastrum* Bgt. as a generic receptacle for *Ancylus fluviatilis* Müll., in case *Ancylus* could not be used, (*ante*, p. 5) I stated that the position of Kennard and Woodward in claiming that *Potella lacustris* L. was the correct type of *Ancylus* was " by no means free from doubt ". A subsequent and exhaustive consideration of the argument advanced by them in support of their proposition convinced me that from the data then known their position was untenable. But Mr. Kennard has recently unearthed an ancient paper, apparently entirely overlooked by the bibliographers, which puts an entirely different complexion on the question.

It appears that in 1823-4 there was published anonymously in Vol. XV of " The Quarterly Journal of Science, Literature and the Arts " of the Royal Institution of Great Britain a series of articles on " Lamarck's Genera of Shells ". In 1823 these articles were reprinted from the original type, with only a change of pagination, bound together and published with a new title page and a portrait of Lamarck. This title-page reads as follows:

" Lamarck's / Genera of Shells / Translated from the French / By J. G. Children F. R. S. / with plates / from original drawings / by Miss Anna Children / 1823."

In this paper (p. 231 of the original, p. 94 of the reprint) there is given a sufficient generic diagnosis of *Ancylus* followed by this statement:

" Type. *Ancylus lacustris* (Patella lacustris Linn.)."

A very fair figure of the type species, which is the species commonly called *lacustris*, is given on pl. VII, fig. 121.

Mr. Kennard tells me " that Children was the first Englishman to use " Type " as we do now ".

It follows, therefore, that this was the earliest designation of a type for *Ancylus* and forecloses any further discussion on that point. *Acroloxus* Beck and *Velletia* Gray consequently fall into the synonymy of *Ancylus*.

Incidentally I would call attention to the fact that Geoffroy, to whom the genus *Ancylus* is usually credited, was not a binomial writer and, therefore, can not be recognized (see Dall, Harriman Alaska Expedition, XIII, 1905, p. 80, as to *Planorbis*). Ancylus should censequently be quoted as of Müller, 1774.

But this leaves the position of *fluviatilis* Müll. and its allies still to be determined. As I have already shown (*loc. cit.*) *Ancylastrum* Bgt. is not available and no other name has been suggested, I would, therefore, propose *Pseudancylus* as the generic name for the group with *Ancylus fluviatilis* Müll. as the type.

I am under great obligations to Dr. H. A. Pilsbry for the data in regard to Children's paper.

SOMETHING ABOUT ANGITREMA

CALVIN GOODRICH

In the Duck river at Centerville, Hickman co., Tenn., Dr. A. E. Ortmann last summer collected nearly 200 specimens of *Lithasia* (*Angitrema*) *geniculata* Hald., 1840, young and adult. About one-third of the material was typical *geniculata*, as it is known from the Cumberland river. The rest shaded from these forms into *Lithasia fuliginosa* (Lea), 1841, by scarcely perceptible gradations.

Farther up the river at Columbia, Maury co., Dr. Ortmann took a second lot of these mollusks. Here the form *geniculata* was almost rare while *fuliginosa* was common. Yet examination showed them all to be of the same species.

The collections of Dr. Ortmann in the Harpeth river were equally as novel. At Belleview, Davidson co., Tenn., most of the shells were of the form that appears in cabinets as *Angitrema duttoniana* (Lea), 1841. A single specimen was unmistakably adult, and that would be identified by anyone as *Lithasia* (*Angitrema*) *armigera* Say, 1821. Two specimens taken corresponded to what I have found recognized as *Lithasia* (*Angitrema*) *venusta* Lea, 1841. At Kingston Springs, Cheatham co., near the mouth of the river, *armigera* was collected in numbers. In addition was collected plentifully a *Lithasia* identical in shell characters with *fuliginosa* of the Duck river. A few only show the link with *geniculata*. A curious thing was the fact that all of these shells of the *fuliginosa* form, when banded, had the banding formula not of *geniculata-fuliginosa*, but of *Lithasia obovata* Say.

It is perhaps useful here to explain that though any given species of the *Pleuroceridae* may have several banding arrangements, yet in this given species will be found one formula which occurs many more times than any other, constituting a characteristic the perplexed student of this family feels he can be depend upon. Whether the Kingston Springs shells show a relationship between *geniculata* through *fuliginosa* to *obovata*, or blow this rule about banding formulas out of water, is for some one more competent than myself to decide.

On the findings of Dr. Ortmann, *fuliginosa* cannot be recognized as more important than a variety of *geniculata*. Under *Lithasia armigera* might be listed these subspecies:

Duttoniana (Lea), nearly smooth, or smooth, and having a prolonged basal sinus.

Angulata (Weth.), nearly smooth, or smooth, and lacking the prolonged sinus.

Parva (Weth.), a dwarf form, seemingly occurring with *angulata*.

Venusta (Lea).

Downiei Lea, 1881, possibly only a mutation of *armigera*.

The genus *Angitrema*, with chief character " shell spinous ", was established by Haldeman in 1841, the type to be *Melania armigera* Say. Dr. Pilsbry[1] reduced it to the position of a section under *Lithasia*. Even that leaves *geniculata* and *armigera* separated from some of their offspring. There seems to me to be no other course now than to eject *Angitrema* altogether.

[1] *Proc. Acad. Nat. Sciences*, 1896, p. 496.

FREDERICK MORTON CHAMBERLAIN.

On August 17, 1921 Frederick Morton Chamberlain died of tuberculosis in a hospital in Oakland, California. The brave and sometimes hopeful fight lasted eight years. Mr. Chamberlain was associated with the U. S. Bureau of Fisheries from 1896 to 1913 and during the greater part of this time he held one of the scientific positions on the steamer *Albatross*. As Naturalist he accompanied that vessel on some of her noteworthy cruises. Thus he helped explore the waters of Bering Sea, Japan, Hawaii, the Philippines and the South Seas. Thousands upon thousands of marine animals were collected and prepared by him on these trips and many hundreds of species have been described from his dredgings. It has been said that Henry Hemphill collected more mollusks than any other man who has ever lived, but if the numbers could be ascertained in is likely that Chamberlain's would not be far short. Unfortunately the impersonal manner in which the work of the personnel of the *Albatross* has been recorded leaves the men who do the actual collecting almost if not entirely unknown. Thus some pieces of iron, riveted together into a ship and named after a bird will live for centuries in the annals of science but the genius which made the machinery produce the treasures of the deep sea will pass to oblivion mourned only by his circle of personal friends. Of the enormous number of new species of mollusks, crustaceans and echinoderms collected by Mr. Chamberlain, I do not know of a single one which has been dedicated to his memory. Two fishes and an Alaska bird however have been named for him. He was not a prolific writer and his published reports deal chiefly with fishes and fishery industries. All of them bear the stamp of the master workman and the thorough scientist. One of them on the salmon and trout of Alaska really marks an epoch in the study of these important fishes.—G. Dallas Hanna.

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PUBLICATIONS RECEIVED.

A Revision of the Australian Tridacna. By Charles Hedley. (Records Australian Museum, vol. 13, pp. 163-172, pls. 27-34, 1921.) A most interesting account of the giant clams. The Tridacna are divisible into two groups, the smaller species that burrow and the larger ones that lie on the surface. In classification the more natural place for the family is next the Carditidæ rather than the Cardiidæ. The author now considers *T. rudis* Reeve as a young stage of *T. gigas* L. C. W. J.

OBSERVATIONS ON THE HABITS OF COCHLITOMA ZEBRA VAR. FULGURATA (PFR.) AND C. Z. VAR OBESA (PFR.) IN CONFINEMENT. By Jane Longstaff, F.L.S., F.G.S. Proc. Zool. Soc. Lond., 1921, 379. A specimen of *C. z. obesa* lived 6½ years. An interesting account is given of the reproduction, food and habits. Three plates.

A NEW CLASSIFICATION OF THE SHIPWORMS AND DESCRIPTIONS OF SOME NEW WOOD-BORING MOLLUSKS. By Paul Bartsch. (Proc. Biol. Soc. Wash., vol. 34, pp. 25-32, March, 1921.) This is a preliminary paper offered in advance of a monograph on the American shipworms. Two new subgenera of Bankia (*Neobankia* and *Bankiella*) and three new subgenera of Teredo (*Teredothyra, Teredops* and *Teredora*) are proposed and five new species described, also two new species of *Xylophaga*. C. W. J.

NEW MARINE MOLLUSKS FROM THE WEST COAST OF AMERICA. By Paul Bartsch. (Proc. Biol. Soc. Wash., vol. 34, pp. 33-40, March, 1920.) Nine new species are described belonging to the following genera: Turbonilla, Odostomia, Cerithiopsis, Alvania and Vitrinella.

TERTIARY MOLLUSCA FROM THE LARES DISTRICT, PORTO RICO. By Bela Hubbard. (Scientific Survey of Porto Rico and the Virgin Islands, vol. iii, pt. 2, pp. 79-164, pls. 10-25, 1920; N. Y. Acad. Sci.) An exhaustive treatise on the Tertiary fossils of that region, representing various beds of the Oligocene. Some 66 new species and varieties are described and figured.

EGG-CAPSULES OF THE TEN-RIBBED WHELK. By C. W. Johnson. (Boston Soc. Nat. Hist., Occasional Papers, vol. 5, pp. 1-4, pl. 1, May, 1921.)

MOLLUSCA OF NORTH DAKOTA. By Mina L. Winslow. (Occasional Papers, Mus. Zool. Univ. Mich., no. 98, pp. 1-18, 1921.)

SHELLS FROM ALCONA, OSCODA AND CRAWFORD COUNTIES, MICHIGAN. By Mina L. Winslow. (Occas. Papers, Mus. Zool. Univ. Mich., no. 102, pp. 1-5, 1921.)

Fauna Molluscorum extramarinorum Islandiæ. By Hans Schesch. (Reprint from Report Scientific Society of Iceland, pp. 1-35, 1921.)

Hypertrophy in the Ancylidæ. By Bryant Walker. (Reprint 22nd Rept. Mich. Acad. Sci., 1920.)

Relations of the Ancyline Fauna of South Africa and South America. By Bryant Walker. (Reprint 22nd Rept. Mich. Acad. Sci., 1920.)

Les Variations et leur Héredite chez les Mollusques. Par Paul Pelsener. (Mémoires Acad. Royale de Belgique, Classe des Sciences, 2nd ser., Tome V, 826 pp., Dec. 1920.)

Eggs and Young of the River Limpet, Ancylus fuscus C. B. Ad. By William F. Clapp. (Occas. Pap., Boston Soc. N. H., vol. 5, pp. 5-10; plate.) Interesting account of the pairing and the early development.

NOTES.

The Hinkley and Nason Collections:—The Museum of Natural History of the University of Illinois has recently acquired the collection of the late Anson A. Hinkley. This collection contained upwards of 200,000 specimens of land and fresh-water mollusca. The heirs of the W. A. Nason estate have presented Dr. Nason's collections of insects and mollusks to the above museum, consisting of upwards of 50,000 specimens of insects and 10,000 specimens of mollusks. —C. W. J.

The collection made by the late Mrs. Williams of Chicago has been acquired by Mr. W. F. Webb of Rochester, N. Y. It is very rich in handsome shells, containing about 4000 specimens of *Cypræa,* 350 species of *Conus,* 90 of *Voluta,* 100 of *Oliva,* 2 perfect Pleurotomarias, an *Argonauta argo* 12 inches in diameter, among many other fine things.

Crepidula fornicata in the British Isles: The following interesting note is taken from "Animal Life in Scotland," by Dr. James Ritchie: "Even our seas have been enriched by strange aliens which have clung through thick and thin to their hosts during the vicissitudes of transportation. An interesting recent example is furnished by the appearance of the American Slipper Limpet (*Crepidula fornicata*) in the Thames estuary. The first sign of its presence there was a dead shell found on the shore at St. Osyth in 1891, although a fisherman had recollection of the 'Crow oyster' extending back some fifteen or twenty years. In 1893 a living example was found amongst oysters from the River Cronch, and thereafter records came with ever-increasing frequency, until it was discovered that the Slipper Limpet, from being a rarity, had become a pest. Its numbers on the oyster beds became so troublesome that endeavors were made to eradicate it, a special crushing apparatus being arranged for converting into manure the 'Limpets' dredged from the bottom. About 1911 the Blackwater Fisheries alone yielded 35 tons of Slipper Limpets in four weeks; and since then the multiplication of the alien has been even more rapid, for in twelve months in 1914-15 upwards of 1000 tons, dredged chiefly from the estuaries of the Blackwater and the Coln, were crushed and used for manure by the farmers of the district. The precise relationship between the Slipper Limpet and the oyster is unknown, but whether the former be a semi-parasite or only a constant messmate, there seems to be little room for doubt that it was introduced with foreign and probably American oysters brought for relaying in the oyster beds of the Thames estuary."

In the same work is the following note bearing on a fresh water mussel: " In 1824 the Linnean Society received the first recorded British specimens of the zebra mussel (*Dreissensia polymorpha*), these having been found in abundance attached to shells and timber in the Commercial Docks on the Thames. The zebra mussel lives in fresh water in the Danube and the rivers of Russia, and in northern France, Belgium and Germany. It is supposed to have been originally carried to Britain with cargoes of wood from the Volga, and it has actually been seen attached to Baltic timber ere yet the timber was removed from the ship's hold. The success of the zebra mussel as a colonist has been remarkable. It has spread from one locality to another until it has stations in some twenty English counties. In Scotland it is common in the Paisley canal and in the Forth and Clyde canal, where it used to be found 'in vast abundance.' Even in the most out-of-the-way places it has succeeded in obtaining a hold and in making headway; it is a common member of the fauna of water-pipes, and in 1912 a stoppage of the water supply at Hampton-on-Thames led to the discovery that the diameter of the 36-inch main for unfiltered water had been reduced to 9 inches by masses of zebra mussels which were growing attached to the inside of the pipe. Ninety tons of the shells are said to have been removed before the main was again put in working order."

These are both interesting examples of introduced species becoming pests. It is a problem that is always confronting us and constant care should be taken, for we already have too many similar cases. In this country, to my knowledge, the oystermen have never complained of the *Crepidula*, nor have I ever heard of its being so prolific. The possibilities of a fresh-water shell like the "zebra mussel" being introduced is very great. There is entirely too much reckless dumping of aquaria into our ponds and streams. A number of foreign fresh-water shells, etc., have been introduced in this way. Why not the mussel? This was the way the water-hyacinth was introduced into the St. Johns River, Florida.—C. W. J.

Shells in Luray Cavern: The loose dirt collected from shelving places in the Luray Cavern, Luray, Page County, Virginia, by Mr. James B. Clark on October 9, 1921, was found to contain many fragments of *Polygyra fraudulenta* Pils. and *Polygyra thyroidus* Say, associated with bones of bats and mice. The material was gathered about 200 feet down and about ¼ of a mile from the entrance of the cave. All the specimens are in the collection of the Academy of Natural Sciences of Philadelphia.

E. G. Vanatta.

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A SEARCH FOB LIGUUS.

BY CHARLES TORREY SIMPSON.

For a considerable time in the past I have been making annual trips to the Florida Keys for the purpose of studying the life of the region, its geographical distribution and the geology. Sometimes I have gone by boat but oftener by train, running to the most southern point visited and tramping back. I formerly went alone carrying no load and like an invading army trusting for sustenance on the territory I visited; but I have been so regularly taken for a tramp or bad man and driven from the doors of the natives, that of late I carry a small tent, bedding, provision, even drinking water, and by that means I am independent and can camp whenever and wherever night overtakes me.

Several islands of the lower chain have a considerable growth of the Carribean pine (Pinus caribaea), found generally in the southernmost part of the State. Big Pine Key is pretty well clothed with this kind of forest; and it is found on No Name, Little Pine, Cudjoe and several other keys.

Big Pine is a sort of headquarters from which I make trips to nearby islands. It is the largest of the lower keys, being over eight miles in length and about two and a half in width at its widest part. It runs from north northwest to south southeast and in shape reminds one somewhat of one of the modern Ku

Klux clothed in full regalia, its robe flowing irregularly down its body and ending above in a comical, twisted headgear. There are two projections on its eastern side, the southernmost being a considerable island at high tide but connected when the water is low, and the whole is called "Doctor's harm" (arm). A long strip of swamp stretches southward from its southeast corner which suddenly turns to the westward and the projection is called "The helbow." All the island except the long strip on the south is oolitic limestone, the latter part being an old coral reef and a part of the upper chain which ends with the nearby Newfound Harbor Keys.

One who visits the islands for the purpose of collecting tree snails may be said to almost be "between the devil and the deep sea." It is probable that not more than 35 inches of rain fall yearly on a considerable area of the Lower Keys, and the greater part of this comes in the warmer season. During the drier part of the year what few arboreal snails still remain on the keys hide away in holes or crevices of the trees or even deep under rocks so that it is well nigh impossible to find them. This is the period which is supposed to be free from mosquitos and the only one during which a collector can have any comfort. During the warm season when most of the rain falls the keys are generally an inferno caused by these insects. Sand flies are in order at all times of the year. I generally go the latter part of October, hoping to find the mosquitos departing and the snails still somewhat active, and come back early in November.

On a recent visit to the keys I stopped as usual on Big Pine and made my way back on the railroad to the "helbow" where a noble piece of hammock, covering perhaps forty acres or more, once stood. Part of it was long ago cleared and planted but later abandoned. Charcoal burners have cut the best of the timber for their business and hurricanes have wrought great destruction in it, as it is in a badly exposed locality.

Between the railroad embankment and the hammock a tide-way, about twenty feet wide and three feet deep, drained the great swamp into the open sea. I would either have to wade it and get my clothes wet or take off trowsers, shoes and leggins and on my return go through the same operation. I set my wits to work to contrive a bridge from the timbers which were thickly scattered about by a former hurricane. I laid a track of plank, got a piece of an oar and a broken gaff out of which I made a couple of rollers. Then I strained and lifted onto these a twenty-foot timber, six by twelve, which had done duty in some old railroad bridge, and rolled it down into the water. I shoved the far end of it into a little cove on the opposite side, staked the near end to keep it from drifting away and triumphantly walked across it, saying to myself, "When a man uses his brains he can save himself a lot of discomfort." In front of me grew perhaps a half acre of saltwort (Batis maritima), a dense, half-erect shrub with very succulent leaves, and I strode through this on my way to the sandy shore beyond. Suddenly I bogged down, going over my knees into water and mud that the deceptive shrub had entirely concealed, and after floundering across a couple of rods of this loblolly I crawled out on the opposite side completely bedraggled and disgusted. I reached the sandy shore and a little farther on the hammock. This piece of forest is doubtless classic ground. In the first half of the nineteenth century there lived in Key West a Dr. John Blodgett, who practiced medicine and carried on a drug store. He became greatly interested in the botany of the keys and made collecting trips among them. He discovered two Clusias, tropical strangling trees, and a Cupania, a member of the soapberry family on Big Pine, and as this hammock was very accessible to any one coming from Key West he no doubt collected in it and in all probability discovered these trees in it. I have searched the forests of Big Pine, and Dr. John K. Small of the New York Botanical Garden has done likewise, but no vestige of any of them has been found, and they are probably extinct so far as our flora is concerned. Henry Hemphill, perhaps the best conchological collector of his time, worked, I believe, on this key (perhaps in this hammock) and the adjoining No Name and found beautiful Liguus solidus in variety.

Without a doubt these snails have lived in this hammock until lately, perhaps until the dreadfully disastrous hurricane of September, 1919. I visited it a couple of months later and found many dead and broken Liguus along the shore in front of it, some of them still well colored, probably washed out by the exceedingly high tide which covered much of the floor of the forest with sand and debris. At the time of my last visit I spent the better part of a day carefully combing it over in the hope of finding this snail alive, but in vain. My search only brought to light a few dead, faded shells inhabited by hermit crabs.

This hammock although nearly ruined seems to be headquarters for cacti on the Lower Keys. Chapman's "Flora of the Southeastern States" only gives six species, two of which are introduced, for the entire region covered by his book, but Dr. Small lists no less than eight natives from this hammock alone. Among them is a tall, columnar Cereus with trunks as large as a man's body and twenty feet high, and another more slender but erect form which I discovered on Lower Matecumbe Key several years ago. One of the prickly pears (Opuntia) is nearly prostate and has joints about the size and shape of an old-fashioned hunting-case watch—a most striking form. In fact whatever time and attention one is not compelled, when in this hammock, to give to fighting mosquitos and sand flies, must be devoted to crawling through and avoiding cacti.

A few days later I was joined by my friend Dr. Edward Mercer, formerly of Philadelphia but now of Miami, who has been with me on several recent trips. In the village of Big Pine I was told of a man, who, not long before, had found *Liguus solidus* in variety on the northeastern part of the island where he had gathered a quantity and could have taken a "hatful." That has become a stereotyped word, and every time I visit the Lower Keys I am told of some one who could have filled his hat with them. And when traced down it turns out that he has perhaps gotten a few Oxystyla, which still sparingly persists on some of these islands, or *Drymaeus multilineatus*, a very abundant but much smaller form. In some cases the bona fide sworn-to Liguus turns out to be *Litorina angulifera.* I have come to believe that the spot where *Liguus solidus* is abundant is either at the end of the rainbow or where you pick up the will-o-the-wisp. One man volunteered for a consideration to guide us to the exact hammock where these snails had been found, but when we had arrived at a couple of tumbledown houses in the northern part of the island he didn't know just where it was, but swept his hand around the horizon in a vague way and said the hammock was "off yonder." We found nothing, not even a bone.

We determined to tramp across the island and make an attempt to find Watson's Hammock which lay on the opposite shore. We had been told that we would find the walking fairly good and were given the general direction. In two minutes we ran into a buttonwood swamp which I have since learned covers the greater part of the interior of the island. This is not the buttonwood or sycamore of the northern states, or any kin to it, but a tropical tree with dark, greenish, very combustible wood which inhabits brackish swamps or their immediate vicinity. It is a strange tree, having many forms, sometimes erect with a height of 70 feet and a trunk diameter of two feet; again it falls over and becomes a gigantic, writhing half-vine. On drier ground it is a small, somewhat erect tree, and in this swamp it grew in this fashion, only it threw out a good many stiff, crooked branches just at the ground which admirably served to trip our tired feet. It was only a short time until we came to more or less extensive pools and ponds of beer-colored, brackish water, which we tried for awhile to avoid by making a circuitous tramp around them. Soon, however, it became apparent that we must wade, and we plunged in, often to the depth of three feet, blundering and even falling over the very irregular bottom. Then for a long distance we encountered stands of buttonwood, dense scrub hammock and water. This hammock was, without exception, the most difficult to get through I ever saw. A considerable part of it consisted of a small tree or large shrub, a Bumelia or ant's wood, with narrow leaves and innumerable branches. The whole purpose of the tree seemed to be to develop and carry an immense load of long, excessively sharp thorns which for their ability to catch hold and hang on cannot be surpassed anywhere. It formed thickets, not quite as dense as a haystack, but the next thing to it, and we could no more crawl through it than we could through the side of a battleship.

This growth which belongs in slightly brackish ground bordered the hammocks and we had to get through it in some way to get across the latter. Often we got into a pocket and after fighting our way along for a while we were obliged to turn back and get out the way we came in. At other times I got down and cut my way through with my pocket knife so that we could push our bags ahead and crawl after. In the real dry hammocks the Bumelia was replaced by the pull-and-haul-back (Pisonia aculeata), and a tropical prickly ash (Zanthoxylum), to such an extent that they were nearly impassable. Wherever we found hammock I strained my eyes to find Liguus but saw none.

There was only the ordinary development of sand flies and common gray mosquitos, but we had scarcely gotten into the swamp before we began to encounter swarms, or herds, or droves, whichever they might best be called, of an enormous black mosquito, the largest and most terrifying I have ever seen. They shone as if freshly varnished and came on with a steady, leisurely flight as if they were sure of their victims. The fore part of these monsters bent down in a remarkable way, probably to allow the proboscis to get into action for some time before the rest of the insect arrived. The doctor at once called them "Dirigibles" which we soon shortened to "Blimps" on account of the inconvenience of using a word of four syllables whenever we encountered them. When one of these became filled with blood and slowly sailed away with its various appendages trailing below and after, it suggested a zeppelin in a remarkable manner.

For five dreadful hours we fought our way through this inferno. Often the growth was so dense that we could not see the sun and we constantly consulted our pocket compasses and bore off to the west or northwest whenever it was possible. Sometime before sundown I saw an open spot in front, then I caught a glimpse of the sea and a date palm which some one had long ago planted near the shore. In a moment we stepped out onto a level, smooth, grass-covered prairie that stretched to the Torch Key Channel, and we swung our hats and capered about like boys. Taken all in all, I believe this was about the most difficult short tramp I ever made, and when we got near the shore I was glad to throw myself down on the grass and rest.

The doctor is a delicate man of 60 whose health is none the best, and when he first proposed to go tramping with me I felt very doubtful whether he would be able to endure the hardships of such a rough-and-tumble life. Instead of lying down and resting that evening he took a long walk through the pine woods apparently for mere relaxation. In our various excursions I found him always ready to lead, and he never gave any intimation that he felt the slightest fatigue.

We pitched our tent on a growth of sedges (Eleocharis), so dense and tall that we could walk on it without pressing it to the ground—an admirable bed. Then we crawled in and after driving out the mosquitos carefully closed, as we thought, every aperture and congratulated ourselves on the prospect of a fine sleep. I did sleep but uneasily and was vaguely conscious that the doctor was much disturbed. When daylight came we could see that the inside of the walls and roof of the tent were so covered with mosquitos gorged with our blood that in places one could not have put his finger on them without touching an insect. We discovered a minute opening, just large enough to admit them in single file, and they had been industriously passing in all night.

We searched some small hammocks which lay to the northwest of us without results and then turned southward along the shore, finally reaching the great Watson's Hammock. Formerly this covered a considerable area and consisted of a magnificent growth of tall, closely-set tropical trees. Much of it has been cut out; but there still remains a splendid remnant, and this we diligently searched but found only a few faded bones. I first visited this forest in 1885, arriving just before sundown. My boatman who was anxious to get on only consented to allowing me a few minutes on shore, but during that brief time I could see that the trees were full of splendid Liguus. Had I been allowed a little time I could have actually gotten "a hatful." As it was I found the type of my *Liguus solidus crassus*, a form with a very solid shell and truncate columella, ivory white with a narrow bronze-green peripheral line, also a couple of specimens of the form *graphicus*.

We struck off down the island in a general southeast direction, but in trying to avoid the swamps were obliged to zigzag about considerably. The walking on the lower islands is much better than that of the upper ones, the general surface being level and comparatively smooth. This is an oolitic limestone much like that of the Miami region, but it was deposited in a shallow sea while the latter formed a retreating shore and is irregularly stratified. In many places the rock of the Lower Keys has split loose in thin layers and become broken up, and between the pine trees there is often a dense growth of a palmetto (Thrinax microcarpa). The whole is generally tied together with a villainous climbing smilax which is most liberally provided with thorns.

After a long tramp we reached the village, and the next morning had my old friend Joseph Sears take us across the strait to No Name Key. Sears is a powerful Bahama negro, good-natured and voluble, and in time past he has taken me to many of the keys in his boat, the "Three Fannies."

We camped in the front yard of an abandoned place, again getting a bed of the Eleocharis, and this time were fortunate enough to entirely shut out the mosquitos, but we could hear their angry humming all night, music which lulled us to sleep. No Name is nearly three miles long and about a mile wide, its northern part being pine forest with a dense undergrowth of palmettos. There is, or has been, a great central hammock of magnificent tall, closely-set tropical trees, but about 60 acres of it have been cut out. Much of the southern part of the island has been hammock but most of it is now destroyed. We carefully searched this interior forest, almost tree by tree, but found no living Liguus. In places the ground was thickly strewn with broken and bleached shells, some of the fragments still retaining color.

It may be asked, "What has become of them?" Their disappearance is due to several causes, man being the chief. The building of the extension of the Florida East Coast Railway wrought terrible destruction among the hammocks on the keys. One of the finest pieces of this growth was located on Key Largo where sparks from the engines set the timber cleared from the right-of-way on fire and destroyed hundred of acres of splendid

Liguus-bearing forest. There has been a series of years with a deficiency of rainfall, twelve in number according to a well-informed settler on one of the keys, and the snails have been driven to take refuge in crevices of trees and under the rocks while doubtless many have been exterminated. Birds have killed many more. Possibly dry weather has made food scarce and caused the birds to prey to a greater extent on the snails than usual.

I am strongly inclined to believe that a few colonies of the *solidus* may still exist on the Lower Keys. Three years ago I found three adult specimens of the typical form of this on trees back of the village of Big Pine. Several years ago Henderson and Clapp found a large colony of *solidulus* on Stock Island, but at my last visit to this only a few dead shells could be obtained. Within a couple of years I have found several tolerably fresh shells of *graphicus* on No Name, two on Sugarloaf and a fairly good young *solidulus* on Summerland and Boca Chica. There is still a good deal of hammock, some of it second growth according to my friend, J. T. Knowles, of Big Pine Key, on several of the islands, and the fact that settlement is decreasing rather than extending on the lower chain makes it probable that this growth may spread. If we could have a series of wet years it is easily possible that these snails might increase and be abundant again in places. There is no group of land snails on earth with more wonderfully beautiful shells than those of *Liguus solidus.* Their texture is of a marvellously delicate porcelain, their polish is remarkable and the colors of some are bizarre and extremely rich.

NOTE.—The above forms part of a chapter of my forthcoming book entitled "Out of Doors in Florida."

NOTES ON THE TAXONOMY OF NUDIBRANCHIATE MOLLUSCA FROM THE PACIFIC COAST OF NORTH AMERICA.

I. On the Identification of *Cavolina* (*i. e. Hermissenda*) *crassicornis* of Eschscholtz.

BY CHAS. H. O'DONOGHUE, D. SC., F. Z. S.,
Professor of Zoology, University of Manitoba.

In 1831 Eschscholtz described three nudibranchs collected by Captain von Kotzebue in Alaska in 1824,—the first to be recorded from the Pacific Coast of North America. The second of these (7, p. 15) is named *Cavolina crassicornis*, and in view of the rarity and consequent inaccessibility of this work, it may be permissible to quote from it in some detail:

"Corpore pallido; capite tentaculisque anticis crassis flavis; collo lineis tribus rubris; appendiculis dorsalibus atris apice rubris.

"An der Nordwestküste Afrika's (sic) an der Insel Sitcha, wo diese Art auf breitem Seetange und Ulven lebt.

"Länge drei Zolle. Der Leib hell hornfarben, der Rücken blass grau. Kopf und vordere Fühler gelb; letzere sind an ihrer Wurzel sehr dick und übertreffen die hintere stark geringelten braunen Fühler, welche eine gelbe Spitze haben, an Lange betrachlich. Auf der obern Flache der vordern Fühler beginnt von der Spitze ein gelber Streifen und setzt sich auf dem Nacken fort, wo er sich sehr breit wird und allmälig eine perlblaue Farbe annimmt; auf der Mitte des Nackens ein brennend oranger Streifen, ein gleicher an jeder Seite; jeder orange Streifen ist von einer weissen Linie eingefasst. Auf der Mitte des hell hornfarbenen Rückens bemerkt man eine Stelle, unter welcher das Herz pulsirt; über dem ganzen Rücken bis zur Schwanzspitze estreckt sich ein perlmutterfarbener Streifen. Der kiemenartiger Fortsätze an den Seiten des Leibes unterscheidet man vier bis funf Bundel; jeder einzelne Fortsatz is 2–4 Linien lang, an der ganzen untern Seite hornfarben, oben schwarz mit einem breiten weissen Langestreifen und breiter oranger Spitze. Auf dem platten weissen Schwanze bemerkt man ausser der mittlern Linie noch zwei weisse Längestreifen. Auch der hornfarbige Fuss hat eine weisse Randlinie."

From the itinerary and the context it is obvious that "Nordwestküste Afrika's" is a misprint for "Nordwestküste Amerika's," and the island referred to is Sitka, Alaska.

In 1862, Cooper (5, p. 205) described a species *Aeolis* (*Flabellina?*) *opalescens* with an opaline color on the dorsal tentacles and an orange stripe between them. Again in 1863 (6, p. 60) the same author also records this species as *Flabellina opalescens*, mentioning a pale variety with white-tipped branchiæ (i. e. papillæ).

Bergh in 1878 (1, p. 573) and again in 1879 (2, p. 81) formed a new genus *Hermissenda* for this species. It is closely allied to *Phidiana* but differs in the produced angles of the foot, the form of the teeth, but especially in the absence of a hook on the penis; and in these papers he identifies the *Aeolis* or *Flabellina opalescens* of Cooper as *Hermissenda opalescens*, the only member of the genus. The rhinophores are stated to be yellow with an orange stripe between (cf. Eschscholtz). The papillæ are yellow with the purple-red liver diverticula shining through.

Cockerell in 1901 (3, p. 122) also described the same form, calling attention to the two "opal-blue" lines forming practically one, but dividing on the head and just behind it to admit "a bright orange streak". He also mentions the "broad orange stripe on each side of the head", the fact that the papillæ possess an "orange subterminal ring" and that they are "easily deciduous."

The same author describes this species in conjunction with Eliot in 1905 (4, p. 50) but strangely enough gives no reference to his previous paper. This paper also mentions the "opalescent stripe down the back, bifurcating anteriorly so as to include an oblong area of bright orange."

The first full account of the coloration of this species was furnished by O'Donoghue in 1921 (8, pp. 201 and 202) but at the time this paper was written the author has overlooked Cockerell's paper of 1901 for the reason given above and had not access to Eschscholtz's Atlas. A second paper by the same author (9, ——) deals with the range of color variation met with in the same species and also its spawn (11, ——). In these two papers practically every point in regard to color mentioned in Eschscholtz is also described; the opalescent line along the back bifurcating at the front to include a bright orange area and then passing on to the oral tentacles; the orange area on each side of the head and neck; the light-colored opalescent line below this area; the interior of the cerata may be almost black and they have a white line on their outer border; the cerata in the dark varieties have an orange tip; the two lateral light lines in the tail region; and the light opalescent line along the margin of the foot.

These points are taken from O'Donoghue and arranged in the order in which they are dealt with in Eschscholtz and I think it will be obvious at once that such a closeness of description makes it certain that the same species is under consideration in both cases. If only the intervening observers had given a closer account of the color of the living specimen, I think the identity of *Hermissenda opalescens* with *Cavolina crassicornis* would have been established earlier. Examination of the radula shows that Bergh, Cockerell and Eliot and O'Donoghue were all dealing with the same species. The name *opalescens*, therefore, must be discarded in spite of its familiarity and of the fact that it describes the characteristic opalescent appearance of the lines of this beautiful species so well, and the older name *crassicornis* substituted for it.

The classification and synonymy of this form is, therefore, as follows:

Family: Æolidiæ Eliot, 1910.

Genus: *Hermissenda* Bergh, 1878.

Species: HERMISSENDA CRASSICORNIS (Eschscholtz, 1831).

Aeolis (Flabellina ?) opalescens Cooper, 1862.

Flabellina opalescens Cooper, 1863.

Hermissenda opalescens Bergh, 1879; Cockerell, 1901; Cockerell and Eliot, 1905; O'Donoghue, 1921; O'Donoghue and O'Donoghue (in press).

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OBSERVATIONS UPON THE NOMENCLATURE OF SLUGS.

BY H. A. PILSBRY.

In preparing a faunal work the writer had occasion to mention the types of *Limax*, *Agriolimax* and *Arion*. The attempt disclosed various irregularities in the current use of these names.

Before incorporating radical changes into a formal work, it has seemed well to give the data here, in order that others interested may criticize the inferences drawn, and possibly suggest some mitigation of the unpleasant situation. While the facts bearing on the names discussed have been carefully collected, it is always possible that some name or publication has been overlooked.

I. *Limax* L. replaces *Arion* Fér.

LIMAX Linnæus, Syst. Nat. (10), I, p. 652, for *L. ater*, *rufus*, *maximus*, *agrestis*, *flavus*. Lamarck, Syst. An. s. Vert. 1801, p. 64. *L. rufus* mentioned as an example. Children, Lamarck's Genera of Shells, 1823, p. 99. "Type, *Limax rufus* [idem. Linn.]." Gray, P. Z. S. 1847, p. 170. Type, *L. rufus*.

ARION Férussac, Hist. Nat. Moll. 1819, p. 53, for *A. empiricorum* Fér. (including as varieties *ater* and *rufus* L., etc.), *A. albus* Müll., *A. fuscatus* Fér., *A. hortensis* Fér.

Férussac's action in dividing *Limax* L. was perfectly proper and a great advance. He created *Arion* for the first two Linnæan Limaces and others, and restricted *Limax* to Linnæus' last three species. Unfortunately he did not name types for either genus; so that his work was overturned by Children, in 1823, who selected Linnæus' second species (an *Arion*) as the type of *Limax*. This restriction of *Limax* to the Arions was confirmed by Gray in 1847, though as often happened, he did not know what he was doing.

So far as I know, the only modern author to substitute *Limax* for *Arion* was F. Jousseaume, in the Bull. Zool. Soc., France, I, 1876, p. 26. He took this stand on account of the publication of *Limacella* for the *maximus* and *agrestis* groups by Brard.

II. *Eulimax* Moq.-Tand. replaces *Limax* Auct.

Limax being relegated to what we have called *Arion*, it remains to provide a name for what has hitherto passed as *Limax*. The group has been named several times, and the older names included both the large and small limaces. EULIMAX Moquin-Tandon, Hist. Nat. Moll. France II, 1855, pp. 18, 22, originally proposed to distinguish Limaces from Amalias, has subsequently been restricted to the *maximus* group. It may be used in a generic sense with *Limax maximus* L. as type.

III. *Limacella* substituted for *Agriolimax*.

In his useful Check-list of the Slugs[1] Professor Cockerell called attention to the nomenclature of the group generally known as *Agriolimax*. He found that there were several names

[1] The Conchologist, II, 1893, p. 199.

earlier than *Agriolimax*, but as their authors did not mention truly generic characters, the name in common use was allowed to stand, though evidently with misgivings. It may be mentioned that Mörch also had little idea of the true generic characters of *Agriolimax.*

The names preceding *Agriolimax* are as follows:

LIMACELLA Brard, Hist. des Coquilles, env. Paris, 1815, p. 107, for *Limacella parma, unguiculus, obliqua, concava. Limacella obliqua* (= *Limax agrestis* L.) here selected as type. Not *Limacella* Blainville, 1817.

DEROCERAS Rafinesque, Annals of Nature, 1820, p. 10; Binney and Tryon's reprint, p. 65. For *Limax gracilis* Raf.[1]

KRYNICKIA Kaleniczenko, Bull. Soc. Imp. Nat. Moscou, 1839, p. 30, for *K. melanocephala* Kalen. A nude name.

KRYNICKILLUS Kalen., Bull. Soc. Imp. Nat. Moscou, XXIV, 1851, p. 220, for *K. melanocephalus,*[2] *minutus, cristatus, maculatus, eichwaldii, dymezeviczii,* all new species.

The type of *Krynickia* and *Krynickillus* Kalen. and *Megaspis* Krynicki, is *K. melanocephalus* Kalen.

Krynickia melanocephala was published as a bare name in 1839, but cited as a synonym of *Krynickillus melanocephalus* in 1851, together with *Megaspis melanocephalus*. *Krynickillus* therefore takes precedence if any use is found for the name.

MALINO Gray, Catalogue of Pulmonata, Brit. Mus., Pt. I, 1855, p. 178, for *Limax lombricoidss* Morelet.

MEGAPELTA Mörch, Journ. de Conchyl., 1857, p. 282, for *Limax* (*Megapelta*) *semitectus* Mörch. (Described from a draw-

[1] "*Limax gracilis.* Body slender, head and lower tentacula fulvous, neck grey, upper tentacula brownish, mantle dark fulvous, back smooth brown, beneath dirty white; tail brown, obtuse above, mucronate and acute beneath.—Probably a real *Limax*, yet it has the two long tentacula inserted above the neck, while the small ones are terminal, and all slightly club shaped. It may perhaps form a sub-genus *Deroceras.* Length over one inch. Found near Hendersonville in Kentucky, and in woods."

There can be very little doubt that this is *Limax campestris* Binn.

[2] With the synonyms *Krynickia melanocephala* Kalen., 1839, and *Megaspis melanocephala* Krynicki, unpublished.

See *Agriolimax melanocephalus* Simroth, Die Nachtschnecken fauna des Russischen Reiches, 1901, p. 154.

ing. Thought by von Martens to be probably not distinct from *Limax lævis,* in the wide sense.)

Agriolimax Mörch, Journ. de Conchyl., 1865, p. 378. *L. agrestis* here selected as type.

Since 1865 several additional names have been proposed, some of which have been used for subdivisions, such as *Hydrolimax* Malm., for the *lævis* group. Of the names given above, it will probably be best to revive Limacella Brard, with the type *L. obliqua* = *L. agrestis.* Brard's name has been discredited because he founded a genus upon the *shell* as distinct from the animal; but after all, he was only following the example of Linné, who based his genera of testacea wholly upon the shells, prefacing the conchological definition with "animal a Limax." Brard's nomenclature was indisputably regular, being on absolutely Linnean lines. He left *Limax* for the slugs without a shell (*L. rufus* Linn.).

Jousseaume in 1876 (Bull. Soc. Zool. de France I, p. 25), followed by Mabille in the same publication (p. 96), used *Limacella* for the *L. maximus, flavus* and *agrestis* groups, without selecting a type.

Limacella of Blainville, 1817, was incorrectly defined, but Prof. Cockerell has shown that its type is a *Philomycus.* Being later than Brard's *Limacella,* this use of the name is not admissible under the existing rules of nomenclature.

TETHYS WILLCOXI IN NEW ENGLAND WATERS.

BY S. N. F. SANFORD.

On Oct. 9, 1921, a number of those curious tectibranch mollusks known as Sea Hares, *Tethys* (*Aplysia*) *willcoxi* (Heilprin), appeared in the West Passage of Narragansett Bay, R. I., coming in on the flood of the tide and disappearing with its ebb. As the tide was going out only two specimens were secured by the writer and his companion, Mr. Orville C. Minkler, although several others had been seen during the day. A second trip to the same station, on Oct. 16, yielded two more specimens, but none was found on any other R. I. or Conn. shore as far south as New London.

All of the specimens were alive when captured, two of them swimming by the undulation of their fleshy pleuropoda or swimming lobes. When not in motion the swimming lobes were folded over the dorsal organs, affording some if not full protection. When handled they exuded from their mantles a red-purple fluid which became bright crimson or wine color when diluted by sea-water or alcohol.

In life the colors were dark purplish-brown, variously mottled with large areas of dirty white. The distribution and relative quantity of these colors differed much, however, according to the degree of extension or contraction of the animals. It was also noted that the dark pigmented surfaces were thin and easily rubbed off, making color description an uncertain factor except with fresh specimens. In alcohol the dark portions turned nearly black, and the light areas at first changed to a bright pea-green, then back again, in the course of a week, to the original dirty white.

Two of these specimens, now in the collection of the Boston Society of Natural History, measured 8 inches in length, 7 inches across the expanded swimming lobes. These measurements were dorsal and taken before relaxation following death. The other specimens were much smaller.

The shell, covered by a tough membrane, was oval in general outline, very thin and fragile, and composed of two plate-like layers. A test with dilute acid proved the inner layer to be a thin surfacing of lime, not quite covering the outer chitinous plate. White, concentric lines, describing smaller arcs towards the hook-like apex, were crossed by finer, radiating lines converging at this point.

The odor of the colored fluid (possibly mixed with other secretions) was slightly unpleasant, and the dyeing quality, unlike the "Tyrian purple" of some mollusks, was not very good. When fresh it was readily washed from the hands, and almost as easily from cloth, but unsized paper appeared to hold the stain rather persistently. No fixing agents, except hot water and dry heat, were tried, however.

While other members of this genus are not uncommon in Florida and the West Indies, the New England records for this particular species are few, and, according to Mr. C. W. Johnson,[1] are nearly all from Buzzards Bay, Woods Hole and adjacent Massachusetts waters. Although the Sea Hares belong to warmer regions, it is interesting to note that all the New England specimens were taken in *October*. The mollusks disappear as mysterously as they come, and neither the cause of their presence so far north, nor where they go, seems to have been definitely determined, although the high summer temperatures of 1906, 1910, and 1921 may be significant.

SHORE REEF HUNTING IN THE HAWAIIAN ISLANDS.

BY CHARLES F. MANT.

Being anxious to visit the shore reefs by night on the western side of this Island, Oahu, a friend and myself agreed to start on the first occasion when tides were at their lowest.

Having made all arrangements we left Honolulu at 3:00 p. m. on October 18th., and motored to Kawaihapai, a two and a half hours trip, part of the distance being over very bad roads and trails, but our little car was staunch, and we arrived safely. After a brief meal we changed into overalls, and filled our torches—large iron cylinders stuffed with a sack for wick. Then slinging our collecting bags over our shoulders we started off along the railroad track which here follows the shoreline for some miles. The scenery was very wild, the mountains coming down almost to the shore on the one side, whilst on the other the reef-lined shore stretched as far as one could see bordered with a white fringe of surf.

After about an hour's tramp we decended to the shore, and lighting one of the torches commenced our search.

At first nothing much except a few common things were

[1] Occ. Papers, Bost. Soc. Nat. Hist., VII, Fauna New England 13, Mollusca, pp. 153–4.

found, the raised portions of reef at high-water mark being covered with thousands of *Littorina pintado*, *L. picta*, and *Nerita picea*. We proceeded a mile or so further, and then examined a rocky "flat" where the reef was full of deep holes in which brilliant little fish of many colors were swimming, whilst on the rocks were numbers of the Rough Sea Urchin (*Podophora pedifera*) the "Haukeke" of the Hawaiians who esteem this and other species as food. One had to be careful, as here and there were "blow holes" which spouted the water high into the air when a wave came in.

Presently the first "find" was made of a fine *Cypraea mauritiana*. Then a specimen of *Acanthochites viridis* was discovered on a raised coral rock. It was whilst trying to remove this shell that a big wave came in unexpectedly, knocked me over the rock, whilst my torch, collecting bag, etc. went in different directions, and a sandwich that I carried in my upper pocket was reduced to pulp! However, things were soon put right, and now we began to find the shells. In the rocky pockets were many *Cypraea caput-serpentis*, and various Cones, on the weedy rock Ricinulas, on the raised reef Chitons, Helcioniscus, Littorinas, Purpuras, nerites, etc.

The luck of the evening came to my friend who had ventured out to where the surf dashed from time to time on the large rocks, for he discovered five magnificent specimens of *Cypraea mauritiana*.

We had hoped to collect some specimens of *Cypraea reticulata* which had been found upon a former occasion, but this time we were disappointed.

It was now getting late, and the tide had turned; so we retraced our steps and returned to our headquarters, the light of the full moon making the track clearly visible.

After some supper and a change into dry things we took our blankets to the beach and slept until 5:00 a. m., being awakened by the piping of Alaska Plovers busily feeding along the shore.

The view in the early hours was very lovely, the moon still shining whilst in the distance the orange and yellow rays of the sun rising behind a bank of dark clouds with the loom of the mountains and coast beneath. For miles on either side of us stretched the shore with the blue Pacific and endless lines of snowy surf.

We started for home at 6.30, arriving at 9:00 a. m., tired and well pleased with our trip.

Among the shells collected were:

Cypraea mauritiana L.
Cypraea caput-serpentis L.
Purpura harpa Conr.
Purpura intermedia Kien.
Ricinula horrida Lam.
Ricinula morus Lam.
Ricinula ricinus L.
Ricinula tuberculatus Blain.
Conus ceylonensis Hwass. v. *pusillus.*
Conus hebraeus L.
Conus lividus Hwass.
Conus abbreviatus Nutt.
Nerita picea Recluz.
Nerita polita L.
Littorina pintado.
Littorina picta Phil.
Littorina feejeensis.
Acanthochites viridis Pse.
Helcioniscus exaratus Nutt.
Strombus maculatus Nutt.
Siphonaria amara Nutt.
Siphonaria amara var.
Columbella zebra.

NOTE ON ALABA AND DIALA.

BY W. H. DALL.

In working over some of the minuter Hawaiian shells it became necessary to make comparisons with *Diala* and *Barleeia*, etc.

Examination of the Pacific coast species referred to by Carpenter revealed some unexpected peculiarities.

The genus *Alaba* was named by Arthur Adams in December, 1853, in the "Genera of Recent Mollusca," p. 241. It contained two species, both West Indian, of which the first, *Rissoa melanura* C. B. Adams, is now selected as the type.

The genus *Diala* was proposed by Arthur Adams in 1861, with five species of which the first, *D. varia* A. Adams, is now selected as type. This group closely related to *Alaba*, differs by the absence of varices, and generally more compact and flatsided shell. *Diala* was adopted by E. A. Smith in 1875, who figured a shell and operculum under the name of *D. leithii* from California, where it has not since been recognized, but probably is a Lower Californian shell.

Alaba supralirata Carpenter, was described in the Mazatlan Catalogue and is an abundant Lower Californian shell. An examination of a dry specimen shows it to have an operculum paucispiral and like that figured for *Diala leithii* Smith, with no spur or outstanding spiny process. The radula is not quite like that figured by Troschel. The rhachidian tooth has a squarish base with three rounded cusps, the central one larger than the others. The extreme minuteness of the object and the tangled condition of the radula did not enable me to determine the form of the stems of the inner laterals, but the outer ones and apparently the others were slender, the distal ends forming a semicircular curve with extremely fine serrations on the edge. The radula and operculum of *Alaba* have not previously been described.

The shell listed by Carpenter as *Diala marmorea* though shaped and colored like some of Adams' Dialas, does not belong to the genus. It has the operculum and radula of *Barleeia* but differs in having a smooth nucleus while that of *Barleeia rubra* is thimble-pitted. The rhachidian tooth of *marmorea* is more squarish than that of *B. rubra* as figured by Troschel, and has five rounded cusps, the middle one larger. The styliform process of the operculum is remarkably long in proportion to the size of the operculum. Whether the difference in the nuclei warrants a distinctive name for *B. marmorea* need not now be decided.

OBSERVATIONS ON LIVING GASTEROPODS OF NEW ENGLAND

By Edward S. Morse, Peabody Museum, pp. 1-29, plus. I-IX.

BY PAUL BARTSCH

Two years ago Professor Morse published his paper " Observations on Living Lamellibranchs of New England ", in the Proceedings of the Boston Society of Natural History, (Vol. XXV, No. 5) in which forty-eight species are described and figured.

The present paper is a companion to that one, dealing with Gastropoda and one Scaphopod. Forty-six forms are figured in the 118 sketches, on nine plates illustrating the paper. The first twenty-two pages are given to a discussion of the anatomic structures figured, while the last seven are devoted to an arraignment of modern nomenclatorial methods.

In it interesting to note that of the forty-six species figured, ten bear names that were originally bestowed upon East Atlantic specimens. These species were later recognized as existing in American waters. Experience has taught me to look upon such a distribution with a critical eye, and for that reason I have subjected, in this instance, these ten species to an examination, comparing our splendid collection of East American specimens with the fine lot of material contained in the famous Jeffreys Collection of European Mollusca now resting in the National Museum, with the following results:

Figure 2, Acmaea testudinalis Müller. The American shells average much larger than the European. Some of the specimens actually attain more than double the size of the largest contained in the Jeffreys Collection. There are other essential differences in color pattern, etc.; enough, I should say, as Acmaeas go, to separate the American from the European form, at least subspecifically. We may therefore call it *Acmaea testudinalis amoena* Say, a name that was bestowed upon the American species by Say in 1821, Journ. Acad. Nat. Sci. Phila., vol. 2, p. 223.

Figure 8, Cemoria noachina Linnaeus. The American shell has long since been recognized as distinct from the European, under the name of *Puncturella princeps* Mighels & Adams, Bost. Journ. Nat. Hist., vol. 4, p. 42, 1842.

Figure 14, Lacuna vincta Montagu. An examination of the East and West Atlantic specimens passing under this name shows that there are sufficient differences in the form of shell, shell texture and finer sculpture to separate the West Atlantic from the East Atlantic form, at least subspecifically. The name available for the West Atlantic will be *Lacuna vincta pertusa* Conrad, Journ. Acad. Nat. Sci. Phila., vol 6, p. 266, 1829.

Figure 20, MENESTHO ALBULA Moller. The specimens referred to under this name are not that species, but *Couthouyella striatula* Couthouy.

Figure 21, VELUTINA LAEVIGATA Linnaeus, and Figure 23 LAMELLARIA PERSPICUA Linnaeus I do not know.

Figure 34, BUCCINUM UNDATUM Linnaeus. This species was described from Europe. As at present conceived it is a most variable form and will require intensive anatomic study and breeding to decide whether we are dealing with a fluxed hybrid element, or whether this name is made to cover a host of species. With the present state of our knowledge it would be folly to attempt a differentiation of the American from the European forms.

Figure 39, TROPHON CLATHRATUS Linnaeus. The size, shape and sculpture differentiate the American from the European form. The West Atlantic members will have to be called *Trophon scalariformis* Gould, Invert. Mass., p. 378, 1870.

Figure 44, ALEXIA MYOSOTIS Draparnaud. More detailed anatomic study will have to be made before we can be sure that the European species is really the same as the American.

A bit of rectification, where needed, of the rest of the nomenclature may not be out of place, and I am sure that Professor Morse will be only too glad to have someone relieve him of this task, so we give the following:

Figure 1, ENTALIS STRIOLATA Stimpson is now *Dentalium (Antalis) entale stimpsoni* Henderson.

Figure 11, TROCHUS OCCIDENTALIS Mighels & Adams. This is *Calliostoma occidentale* Mighels & Adams.

Figure 13, RISSOA MINUTA Totten is *Paludestrina minuta* Totten.

Figure 24, NATICA HEROS Say.

Figure 25, NATICA TRISERIATA Say.

Figure 27, NATICA IMMACULATA Totten; all three must be referred to the genus *Polinices.*

Figure 29, BELA DECUSSATA Couthouy becomes *Lora decussata* Couthouy.

Figure 30, COLUMBELLA LUNATA Say becomes *Alia lunata* Say

Figure 31, COLUMBELLA AVARA Say becomes *Anachis avara* Say.

Figure 32, NASSA OBSOLETA Say becomes *Alectrion* (*Ilyanassa*) *obsoleta* Say.

Figure 33, NASSA TRIVITTATA Say becomes *Alectrion* (*Tritia*) *trivittata* Say.

Figure 35, BUCCINUM CINEREUM Say is now *Urosalpinx cinerea* Say.

Figure 36, FUSUS ISLANDICUS Gmelin. This should bear the name *Colus stimpsonii* Mörch. It is interesting, in this connection, to call attention to the fact that an error has slipped into Johnson's "Fauna of New England", in his citation under this species on page 137. He cites the type locality as as Faerö. The fact is, Mörch states at the reference cited that *Fusus stimpsonii* (*F. corneus* Say, Amer. Conch.), is the American species; that the Faerö specimens differ from it, are thinner shelled, and have flatter whorls than *F. stimpsonii.* Say misidentified this as the *corneus* of Linnaeus.

Figure 37, FUSUS PYGMAEUS Gould is *Colus pygmaeus* Gould.

Figure 38, FUSUS DECEMCOSTATUS Say is now *Chrysodomus decemcostatus* Say.

Figure 41, RANELLA CAUDATA Say is now known as *Eupleura caudata* Say.

Figure 46, MELAMPUS BIDENTATUS Say is now generally considered to be *Melampus lineatus* Say.

There have been so many changes and so much discussion in the preceding remarks that it might seem as if Professor Morse's paper had been criticised. I wish here to dispel any such impression. All that we have attempted is to bring up to date an involved nomenclature that will render his contribution the more intelligible to those who do not have the mass of literature necessary to effect these needed changes.

Professor Morse's drawings and anatomic notes will be always extremely useful, since they add materially to the sum total of our knowledge of our northeastern mollusks, and it is only to be hoped that Professor Morse will continue to employ the wonderful gift which he possesses to fix on paper observations on all the other forms with which he will come in contact in the future.

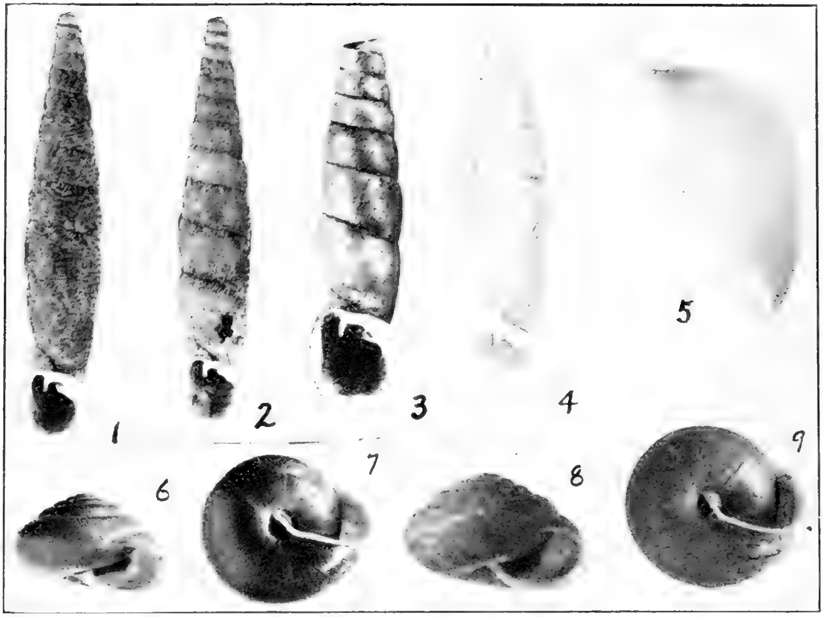
The only criticism in the entire paper pertains to figure 18, that of *Aporrhais occidentalis* Beck, in which an appendage is described which is evidently an abnormality, a curious accidental development, which Professor Morse himself tells me in a letter is the case, although he did not recognize it as such when he prepared his manuscript.

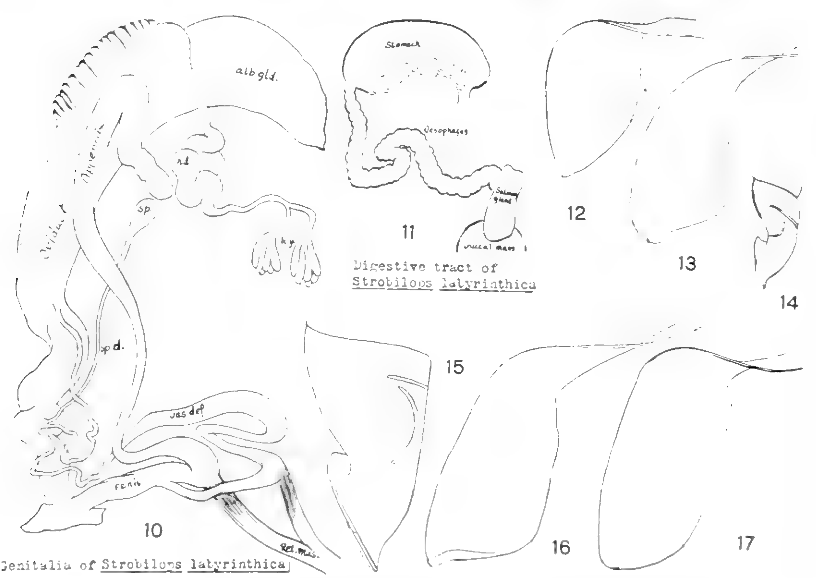
As to the appendix, pp. 23-29, we agree with Professor Morse that it is an arduous task to keep pace with the ever shifting nomenclature. Some of the changes produced might be dispensed with, but the major part reflects the advance of our knowledge, and is necessary. I have recently had occasion, in revising the Vitrinellidae, to refer specimens that had been assigned to this family at various times, to six other families than the Vitrinellidae, their operculum, radula and other anatomic features demanding this shifting. Changes like these will continue to be required until the final adjustment has been made.

We in the Government offices are constantly called upon to furnish the very latest in nomenclatorial dictum and a large part of our time is taken up with the chase after the correct name. I have frequently wished that some organization could be prevailed upon to undertake the preparation of a card catalog of scientific names, generic and specific, beginning with Linnaeus, giving in addition to the name and citation of publication, the family to which a given genus belongs and for species in addition the type locality. In the case of secondary combinations, a cross-reference card should be prepared for filing under the proper places. Such a work carefully executed would eliminate at once almost all the changes in nomenclature due to priority only, the names, that seem to irritate most grievously the men who are not actually engaged in revisional work.

The reviser usually has only one aim, or should have only one aim in mind, and that is to achieve stability by applying the rules of the international code consistently, no matter how much he may dislike to so do. No nomenclatorial stability can be achieved if each of us follows an independent method. A catalog of the kind above referred to would make a quick revision possible, the main points of which would stand for a long time to come, and the minor shift could easily be kept current by the small force that should prepare the cards for the new things published year by year. I wish to heartily recommend this undertaking to the National Research Council. I am sure that the whole zoological fraternity, yes, not only zoological but botanical fraternity, would be grateful for such a work.

Another point that should find expression in this review is the fallacy, or should I say dogma, entertained by many that the soft anatomy of mollusks expresses more nearly the true phylogenetic relationship than does the shell. It has come to be believed, why I do not know, that shell characters are readily modified, and that the soft parts only remain constant. The facts adduced by our breeding of Cerions do not accord with this. Here, at least, we have found the shell characters not affected by changed environment. By hybridization we have produced not only changes in shell characters but even greater changes in the organization of the soft parts. This would show that the soft parts are at least as readily changeable, if not more so, than the skeletal characters. Furthermore, we should not lose sight of the fact that the gastropod shell, in its nuclear whorls, retains a lot of embryologic and subsequent metamorphic developmental history which is largely, if not entirely, lost in the adult anatomy of the animal. The shell therefore furnishes ever so much more phylogenetic information than the adult soft parts, since it records almost the complete ontogeny of the species. No single set of characters tells the whole story—shell, cytology, embryology, anatomy, not to forget physiology, all furnish helpful hints to a complete understanding, and Professor Morse's notes and figures will prove exceedingly useful to all of us who may not have ready access to living material.





1, 2, 15, 16, 17, NENIA BELAHUBBARDI. 3, N. F. TINGAMARIÆ.
4, 5, 12, 13, 14, N. BRYANTWALKERI. 6, 7, POLYGYRA C. SHASTA.
8, 9, P. SIERRANA. 10, 11, STROBILOPS LABYRINTHICA.

NOTES ON THE ANATOMY OF STROBILOPS LABYRINTHICA (SAY).

BY G. DALLAS HANNA.

(Contribution No. 102, from the California Academy of Sciences.)

Several years ago, some examples of *Strobilops labyrinthica* (Say) were collected alive at Great Falls of the Potomac River, in Virginia, and advantage was taken of the opportunity to ascertain some points regarding the anatomy. Drawings and notes were made at the time of dissection but other activities have prevented their preparation for publication until now.

The small, ribbed, dome-shaped shells with internal lamellæ are common in the eastern part of the United States and their familiar forms need no special mention here. Say described the first species as *Helix labyrinthica.* (*Journ. Phila. Acad. Sci., I, 124, 1817.*) Morse in 1864 (*Journ. Portland Soc. Nat. Hist., Vol. I. p. 26, 1864*) created the genus Strobila for it; but this name, unfortunately, was preoccupied several times. Pilsbry (*Proc. Acad. Nat. Sci. Phila. 1892, p. 403*) renamed the group, *Strobilops* in 1892. (*See also in this connection, Pilsbry,* NAUT., *VII, p. 56, 1892.* NAUT. *XXII, p. 78, 1908.*) According to him the genus is represented by numerous species in the European Tertiary from the Eocene; also in America it is found from Maine to Venezuela, west to the Rocky Mountains and possibly it is found on the Galapagos Islands. Several species are found in Japan, Eastern Asia and the Philippines.

A cursory examination reveals the following names which have been applied to American material: *labyrinthica* (Say): *strebeli* (Crosse and Fischer): *virgo* (Pilsbry): *affinis* Pilsbry: *morsei* (Dall): *salvini* (Tristram): *hubbardi* (A. D. Brown): *vendreyesiana* (Gloyne): *texasiana* Pilsbry and Ferriss. There may be others.

The anatomy, Plate 2, figs. 10, 11, indicates that the genus is distinctly Pupillid in its relationships. The kidney, being parallel to the rectum, separated therefrom and leading directly to the mantle margin, places it in the superfamily or tribe, *Orthurethra* Pilsbry. Fundamental shell characters are sufficient to segregate the group as a distinct family, *Strobilopsidæ.* (*When*

STROBILOPS *replaces* STROBILA, *then* STROBILOPSIDÆ *must replace* STROBILIDÆ *according to the rules of priority and synonymy.*)

The following description applies only to *S. labyrinthica.* How closely the other species come to this, and the amount of variation in the group, can only be ascertained by more extended anatomical investigation.

Animal without pedal grooves or caudal mucous pore but having a network of incised lines on the surface of the skin. The meshes of this are quite large. Tentacles and eyestalks, normal. Genital opening just back of the right eyestalk. Fore part of the body, black: tail region light gray and sole of foot white.

Kidney, long and slender, very little larger than the duct, the ureter, which leads directly therefrom to the mantle margin. The duct is separated from the rectum by a distance equal to the diameter of the latter. It appears to discharge immediately above the breathing pore.

The genitalia are characterized by the excessively long flagellum on the penis. One branch of the bifurcated retractor muscle is attached at the junction of the penis and flagellum: the other is attached to a bend of the vas deferens a short distance above its union with the penis. The distal end is attached to the right optic retractor muscle. The vas deferens is considerably swollen in the section nearest the penis. Here it is almost as large as the latter organ. It gradually becomes smaller however and discharges high up on the oviduct. The appendix is swollen in its distal end to the diameter of the penis and it has there an abrupt flexure. Whether this is due to the retraction of the organs and therefore accidental or whether it is natural, has not been ascertained. The penis and vagina unite at the point of exit. There is no appreciable atrium or cloaca.

The vagina is a thin-walled, slightly pouched organ, smaller in diameter at its junction with the penis than elsewhere. The upper end corresponds to what is usually called the oviduct in land snails, but there is not a point of demarcation between the two in this species. The upper end is folded into a series of lamellar pouches, all of which fit close together like plates. The walls in this region appear to contain some glandular tissue.

The albumen gland is large and finely granulose. Its separaion from the vagina-oviduct is not well marked. The hermaphroditic duct empties at the junction of the two. This duct is greatly convoluted and swollen in its lower portion. Upwards, it is thin and slender. The hermaphroditic gland is composed of two portions, grape-like granules embedded in the coarsely granular liver. The spermatheca is pear-shaped and empties into the vagina a considerable distance below the termination of the vas deferens.

The digestive tract is composed of the usual elements; buccal mass, salivary glands, oesophagus, stomach and intestine. Two features seem to be noteworthy. The oesophagus is not a slender duct as usual, but the walls are "knotty" or slightly convoluted throughout. Also on the stomach there appears to be an accessory gland, closely appressed to the walls of that organ. The salivary glands are united into one but they seem to discharge into the buccal mass at the usual two points.

The jaw and radula were not examined but the description of these organs has been repeated so many times that it does not need to be quoted. Binney in the Manual of American Land Shells, p. 263, 1885, considers them in detail.

SOME PERUVIAN CLAUSILIIDÆ.

BY HENRY A. PILSBRY.

The species of *Nenia* noticed below were collected in the valley of the Huallaga River, eastern Peru, by Dr. Bela Hubbard, in the course of geological exploration in that region. I owe the privilege of studying them to Dr. Bryant Walker.

NENIA BELAHUBBARDI n. sp. Pl. 2, figs. 1, 2, 15–17.

The shell is fusiform, rather slender, widest at the penult whorl, attenuate above; quite thin; light brown variegated with white, which appears on the striae only, in many small, irregular patches. Sculpture of fine, close, oblique striæ, 12 or 13 in 1 mm. on the face of the last whorl. They are continuous, very slightly irregular or waved, but appearing more so from the white variegation; below the suture there are spaced groups of slightly enlarged white striæ, giving the appearance of very low, protractive folds there. The first 1½ whorls are smooth and glossy, apex flattened; following whorls are slightly convex; last whorl flattened, projecting in a short, rounded neck. The aperture is squarish-ovate, vertical, light brown within. Peristome pale brown, rather broadly expanded. The superior lamella is vertical, strong but thin, concave on the left side, curving to the left where it joins the spiral lamella, which penetrates scarcely deeper than the dorsal side. The inferior lamella is moderately developed, becoming strong within, and penetrating to a mid-ventral position. The principal plica is about half a whorl long, running from the middle of the right side to a little past the beginning of the neck. The lunella is dorsolateral, well developed and strongly arched.

Length 27.8, diam. at penult whorl 4.7 mm.; longest axis of aperture 5.4 mm.; 12 whorls.

Length 26.3, diam. 4.6, aperture 5 mm.; 12 whorls.

The clausilium is bluntly pointed at the palato-distal extremity, slightly excised at the filament.

Caspisapo, Rio Huallaga, Peru. Cotypes in A. N. S. P. and Bryant Walker coll.

Nenia pampasensis (Pils.) has about the figure of this species but differs in sculpture among other features.

NENIA FLACHI TINGAMARIÆ n. subsp. Pl. 2, fig. 3.

This form agrees in the main with *N. flachi* Boettger, but differs by the more widely spaced striæ. In *N. flachi* the striæ are crowded, 16 to 18 in one millimeter on the face of the last whorl. In this race there are 8 to 9 in one millimeter. Coarse, low, spiral striæ are present and well developed. The color is a very pale brown, somewhat translucent, the shell being quite thin.

Length 23.2, diam. at penult whorl 5.2, largest axis of aperture 6.6 mm.; 6½ whorls remain.

Length 23.5, diam. 5.2, aperture 6.8 mm.; 6½ whorls.

Tinga Maria, Peru. Cotypes in A. N. S. and Bryant Walker collections.

The group comprising *N. peruana* (Trosch.), *N. slosarskii* (Lub.) and *N. flachi* Bttg. is a rather intricate one, the species being closely related and likely to give trouble as more races turn up; but the striation of the new one, very much more spaced than in the specimens of these three species compared, appears to make another race necessary.

Two forms I have not seen, *Clausilia granulosa* Sykes and *C. s. rosenbergi* Prest. are placed in the synonymy of *N. flachi* by Boettger, in his latest consideration of the subject (Nachr.-bl. D. M. Ges., 1910, 77). These two and *N. flachi* are from Chanchamayo, Peru.

Nenia bryantwalkeri n. sp. Pl. 2, figs. 4, 5, 12–14.

The shell is fusiform with entire summit. Color undetermined, as the type is bleached. Sculpture of slender, widely separated riblets, 5 riblets and intervals in 1 mm. on the face of the last whorl. On the neck they became closer. The whorls are quite strongly convex, the last becoming free and descending more rapidly, the neck rounded. The aperture is carried a little forward, vertical, ovate, with strongly expanded peristome. The superior lamella is strong, vertical, concave on the left side, continuous with the spiral lamella, there being no bend or sinuosity marking their junction. The inferior lamella is inconspicuous in a front view but rapidly becomes high within, penetrating to the mid-ventral line. The principal plica is half a whorl long, dorsal in position. The lunella is strong, subdorsal in position, strongly arched.

Length 15, diam. at penult whorl 3.4 mm.; 7½ whorls.

The clausilium is thickened along the oblique distal end, and pointed at the palato-distal extremity. There is a quite small excision at the filament.

Province of Huallaga, Peru. Type in the Bryant Walker collection.

This species is probably nearest to *Nenia filocostulata* (Lub.), a decollate species retaining 8 whorls, with a length of 17 mm., according to Lubomirski, or having 7 whorls, length 15, diam. 3 mm. in a specimen measured. Besides the constant decollation, it differs from our new form by the unevenly spaced costulæ, less swollen shape and longer neck.

NOTE ON ACTEOCINA.

BY WM. H. DALL.

Mr. A. M. Strong in the October NAUTILUS calls attention to some apparent discrepancies in the distribution of the West Coast species of this genus as recorded in my "Summary" of the West American Shells.

My record of the distribution as published is taken from the series contained in the collection of the National Museum and not (except when otherwise verified) from the literature. The only real discrepancies in Mr. Strong's table are those of *A. culcitella* (+ *cerealis*) and *A. infrequens* C. B. Adams. I have 127 different lots of *A. culcitella* comprising about 500 specimens and see no reason for changing my identification. Mr. Strong errs in supposing that the Kodiak fauna is Arctic. On the contrary it is Oregonian and contains a large proportion of Puget Sound species. The question of the identity of *cerealis* and *culcitella* has been in dispute for more than forty years. The trouble is that eliminating *cerealis* one finds no specimens of young *culcitella*, and they are generally found together. I presume it will take anatomical study to settle the question. The color of the periostracum varies from white to ruddy brown just as in *Cylichna alba*.

In the case of *infrequens*, in taking off the distribution from the collection, I did not notice that the Santa Monica specimens were fossil. Our "live" series begins at Cape St. Lucas with the Panamic fauna. Otherwise there is nothing to change in my record of distribution.

I may add that the fine spiral striation is inconstant in strength in these shells, as is also the carination at the shoulder. A good example of this variability will be found in any large series of our common East Coast *Acteocina canaliculata* Say, where the channel at the shoulder varies from clear-cut and sharp, to a state so obsolete as to be hardly perceptible.

Mr. Strong's criticisms are welcome, and I hope he will continue his scrutiny of what appear to be doubtful cases. It is only by such means that we shall finally attain a perfect list of the fauna.

PUBLICATIONS RECEIVED.

The Gray Garden Slug with Notes on Allied Forms. By A. L. Lovett and A. B. Black. Bulletin 170, Oregon Agricultural College Experiment Station, pp. 1–43, pls. I–IV, text figures 1–14, June, 1920.

Under the above title two entomologists have given one of the most instructive accounts of the "garden slug, *Agriolimax agrestis*, the greenhouse slug, *Milax gagates*, and the reticulated slug, *Prophysaon andersoni*," which has probably appeared. The paper deals particularly with the depredations of these mollusks, methods of control, life history, etc. The technical descriptions of anatomy are quoted from such well recognized authorities as Taylor (Monog. Land and Fr. Water Moll. of the Brit. Isles, Vol. II, 1907) and Pilsbry and Vanatta (Proc. Acad. Nat. Sci., Phila., 1896 and 1898). Many original observations on the food and breeding habits are given. It was found after much experimentation that Bordeaux mixture made an excellent repellent to prevent slugs from entering restricted areas and a poisoned bait of calcium arsenate on lettuce was the best eradicator. The three species are shown lifelike in six beautiful colored illustrations on Plate I.

From the standpoint of the conchologist there is little to criticise. The spelling of the specific name *andersoni* with a single "*i*" might be mentioned since Cooper used two in his original description. Also citations of reference are sometimes too brief for ready location. A partial bibliography is given on page 43.

I think our chief regret should be that workers from another field should have had to be called upon to contribute this valuable investigation. Most of the original information should have been known long ago but it was not. This paper illustrates forcibly the great field of research on the life histories of the mollusks whether they be land, freshwater or marine. It is a subject which is practically untouched. Unfortunately there have been no Fabres in conchology.—G. Dallas Hanna, California Academy of Science.

PROCEEDINGS OF THE MALACOLOGICAL SOCIETY OF LONDON, Oct., 1921, Vol. 14, parts 5 and 6.

Notes on the Distribution of British Land and Freshwater Mollusca from the point of view of Habitat and Climate. By Dr. A. E. Boycott, pp. 163–167, pls. 5 and 6.

Oecological Notes. By Dr. A. E. Boycott, pp. 167–172.

Description of a New Phasianella (*P. tomlini*) from Western Australia. By J. H. Gatliff and C. J. Gabriel, p. 173, figs. 1–3.

On Helicella, Ferussac. By G. K. Gude and B. B. Woodward, pp. 174–190.

The Anatomy and Relationships of Helix subplicata Sowerby. By Prof. T. D. A. Cockerell, pp. 191–195.

Helix pisana in Porto Santo. By Prof. T. D. A. Cockerell. pp. 196, 197.

Molluscan Nomenclatural Problems and Solutions, No. II. By Tom Iredale, pp. 198–208.

Notes on some Species of Pisidium. By B. B. Woodward, pp. 209–220.

Notes on pearl formation and Japanese culture pearls. By T. H. Haynes, pp. 221–226, pls. 7 and 8.

The Mollusca as material for genetic research. By Guy C. Robson, pp. 227–231.

THE PLIOCENE MOLLUSCA OF GREAT BRITAIN. By F. W. Harmer (Palaeontological Society, Vol. II, pts. 1 and 2, pp. 485–705, pls. 45–56, 1920–21), These parts are a continuation of the author's valuable work covering this field. The introduction contains a summary of his views as to the relation of the various horizons of the English Crag, to each other and to those of Belgium and Holland. The nomenclature used is largely that of Fischer's Manual, but in the very full synonymy most of the genera now being used are referred to. Under *Littorina littorea* L. 15 vars. are recognized, six being new, and under *L. rudis* 12 vars. one new. The author considers *L. palliata* Say a distinct circumpolar species and not a var. of *L. obtusata*. The figures are excellent.—C. W. J.

Some Marine Molluscan Shells of Beaufort and Vicinity. By Arthur P. Jacot (Jour. of the Elisha Mitchell Soc., Feb., 1921, pp. 129–145, pls. 11–13). This has been a favorite collecting place since the days of Dr. Stimpson, who published a paper "Mollusca of Beaufort, N. C.," in 1860. Being the meeting ground of a northern and southern fauna, it is an interesting locality to study distribution. The fauna is also divided by two marked local conditions—those frequenting the ocean or outer beach and those of the sounds or quiet waters. The *Pteria eximia* Reeve, referred to, may represent only the young or a variation of *P. colymbus*. *Panopea floridana* Heilp. = *P. bitruncata* Conr., the type locality of the latter was Fort Macon, N. C. The species figured as *Alectrion ambigua* Montg is *A. acuta* Say. One new species *Odostomia* (*Menestho*) *beauforti* is described.—C. W. J.

NOTES.

In the Proceedings of the Malacological Society of London, volume 14, page 202, 1921, just at hand, I find a statement by Iredale in which he says that the name *Syncera* Gray, 1821, is a *nomen nudum*, and therefore unavailable in the "connexion" used in my paper "The West American Mollusks of the families Rissoellidae and Synceratidae and the Rissoid genus Barleeia."

If this be true, then my understanding of a *nomen nudum* must be at fault. In order that there may be no misunderstanding in the matter I quote from Gray's paper "A Natural Arrangement of Mollusca, according to their Internal Structure," by Mr. John Edward Gray, in "The London Medical Repository, Monthly Journal and Review," volume XV, page 238, 1821.

"Nerita Syncera Hepatica, N. S.—The animal of this shell differs from all the others of this order, by the eyes appearing to be at the ends of the tentacula; but, I believe, that they are placed on a peduncle, as long as the tentacula, and the peduncle and tentacula are soldered together."

I am at a loss to account for the mental process which has led Mr. Iredale to his deductions.—PAUL BARTSCH.

ERRATA.—In the article: On the status of Chioræra, by H. P. Kjerschow-Agersborg, on p. 55, second reference, for "Dendrototidernes" read *Dendronotidernes,* and for "Pække" read *Række.*

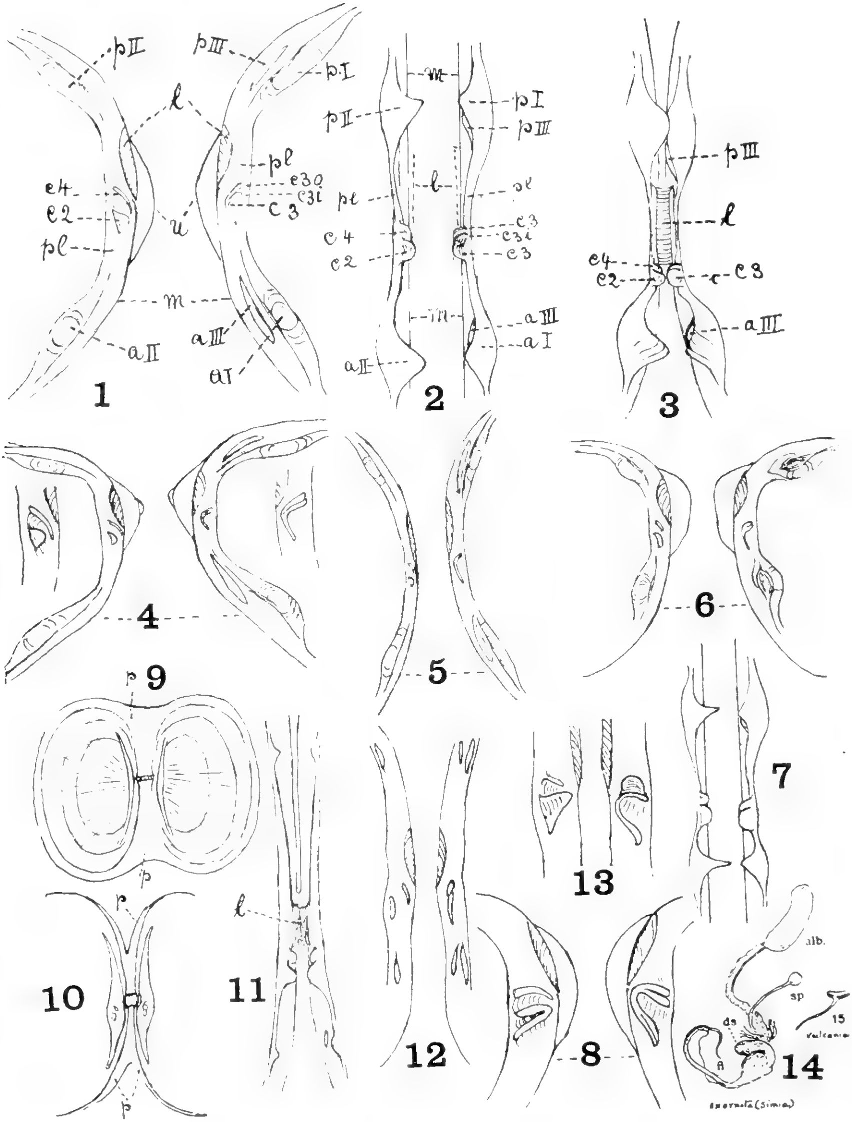
The second correction should also be made in the reference to Bergh, 1902, p. 56.

CONCERNING HELIX CALCAREA PFR.—In his interesting notes on Madeiran Land Shells in the October NAUTILUS, Dr. Cockerell states that *Helix calcarea* "has been ignored since its publication by Pfeiffer in 1848". He is mistaken; for Lowe, as long ago as 1854, reached Cockerell's conclusion regarding the shell in his admirable List of the Land Shells of Madeira in Proc. Zool. Soc., London, p. 171, where he says of it, under *H. pisana* Müll.: "Var. *albida decolorata* (nec subfossilis) est *H. calcarea* Pf. in Proceed. Zool. Soc., 1848, p. 110: Kust. M. et C. p. 275, no. 757, t. 123, f. 3, 4. (Ex autopsia exempl. in Mus. Cuming!)"

On the same page Lowe names the type locality of his *H. ustulata* "In insulis 'Salvages'."—WILLIAM G. MAZYCK.

The life story of Sir Marcus Samuel, who has purchased from the Earl of Berkeley for the sum of $25,000,000 a parcel of the fashionable residential section of London, known as Berkeley Square, furnishes one of the real romances of the business world.

Sir Marcus, in his early days, kept a little shop in one of the poorer quarters of the British metropolis, where he made and sold for a shilling or two ornamental boxes made of shells from the seashore. Later he invested his savings in oil, made money and started a company called the "Shell," thus identifying his big new venture with his original struggling business. Since those days he has accumulated a fortune of many millions and has been honored with a baronetcy. And all from selling shells from the seashore—mixed with an abundance of brains and energy.—*Washington Evening Post.*



1-13. STERKI: HINGE OF SPHÆRIIDÆ.
14, 15. COCKERELL: ANATOMY OF LEPTAXIS.

THE NAUTILUS.

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THE HELICOID GENUS LEPTAXIS LOWE

BY T. D. A. COCKERELL

Professor Pilsbry, in his guide to the Helices, treated *Leptaxis* as a valid genus, including the groups *Leptaxis* proper, *Pseudocampylæa* Pfeiffer, and *Lampadia* Albers. *Cryptaxis* Lowe and *Katostoma* Lowe were merged in true *Leptaxis*. Unfortunately the anatomy of only one species, *undata*, was known. I am greatly indebted to Mr. C. B. Cossart for living specimens of *L. erubescens* Lowe and *L. vulcania* Lowe, which he collected last month on Deserta Grande. The genitalia of *erubescens* prove to be of the same general type as those of *L. undata*, but with some striking differences, the most noticeable character being the regularly globose spermathecal bulb, in contrast with the boot-shaped structure of *L. undata*. That this feature of the spermatheca is not purely a specific one is shown by *L. vulcania* (pl. 3, fig. 14), which has the boot-shaped form of *undata*. Other features of *erubescens* (pl. 3, fig. 13) are: albumen-gland very large; penis-sac elongate, abruptly contracted at the beginning of the flagellum, which is about 5 mm. long; spermatheca with duct 8 mm. long; dark-sac as usual in the genus; filiform glands about 11, simple, three attached longitudinally. In *L. vulcania* the flagellum is much longer, about 12 mm., but the snail is much larger. I examined the radulæ of *erubescens* and *undata* in the Gwatkin collection. They differ appreciably, *erubescens* having well-developed outer cusps on first laterals, and marginals with outer cusp bifid or trifid.

We must, I think, conclude that Pilsbry's *Leptaxis* s. str. is divisible into two subgenera, if not genera. Typical *Leptaxis* includes *erubescens, furva, chrysomela, fluctuosa,* and I believe *membranacea,* which is not to be associated with *Lampadia webbiana* (Lowe). The other subgenus, *Cryptaxis* Lowe, will include *undata, vulcania, leonina, nivosa, psammophora, wollastoni* and *forensis*. *Pseudocampylæa* includes *lowei* and *portosanctana*.

The species of these groups require some revision, toward which I offer a few notes, partly dealing with nomenclature.

Pseudocampylæa lowei Fér. First described and figured by Lowe as *Helix portosanctana* var. *gigantea,* but Lowe's name is preoccupied in *Helix,* and cannot be taken up.

P. lowei var. *minor* (Paiva). This variety, with whorls flattened above, and spire depressed, is very distinct. Mr. A. C. de Naronha gave me a specimen, and showed me others. It occurs fossil at the Zimbral d'Areia, Porto Santo, and is absent from other localities where *lowei* abounds. Paiva's varieties must apparently be recognized as named according to the rules, although the word in italics is always the first word of the diagnosis, and the proposal of definite names seems more an accident of printing than a deliberate purpose.

Leptaxis (*Cryptaxis*) *groviana* (Fér.). This must be the name for the common Madeiran *undata* Lowe, the latter name being preoccupied (*Helix undata* Gmelin). The name *corrugata* Solander cannot be taken up, as *H. corrugata* Gmelin was earlier published.

Leptaxis fluctuosa (Lowe). I can only conclude that this is a distinct species, in spite of the existence of forms more or less intermediate between it and *L. chrysomela* Pfr. On Jan. 23 I was very fortunate in finding some splendid specimens of *L. fluctuosa,* of unusually recent appearance, in the gulch east of the Pico d'Anna Ferreira, Porto Santo. The largest has max. diam. 20 mm. One specimen, with max. diam. 18.5 mm., is beautifully ornamented with interrupted clear ferruginous bands, one a short distance below the suture, the other just above the keel. These bands are interrupted by irregular white opaque flecks at frequent intervals. The shell is much thinner and more sharply keeled than *L. chrysomela*. The species is considered to be extinct, but the finding of such fresh specimens suggests that it may yet be found alive.

L. chrysomela var. *bifasciata* n. var. Max. diam. 11 mm., with the usual solid form and orange mouth. Two very broad (diam. about 1.5 mm.) grey bands, flecked with white, one above, the other below the periphery. The bands have a faint reddish tint, and were doubtless dark or red in life. Fossil in Porto Santo. The typical form is chalky white, unbanded.

Leptaxis exornata (Deshayes). This seems to be the proper name for *L. erubescens,* Lowe's name being invalidated by *H. erubescens* Solander, Portland Cat., 1786, as Mr. Tomlin kindly pointed out to me. The description of *exornata* agrees exactly, except that the pale band between the dark ones is not really white, with a small elevated form of *erubescens* found in Madeira. My specimens are from the Pico do Infante, collected by the Rev. Drummond Paterson. *H. simia* Férussac is also apparently *erubescens,* but if so, the figure is extremely bad, and Pfeiffer in Conchylien Cabinet remarks that he might have thought it a variety of *H. splendida* had not Beck declared it to be from Madeira. Pfeiffer had not seen the shell, but described it from Férussac's figures. The shell is rather unusually depressed for *erubescens.*

Leptaxis furva var. *grandissima* n. var. Shell very large, almost 26 mm. max. diameter; last whorl swollen and aperture large; one band in the usual position, but the shell is white and the band is colored as in the specimen of *fluctuosa* described above. In the R. McAndrews collection at the University of Cambridge. The label gives only Madeira as the locality, but the specimen is probably a fossil from Caniçal.

Leptaxis forensis (Wollaston). This is certainly very close to *L. wollastoni* Lowe, and if considered only a variety, it must take the name *L. wollastoni* var. *minor* (Paiva), which has priority.

SOME NOTES ON THE HINGE OF THE SPHAERIIDAE

BY V. STERKI

The configuration of the hinge of the Sphæriidæ has attracted the attention of malacologists for a long time, and there has been a good deal of discussion about some of the features. It appears that a few points are still open to controversy, and some may have been overlooked. The notes following contain part of the results of examining many thousands of specimens during the last thirty years. Special attention has been paid to the primitive formation of the hinges in the early nepionic stages of these mussels, with the subsequent changes to maturity, and to the particularly interesting subject of variation, with respect to the classification and the standing of species. This last topic, however, can be only summarily sketched here, and will have to be considered in a special article.

General Configuration. — In all of the Sphæriidæ now known, principally the genera *Pisidium, Sphærium, Musculium* and *Eupera,* the hinge is uniform so far as essential features are concerned. It is much of the same configuration as that of the *Cyrenidæ,* yet with some significant differences, especially in the cardinals, and there are probably some differences in the soft parts. On the other hand, this hinge is markedly different from that of the Naiades, not only by the presence of all "teeth" in all species, but also by the fact that there is no such embryonic larval stage as the glochidium and lasidium.

Of teeth, there are the CARDINALS at the center, in front of the ligament, one in the right valve and two in the left, and the LAMINÆ, two anterior and two posterior in the right and one of each in the left valve. The term "lateral teeth," for the same, is not only cumbersome but inadequate, inaugurated at a time when the parts of the mussel, i. e. the animal, were misunderstood. The term "laminæ" appears to be prefer-able, and it has been used long ago by some writers, e. g. for the "lateral teeth" of the Naiades.

It may appear somewhat surprising that the hinge of *Pisidium,* as a whole, is generally better formed, and much more diversified, than those of the other genera. Even in mussels two millimeters long or less when full grown, the hinges are perfect. But there are considerable, or extreme, differences as to the general shape, and the configuration of the several parts, as exemplified in pl. 3, figs. 4-6.

In order to simplify description, symbols—that is, letters and numbers — have been used by F. Bernard and others, especially for the cardinals and lamellæ; see pl. 3, figs. 1 to 3 and explanation.

THE RIGHT CARDINAL. It has been stated by earlier writers, e. g. Baudon, Prime, Clessin, Westerlund, that in the right valve of *Pisidium amnicum* Müller and *dubium* Say [1] there are two cardinals, and a group, or subgenus, has been established principally on the strength of that feature. But it was a misconception, due to careless examination; in adolescent and mature mussels, C3 is more or less deeply emarginate in the middle, and the anterior and posterior parts were taken for two teeth. (See Sterki, l. c.) It should be noted that in some other species of *Pisidium* the crest of C3 is more or less emarginate, and also generally and markedly so in *Musculium.*

This mistaken view has been applied indiscriminately to all species of *Pisidium* by some authors, e. g. T. Prime, and even to all *Sphæriidæ* (Prime, '65, pp. 2, 33, 36 etc.), and it was copied, evidently without examining a specimen, by some American writers, e. g. R. E. Call (1900, p. 438 etc.).

While in the sense pointed out the right cardinal is single, its posterior part is more or less distinctly complex in most species, and also in *Sphærium* and *Musculium.* In many descriptions it has been stated that in *Pisidium* the posterior

[1] Generally known as *virginicum* (Gmelin) Jenyns; but its identity has been doubtful. Recently, upon careful investigation, Dr. Pilsbry has restored T. Say's name *dubium* (*Cyclas dubia*).

part is thicker, and grooved, "sulcate", to bifid or bifurcate. In fact, it is complex from its early nepionic formation, even when quite small (see pl. 3, figs. 11, 12).

Aside from that feature, which will have to be considered later, C3 shows considerable differences as to shape. In some species with thin shells and slight hinges, apparently more primitive, it is straight or nearly so, longitudinal, with its posterior end not or little thickened, barely or not complex. But in most, the anterior and posterior parts, especially the latter, are more or less curved downward, and generally the posterior is more or less complex, as in pl. 3, figs. 1, 4, 6, 8). The extreme of this formation is reached in P. *amnicum* and *dubium,* when C3 is horseshoe or ʌ-shaped. These species have another feature which may be worth mentioning: the two shanks or rami of C3 show a slight but distinct forward direction in their lower parts. That is evidently caused by the growth and shape of the mussel: its anterior part becomes much larger than the posterior and directed downward, the dorso-ventral axis forms a curve, and in concordance with that, the cardinals, C3 and C2, also grow obliquely.

THE LEFT CARDINALS. The anterior, C2, fitting in below C3 in the closed mussel, is generally of similar shape, except that it is simple. Its base is straight, or more or less curved, and then its lower face is more or less concave. The crest is rounded or more often pointed, and from being bent more or less upward, appears to be massive in lateral view. Its position shows marked and significant differences: in some species it is on the edge of the hinge plate and often even more or less projecting downward over it, while in others it is rather high up on the plate, which then is usually broader.

The left anterior, C4, near the anterior end of the ligament in its upper part, and adjacent to the posterior part of C3, is usually more or less oblique and curved, its edge straight (truncate) to somewhat rounded. In species with C3 and C2 straight and longitudinal, C4 is usually conform and parallel with them. Generally its anterior (upper) part passes forward above part of C2, and sometimes its whole length. And very often it becomes connate with the end of the anterior valve margin (the "nymph") and may even appear to be a downward continuation of it.[2]

Baudon, 1857, p. 42, etc., states that *P. amnicum* has two cardinals in the right valve "réunies par leur sommet," and says the same of the two in the left, which are in fact separate from the nepionic stage. More surprising is the statement that *casertanum* has three cardinals in each valve, due to a misconception from insufficient examination and preconceived ideas. The author evidently has never examined young specimens and observed the devlopment from the primitive formation to the adult.

Clessin, 1879, pp. 8, 9, and Westerlund, pp. 18, 19 divide the Pisidia in three groups: *Fluminina* (*P. amnicum*) with two cardinals in each valve, standing "side by side"; *Rivulina* (type *P. supinum*) has one cardinal in the right and two in the left valve, also "side by side"; in *Fossarina* there is one in the right valve and two in the left, "one behind the other," which really means: one above, resp. below, the other; just as in place of "side by side", above, it should be: one behind, or in front of the other, if the parts of the animal are considered (anterior and posterior, dorsal and ventral). This by the way. But between the two last groups there are intermediate forms, and it appears that they are not clearly separable.

In *Musculium,* the right cardinal is markedly different from that of *Pisidium* and, it might be said, of a quite peculiar formation (see pl. 3, fig. 13). Its anterior part may be strictly longitudinal, straight, and rather long, but more often it is oblique, more or less curved with the convexity below; at the center it is strongly and sharply curved down with C3i directed at right angles towards the plate edge, or more often even forward, forming a hook, C3o is large and winglike, somewhat different with the several species, and rather

[2] The fact has often been overlooked that the dorsal shell margin of each valve is not continuous but interrupted by the ligament. The proximal, or central, end of the anterior part is slightly bent inward under the anterior "end"—the initial part—of the ligament.

variable as to size and shape. In the middle, above, there is usually a rather deep emargination in the crest.

The anterior left, C2, is nearly straight to slightly curved at its base, triangular, directed obliquely backward, and bent upward, with the apex pointed, or nearly so, and opposite the emarginate middle of C3. From its aspect in lateral view it appears to be massive, and must be examined from other angles also in order to see its real shape. C4 is more or less oblique, little projecting, generally rather short, and occasionally vestigial. It is evidently of less consequence in the mechanism of the hinge than its equivalent in *Pisidium*.

It may be added that this combination of "teeth" with their interlocking is quite an interesting object of study. The primitive shape in the young nepionic mussel, especially of C3, should be compared and then the gradual changes followed up to the final configuration in the adult.

In *Sphærium* the shape of the cardinals is somewhat the same, but they are comparatively smaller and plainer; C4 is quite small, short and often rudimentary or wanting. With *Eupera*, the hinge is generally slight, and the cardinals are small and plain, and C4 is more often rudimentary or wanting than developed.

The Laminæ. It is well to distinguish between a lamina *in toto* and its cusp, or apex as it is also termed, that is a more or less projecting part of its crest, usually pointed. Many laminæ have no cusps or only rudimentary. Quite generally the laminar cusps of the left valve, aII and pII, fitting into the grooves, or fossæ, between aI and aIII anteriorly, resp. pI and pIII posteriorly, are projecting over the median plane, or the level of the valve-edges, while the right ones are not so, or only exceptionally and slightly, and except in reversed hinges (q. v.).

In *Sphærium*, *Musculium* and *Eupera*, the posterior laminæ are longer than the anterior, but the latter, aI and aII, are generally stouter and have well-formed, pointed cusps, and so has aIII, though it is usually quite small. Sphæria generally have a distal, rounded cusp on pII, and a slighter one on pI, and Musculia have the same, still less marked, and in nearly all species the laminæ are very slight.

In *Pisidium,* having the anterior part of the mussel larger, with a few exceptions, the anterior laminæ, aI and aII, are generally somewhat longer and stouter than pI and pII. The whole hinge and the laminæ, with their cusps, show great differences of configuration, that it is out of place here even to sketch the principal forms; pl. 3, figs. 4-6 show a few of them, and some notes will be found later on. The outer laminæ of the right valve, aIII and pIII, are generally much smaller than aI and pI, in some species constant, in others occasionally only vestigial or wanting.

Some laminæ, especially the stouter ones, and again especially those of the right valve, on the surfaces surrounding the grooves between them, are microscopically rugulose. It may be noted in this connection that the feature is especially developed, locally, with species of *Sphærium,* e. g. *solidulum, sulcatum, rivicola,* etc. In these, on the upper face of aI, there is a circumscribed, rather small area, somewhat concave, and often walled in by a more or less raised rim, not only rugulose but densely beset with separate, round, wart- or tubercle-like prominences; the opposite, lower face of aIII shows the same, though less marked: the place where the tip of the cusp of aII enters; yet the latter is smooth or shows only very slight rugosity.

Reversed Hinges. — In some specimens the hinges are reversed, that is: the teeth of the left valve have the formation of the right ones, and *vice versa,* as the normal ones would be seen in a mirror reflection. The hinge is either (1) totally reversed, each valve showing all the features of the opposite one, or (2) only the anterior part is reversed, namely the cardinals and the anterior laminæ, or (3) only the posterior laminæ. No specimen has been seen in which only the anterior laminæ were reversed, or only the cardinals, or the posterior laminæ plus the cardinals. This is certainly of interest morphologically. Such hinges are quite frequent with the species of *Sphærium,* e. g. *striatinum, solidulum,* etc.; twenty-five or even more per cent of the specimens in a lot have often been seen. With *Pisidium* they are less frequent, though noticed in many species, and with *Musculium* they are apparently scarce. (See B. Walker, 1896, 1899.)

Reversed hinges, whether totally or partially so, are not the result of abnormal growth, tantamount to monstrosity; for, aside from the reversal, they are perfectly formed. And they are formed that way from the earliest stages of the nepionic shell. On the other hand, they are not hereditary, or at any rate not regularly or even prevalently so: nepionic mussels with reversed hinges have been taken from normally hinged parents, and *vice versa;* also, young with normal and others with reversed hinges may be found in one parent.

What is the explanation? Has this tendency been the same with their early ancestors and transmitted, or has it developed later? Examination of good numbers of tertiary, cretaceous and earlier fossils might show — and such are needed even more for the study of phylogeny. The question is of interest also in view of the fact that with the Naiades reversed hinges are at least very rare. It might be worth while to examine large numbers of the related *Cyrenidæ.*

Early Nepionic Formation.

Félix Bernard ('95-'97) has made careful studies on the hinges of the Pelecypoda. In looking over his publications, somewhat hurriedly, I failed to find the exact statements on the points to be considered here, and cite the following from Pelseneer and B. B. Woodward.

"The permanent hinge teeth are only formed at a later period, by the growth of distinct laminæ on the surface of the hinge. Thus, in the typical Eulamellibranchia, the first lamellæ originate at the extremities of the hinge surface, below the provinculum [= a series of little transverse denticulations], and grow towards the center of the hinge area; the internal ends of the anterior lamellæ become hook-shaped, and their hooks become separated from their external ends; the latter form the outer lateral teeth" (Pelseneer l. c., p. 213).

"In the group to which *Pisidium* belongs, in the right valve

C3 is at first continuous with aIII, and in the left valve C2 with aII, C4 with a subsequently suppressed aIV" (B. B. Woodward, 1913, p. 3).

The mode of formation as set forth has not been seen in any of the hundreds of young nepionic mussels carefully examined, of many species of *Pisidium, Sphærium* and *Musculium*. This does, of course, not mean to deny its existence in other forms of Eulamellibranchia. Those under consideration may be somewhat aberrant.

In the very young shelly nepionic valves, deposited on the primitive continuous shell membrane to be the periostracum, the initial hinge-plates are formed centrally, one in each valve, callus-like, and growing out towards either end (pl. 3, fig. 9). At a somewhat later stage (fig. 10) the cardinals are forming, as small nodules, and the laminæ aI and aII, pI pI and pII are beginning to form. Of aIII and pIII, there are not even "vestiges"; they appear later, at least in some instances, apparently branching out from aI and pI, when C3 has grown somewhat, is generally larger than aIII, and well confined. From this it is evident that the right cardinal cannot be the "internal" or proximal end of aIII; so far as seen, the two are never connected.

In the left valve, as stated, C2 is present, and well confined before there is really an anterior lamina, and so it also cannot be the internal, and last formed, end of aII. In some Pisidia, however, e. g. *pauperculum,* with a peculiar thickening of the hinge-plate in the adolescent and adult, aII becomes subsequently connected with C2; but in other specimens of the same, the proximal end of C2 curves upward and stands above C2, without connecting. In *Musculium,* C2 is often prolonged anteriorly, at it base, and is parallel to the proximal part of aII. Of an early formed—and subsequently suppressed—aIV, not a vestige has been seen, and C4 has been growing out on the plate at the same time with C2 and C3.

It should also be noted that nothing of a provinculum has been seen in any specimen, and that stage of development appears to have been skipped in the *Sphæriidæ*.

Changes with Growth.

While the morphology of the adult shells has been studied, and also the formation of the young, the intermediate stages and changes have been somewhat neglected. Yet they are essential for a real understanding of at least some of the features of the full-grown. The growth of each valve at the periphery is accompanied by a gradual turning outward around the axis in the ligament, to an angle of about 80 to 120 degrees in the mature mussel, or twice as much for the two. With this turning the "teeth" have to keep step, growing, in order to maintain their contact and interlocking. Each cardinal thus forms a widening spiral, though somewhat modified by growth not only towards the opposite valve and cardinal but also upward. But at the same time its base is lengthening, and in most of the species the anterior and posterior ends grow more or less downward over the thickening or widening hinge-plate, and it thus becomes curved or angular. It has been noted before that in some species C3 and C2 remain straight or nearly so, and these grow out mostly at their anterior ends. With C4, growth is somewhat different, except for the last-mentioned forms: it is mostly the posterior or lower part which grows, and obliquely downward. Of the posterior part of C3, the two components may remain closely connate, as in *P. compressum, variabile, cruciatum* etc., or they grow more and more apart.

There is another element which affects the configuration of the cardinals. With growth and the turning of the valves, the hinge-plate grows, as in length, so in thickness. But the increase in thickness is slight in some species and forms, and in these the cardinals generally stand out free, e. g. *splendidulum, tenuissimum* etc. In others the hinge-plate becomes much thicker, broader in lateral aspect, and it grows around the cardinals so that they are projecting only slightly, or partially not at all; these again are: *P. compressum, supinum, kirklandi, fallax* etc., and *æquilaterale, variabile, pauperculum* etc., in which C3i and C3o are connate in a compact mass, as there is no space to expand in. There is a well-confined, deep fossa or excavation below C3, between it and the plate edge, which just at that place is sometimes even raised over the general level, tooth-like, and it may be mentioned that such a form of *variabile* has been described as *mirabile* by Clessin. That fossa is left unfilled for the accommodation of C2, and a similar one is in the left valve, between C2 and C4, for the reception of the posterior part of C3.

A large number of species are in a broad sense intermediate between these extremes, not counting *dubium* and *amnicum*, which have been mentioned above. In many, the hinge-plate is moderately broad with the edge in its whole length somewhat projecting, the cardinals are moderately curved, in many partially "buried", with a more or less marked groove below, and with C3i and C3o generally distinct and more or less divergent. Some of these species are: *P. noveboracense, abditum, politum* etc.

With the growth in length of the valves, the LAMINÆ grow distad, but they not only lengthen but move, change their positions, somewhat as the adductor muscles and their insertions do; that is, the laminæ of the young mussel have disappeared in the adolescent and adult, inclosed first in the growing hinge-plate and later in the proximal part of the thicker laminæ. With them proceed also the cusps, the fossæ of the right valve and the rugose areas described above. As growth in many mussels is not continuous but interrupted by rest periods, marked by lines on the outer surface, so it is to some extent with the laminæ, and they often can be distinctly seen in aI and aII of the larger Sphæria.

At the same time the laminæ grow medianward, as the cardinals do, and show a more or less distinct curving upward. Also they gain in thickness, though moderately so in *Sphærium* and little in most species of *Musculium*. With both of these, the hinges do not change very much in shape during growth, after the nepionic stages, and also the essential features of the mature mussels are rather the same in the several species of each genus. (The shape of the laminæ of a Sphærium is shown in fig. 3, with the "history" of its growth).

The same cannot be said of Pisidium. In quite young nepionic mussels the laminæ are about of the same shape in the several species, but differences become manifest early, and in the adolescent and mature are extreme. In some species the laminæ are at slight angles to the hinge-plate, in others at strongly marked angles (conf. figs. 5, 4) ; in some they are very slight, in others very massive; the cusps may be little marked or strongly so, may be at the distal ends of the laminæ or near the center. In some they are very short at the bases, very abrupt, spine-like, fig. 71, and there are forms where a small cusp is about all that can be seen of a lamina.

The Hinge in Classification.

Up to date, some authorities have insisted on treating *Musculium* as a subgenus of *Sphærium*. There is hardly a specimen which cannot be recognized as being of one genus or the other, by its hinge; but there are other features also proving that *Musculium* is decidedly distinct.

As to specific distinction in *Sphærium*, we may simply repeat what has been said above. True, there are very conspicuous differences in regard to size, curvature and heaviness of the hinges, as exemplified by *sulcatum* and *stamineum* or *solidulum*. But they are more of quantity than quality, so to say, and moreover, extreme forms of one species are often more different from each other in this respect than some manifestly distinct species are from others. Other features of the mussels must be considered also, such as size, shape, prominence of the beaks, surface sculpture etc. Though outside of the subject under consideration, it may be added that many species show considerable variation in these respects also, and exact identification is in many instances rather difficult. The same is generally true with *Musculium*.

In *Pisidium* the hinge formation is much more diversified than in the other genera, as has been pointed out, and is a principal factor in distinguishing species. It has been proposed to consider the hinges alone, excluding all other features of the mussel as too variable, and consequently worthless. But it must be stated that, in the first place, two or several manifestly distinct species may show the same essential hinge characters, as e. g. *P. compressum, supinum,*[3] *fraudulentum,* forms of *variabile, æquilaterale,* and one or two others, so that they could not be recognized with certainty by the hinges alone; in *amnicum* and *dubium* the hinges are practically alike; and the same must be said of species of some other groups. Consequently it is necessary to consider other features also, and upon careful and judicious examination it will be found that they are not worthless.

In some species the hinges are quite peculiar, with features seen in no others, just as there are some characteristic and recognizable irrespective of their hinges.

On the other hand, in examining numerous specimens it will be found that the hinge also shows more or less of variation in most of the species. A description carried to minute details, as thus postulated, is liable to disrupt an actual species the hinge of which is variable. And to state again: if the hinge alone is considered in establishing and recognizing species, regardless of other features, manifestly distinct species will be "lumped" into one.

Even Baudon, '57, p. 17, came to the conclusion that differences of the hinge and its teeth are applicable for the distinction of groups, but not of species and varieties. "It is consequently necessary to rely on other features also in order to separate each type."

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[3] *supinum* comes very close to *compressum.*

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EXPLANATION OF FIGURES, PLATE III.

Hinges of Sphæriidæ; in all figures, the right valve is on the right, and the left on the left hand, the posterior is above, the anterior below.

Fig. 1: lateral view of the hinge of Pisidium, diagrammatic; l, ligament; m, dorsal valve margin; p. (in figs. 9 and 10, periostracum = shell membrane; pl, hinge plate; u, umbones (beaks); cardinals: C3 of the right valve; C3i, posterior part of the same, proper, or inner; C3o, additional or outer component; of the left valve: C2 anterior, C4 posterior; laminæ: aI anterior inner or principal, aIII anterior outer of the right valve; aII anterior left; pI and pIII posterior inner and outer of the right valve, pII posterior left.

Fig. 2: the same, viewed from below; notice that the cusps of the left laminæ are projecting over the level of the valve-edges, and thus over the median or sagittal plane, and the same in figs. 3 and 7; symbols the same as in fig. 1.

Fig. 3: *Sphærium solidulum* Prime, viewed from below in partly open (gaping) mussel.

Figs. 4, 5, 6 to show differences in the configuration in some species of *Pisidium;* 4, *P. compressum* Prime, form, half-diagrammatic; mussel about 4.5 mm. long; the separate figures show cardinals somewhat in detail.

Fig. 5, *P. fabale* Sterki (from Montana), about 7 mm. long (the plate of the right valve is somewhat too broad).

Fig. 6, *P. vesiculare* Sterki, mussel about 2 mm. long; the hinge, in profile, is somewhat like that in fig. 7, but of the laminæ little is to be seen but the small, pointed cusps not much larger than the cardinals.

Fig. 7. *P. ovum* Sterki (Montana, Alaska), hinge viewed from below.

Fig. 8. Cardinals of *P. dubium* Say.

Fig. 9. Very young nepionic mussel of *Sphærium stami neum* Conrad, 0.6 mm. long, showing the valves deposited on the continuous shell membrane, the very short ligament, and the primitive hinge plates; very fine and slight radial lines are seen on the beaks of most Sphæriidæ.

Fig. 10. Nepionic of the same, somewhat more advanced, 1.3 mm. long; the cardinals are just beginning to form on the plate.

Fig. 11. Young nepionic hinge of *Sphærium occidentale* Prime, viewed from below in the open mussel; the cusps of the laminæ are just beginning to form and are smaller than the cardinals; aIII is very small and remote from C3, which is plainly complex; pIII is not yet formed.

Fig. 12. *Musculium transversum* Say, nepionic, at an early stage; the plates are somewhat too broad.

Fig. 13. *Musculium* sp., cardinals.

OBSERVATIONS ON THE NOMENCLATURE OF SLUGS. II

BY H. A. PILSBRY

The notes on this subject in the January NAUTILUS, p. 77, provoked several letters on the subject, bringing out facts which materially alter the tentative conclusions of that paper. Mr. Tom Iredale, who has run to earth so many stray names, writes as follows:

"Upon investigation I find that when Férussac introduced *Arion* (Hist. Nat. Moll., Vol. II, pt. I, 1819, p. 50), dealing with the anatomy on p. 67 he wrote: 'L'on peut consulter d'ailleurs, pour se convaincre de leur analogie, les descriptions que Swammerdam a donnée de l'anatomie du *cochlea nuda domestica*, et du *cochlea agrestis sive viarum*, types de ces deux genres.'

"As Férussac had previously cited Swammerdam's two species correctly in his synonymy [of *Arion empiricorum* (= *A. ater*) and *Limax maximus*, respectively], I conclude that, in the strictest sense, this can be regarded as type designation, and consequently the type of *Arion* was fixed by original designation, and the type of *Limax* was first selected by Férussac at the place cited. As this agrees absolutely with conventional usage, it is a delightful result.''

This passage in Férussac's long account, which I had overlooked or not recognized as significant, therefore leaves *A. ater* the type of *Arion*, and *A. maximus* the type of *Limax*.

Mr. B. B. Woodward has called my attention to the fact, hitherto overlooked, that Turton, in his Manual of Land and Fresh-water Shells of the British Is., 1831, p. 4, said under *Limacellus* (evidently an emendation of *Limacella* Brard)—''Type *Limacella parma* Brard''. This = *L. maximus* L., thus making *Limacella* an exact synonym of *Limax*, and finally eliminating it from zoological nomenclature. *Eulimax* Moq., with the same type, is also finally disposed of.

RAMBLES OF A MIDSHIPMAN. I

BY P. S. REMINGTON, JR.

In 1918 I had the good fortune to receive a senatorial appointment to the U. S. Naval Academy at Annapolis, and entered it with visions of opportunities to collect in foreign stations on my cruises. I went on my first cruise the following summer, in June 1919, and began to realize these visions.

Our first port of call was St. Thomas, Virgin Islands, and we were one and all glad to see the rocky shores of these islands rising sheer out of the water, after a week at sea. It was my first experience with the West Indies and I was seeing everything through a many-colored glass. To heighten the tropical aspect, we had no sooner dropped anchor off the harbor entrance than our ships were surrounded with bumboats loaded with fruit, corals, sea fans, huge *Strombus gigas*, and other things. The negroes dove expertly for coins, treading water and calling, "You heave, I dive, chief!"

I was all on fire to get ashore, and had the opportunity next day. We went in and tied up to the dock to coal, all hands donning khaki and going on liberty. With a friend, whom I had managed to interest in collecting (to his subsequent sorrow), I set off across the hills. The heat was intense and we were anxious to reach the shore for other reasons than conchological. On the way up a large hill I turned over some fallen boards near an old shanty, and was surprised to find hundreds of live *Bulimulus exilis,* in company with a few *Subulina octona.* I picked a boxful and we then moved on. That was all the land collecting I was able to do in St. Thomas, for reasons which will appear shortly.

We came out at last on a smooth beach and hastened to strip and get in for a swim. While my companion was sporting in the waves, I was scurrying over the rocks picking up Neritas, Thais, Littorina, Planaxis, Fissurella, large *Livona pica,* and many Chitons. Compared to the drab and meager fauna of New England which I was familiar with, this was a riot of wealth.

Alas! I reckoned not on two things. The first was the West Indian Echinus. I had the misfortune to stumble through a bed of these infernal black, long-spined fellows twice, and for a moment forgot collecting. Even the voluminous vocabulary of the Navy seemed inadequate to do justice to the occasion, but the worst was yet to come.

The second thing I disregarded was the tropical sun. Those of my readers who have been in the tropics will scarcely resist smiling when I say that after our swim we stretched out on that beach *sans* raiment for *two hours* in the full glare of the sun, broken by short dips in the delightfully warm ocean! We soon repented our folly and learned to respect the power of the sun's rays.

At length we leisurely dressed, gathered up our conchological treasures, and started back to the ship, intending to visit the town also and pay our respects to the ice-cream parlor there. This last we never did, for we had not been on the road ten minutes before the punishment we had been taking from the sun's rays began to assert itself and we began to realize that we were "sunburnt"! By the time we reached the ship we felt exactly like two live broiled lobsters. In addition, we had a dizzy feeling, which we tried to ease by lying down. But we could no more lie down than fly, for we were sunburnt on every blessed inch of our bodies! After a night of misery, we presented ourselves at sick bay next morning and asked to be relieved and turned in. The doctor certainly told us what he thought of us and ordered us to be painted with picric acid and turned in. I had just forethought enough before turning in to dump my shells in a bucket and stow it in an unused bulkhead. For three mortal days we twisted in agony, getting no rest or sleep, while the skin peeled off us in slabs. Meanwhile we had left port and put to sea. But to crown my misfortunes, while I was laid up some able seaman found my bucket of shells and dumped the smelly mess overboard! I didn't mind the sunburn and the loss of liberty (though my companion did), but I did bewail the loss of my beloved shells.

Our next port was Guantanamo, Cuba, where I found all the species I had taken at St. Thomas, as nearly as I could remember, and more too. On the coral cliffs near the marine encampment I found *Tectarius muricatus* way above high water, four species of Nerita, two Littorinas, Trochus, Livona, and many others. The rocks were just paved with thousands of *Acanthopleura granulata* and *Chiton squamosus*. These last were way out where the surf was crashing and many times I had to drop my knife and hang on like a limpet while a wave broke over me and soaked me to the skin. This time, however, I took the precaution to keep my skin well covered. On a nearby beach I found *Modulus modulus* and *Cerithium atratum* in company on the eel grass, also my old friend the Echinus. Burrowing through the mud, I found several *Strombus gigas, S. bituberculatus* and *Vasum muricatum*. On the way back I noticed a white land shell plentiful on all the bushes, which I later identified as *Cepolis ovum-*

reguli. I also found a single specimen of *Macroceramus,* which I have not yet identified.

Of course I was much handicapped by the fact that I was in uniform, and consequently rather conspicuous, also that I had no means of properly caring for the shells on board once I had collected them. For these reasons I didn't collect as intensively as I might have, and I have often kicked myself since for it. Some day I hope to return to these interesting islands.

The following is a list of the mollusks I collected in the West Indies, as far as I have been able to determine them. Mr. Charles W. Johnson and Mr. W. F. Clapp have kindly aided me in identifying the material.

St. Thomas, Virgin Islands.

Bulimulus exilis Gmel.
Subulina octona Brug.

Guantanamo Bay, Cuba.

Thais patula L.
Thais undata Lam.
Sistrum nodulosum C. B. Ad.
Cymatium aquatile Rve.
Leucozonia cingulifera Lam.
Strombus bituberculatus Lam.
Strombus gigas L.
Cerithium litteratum Born.
Cerithium atratum Born.
Littorina ziczac Gmel.
Littorina z. lineatus Lam.
Tectarius muricatus L.
Echinella nodulosa Pfr.
Modulus modulus Lam.
Planaxis nucleus Wood.
Nerita praecognita C. B. Ad.
Nerita versicolor L.
Nerita peleronta L.
Nerita tesselata Gmel.
Chlorostoma excavatum Lam.
Livona pica L.
Vasum muricatum Born.
Fissurella nodosa Born.
Fissurella barbadensis Gmel.
Acmaea candeana Orb.
Cepolis ovum-reguli Lea.
Macroceramus sp.
Chiton tuberculatus L.
Chiton squamosus L.
Acanthopleura granulata Gmel.
Codakia orbicularis L.
Lucina chrysostoma Mörch.
Arca occidentalis Phil.
Arca deshayesii Hanley.

NOTES ON ACTEOCINA

BY A. M. STRONG

Dr. Dall in the January NAUTILUS gives the reasons for some of the confusion in the published ranges for the West Coast members of the genus *Acteocina* to which I called attention in the October number. Unfortunately he does not give the corrected range for *A. culcitella*, which is much greater than that given in his "Summary". For the present, at least, it will be well to consider that the known ranges are fixed by the large amount of material that has accumulated in the United States National Museum. If this is done the ranges given in the older publications will have to be considerably emended. It would also seem that the published descriptions should be extended to cover the variations found in the different individuals of the several species.

This would give us, as I understand it, the following known ranges for the West Coast species:

A. eximia (Brd.). Confined to the Oregonian fauna as a living shell, extending from Puget Sound northward to Kodiak Island. Also found as a fossil in Southern California but not living as given by Arnold.

A. culcitella (Gld.). A variable species with a wide range, Puget Sound and northward to Kodiak Island, off the Golden Gate, and through the Santa Barbara Channel, Santa Barbara to at least as far south as San Diego. Also fossil in Southern California.

A. cerealis (Gld.). With the last and probably only a junior of it, but listed as a separate species in collections and literature, both as living and fossil.

A. inculta (Gld.). Through the Santa Barbara Channel and extending northward to Monterey and southward to San Diego.

A. carinata (Cpr.). A Gulf of California species extending as far north as San Diego, and if Zetek's list is correct, as far south as Panama.

A. smirna (Dall). With the last, San Diego to San Salvador.

A. infrequens (C. B. Ads.). A Panama species extending as far north as Cape San Lucas. Also found as fossil in Southern California.

A. planata (Cpr.). Described by Carpenter from specimens labeled from San Diego, but seemingly not known from there by present-day collectors.

There would seem to be a probability that further collecting and a careful examination, both as to identification and locality, of the material in other collections, would extend these known ranges.

SONORELLAS AND SCENERY

BY EDWIN E. HAND

> "Master of human destinies am I.
> I knock unbidden once at every gate."

As Senator Ingalls said, it was my "hour of fate". For years I have had a great desire and a standing invitation to go snailing in Arizona with the veteran collector, James H. Ferriss. Last summer, opportunity knocked, the gate opened, and my dream came true.

With Dr. W. T. Miller of Los Angeles to initiate us into the mysteries of Dame Nature's landscape and all their beauties, botanical, geological and the rest, we three left Tucson on the afternoon of June 27th, headed toward the Grand Canyon. We made no schedule. We were to stop whenever and wherever any of us wished and stay as long as we could find entertainment. A joyful trio were we. Everything was new, strange, pleasing. We shall never forget the sights, sounds, thrills of this Arizona trip. We not only found "landscapes", under his magic spell, but we found snails. And if the learned artist becomes not too deeply engrossed in his chosen work, be not surprised to meet a "*milleri*" from California in the near future.

Our first camp was in the desert solitude miles away from anywhere. We made our frugal fire, our magic meal, and then our bed in the open under the stars, amidst sand and sage, in the shade of a palo verde. Scattering desert vegetation and sand extended in every direction, and over all the blue, and the stars so bright, so near, so friendly to us. It was hot awhile, then cool, and ere dawn, with all our blankets, we were cold.

We are often asked: "But weren't you afraid of rattlesnakes?" There are ten rattlers in Arizona and Mr. Ferriss needs only three to complete his collection. Therefore, we were looking for them all the time but saw not one. A horned toad, mailed home, presented her new owner with seventeen little ones just after her arrival. That is the most exciting adventure we had 'mongst reptilia.

The giant cacti (*Carnegiea gigantea*) were abundantly decorated with what I thought were flaming scarlet flowers, but friend Ferriss soon taught us that they were ripe fruits. Long poles enabled us to get enough to thoroughly appreciate their fig-like lusciousness. The birds, bees and other creatures enjoy them too and it seemed a shame to rob them of their harvest. But the miles and miles of the "trees" in every direction seemed evidence that there was plenty for all. This first taste of the quiet of the desert was repeated many times on our trip and we city dwellers loved it so we never tired of its restfulness.

Our chariot was a Ford, and it is still beyond my comprehension how anything made of metal by mere man can stand up under the millions of maulings administered.

But on we go past Florence and Superior. Here on Picket Post Mountain we found our first shells and got a good taste of desert savagery, as we nearly perished from thirst in our too eager attempt. But it taught us to go slower next time, and after cooling off at Superior we were all right again.

Passing over the finished part of a new road, we ran upon a peculiar and decided novelty *re* the road-builders near Miami. This region used to be an Apache stronghold and as late as fifty years ago was dangerous for a white man to traverse. Now, these same Indians are found to be very faithful road workers. Their villages are pitched near by and the braves are helping their white brothers build the roads. But no, they are not quite willing to fraternize with us. For in conversation with the big, young fellows, unusual specimens of the physical man who have been educated at the government schools, we learn that: "The teachers don't know anything," and "All the white men are dishonest." Our efforts to argue this away were unavailing, for these men spoke from experience. Later facts, to our shame be it said, showed that they spoke the truth.

Soon we sight Salt River and learn that it is dammed at Roosevelt. We skip along over knolls and mesas, skirting the south shore of the lake for twenty miles or more and detour one mile to cliff dwellings. A stop here and a tramp up the fine trail to the former abode of an ancient people, leads us to our next *Sonorella*. A new one, Mr. Ferriss said, and right in Chief Montezuma's dooryard. We camped here, found the accompanying spring of the people of long ago, drank, bathed, loved the tropical grove of walnuts, cottonwoods, willows, but found no more snails.

We lingered long on the Roosevelt Dam boulevard, the most impressive work of man our eyes ever beheld. We ate a fine dinner at that "shadow of a rock in a weary land," Apache Lodge, replenished our gas, air, water, and then on to Mills Canyon, where we easily found a large colony of Sonorellas. On the top of a hill overlooking the water we made our camp. The lake is nearly fifty feet lower than usual. And now we are to see so many signs of suffering man and beast when no rain falls in a dry climate and the water-holes fail. One woman had a dozen young calves she was trying to raise whose mothers had perished of thirst. Whitening bones, some covered with dried hides, some naked, were frequent sights.

Now we are in the Mogollon Mountains, Tonto Basin region, Zane Grey's country. We did not see him this time and forebore to visit his hunting lodge, sixteen miles by trail from Payson. But we heard much about him and his Pleasant Valley and had long talks with his guide, Al Doyle, at Flagstaff. Mr. Ferriss knows everybody, as this is his fifteenth trip to Arizona. We found no snails but the cutest little cacti ever! One I mailed home is watching me as I write and holding for me on each of its curved spines a pleasant memory.

Three miles off our road we see two acres of grapes and alfalfa right on top of a natural bridge. And you cannot realize that you are on an arch 150 feet high, 140 wide, 400 long and 75 thick until you follow the path around and down, get underneath and gaze upward. It was as interesting as geometry to solve this "pons" saeculorum. A large spring carries lime compounds in solution. It flows to the granite canyon walls of Pine Creek. On evaporating, the deposit of calcareous tufa tries to fill the canyon bed of the creek. Here a battle royal is fought and the overwhelmed stream capitulates with a subway, Q. E. D. Just like the ice bridges we crossed in the Sierras, the avalanche blocks the stream, which bores its way through, and the gentle murmurs from below whisper its presence.

Before leaving this oasis we found a *Sonorella* which Mr. Ferriss declared to be the queen of them all. And here I solved my mystery—how to find new species. When I am tired out and have said very decidedly, "Come on, let's quit. There is absolutely nothing here," my companion hears not, heeds not, but soon sings out, "Sonorella, one bone. A fine one. New species." Then I go to work again and soon find a "live" one. Dark catches us with fifteen or twenty good dead ones and four or five live ones. And how we had to dig for them! The sun shone merrily. It was very hot but patience, perseverance, and hard work accomplished the impossible. And is not this a key to success in every walk of life?

We were glad to run into Pine in Pleasant Valley. A place ever to cherish and to which we are to return after our mentor, Dr. Miller, leaves us at Grand Canyon. Pine is in a valley about three miles long and one wide. Its elevation is 5500 feet and black lava mountains 3000 feet higher covered with noble pines hem it in. A clear stream, fed by springs miles away, runs through Main Street and the people dip their pails into this and carry the water into their homes only a few feet away. They also use this stream to irrigate their orchards and gardens. Peaceful Pine, Pleasant Valley, balm for tired humans! How we worked the slides on those lava mountains! And we worked our "secret" too 'midst soaking rain and pelting hail, often finding shells after all hope was gone. Here we decided that the rainy season is not the best time to find snails. Scores of "marks" on the rocks but no "markers" led Mr. Ferriss to announce that "Madam snail had gone gadding". We found one right out in the open on her way home.

Through Coconino County (200 miles by 150 miles, larger than several eastern states), over natural roads good when it doesn't rain, we ride to Flagstaff. As we left the desert and approached the forest preserve, how the trees ran to meet us! First the youths, then their parents by scores and hundreds hemmed us in and gave us a royal welcome. The pine forest through which we ride is second only to the President's preserve on Kaibab Plateau beyond the north rim of Grand Canyon. (Read Emerson Hough in *Saturday Evening Post.*)

On past the snow-capped San Francisco peaks, Sunset Crater, and the edge of the Painted Desert to Grand View, we speed our way. Now we camp in the desert and now in the pine forest. But there are no snails to be found here. And then the sunset and sunrise views of Grand Canyon, the pictures, mid storm and sun—the despair of artists and poets —what can a poor snailer say or do? Just drink it in and afterward try to remember. That's all. Down Bright Angel Trail, not as Dr. Cooke on a mule, but on our own feet, we took two days for the trip. Where he saw his fifteen or twenty we found several hundred, all dead. There is an an immense dike of limestone here in the midst of the sandstone and snails must have recently flourished. But there were very few live ones. We spent the night in an old mine tunnel 'midst age-old granite walls. Theodore Roosevelt says truly: "The sullen rock walls towered hundreds of feet aloft, with something about their grim savagery that suggested both the terrible and the grotesque. No one could paint or describe it save one of the great masters of imaginative art or literature —a Turner or Browning or Poe.''

This night, ere we went to sleep, Dr. Miller told us of the Arnold Arboretum of Bailey's Cyclopedia of Horticulture and of many interesting phases of his life. He said he was going to put us to sleep. But his stories had the opposite effect. The morning bath in the pools edging the roaring Colorado, the little fire on its clean sand, to boil our coffee, the walk back, the odor of fragrant shrubs in the rain; these are delightful memories of the Grand Canyon. We made good use of Harvey's restaurant, of Kolb Brothers' studio, and Uncle Sam's post-office, mailing cacti, agaves, etc. to Washington and to our homes. And we spent part of two days and nearly all night with the grand old scout, W. W. Bass. If you visit this region do not fail to meet Bass. And the treatment he has received from ''the white man'' makes that of the Indian read like a romance of benevolence. 'Tis Sunday, July 17th, and more than one-third of our life departed when Dr. Miller left for his home in Los Angeles.

Mere chance took us to Walnut Canyon, the fourth of the great, outstanding features of our trip. Here we spent a week under very pleasant auspices. The meeting of Mr. Ferriss and his old friends of the Catalina Mountains, Mr. and Mrs. Erickson, who are now the custodians of this National Monument, was worth traveling miles to see. The dinners served by this estimable couple to two auto-campers were worth traveling miles to taste. The scenery and cliff dwellings of Walnut Canyon are worth a stop over at Flagstaff to visit. They are only ten miles from town over an excellent road. There are miles and miles of cliff dwellings, two and, in some places, three tiers high in this rugged, twisted gash in the earth. There must have been a half-million inhabitants here, judging by the broken pottery scattered so thickly about. We found a few hundred large shells and hundreds of thousands of little fellows. Your humble correspondent had the wonderful privilege of going clear to the bottom of the canyon with Dr. Thornber of Tucson, who was making first-hand notes on the shrubs of Arizona. Here I found for the first time the wild potato, and an *Oenothera* with corolla tube seven inches long and caulis reduced to zero. The flower came from a dandelion-like rosette of leaves and was a delicate rose color. It grew on the edge of a wet swale on the rim and there were nineteen individuals in the colony.

Mount Elden and the craters and canyons called us. We found small shells everywhere, but few large ones in the next four weeks. The rain descended upon us and soaked us. The sun or camp fire dried us. We did not catch cold as we would have done at home. We were living the outdoor life and loved it so. When the rainy season came we added mushrooms to our menu. Mushrooms both edible and questionable sprang up everywhere. For weeks we saw a dozen new kinds a day. What a paradise for a mycologist! There were all colors, shapes and sizes. Near the forest lookout on Mt. Mahan we measured a big one. It was only eleven inches in diameter. We thought surely it was a foot!

We returned to Peaceful Pine, eighty-five miles, for some property we had cached there, expecting to return to Flagstaff to entrain. The rains had made the roads impassable, so we turned to the right, toward Winslow. This wild road was as good as a boulevard, and soon led us from the pine forest to the desert edge with its scanty junipers and pinons. This was a remarkable change and the bleak desolation of those last twenty or thirty miles seemed to rise and strike us in the eyes. The mirage did not plague us as it did the prairie schooners of yore, for we had plenty of water and gas and speed.

One of us must return to civilization, and one go on and on, ever westward, through the great desert, to California. This is the realization of a beautiful dream of searching for beautiful Soronellas 'midst the beautiful scenes of Arizona.

NEW SPECIES AND VARIETIES OF MOLLUSCA FROM LAKE WINNEBAGO, WISCONSIN, WITH NEW RECORDS FROM THIS STATE *

BY FRANK C. BAKER

Winnebago Lake is the largest inland body of fresh water in eastern America as it is also the shallowest in relation to its area. Its greatest length is about 28 miles, its greatest width about 10 miles, and its maximum depth 20¾ feet. The lake is fed by several large streams, Wolf River emptying into Lake Poygon and Fox River entering Lake Butte des Morts. Lakes Butte des Morts, Poygon, and Winneconne extend to the west of Lake Winnebago and are marsh-bordered bodies of water. Butte des Morts has a maximum depth of 15 feet, as has also the lower part of the Fox River. All of these lakes are really widened-out parts of the Fox and Wolf rivers, which encountered these shallow basins when the ice receded to the north during the waning of the Wisconsin ice cap.

The Lake Winnebago region offers unusual opportunities for the study of ecological variation. The Fox River, which flows for many miles as a typical river, expands to form Lake Butte des Morts, then narrows to form another river, which at Oshkosh again widens into the great body of water known as Lake Winnebago; from this lake a river flows, the lower Fox, which empties into Green Bay of Lake Michigan. The river, both above and below the lakes, contains a typical river fauna of mollusks. The lake fauna, however, although but a continuation of the Fox River, it is not like the river fauna, the species being smaller and otherwise differing from the typical river species. This variation was almost universally noted among the naides, the lake shells being easily distinguished from the river shells. The gastropods also varied in like manner. The fauna reached its present location by way of the Wisconsin-Fox valley, following the retreat of the continental ice cap, and the varieties in Lake Winnebago and Lake Butte des Morts were probably evolved subsequently.

* Contribution from the Museum of Natural History, University of Illinois, No. 21.

The study of this lake region was carried on under the auspices of the Wisconsin Geological and Natural History Survey as part of a wide field study to ascertain the distribution of the molluscan fauna of the State, preliminary to the preparation of a monograph of the aquatic species. An extensive paper is in preparation covering in detail the ecological features of the Winnebago fauna, both molluscan and general invertebrate, in which all of the molluscan species are discussed. This will be published in the Transactions of the Wisconsin Academy of Sciences, Art and Letters. Only new forms and the more interesting new records are discussed in this paper.

Truncilla triquetra Raf. A single specimen of this Truncilla was dredged at Omro, Fox River, from gravel bottom, at a depth of 8½ feet. This is a young shell, measuring, length 23, height 17, width 12 mm. *Triquetra* has not heretofore been reported from Wisconsin and its presence in the Fox River is surprising. It is known from southern Michigan and from Will County, Illinois. The specimen was living when dredged.

Lampsilis recta (Lamarck). Lakes Winnebago and Butte des Morts. The *recta* inhabiting the lakes are uniformly smaller than individuals living in Fox River. The relative difference is shown in the table below in which the largest lake shells are measured:

Length 115, height 50, width 36 mm. Male, Doemel Point, Lake Winnebago.

Length 121, height 52, width 34 mm. Female, Long Point, Lake Winnebago.

Length 138, height 62, width 41 mm. Male, Princeton, Fox River.

Length 135, height 59, width 39 mm. Female, Princeton.

This is a dwarf form produced by lake conditions and is paralleled by *Lampsilis ventricosa canadensis* and *L. luteola rosacea*. The Winnebago shells are somewhat different from the Lake Erie form named *recta* by Lamarck, the posterior ridge not being as well marked, but they seem clearly referable to the same type. They are different from the ordinary river form of *recta* (*latissima*) which is abundant in Wisconsin.

Lampsilis gracilis lacustris n. var. Lakes Winnebago and

Butte des Morts. Common on rock and sand bottoms in water one to ten feet in depth.

As in Proptera and Lampsilis, the lake environment has produced a shell somewhat different from typical *gracilis*, which is a river species. Compared with *gracilis* from the Fox River at Omro, the lake shells are rounder, higher in proportion to their length, the dorsal margin is strikingly alate in the male, forming a distinct wing, the shell is more compressed, the color is usually pale straw-yellow with few or no radiating lines, and the rest periods are very distinctly marked. The largest specimen from Plummers Point, Lake Butte des Morts (the type) measures as noted below, a small specimen of *gracilis* from Omra being also added for comparison:

Length 94, height 61, width 30 mm. Butte des Morts. Type.
Length 100, height 67, width 35 mm. Omro, Fox River.

Gracilis from Illinois and other localities in the Hinkley collection (about 15 lots) are without the marked wing so well developed in the males of the Winnebago Lake individuals and are also much larger. Female shells of *lacustris* are smaller, more ovate and narrower, but there is not as great difference in the dorsal wing as in the male shells. They are uniformly yellowish and have well marked rest periods.

Ortmann (1920, p. 249) has noted a difference between the Lake Erie form of *gracilis* and the Ohio River form, but does not believe the difference of enough value to distinguish. The material from Wisconsin is quite strikingly different and the separation of the lake form seems warranted. This, as well as the other lake forms, are true ecological varieties, produced by the change in environment.

Strophitus edentulus rhombicus (Anthony). Lakes Winnebago and Butte des Morts, on a rocky or sand bottom, in one to five feet of water. The *edentulus* of the lakes differ markedly from those individuals living in rivers. They are much smaller, more regularly elongated or subelliptical, and the umbones are more depressed. A large individual from Lake Winnebago (Long Point Island) measures, length 57, height 35, width 23 mm. This is a characteristic lake form and is probably the same as that mentioned by Ortmann as living in Lake Erie

(Ortmann, 1920, p. 200). Anthony's *rhombica* appears to fit this form and renders a new name unnecessary (see Amer. Journ. Conch., I, p. 158, pl. 12, fig. 5). The same form occurs in Lake Michigan near Chicago. Walker has apparently recognized the variety in Michigan (1911, p. 127).

Lasmigona costata eriganensis Grier. Long Point Island, Lake Winnebago. The two specimens of this form found in beach debris appear to be referable to the Lake Erie form described by Grier. Measurements are given below:

Length 90, height 53, width 30 mm.

Length 80, height 43, width 24 mm.

These conform to the diagnosis of Grier and are certainly distinguishable from the river form.

Elliptio gibbosus sterkii Grier. Lake Winnebago, sand and gravel bottom, in water as deep as 10 feet; Lake Butte des Morts, gravel and stone bottom, water from one to three feet deep.

(*To be continued*)

NOTES.

FISH-CATCHING MUSSELS.—When the U. S. S. *Albatross* went through San Francisco Bay from Sausalito into dry dock at Mare Island in preparation for the cruise of 1914, three mussels which were subsequently found attached to the bottom had made a curious mistake. They had each been so unfortunate in closing their shells as to catch a little fish called anchovy by the head. It would be interesting to know which animal was most surprised by the encounter.--EDWARD C. JOHNSTON.

Mr. Edward C. Johnston of the U. S. Bureau of Fisheries has recently transferred his large collection of shells to the California Academy of Sciences, San Francisco. The collection consists of about 30,000 specimens, chiefly land and fresh-water species of the Mississippi Valley. Almost all of the material was cataloged, identified and indexed, ready for reference at once. It is not often that a museum receives a collection which requires so little labor for its installation. It is hoped that a man who has so distinguished himself as an expert collector as Mr. Johnston has in the past, will continue his conchological explorations.—G. DALLAS HANNA.

NOTE ON DIALA LEITHII SMITH.—In the last number of the "NAUTILUS" Dr. Dall calls attention to this species and conjectures that it may be a native of Lower California.

There appears to have been some inexplicable confusion between Smith's paper on this species and the paper on *Carinifex ponsonbii* which immediately precedes it in the P. Z. S. for 1875. It is obvious that the figures in these two papers are transposed. I have examined the type lot of *D. leithii* in the Brit. Mus. (eleven shells and two opercula, reg. no. 75.6.17.1) and find that it is labeled "Bombay Harbour, Dr. A. H. Leith." I have no doubt that this is the correct locality, and I have in my own collection a single example collected by the late Dr. Archer at Singapore.—J. R. LEB. TOMLIN.

CYTHEREA VIRGINEA A. ADAMS AND REEVE.—This species is described and figured in the "Mollusca of the Voyage of H. M. S. Samarang," p. 78, pl. 24, f. 10, and the locality given is "Eastern Seas." The British Museum possesses the figured type of this shell, received from the famous Lombe Taylor collection, into which many of the "Samarang" treasures found their way, as well as two other examples, and all three are juvenile specimens of *Tivela stultorum* Mawe.

Hinds was probably responsible for the introduction of this impostor amongst the Samarang's collections.—T. R. LEB. TOMLIN.

LIMAX FLAVUS AT BAR HARBOR, MAINE.—I found several specimens of this slug in 1920, and again last year.—C. W. JOHNSON.

In Proc. Cincinnati Soc. of Nat. Hist., 1875, A. G. Wetherby described *Lithasia plicata* as from Green River, Jackson Co., Ky. Green River does not enter Jackson county and there are no streams in the county large enough to require a ferry. As the shells occur in the Kentucky River, it may be assumed that Wetherby meant the Clay's Ferry of that stream. It is upon a part of the river forming the border of Clark and Madison counties. Richmond is the nearest large town.

A letter-writers' controversy that raged for several days in a New York newspaper brought out little known facts about the spelling of the "Muscle" part of Muscle Shoals. Philologists who contributed to Murray's exhaustive dictionary have mobilized no less than 26 English spellings for the mollusk called mussel. A writer of 1584 informed his readers that witches "can saile in an egge shell, a cockle or muscle shell." A traveler's book of 1681 reported that "The natives of Brasile use muscle shells for spoons and knives." In Glover's History of Derby (1829) mention is made of "a stratum of muscle shells." The poet Browning, in 1873, said that:

> "Granite and muscle shell are ground alike
> To glittering paste."

Messrs. Wharton Huber and Fletcher Street sailed for Bluefields, Nicaragua, Feb. 28th. They are to collect zoological and botanical specimens for the Academy of Natural Sciences of Philadelphia.

PUBLICATIONS RECEIVED.

RECENT MOLLUSCA OF THE GULF OF MEXICO, AND PLEISTOCENE AND PLIOCENE SPECIES FROM THE GULF STATES. Part 2. *Scaphopoda*, *Gastropoda*, *Amphineura*, *Cephalopoda*. By Carlotta Joaquina Maury (Bull. Amer. Paleontology, Vol. 9, No. 38, pp. 34–142, 1922). A useful list with bibliography and distribution. We notice a few cases where the author has overlooked some important changes in nomenclature. *Siphonaria lineolata* is preoccupied and *S. naufragum* Stearns should be used instead. In place of *Oliva circinata* Marr. *C. sayana* Ravenel should be used (NAUTILUS, Vol. 28, p. 138, 1915). *Scaphella junonia* is the type of the genus *Maculopeplum* Dall, 1906. *Busycon eliceans* is at most only a variety of *carica.* In using *Janthina janthina* Linn. *J. communis* Lam. becomes a synonym. The species *showalteri* is left in *Neritina.* There are various misspellings such as *Apicinca* for *Apicina*, *Epitomium* for *Epitonium*, *Petrotrochus* for *Perotrochus*, etc.—C. W. J.

Final Report on the Study and Appraisal of Mussel Resources in Selected Areas of the Upper Mississippi River. By N. M. Grier (Amer. Midland Nat., Vol. 8, pp. 1–33, 1922). An interesting paper on the economic problems of the mussel fisheries. A may showing the various areas considered is given.

The Life of the Pleistocene or Glacial Period. By Frank Collins Baker (Univ. Ill. Bull. 41, Vol. 17, pp. 1–476, pls. 1–57). This great work on the "Life of the Pleistocene" was begun about nine years ago when a drainage canal called the North Shore Channel was being excavated; all of the exposures in this as well as those of the Calumet-Sag Channel were carefully studied. The study of the Chicago region led to the consideration of other regions once covered by the great ice sheet, and the results of these studies are embodied in this volume. There is a most exhaustive study of the life of the old bed of glacial Lake Chicago, with a chapter on the post-glacial biota of the great lakes region and pre-glacial conditions and life. The various ice invasions and a summary of the life of the Pleistocene is followed by a full bibliography.—C. W. J.

On the Cephalopoda obtained by the Percy Sladen Trust Expedition to the Indian Ocean in 1905. By G. C. Robson. Trans. Linn. Soc. London, XVII, pt. 4. The most interesting form is a very minute Benthoteuthid about 9 mm. long, but believed to be adult, for which the new genus *Chunoteuthis* is proposed.

New Eocene Species from Alabama. By T. H. Aldrich (Bull. Amer. Paleont, IX, No. 37). Many new species had one new genus, *Tenuiactæon.*

THE

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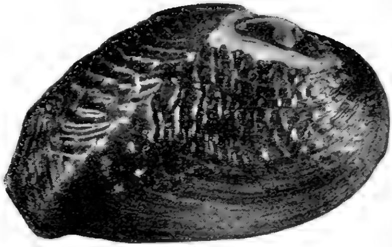

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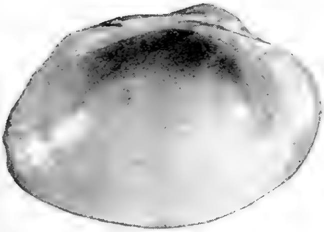

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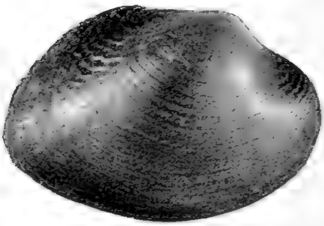

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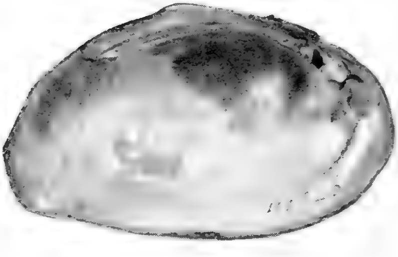

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1, 4. QUINCUNCINA BURKEI WALKER.
2, 3. NODULARIA CRONINÆ WALKER.

The Nautilus.

Vol. XXXVI JULY, 1922. No. 1

A NEW GENUS AND SPECIES OF AMERICAN NAIADES

BY A. E. ORTMANN AND BRYANT WALKER

The generic diagnosis, and the anatomical work on which it is based, was done by Ortmann. The determination of the specific distinctness of the form was made by Walker before any anatomical work had been done and the specific description has been prepared by him.

QUINCUNCINA Ortmann.

The genus *Quincuncina* is founded upon the new species *Quincuncina burkei* Walker. I have received from the late H. H. Smith from the Choctahatchee River, Blue Springs, Barbour County, Ala., several shells and the soft parts of seven other, five males, one barren and one gravid female, the latter collected May 12, 1915.

Supraanal opening present, separated from the anal by a short mantle-connection. Anal opening about as long as the supraanal, its inner edge finely crenulated. Branchial opening about as large as the anal with distinct papillæ. Palpi subfalciform, their posterior margins connected for about one-half of their length.

Gills of normal Unione shape and structure. Inner lamina of inner gill free from abdominal sac except at its anterior end. Since the gill is rather short, the connected portion is about one-third the length of the abdominal sac. Gill diaphragm of the usual type.

Septa of the gills, in the male, moderately developed, not very closely set; in the female, *all four gills serve as marsupium*, and the septa are strongly developed and stand close together. When gravid, the gills do not swell much and the ovisacs (water-tubes) are filled with *subcylindrical* placentæ.

The gravid female at hand had only embryos in an early stage, but no glochidia. The color of the placentæ could not be ascertained in consequence of the preservation in alcohol, in which they appear grayish-white.

The most characteristic anatomical feature of the present species is found in the marsupium, which is formed by the *four gills*, and has *subcylindrical placentæ*. In these particulars it resembles only one genus, *Fusconaia*, and also the rest of the anatomy does not differ from that of this genus.

However, in shell characters, this species is distinct from all known species of *Fusconaia*. In the latter we never see any sculpture on the disk and the beak sculpture is quite poorly developed, simple and concentric. In *Quincuncina* we have a rather complex zig-zag sculpture on the shell, following the subconcentric beak-sculpture.

Certain species of *Quadrula* have indications of the sculpture (*Q. cylindrica*, for instance); but these species differ from the present one by the lanceolate and compressed placentæ. However, there are two species which have been placed in *Quadrula*, *U. infucatus* Conrad and *U. kleinianus* Lea, which have a sculpture much like that of *Quincuncina burkei*. Of *U. kleinianus*, Lea (Journ. Acad. Phila., 1863, p, 404, and Obs. 10, 1863) has described the soft parts and, so far as the description goes, it agrees very well with the present species, except that the inner lamina of the inner gill is said to be free only half the length of the abdominal sac and that the anal opening is described as smooth; these are very insignificant differences, indeed. The most important character mentioned by Lea is that all four gills of *kleinianus* are marsupial.

H. H. Smith has sent me the soft parts of two males of *infucatus*. Also here the anatomy is the same so far as can be observed. The inner lamina of the inner gill agrees with *Q. burkei*, while the anal opening is smooth as in *U. kleinianus*.

It is more than probable that *U. infucatus* and *kleinianus* also belong to our new genus *Quincuncina*, the type of which is *Q. burkei*. It is a very primitive form of the subfamily *Unioninæ* and stands, in its anatomy, close to *Fusconaia*, from which it differs, however, by the very peculiar sculpture of the shell, which, indeed, is rather unique among North American Naiades.

The generic diagnosis of *Quincuncina* would be as follows: Soft parts of the type of the family *Unionidae*, subfamily *Unioninæ*, much like those of the genus *Fusconaia*. All four gills marsupial, when charged not much swelled, and with subcylindrical (not lanceolate and compressed) placentæ.

Shell sculptured. The beak sculpture subconcentric, and followed upon the disk by bars of zig-zag type extending to a considerable distance and being much broken up so as to offer, at least upon parts of the disk, a quincuncial arrangement of nodules.

Quincuncina burkei Walker. Plate I, figs. 1 and 4.

Shell of moderate size, subrhomboid, very inequilateral, subsolid, somewhat inflated; beaks only slightly elevated above the hinge-line, their sculpture consisting of strong, subcircular ridges, stronger along the umbonal ridge and curved up sharply behind, fading out anteriorly and becoming nearly parallel with the growth-lines; anterior end regularly rounded; base line curved; posterior end somewhat produced, subtruncate, curving down rather abruptly and subangulated as it approaches the posterior point, which is below the median of the disk; posterior ridge strong and angulated by the junction of the surface ridges; posterior slope with strong ridges, curving upwards, extending from the posterior ridge to the posterior margin, these form a sharp angle on the posterior ridge with heavier ridges extending downward and forward, which become more or less broken and tuberculous toward the margin and much weaker on the anterior end where they assume a rather quincuncial arrangement; epidermis in mature shells black or sometimes dark brown, in young shells brown or occasionally greenish-yellow, in which case obscure radial stripes of darker green are visible; pseudocardinals double in both valves; in the right valve the anterior is low and oblique, the posterior strong and erect; in the left valve the anterior is rather long and projects obliquely forward, the posterior is larger, erect and more or less split up; the laterals, two in the left valve and (usually) one in the right are only a little curved, that in the right valve is sometimes more or less inclined to be double; beak cavities not very deep nor compressed; anterior muscle scars well marked, the superior one deep and extending under the base of the anterior pseudocardinal; posterior muscle scars distinct, but not deeply impressed; nacre light purplish, deeper in the beak cavities and iridescent behind.

Length 51.4, height 31.5, diam. 18.5 mm.

Type locality, Sikes' Creek, a tributary of the Choctahatchee River, Barbour County, Ala. Also in the Choctahatchee River, Blue Springs; Pea River at Elamville, Clio and Flemings' Mill and Campbell's Creek near Clio, Barbour County, and Hurricane Creek, near Hartford, Geneva County, Ala.

Type, No. 41626, Coll. Walker. Cotypes in the Alabama State Museum and the Carnegie Museum.

This very distinct species was first discovered in the Pea River at Elamville, Ala., by Joseph B. Burke and is named after him by the request of the late H. H. Smith.

So far as known it is restricted to the Choctahatchee drainage system.

There is some variation in shape and considerable in sculpture shown in the series from the several localities listed above. As shown by the figure the type is quite distinctly biangulated at the posterior extremity, but in many specimens the upper angle disappears and the dorsal outline curves directly down to a sharp posterior point. The surface sculpture is some times nearly obsolete. This is quite marked in the shells from Hurricane Creek and the Pea River at Clio. On the other hand the series from Campbell's Creek are larger and have a much coarser sculpture than any of the other lots. The largest specimen seen is in this lot and measures 67.5 x 38 x 23 mm.

The species is extremely subject to erosion and for this reason the type was selected from the series from Sikes' Creek, which were in much better condition than those from the Choctahatchee, which supplied the alcoholic material on which the generic diagnosis is based.

The description of the beak sculpture is based on a single young shell from the Pea River, which is nearly in perfect condition.

As stated in the generic diagnosis the affinities of this species lie clearly with *U. infucatus* Con. and *U. kleinianus* Lea. It differs from both in its more elongated shape and less compressed beak cavities. But the peculiar surface sculpture is the same in all.

NODULARIA CRONINÆ n. sp., Walker. Pl. I, figs. 2–3.

Shell of moderate size, oblong, subinflated, rather solid; beaks obtuse; situated at about one-third of the length from the anterior end, heavily radiately folded; anterior end regularly rounded; basal margin curved, fullest in the middle, more rapidly anteriorly and less so towards the posterior end; dorsal margin nearly straight to the end of ligament where it is obtusely angulated as it passes into the posterior margin, which is oblique, meeting the basal margin in a broadly-rounded point below the median line; posterior ridge low, rounded, wider and flatter as it approaches the posterior point; the posterior slope has a series of strong corrugations, which curve upwards to the posterior margin, the upper ones are prolongations of the beak sculpture, the lower ones are wider and more or less irregular and disappear below the median line; in front of the beaks is a series of small ridges curving upwards, the upper ones connected with the beak sculpture, the lower ones are not and gradually disappear before reaching the median line; the beak sculpture in the centre extends only a short distance from the incurving of the beaks; entire surface elsewhere smooth with very fine lines of growth; color brownish or reddish-yellow, slightly tinged with green towards the beaks and in that region with fine, radiating lines of a darker green than the general tinge; pseudocardinals in the left valve two, triangular, flattened, crenate, especially the inner one, on the edge, practically united on the ligamental side, but separated below by an oblique groove, which receives the inner pseudocardinal of the right valve; pseudocardinals in the right valve two, the inner the larger and quite heavily crenated, the outer narrow and smooth; laterals two in the left valve and one in the right, rather slender and nearly straight; beak cavities deep; anterior muscle scars separate and impressed; posterior only slightly impressed; nacre salmon color, more intense towards the beaks, shading into bluish-white below the pallial line and at the ends where it is very iridescent.

Length (type), 42.1, height 28.5, diam. 19.2 mm.

Length (paratype), 38.3, height 24.3, diam. 17.6 mm.

Length (type), 100.00, height .677 %, diam. .456 %.

Length (paratype), 100.00, height .637 %, diam. 4595 %.

As shown by the comparative measurements the paratype is proportionately not quite so high and a little more inflated than the type as might well be expected from the fact that it is evidently a younger shell. The color is a brighter yellow, which extends to the basal margin, otherwise it is in all respects similar to the type.

Type locality, Zambesi River, at Mongu Sealu in the Barotze Valley, North Rhodesia.

Type, No. 59694, Coll. Walker. Paratype in the collection of Mrs. Howard of Somerset East, Cape Province.

Two specimens of this fine species were sent in by Mr. H. C. Burnup of Maritzburg, Natal, who received them from Mrs. Howard. They were collected by Mrs. Edwina Cronin after whom it is named.

It differs from all of the described African species in the distinctive sculpture of the anterior and posterior slopes.

In order to be sure that the species had not been already described I submitted photographs of the type to Dr. Louis Germain of the Museum d'Histoire Naturelle, Paris, the well-known authority on African mollusca, and he assures me that it is quite distinct from all of the described species.

OBSERVATIONS ON THE GENERA LEILA AND ANODONTITES

BY L. S. FRIERSON

The edentulous shells of South America, classed by Dr. Lea as *Anodonta*, were placed by Simpson (1900) in the two genera *Leila* and *Glabaris*, both of Gray.

The latter genus was subdivided into three sections: *Glabaris* proper, s. s., *Styganodon*, and *Virgula*.

This arrangement was practically retained in Simpson's Catalogue of 1914, but the generic name of *Glabaris* (with the typical section of course) was changed to *Anodontites* Bruguiere.

But because of the radical difference between the *Anodontites crispata* Brug., type of the last named genus, and the *Anodonta exotica* Lam., type of the displaced genus *Glabaris*, the two genera can scarcely be considered synonymous, though thus treated by Simpson, as shown.

As Ortmann has recently hinted (in Memoirs of the Carnegie Museum, Vol. VIII, 1921) the type of the section *Anodontites*, s. s., and that of the section *Styganodon* really belong to the same subgeneric group, and in consequence, when the genus *Anodontites* is adopted, the subgenus *Styganodon* must be dropped.

But as constituted by Simpson, in his two works, but notably in his Catalogue, the *Anodontites* is easily seen to be composed of radically diverse elements, and a need of segregating the units thereof into groups more closely and naturally allied *inter se*, becomes more and more apparent. This can be done expeditiously, and in the writer's opinion, most naturally, by the wholesale removal from the genus *Anodontites*, of the group whose leading member is, perhaps, the *Anodonta trapezialis* Lamarck, and placed them in the genus *Leila*.

This will be the more easily done since it will but in large measure restore the *status quo ante* Simpson; many conchologists having so written many, if not all of the species thus indicated.

The enlarged genus *Leila* will then embrace all of those South American *Naiades*, whose general outward appearance so closely resemble that of the North American *Anodonta grandis* Say.

These shells differ from the emended *Anodontites* in having shells of greater size, yet, in proportion, of thinner texture, and of greater inflation. Their coloring and polish of epidermis are also noticeable differences. Internally, they differ in a more or less sinuous post-pallial line. Most of all, probably, they are to be differentiated by the greater extension of the pallial line, beyond the posterior adductor muscle scar. In some instances this extension reaches the ligamental *sinus*. This extended pallial line may be noted in the figure given by Lea of his *Anodonta forbesiana;* and also in the recent figure given by Ortmann (Memoirs of the Carnegie Museum, Vol. VIII, 1921, Plate XLIV, Fig. 2) of the *Anodontites riograndensis* Ihering.

It is shown perfectly in a fine example of *Leila bahiensis* Kuster before me. Lastly, it is shown in a large specimen of *Leila trapezialis* Lamarck. It is likely that this feature follows from the usual gaping posteriors of the group, thus throwing the work of excluding undesirables from the cavity of the gill chambers, upon the post-mantle edges; this in turn brings about a development of the pallial muscles in that region, and the pallial line noted, evidences their presence.

The genus is naturally divided into two subgeneric groups.

Leila s. s. Type, *Anodonta blainvilliana* Lea.

Pseudoleila. Type, *Anodonta ciconia* Gould.

The latter section being proposed by Crosse & Fischer, 1893.

A study of the species listed in *Anodontites* leads to some conclusions at variance with those of the Catalogue and Synopsis. Some of the more interesting are submitted herewith.

Anodon longinus Spix., 1827.

This species is listed in the Catalogue as an *Anodontites* (Pg. 1446), but the writer agrees with Clessin, Sowerby, Dr. Lea and Von Ihering, that it is really a *Mycetopoda.*

Both Lea and Sowerby place it as a synonym of *Mycetopoda siliquosa* D'Orbigny, but that species is almost square posteriorly, while the present species is roundly pointed.

It agrees much better with that very poorly named species *Mycetopus subsinuatus* Sowerby, 1868, a species quite often devoid of the subsinuate basal margin for which Sowerby named it.

A shell lies before the writer, collected in Guatemala by A. A. Hinkley, which has exactly the shape of Kuster's figure of *longinus*, a species recently identified as the *M. subsinuata* Sowerby, by Ortmann, and I think correctly.

The writer therefore writes the species as follows:

Mycetopoda longina Spix., 1827.

Mycetopus subsinuatus Sowerby, 1868.

Anodonta grijalvae Morelet, 1884.

Simpson placed this species in *Glabaris*, 1900 = *Anodontites*, 1914.

A study of the fine figure given by Crosse and Fischer (1893) seeming to show the usual small, semi-oval, ligamental *sinus*, characteristic of the North American *Anodonta grandis* Say, the type specimen in the British Museum was critically examined for the writer by the late Curator, Mr. Smith, who confirmed this impression.

Specimens of *Anodonta grandis* Say, from southern Texas, having very full, high umbones, and very inequilateral in shape, so closely approximate Morelet's shell that the writer places it as one of the myriad phases of that shell.

Anodonta grandis grijalvae Morelet, 1884.

Anodonta grijalvae Morelet.

Glabaris grijalvae Simpson, 1900.

Leila sowerbyana, new name.

Anodon trautwiniana Sowerby, Fig. 134.

This species is of course nothing like that of Lea's as Sowerby had it. From its nearest of kin, *Anodon rioplatensis* Sowerby, it differs most remarkably in the extremely short anterior margin, as well as in some other less obvious characters.

Leila grayana, new name.

Anodonta exotica (Gray) Sowerby, Fig. 57.

This species differs from *Anodonta moricandi* Lea (with which Simpson doubtfully identifies it) in being considerably larger, with higher umbones, and the posterior point is on a line with the base, instead of about half-way the altitude, etc.

Simpson gives for the genus *Anodontites* a masculine ending, but Ortmann observes that since the type was originally written *Anodontites crispata* by its author, the genus should be regarded as feminine.

FOSSIL SHELLS FROM THE ST. LUCIE CANAL, FLORIDA

BY CHARLES W. JOHNSON

I recently examined a small but interesting collection of shells secured by Mr. Frederick Nelson, an engineer, while at work on the dredge that is digging the St. Lucie Canal to Lake Okeechobee. This canal is to be a deep water canal with locks. About eight miles from the east coast the canal passes through a strip of pine woods and it was while excavating there at a depth of about 40 feet below the surface that the shells were obtained.

There were six specimens referable to *Busycon maximum* var. *tritonis* Conr. of the Duplin beds of North Carolina. The younger specimens were almost typical of that horizon, but in form the older ones resemble small examples of the recent *B. carica* Gmel. They are broad and thick in proportion to their size, but lack the very large spines and enlarged canal of the body whorl, characteristic of the recent var. *eliceans* Montf. of the Indian River, Florida. In all cases the enamel of the aperture was well preserved. The four *Busycon perversum* L. were also peculiar, one young specimen was a typical var. *contrarius* Conr. of the Duplin, while a second was a form common in the Caloosahatchie Pliocene, called *obrapum* by Grabau (Amer. Nat., Aug., 1903), characterized by a small rounded body whorl, with a long straight canal. The others are huge adult shells, with broad low spires, the body whorl slightly encroaching on the preceeding whorl at the suture, the canal short and somewhat curved; as a whole they resemble the recent shells of the eastern coast of Florida. One was perforated by the boring sponge, and the other had the enamel of the aperture well preserved. Some grayish sand that was obtained from the interior of the latter shell contained the following species:

Crepidula fornicata L (juv.).
Crepidula aculeata Gmel.
Eulima sp? (polished)
Astyris lunata (with color markings).
Oliva mutica Say.
Mangelia cerina K. & S.
Arca transversa Say.
Glycymeris pectinata Gmel.
Pleuromeris tridentata Say.
Chione cancellata L.
Chione pygmaea Lam.
Dosinia discus Rve. (juv.).
Donax variabilis Say (common).
Donax fossor Say ?
Mulinea lateralis Say.
Corbula sp?

The other large shells were two *Fasciolaria gigantea* Kien., about 20 inches in length. One has small nodes on the shoulders of all the whorls, the other has the shoulders and nodes both wanting, except in a few of the early whorls. If recent, the latter would be considered a very large example of the var. *reevei* Jonas. A number of *Oliva sayana* Rav. (*O. litterata* Lam.) were highly polished and some some showed the dark brown letter-like markings, a large *Crepidula fornicata* L., two large thick shells of *Venus campechensis* Gmel. (*V. mortoni* Con.), a large valve of *Glycymeris americana* Defr., and two modern looking oyster shells, constituted the collection.

With the meager data and material at hand, it is difficult to draw any definite conclusions. Mr. Nelson said that shells were first obtained at about 35 feet and as deep as 45 feet. Two beds may therefore be involved. Dr. Wm. H. Dall in his "Tertiary Fauna of Florida" (Trans. Wagner Free Inst. Sci., Vol. 9, pt. 6, p. 1594) says: "The Miocene appears as a soft limestone rock in the vicinity of Jacksonville, and has been traced by material from artesian wells on the east side of the peninsula as far south as Lake Worth." Although many of the recent shells listed are found in the Miocene, *Busycon maximum tritonis* and *B. perversum contrarius*, are the only ones in any way characteristic; the form *obrapum* I have only seen from the Florida Pliocene. The formation deserves a careful study.

THE STATUS OF HELIX OREGONENSIS LEA

BY G. DALLAS HANNA

Lea described *Helix oregonensis* in 1838[1] from an immature specimen collected by Thomas Nuttal near the junction of the Willamette and Columbia Rivers in Oregon. The type is now deposited in the U. S. National Museum but through some curious error it has catalogued with it an adult shell of typical *dupetithouarsii* such as grows only in the vicinity of Monterey Bay, California. How this happened may never be known. Certainly if they were collected together Lea would have described the adult shell. Whether the association of these two specimens influenced Binney or not may likewise never be known; but he placed *oregonensis* as a synonymy of *dupetithouarsii* in his writings and most conchologists have followed him.

Matters stood thus until 1912 when Henry M. Edson[2] revived Lea's name as a substitute for the widely known *Epiphragmophora mormonum* of central California. Some western conchologists have accepted his reasoning at its face value and have proceeded to change the names on their labels as a result. It would seem that Edson's article contains too many assumptions and misstatements to warrant such acceptance without further inquiry. I have attempted such an investigation and have arrived at a very different conclusion.

Edson appears to have relied upon Pfeiffer's original description of *mormonum* and had no authentic material for comparison. He states that the species has been collected at Klamath Falls, Oregon, "which is close to the original locality of *oregonensis.*" The two places are across the state from each other, 250 miles apart. Moreover the Klamath Falls record is based upon reputed material in the "Washington State Museum, fide H[arold] Hannibal." Mr. F. S. Hall, Curator of that Museum has advised me (letter dated March 2, 1922) that there is no such material in the institution from Klamath Falls.

[1] Observations, Vol. II, p. 100, pl. XXVIII, fig. 9, Trans. Am. Phil. Soc., Vol. VI, p. 100, pl. XXIII, fig. 85, 1839.

[2] NAUTILUS, Vol. XXVI, p. 49.

Through the courtesy of Dr. Paul Bartsch I was permitted to make a careful examination of the type specimen *oregonensis* in Washington in January, 1922. It is unquestionably a young shell of the *fidelis* group. This might be suspected since it came from the heart of the *fidelis* country. It seems to belong to the small race afterwards called *minor* by Binney[1] and should replace that name. The small subspecies has been reported from Seattle and other places and the collection of the California Academy of Sciences contains many specimens from Portland, Oregon (near the type locality of *oregonensis*) The Dalles, Oregon and elsewhere in that state.

The name *mormonum* should therefore remain as it was before, applicable to the shells from Mormon Island, Sacramento California. It really represents a group of variants similar to *tudiculata*, *traskii* and *californiensis* groups and typical *mormonum* seems to be restricted solely to the type locality. Fortunately, through the aid of Dr. Emmett Rixford we have considerable collections from there for comparison and others from that general region, but it is not yet time to revise all of the various elements which may be grouped about *mormonum*; some other territory must be visited before the work can be done well. There is a small race of *mormonum* which is similar to the small race of *fidelis* and with a sufficient amount of material from intervening country the two species might be connected with intergrades. This however may be said of *arrosa*, *tudiculata*, *californiensis*, etc.

Lea described *H. nuttalliana* at the same time as *oregonensis;* and it is generally admitted that with the first he was dealing with *fidelis*, the same having been placed in the synonymy of that species for many years. It may seem strange that he did not place his *oregonensis* with his equivalent of *fidelis*. The two however are so different in the extremes that without a large series of specimens intergradation would probably not be suspected. With the same scanty material to-day, any reputable conchologist would probably duplicate Lea's action.

The following summarizes my conclusions:

[1] Man. Am. Land Sh., p. 121, fig. 91, 1885.

Epiphragmophora fidelis (Gray), Proc. Zool. Soc., London, 1834, p. 67. *H. nuttalliana* Lea, Observations, Vol. II, p. 88, 1838. Chiefly found in the Coast Ranges.

Epiphragmophora fidelis oregonensis (Lea), Observations, Vol. II, p. 100, 1838. *A. f. minor* Binney, Man. Am. Ld. Shells, p. 121, fig. 91, 1885. Chiefly found at some distance inland from the coast.

Epiphragmophora mormonum (Pfeiffer), Proc. Zool. Soc., London, 1857, p. 109. So far as known found only at the type locality. Subspecies *hillebrandi* (Newc.) *cala* Pilsbry and *buttoni* Pilsbry have been described.

Epiphragmophora dupetithouarsii (Deshayes), Rev. Zool. 1839, p. 360. Confined to the vicinity of Monterey Bay, California.

APEROSTOMATINAE

BY H. BURRINGTON BAKER

As indicated below, three exceedingly unfortunate changes from the customary usage are necessary.

1. *Aperostoma* becomes the generic title of what is usually known as *Cyrtotoma mexicanum.*

2. *Poteria* (genus and subgenus s. s.) replaces both *Ptychocochlis* and *Plectocyclotus* as the name of the West-Indian group usually regarded as a subgenus of *Neocyclotus.*

3. The closely related mainland species forming the subgenus *Neocyclotus* (*Aperostoma* of authors), also take *Poteria* as their generic title. Gray allowed *Poteria* to remain as a nude name for ten years after its proposal, but finally defined it in the British Museum Catalogue of the Cyclophoridæ (1850). Hermannsen (1852) and Pfeiffer (1852) recognized the name, but it appears to have been entirely omitted from later authors.

List of generic and subgeneric names

Megalomastoma Swainson (1840). Type (designated) *M. brunnea* "Guilding" Swainson (1840), from St. Vincent.

Aperostoma Troschel (1847). Type (Hermannsen, 1852) *Cyclostoma mexicanum* Menke (1830), from Mexico.

Farcimen Troschel (1847). Type (Gray, 1847) *Turbo tortus* Wood (1828), from Cuba.

Poteria Gray (1840–1847, nude; 1850). Type *Turbo jamaicensis* (Chemnitz) Wood (1828), from Jamaica.

Platystoma "Klein" Moerch (1852), not Meigen (1803). First used by Moerch as a synonym of *Cyclotus*.

Cyrtotoma Moerch (1852). Type (monotype) *Cyclostoma mexicanum* Menke.

Crocidopoma Shuttleworth (1857). Type *Cyclostoma floccosum* Shuttleworth (1857), from Haiti.

Buckleyia Higgins (1872). Type (monotype) *Aperostoma montezumi* "Hidalgo" Higgins (1872), from Ecuador.

Tomocyclus Crosse and Fischer (1872). Type *T. gealei* C. and F. (1872), from Mexico.

Amphicyclotus Crosse and Fischer (1879). Type *Cyclostoma boucardi* "Salle" Pfeiffer (1857), from Mexico.

Habropoma Crosse and Fischer (1880). Type *Cyclostoma mexicanum* Menke.

Neocyclotus Crosse and Fischer (1886). Type *Cyclostoma dysoni* Pfr. (1851), from Honduras.

Ptychocochlis Simpson (1894). Type *Turbo jamaicensis* (Chemnitz) Wood.

Plectocyclotus Kobelt and Moellendorff (1897). Type *Turbo jamaicensis* (Chemnitz) Wood.

Ceratodiscus Simpson and Henderson (1901). Type *C. solutus* S. and H. (Naut., 1901). Compare Pilsbry (Naut., 1914).

Neopupina Kobelt (1902). Type *Megalomastoma flavula* Swainson (1840), from Porto Rico.

Key to genera and subdivisions

A. Shell heliciform to planorbiform.
  B. Operculum corneous (*Amphicycloteæ*).
    C. Shell planorbiform. Ecuador to southern Colombia. Genus *Buckleyia*.
    C'. Shell heliciform.
      D. Peristome reflected and thickened. Mexico. Genus *Aperostoma* (+ *Cyrtotoma* + *Habropoma*).

D'. Peristome simple or thinly reflected. Mexico to Lesser Antilles. Genus, *Amphicyclotus.*

B'. Operculum calcareous (*Neocycloteae*). Tropical America. Genus *Poteria.*

E. Periphery of operculum double because of obliquely raised, spiral, calcareous lamella, which overlaps the outer edge of the basal plate. Cuba, Jamaica, Haiti. Subgenus *Crocidopoma.*

E'. Periphery of operculum simple, or briefly double at the termination of the last whorl; spiral, calcareous lamella almost vertical along inside of whorls. Tropical America.

F. Spiral lamella of operculum prominent; remainder of basal plate with oblique, supporting riblets. Antilles. Subgenus *Poteria* s. s. (+*Ptychocochlis* +*Plectocyclotus*).

F'. Whorls of operculum simply thickened at their inner edges; oblique riblets scarcely visible. Typically mainland. Subgenus *Neocyclotus.*

B''. Operculum unknown; shell discoid and minute (max. diam. 5 mm.). Cuba and Haiti. Genus *Ceratodiscus.*

A.' Shell pupiform to turrite; apex usually deciduous; operculum corneous. (*Megalomastomeae.*)

B. Shell rimate to perforate; either pupiform or with peristome but slightly reflected. Antilles, Ecuador (??). Genus *Megalomastoma.*

C. Shell pupiform; peristome reflected and thickened. Cuba and Haiti. Section *Farcimen.*

C'. Shell elongate; peristome simple. Porto Rico. Section *Neopupina.*

C''. Shell elongate; peristome thin, slightly reflected and often double. Porto Rico and Lesser Antilles. Section *Megalomastoma* s. s.

B'. Shell perforate, turritiform, and with broadly reflected peristome. Southern Mexico and Guatemala. Genus *Tomocyclus.*

THE IDENTITY OF HELIX DEPRESSIFORMIS AND H. PROSTRATA PEASE

BY HENRY A. PILSBRY AND C. MONTAGUE COOKE

Two of Pease's Helices described[1] from the "Central Pacific" have baffled all attempts at identification by other naturalists. The present writers, separately and together, had time and again gone over the descriptions, finally giving them up, as the types could not then be found in the Pease collection. One of us (C. M. C.) recently worked over Pease's shells at Cambridge, finding the original specimens of both *H. depressiformis* and *H. prostrata*, which had been misplaced in the collection. These have now been examined by both of us.

The specimens of *H. depressiformis* were contained in a vial also containing examples of *Pterodiscus alatus* (Pfr.). Labels of both species in Pease's handwriting were present. Pease's species proves to be a very young shell of *Trochomorpha swainsoni* (Pfr.), a Raiatean (Society Island) species. We find that the unique type of *Planamastra peaseana* Pils. (Man. Conch., XXI, 130) is a still younger example of the same species. Its locality "Hawaiian Islands" (from Pease) was clearly erroneous.

Helix prostrata Pease turns out to be *Planorbis opercularis* Gld., a common West American shell. We were able to examine the dentition, as the animal was dried in one of Pease's specimens. Pease's description is fairly good, but it is hardly surprising that the species was not recognized before; the generic reference and locality effectually disguised it.

COLLECTING ON AN ABALONE

BY F. W. KELSEY

Some of my young friends who collect shells at the seashore may be interested in the following method of getting specimens for a collection, when better means are not at hand.

[1] Proc. Zool. Soc., London, 1864, p. 670. They were placed with doubt in the genus *Planamastra* in Manual of Conchology, XXI, pp. 131, 132.

On May fourteenth of this year I took a boat trip to the Coronado Islands, in Mexican waters, about twenty miles southwest of San Diego. Arriving at the anchorage at high tide, shore collecting was out of the question, so I went out with the skipper and mate in a glass-bottomed boat to a portion of the cove known as the "Marine Gardens". The water is very clear and at points where it is from two to three fathoms deep the view of the waving kelp, sea moss, grasses, shells and many colored fish is exceedingly interesting.

With a long-handled trident, or spear, the skipper would occasionally dislodge an abalone from the rocks, turn it over on its back and with a prong of the spear pierce the flesh of the mollusk and bring it up to the boat. About a dozen fine specimens were thus obtained, one being *Haliotis corrugata* Gray and all the remainder *Haliotis fulgens* Phil. The backs of several shells were covered with moss and other growths which I removed with my pocket knife from the backs of seven shells to be brought home for examination. The scrapings were treated to an all-night bath in a three-percent solution of formaldehyde, then rinsed and thoroughly dried, when they were shaken out and carefully examined for shells. From the material scraped from the seven shells I picked ninety-four specimens, including the twenty-five species which follow.

Amphissa versicolor Dall.
Assiminea californica Cooper.
Cerithiopsis columna Cpr.
Lasea rubra Mont.
Lacuna unifasciata Cpr.
Lacuna solidula Loven.
Mangilia striosa C. B. Ads.
Littorina planaxis Nutt. (juv.).
Odostomia americana D. & B.
Odostomia tenuisculpta Cpr.
Phasianella compta pulloides Cpr.
Fissurella volcano crucifera Dall.
Pecten, sp. (juv.).
Crepidula dorsata Brod.
Columbella aurantiaca Dall.
Columbella gausapata Gld.
Eulithidium substriatum Cpr.
Acmaea paleacea Gld.
Acmaea rosacea Cpr.
Acmaea asmi Midd.
Saxicava rugosa Linn.
Philobrya setosa Cpr.
Marginella regularis Cpr.
Psephis tantilla Gld. (1 valve).
Cardita subquadrata Cpr.

NEW SPECIES AND VARIETIES OF MOLLUSCA FROM LAKE WINNEBAGO, WISCONSIN, WITH NEW RECORDS FROM THIS STATE

BY FRANK C. BAKER

(Concluded from p. 133)

The lake forms of *gibbosus* are all referable to Grier's *sterkii*, which is the lake manifestation of this species, though they are smaller than the Lake Erie specimens listed. The Winnebago shells are like Ortmann's figures (1920, pl. 8, fig. 3). Measurements of the Winnebago form are given below:

Length 61, height 33, width 19 mm., per cent 31.
Length 63, height 32, width 20 mm., per cent 31.
Length 64, height 34, width 20 mm., per cent 31.

Fusconaia rubiginosa parvula Grier. Winnebago Lake, gravel and boulder bottom, one to ten feet in depth. The Lake Winnebago shells seem referable to the Lake Erie form distinguished by Grier. Measurements of the Wisconsin shells are given below:

Length 56, height 44, width 32 mm.
Length 55, height 40, width 25 mm.
Length 34, height 33, width 24 mm.
Length 38, height 32, width 19 mm.

Parvula is an offshoot of *rubiginosa* rather than of *trigona*, if the Lake Winnebago specimens are referable to the Lake Erie variety. *Rubiginosa* is common in the Fox River and it is from this stock that the lake shells have sprung. The *parvula* here considered are wider than the river form, more trigonal and strikingly swollen anteriorly. A single specimen from Lake Winnebago (number 3 in the measurements above) is markedly trigonal and approaches *trigona* in general shape. The epidermis is yellowish-brown, becoming darker in old specimens.

Amnicola judayi n. sp.

Shell ovate conic, rather wide, widely umbilicated, with rather more than 5 very convex whorls separated by deeply impressed sutures; whitish or corneous, sometimes light brown, shining, lightly striate longitudinally; apex acute; aperture roundly ovate, a trifle oblique; peristome continuous, somewhat flattened where it is in contact with the preceding whorl.

Length 5.0, width 3.3; length of aperture 2.0, width 1.5 mm. Holotype.

Length 4.4, width 3.1; length of aperture 2.0, width 1.6 mm. Paratype.

Off Doemel Point, Lake Winnebago, on a sandy mud bottom, in nine feet of water.

Associated with *Amnicola limosa porata* is a large form of Amnicola which cannot be referred to any described species. It resembles *cincinnatiensis* in general form, but is smaller with more rounded whorls and a wider umbilicus. It is larger than *winkleyi* Pilsbry (NAUT., Vol. 26, p. 1), with wider whorls and more upen umbilicus. It resembles Tryon's figure of *schrökingeri* Ffld. (Con. Hald. Mon., pl. 17, fig. 1), but is very much larger than that species. It belongs to the group with projecting first whorl and not to the limosa group which is flat on the apex. *Judayi* is one of the most graceful of the Amnicolas, and I take great pleasure in dedicating it to Dr. Chancey Juday, of the University of Wisconsin.

Lioplax subcarinata (Say). Lakes Winnebago and Butte des Morts, sand and mud bottoms, in water one to 13 feet in depth; Omro, Fox River, mud bottom, water 2–3 feet deep. There appear to be several forms of Lioplax included under the name *subcarinata.* The Winnebago Lake shells have subcarinate whorls, which in a large majority of specimens are rounded without a sign of a ridge or carina. Say especially mentions the apex which he describes as "truncated and re-entering". is a peculiar feature which seems to be characteristic of all the material examined from Wisconsin. This is a physiologic character, the truncation and subsequent replacing of the spire with a rounded plug taking place after the shell has acquired five full whorls. All of the young have perfect spires with regularly coiled, rounded whorls. Young shells 8½ mm. long have five whorls, mature shells 16 mm. long have but 4½ whorls; the adult shells, if unmodified, would have 6–7 whorls. Binney's figure 118 fairly well represents the true *subcarinata.* The Winnebago shells measure as follows:

Length 18, width 11.5; aperture length 8, width 6 mm.
Length 14, width 10.1; aperture length 7, width 5 mm.

Subcarinata lives in shallow water in the river and deep water in the lakes. Probably the deeper water of the lake provides the same cool temperature and oxygen supply as the shallow parts of the flowing river.

Planorbis umbilicatellus Ckll. This little-understood species occurred in several places near Lake Winnebago, always in swales or quiet pools. These specimens are somewhat larger than specimens from Colorado and the west. A few individuals have fine, regularly disposed ribs on the base of the shell, where the growth lines are somewhat raised.

Polygyra multilineata algonquinensis Nason. The shells from the Winnebago region are all smaller than typical *multilineata* and the spire is more elevated. These seem nearer Nason's variety *algonquinensis* than any other form (see NAUTILUS, Vol. 19, p. 141). Three specimens measured as follows:

Greatest diameter 21.5; height 15 mm.
Greatest diameter 22.0; height 15.5 mm.
Greatest diameter 18.5; height 13.0 mm.

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NEW LYMNAEAS FROM WISCONSIN AND MINNESOTA WITH NOTES ON SHELLS FROM THE LATTER STATE*

BY FRANK C. BAKER

Lymnaea (Galba) winnebagoensis n. sp.

Shell elongated; rather thick and solid; periostracum very light horn color; surface dull, lines of growth crowded, coarse, crossed by more or less deeply incised spiral lines; nuclear whorls 1¼, small, well rounded, dark wine or light horn colored; whorls 7, flatly rounded, the body whorl more convex; spire long, forming a very regular sharp-pointed cone, longer than the aperture; sutures impressed; aperture ovate; peristome slightly thickened within by an inconspicuous varix edged with purple; inner lip rather wide, reflected and appressed tightly to the columellar region, leaving a very narrow umbilical chink, and forming a wide callous deposit on the parietal wall; columella with a heavy, oblique plait, twisting the axis.

Length 26, width 12.2; aperture length 12, width 6 mm. Type.

Length 22.5, width 10.4; aperture length 10, width 5 mm. Paratype.

Length 19, width 10; aperture length 10, width 5 mm. Paratype.

Length 18, width 9.1; aperture length 9.1, width 4.2 mm. Paratype.

Length 15.5, width 7.1; aperture length 7.2, width 3.5 mm. Paratype.

Length 6.9, width 3.2; aperture length 4, width 1.6 mm. Paratype.

Types No. z11826, Museum of Natural History, University of Illinois.

Type locality. Oshkosh, Lake Winnebago, Wisconsin.

Habitat. When young and immature on vegetation in protected places, like coves and bays. When adult in deeper water on gravel and sand bottom.

* Contribution from the Museum of Natural History, University of Illinois, No. 18.

This characteristic species evidently belongs to the *catascopium* group of Lymnaeas, having the same texture of shell as the lake forms of that species and occupying the same kind of habitat. It differs from all varieties of *catascopium* in its long, pointed spire, small aperture, and flat-sided whorls. It somewhat resembles some large individuals of *Lymnaea catascopium adamsi* Baker from the St. Clair flats near Detroit, Mich., but is much larger and has a differently shaped spire and aperture (see Mon. Lym., p. 393, pl. 42, figs. 5–8). It somewhat resembles *Lymnaea nashotahensis* Baker, a Pleistocene fossil found in Wisconsin, but the whorls of that species are more rounded with deeper sutures. *Lymnaea danielsi* Baker also approaches this species in general form, but the whorls are rounder, the aperture more elongate with a heavier plait on the columella. The aperture is also peculiarly effuse, a character not shared by *winnebagoensis.*

Winnebagoensis is an abundant mollusk in all parts of Lake Winnebago, the shore debris often being made up largely of this species. A more detailed paper on the ecology of this and other species found in this lake is being prepared.

Lymnaea (Galba) minnetonkensis n. sp.

Shell elongated, fusiform, rather thin; periostracum light horn color; surface dull to shining, sometimes spermaceti-like, lines of growth crowded and crossed by deeply incised spiral lines; nuclear whorls 1½, small, well rounded, light horn or dark wine colored; whorls 6–7, flatly convex, the body whorl often much flattened; spire long, pointed, forming a rather wide cone about as long as the aperture; sutures well impressed; peristome thickened within by a heavy varix edged with dark red or purple; inner lip rather wide, reflexed and tightly appressed to the columellar region leaving a small umbilical chink; a wide callous deposit is formed on the parietal wall; columella with a heavy oblique, twisted plait.

Length 27, width 13; aperture length 14, width 7 mm. Type.
Length 31, width 15.6; aperture length 16.7, width 8 mm.
Length 27, width 14.5; aperture length 14.5, width 7 mm.
Length 22.5, width 12.4; aperture length 12, width 6.1 mm.

Length 26.5, width 13; aperture length 13.7, width 7 mm.
Length 22, width 12; aperture length 12, width 6 mm.
Length 22.6, width 13; aperture length 12.5, width 5.6 mm.
Length 24, width 12; aperture length 13, width 6 mm.

Types No. z11827, Museum of Natural History, University of Illinois.

Type locality. Assembly grounds, Lake Minnetonka, Minnesota.

Minnetonkensis is also a species of the *catascopium* group of Lymnaeas, in which the spire is lengthened and more acute and the body whorl is more elongated and compressed than in the typical *catascopium* as found in Michigan and New York. It is also much larger than *catascopium*. It resembles two species of Lymnaeas which occur in lakes; *danielsi* Baker, which has a longer spire with rounded whorls and a peculiarly effuse aperture with a marked columellar plait; and *winnebagoensis* (herein described) which has a longer spire, flatly and sharply conical, with flat-sided whorls, a narrower shell and a shorter, wider aperture (compare the measurements on previous page). *Winnebagoensis* also has a thicker shell. The Minnesota shell occurs in countless numbers in Lake Minnetonka, the shore debris being composed largely of this species. No living specimens were found, the time spent at the lake being limited.

The three species of Lymnaeas mentioned and described herein are evidently related and are probably expressions of a response to habitat conditions, hence ecological species. The lakes of the northern part of the United States and Canada abound in such ecological species, to which region most of these variations are confined.

Several days were spent in southeastern Minnesota during the latter part of June, 1920. Lake Minnetonka and the vicinity of St. Paul were the principal localities visited. The following were collected.

Beach debris, south side of lake near assembly grounds, Lake Minnetonka, Hennepin County.

Anodonta grandis footiana Lea.
Lampsilis luteola rosacea (De Kay).
Planorbis deflectus Say.
Planorbis exacuus Say.
Planarbis parvus Say.

Sphaerium sulcatum (Lamarck).
Lymnaea stagnalis appressa Say
Lymnaea (*Galba*) *minnetonkensis* Baker.
Lymnaea (*Galba*) *obrussa decampi* Streng.
Planorbis trivolvis Say.
Planorbis campanulatus Say.
Planorbis antrosus Conrad.
Planorbis a. unicarinatus Hald.
Physa sayii Tappan.
Physa niagarensis Lea.
Vulvata tricarinata (Say).
Amnicola limosa porata Say.
Amnicola lustrica Pilsbry.
Succinea retusa Lea.
Succinea avara Say.
Vitrea hammonis (Ström.).

Banks of Mississippi River, St. Paul, Hennepin Co.

Polygyra profunda Say.

Polygyra profunda pleistocenica Baker. A specimen comparing in size and shape with the form named *pleistocenica* (see NAUTILUS, XXXIV, p. 66) occurred with normal *profunda*. It was marked by one wide band of color above the periphery.

Zonitoides arborea (Say).
Vitrea hammonis (Ström.).
Pyramidula alternata (Say).
Helicodiscus parallelus (Say).
Strobilops virgo (Pilsbry).

Small stream flowing through ravine on bank of Mississippi River, St. Paul.

Aplexa hypnorum (Linn.).
Physa walkeri Crandall.
Lymnaea (*Galba*) *caperata* Say.
Succinea ovalis Say.

A LARGE QUADRULA HEROS SAY

BY WILLIAM B. MARSHALL

Assistant Curator Division of Mollusks, United States National Museum

The collection of the United States National Museum contains the left valve of an unusually large and internally fine specimen of *Quadrula* (*Crenodonta*) *heros* Say. Mr. Ernest Danglade of Vevey, Indiana, formerly of the United States Bureau of Fisheries obtained the specimen from a pearl fisherman who had crushed the other valve. In transmitting the shell to the Museum Mr. Danglade sent the following note: "The shell was found in Eagle Creek, near Eagle Station, Kentucky, on October 10, 1917. This stream flows through a fertile soil on a limestone formation and of course the water is naturally hard. This condition, in connection with an abundance of food, no doubt accounts for the unusual size and thickness of the shell, as well as the quality of the material." The locality is in Carroll County, Eagle Creek flowing into the Kentucky River a few miles above the junction of the latter with the Ohio River.

This is the largest shell of its kind ever seen by Mr. Danglade, who, as an attache of the Bureau of Fisheries, has observed and handled thousands of shells of this species. It is much larger than any other specimen in the National Museum.

The following data relating to size should be of interest:

Length 216 mm (about 8½ inches).

Height 150 mm. (about 6 inches).

Diameter (if both valves were present would be) 70 mm., about 2¾ inches.

Perimeter 600 mm. (nearly 2 feet).

"Circumference", (i. e., around the shell crosswise to the length) would be 14½ inches. This is two inches larger than the specimen whose measurements were given by W. S. Strode in the Nautilus, IX, p. 116.

Weight of this valve about 723 grams (1 pound, 9½ ounces).

Weight of whole shell must have been about 1446 grams (3 pounds, 3 ounces).

Capacity of this valve, 295 c. c., about 18 cubic inches.

Capacity of whole shell about 590 c. c., about 36 cubic inches.

Amount of material in this valve 263 c. c., about 16 cubic inches.

Amount of material in whole shell about 526 c. c., about 32 cubic inches.

When gorged with water the specific gravity of the animal must have approximated that of water itself, so that it is reasonable to believe that the contents of the shell when living weighed about 590 grams (about 1 pound, 5 ounces) and that the shell, the animal and the water enclosed in the shell had a combined weight when collected of about 2036 grams (nearly 4 pounds, 8 ounces).

The beak is somewhat eroded but the rest of the exterior of the shell is in good condition and most of the periostracum is well preserved. Internally the shell is rather fine, the nacre being silvery and iridescent. The cardinal and lateral teeth as might be expected are massive, the muscular scars and pallial line are deeply impressed.

Doubtless the shell was at about the limit of size attainable to this species but there is nothing about the shell itself (other than its great size) to indicate that there will be no further growth. Apparently the shell-secreting organs of the animal were in full vigor and in readiness to perform their function should further growth of the animal require enlarged accomodations. It seems probable, too, that the secretion of calcareous matter was still going on and that if the animal had been permitted to live there would have been a further thickening.

The specimen is Cat. No. 346631, U. S. N. M.

NOTE ON FENELLA A. ADAMS

BY WM. H. DALL

Fenella (originally spelled *Finella* by a typographical error) was described by Adams in 1860 and has suffered many vicissitudes. The species have been referred to the Rissoidae, Pyramidellidae, Cerithiidae, and Litiopidae. Carpenter made the error of identifying West American species with *Mesalia*, *Styliferina*, and *Alvania*, and a species of *Halistylus* with *Fenella*, which, as well as Adams' typical species, is figured by Tryon in his Manual.

The fortunate discovery in the collection of the National Museum of specimens of Adams' typical species received directly from him many years ago, has enabled me to positively identify *Fenella* with *Alabina* described by me in 1902. It has a normal protoconch of about three smooth brown turbinate whorls which definitely removes it from the Pyramidellidae. The data given by Fischer about the animal might apply to a *Bittium* or a Rissoid, but from an examination of dried specimens I have been able to determine that the operculum is multispiral and circular, which definitely removes it from the Rissoidae. Dried Japanese and Hawaiian specimens were tested for the radula without success but finally a specimen of *Alabina diomedae* Bartsch from California yielded the desired item, which proved to resemble the radular structure of *Lampania*, as figured by Troschel in Das Gebiss der Schnecken. This definitely settles the Cerithioid relations of the genus, which may find a place near *Bittium* in the general system, as I placed it in my summary of the Marine Mollusks of the Northwest Coast of America.

AN ABNORMAL SHELL OF MYA ARENARIA

BY EDWARD S. MORSE

The many deformations in the shells of Mollusca have often been described and figured and their causes easily explained. Some of these deformations have been due to injuries to the shell in its early stages, others are due to an arrest of development—atrophy, or an access of growth—hypertrophy, as are the usual causes of malformations among the higher animals and man. In shells these malformations generally consist in the case of gasteropods of the whorls being separated, elongation of the spire, extra knobs, spines, ribs or keels or simple monstrosities; reversed twirls of the spire in dextral shells, supernumerary teeth in the aperture. These and other modifications of the shell are readily understood. I now present an example of an abnormal growth which has so far been inexplicable to me, and it is hoped that some reader of the NAUTILUS will solve the problem. Recently I received the right valve of the common clam, *Mya arenaria*, from my friend Major John M. Gould, who received it from Levi C. Carter of Loudville, Maine, who got it at Marsh Island, midway between the Kennebec and Penobscot Rivers.

On the anterior portion of the shell a conspicuous raised flattened rib appears which starts near the beak and continually widens with the growth of the shell, and at the margin projects a considerable distance beyond as shown in the figures. An examination of the shell under a lens reveals that by some accident at a very early stage the margin of the shell was broken and there began to form a shallow raised ridge very narrow at first but continually widening as the shell increased in size until at the margin of the shell it was not only 20 mm. in width, but projected 7 mm. beyond the margin of the shell. This flattened rib radiated from the umbone as any rib would radiate in a lamellibranchiate shell. The extraordinary character of this rib is that it is hollow, the interior is open throughout, as the wire *A–B* in the figure shows, the posterior half is interrupted by columns of nacreous material which run from the shell to the upper portion of the tube, indeed there seems to be a partition separating the tube into halves. The upper part of the ridge is broken away for a distance of 25 mm. from the umbone, en-

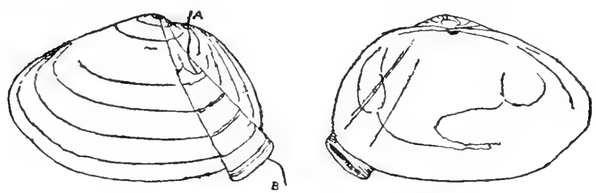

Fig. 1. Abnormal *Mya arenaria.*

abling one to examine the floor of the ridge, and this shows a distinct depression in the shell; on the inside of the shell there is a marked swelling or thickening of the nacre to the extreme border. The upper wall of this ridge projects 5 mm. below the lower wall, which in itself projects 3 mm. below the margin of the shell, thus one is enabled to examine the inner wall of the tube and it is nacreous. Dried animal matter was picked out of the tube. To build this tube a membrane must have had a mantle margin which would secrete layer after layer of shell as the strong lines of growth indicate, as well as epidermis, and the surface of the membrane must have poured out its nacreous layer as the tube is so lined, yet the normal growth of the shell is not interrupted in any way. In some manner a portion of the mantle must have been displaced at the time of the injury to the young shell, if turned back it must have again become reflexed to bring the edge of the mantle free again. It is unfortunate that the specimen was not preserved alive. The other valve of the shell was perfectly normal.

I cannot recall among the lamellibranch or gasteropod shells, either normal or abnormal, a tubular process, indeed the nearest approach is seen in the little tubular processes on the periphery of Aspergillum.

JEANETTE M. COOKE

Miss Jeannette M. Cooke died at her home on Point Loma in the city of San Diego, California, on October 21st, 1920. She was widely known among conchologists on account of the valuable material which she had accumulated from Lower California, which has gone into many of the great museums of the world and into a very large number of private collections.

She was born at Westford, Vermont, on March 10th, 1843, but went to Elyria, Ohio, when about nine years old. She came to San Diego in 1882 and opened "The World Curio Store" in 1886. This she maintained until about 1908 when she retired from business and moved to Point Loma.

Early in the history of the store she sent out a boat in charge of Captain George D. Porter and John Johnson for the purpose of collecting all sorts of marine life on the coast of Lower California. She made several changes in her boats and, about 1895, she purchased a small Chinese junk which had been built in San Diego, and which they rechristened "The World". In this boat these two men went for a more extended cruise into the Gulf of California.

Tiburon Island, the largest island in the Gulf of California, is inhabited by the notorious Seri Indians, who are the Ishmaelites of that region, their hands having been against all of their neighbors from their earliest recorded history. Miss Cooke told the writer that Capt. Porter had promised her that under no circumstances would they land on Tiburon Island. Nevertheless, about the end of October, 1896, they did land on this large island, were ambushed and killed by the Seris, and their boat was looted and burned. An investigation made by the Mexican Government at the request of our State Department elicited the fact that they had landed from a small boat and gone along the beach to collect. A band of Indians ambushed them upon their return, killing Johnson at the first fire, but Porter managed to reach the small boat on the beach and killed five of the Indians before they killed him.

After this Miss Cooke made no attempt to organize further collecting along the Lower California Coast, contenting herself with the purchase of stock and the turning over of the large accumulations of former years. She early became interested in the conchological side of her work and started many years ago to make a private collection which had reached rather large dimensions at the time of her death. She furnished the types of a large number of new species and varieties, most or all of which were described by the late Dr. R. E. C. Stearns, Dr. W. H. Dall and Dr. Paul Bartsch. Probably the most remarkable one of these was taken on Guadelupe Island off the Lower California Coast and was described by Dr. Stearns as *Uvanilla regina*. This shell seems to be a perfect *Uvanilla*, but specimens taken long after the description was written showed the operculum to be Trochoid.

In accordance with Miss Cooke's expressed desire, her private collection has become the property of the Theosophical Society and Universal Brotherhood, of which she was a member, and is held at their International Headquarters on Point Loma.

FRED BAKER.

POINT LOMA, CAL., MAY 25, 1922.

NOTES.

TYPES OF FÉRUSSAC'S SUBGENERA OF HELIX. A few of the subgenera of Férussac's Tableau Systematique seem to be still without definitely designated types, or at least I have not found them. Types are here selected.

Cochlodina Fér., p. 61. Type *Clausilia bidens* Draparnaud.

Cochlohydra Fér., p. 26. Type *Helix putris* L.

Cochlogena Fér., p. 53. Type *Bulimus guadalupensis* Brug.

These designations have no effect upon current nomenclature of the groups concerned. The type of *Helicogena* Fér. is somewhat doubtful. Gray (P. Z. S., 1847, p. 171) mentions *Helix acutangula*, but that species is not in Férussac's list. On p. 173 he mentions *H. candidissima*, which is one of Férussac's species. The name *Helicogena* has generally been used for the *Helix pomatia* series, but I have not seen any early designation of one of that group as its type.—H. A. Pilsbry.

Gemma gemma purpurea (Lea) was recently found by Mr. Frank J. Keeley in vast numbers in Indian River, near Hawks Park, Florida. They occurred in a patch of about a foot diameter, the layer of living shells about 2 inches deep. It was on a mud bar about a foot above low water. Handfulls of pure shells could be scooped up.—H. A. P.

Note on Leptinaria imperforata Fred Baker. In my report on the Land and Fresh-Water Mollusks of the Stanford Expedition to Brazil, published in the Proceedings of the Academy of Natural Sciences of Philadelphia for December, 1911, I described, at page 646, and figured, a new species as *Leptinaria imperforata*. I have just discovered that this name was used by Strebel in 1882, as reported fully in the Manual of Conchology, Second Series, Vol. 18, p. 317, pl. 42, fig. 28, so that my name becomes a synonym. I suggest that my species shall be known as *Leptinaria charlottei*.—Fred Baker.

Localities of Northern Californian Land Snails: a correction. There is a regrettable error in my paper on "Some Land Snails of Shasta County, California," appearing in the Nautilus for October, 1921, which should be corrected before it is perpetuated. Not having access at the time the paper was written to a sufficiently detailed map of California, and being ignorant of the point myself, I perforce followed the field label which accompanied the specimens reported upon. This read "Two miles north of Weed, Shasta County, California." Access to a better map, which I did not gain until too late to change the statement on the printed page, has since shown that Weed is really in Siskiyou County. To avoid being misleading the title of my paper should therefore have read, "Some Land Snails of Siskiyou and Shasta Counties, California."

It may be added that the date "1192" on p. 38 of the same paper should read "1920", as correctly appears elsewhere.—A. Stillman Berry.

Mollusks Dredged from San Diego Bay. Near the foot of State Street, San Diego, California, a long strip of ground formerly covered at high tide, has been filled in by dredgings from the adjoining portion of San Diego Bay. A large portion of these dredgings consist of pure sand, but many tons of shells have also been taken from the bay and used in this new-made ground. In spots probably more than 10,000 cubic feet of broken shells have thus been deposited, and a few notes on these dredgings may be of interest.

Chione contributes the greatest bulk to these shell masses; in my boyhood days *C. fluctifraga* was the most abundant clam collected for food from San Diego Bay. *C. undatella* and *C. succinata* being comparatively rare in the gatherings for food; *C. fluctifraga* is vastly in the minority, however, in these dredgings, *C. succinata* being easily the most abundant content. *Tagelus californianus* is a very prominent constituent in some of these beds, but in many places I find *Crucibulum spinosum* leading easily numerically. Among the Macomas, *M. nasuta* is the most abundant; *Semele pulchra* is not rare though not conspicuous; *Donax* is nearly absent—only a few valves of our two common species being observed in the acre or more of ground inspected.

In my boyhood *Cardium elatum* was not rare in our bay, but I have not heard of a living specimen having been found here in the last thirty years; a few fragments were found in these shell heaps, while *C. substriatum* was abundant, and a few fragments of *C. quadragenarium* were observed; *C. procerum* seemed to be absent, indicating that the dredge had not touched any of the pleistocene deposits surrounding portions of our bay—the shell sands containing nothing that could be ascribed to a past age.

Moerella meropsis and *Angulus carpenteri*, and a few valves of *Cooperella subdiaphana*, *Metis alta* (few), *Pecten acquisulcatus*, *P. monotimeris*, fragments of *Modiolus capax*, many valves of *Ostrea lurida*, a single valve of *Leda*, another of a *Nucula*, and many valves of a *Glycymeris*, *Lucinisca nuttallii*, *Heterodonax bimaculatus*, *Solen rosaceus*, *Cryptomya californica* and a few fragments of *Mactridae*, and numerous valves of *Corbula luteola*, conclude the census of the bivalves.

Dentalium neohexagonum in abundance, and occasionally one of another species, with numerous specimens of *Cadulus nesiotes*, *Bullaria gouldiana*, *Rictaxis punctocaelata*, and thousands of *Acteocinas* were observed. *Cerithidea californica*, and occasionally specimens of *Melampus olivaceus*, one large *Olivella biplicata* and hundreds of *O. boetica* and other forms doubtfully referred to *O. pedroana* and *O. porteri*, were found. One *Marginella jewettii*, many of *M. subtrigona* and *M. regularis*, one *Hyalina californica*, and several *Merovia pyriformis*, were among the small species. *Acmaea depicta* and *A. paleacea* were not rare, but only one *A. insessa* was found. *Alectrion fossata*, *mendica*, *cooperi*, *perpinguis*, and what we used to call *tegula*, were noted, and *Anachis* and *Alia* were plentiful in spots. One *Murex festiva* and one *Tritonalia poulsonii* were the sole representatives of these genera. Fifty or so specimens of *Epitomium* and one or two *Melanella* rewarded my search. *Turbonilla* and *Odostomia*, *Cerithiopsis* and *Bittium*, *Crepidula rugosa*, *Phasianella compta*, one *Polinices reclusiana*, and a few *Omphalius ligulatus*, a very few *Litorina scutulata*, nearly complete the list of species, except for three or four forms formerly termed *Caecum*, not yet specifically determined.—C. R. Orcutt.

PUBLICATIONS RECEIVED.

Proceedings of the Malacological Society of London, Apr., 1922, Vol. 15, pt. 1:—

On the Pseudo-genus Pseudomarginella v. Maltzan. By the Rev. Dr. A. H. Cooke, pp. 3–5.

The Radula of the Volutidae. By the Rev. Dr. A. H. Cooke. pp. 6–12.

Note on Reproduction of Turritella. By Lieut.-Col. A. J. Peile, p. 13.

Some Notes on Radulae. By Lieut.-Col. A. J. Peile, pp. 13–18.

A List of the species and genera of Recent Mollusca first described in "Le Natualiste." By Hugh C. Fulton, pp. 19–31.

Note on the British species of Anomia. By R. Winckworth, pp. 32–34, pl. 1.

Note on a Holocene Deposit at Penton Hook. By J. E. Cooper, pp. 35–36.

Note on the genera Neptunea and Syncera. By W. H. Dall, p. 36.

A Reply on the genera Neptunea and Syncera. By T. Iredale, p. 37.

The nomination of "Recent" fossil mollusca. By T. Iredale, pp. 37–38.

The status of Helicella and Polita. By Dr. H. A. Pilsbry, pp. 38–40.

On the connection between style-sac and intestine in Gastropoda and Lamellibranchiata. By Guy C. Robson, pp. 41–46.

On the genesis of the designation of "types" among Malacological writers. By A. S. Kennard and B. B. Woodward, pp. 47–51.

On the Pisidium gassiesianum of Dupuy. By A. W. Stelfox, pp. 52–53.

Report on the Gassies collection of Pisidia in the Musee d'histoire Naturelle de Bordeaux. By A. W. Stelfox, pp. 54–57.

New Pearly Fresh-water Mussels from South America. By Wm. B. Marshall (Proc. U. S. Nat. Mus., Vol. 61, pp. 1–9, pls. 1–3, 1922). Eight new species and one new genus—*Diplodontites* are described and figured.

The Miocene of Northern Costa Rica. By A. A. Olsson (Bull. Amer. Pal., Vol. 9, pt. 1, pp. 1–168, pls. 1–15, 1922). The material on which this monograph is based represents over two years of field work by the author in Panama and Costa Rica. There is a chapter on the stratigraphy of the region, with a general correlation with other beds. Over 100 new species and varieties of Gastropods are described. The dearth of family names makes the grouping of genera somewhat confusing. The genus *Halia* is now placed in the Volutidae.—C. W. J.

REVISION OF W. M. GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO. By H. A. Pilsbry (Proc. Acad. Nat. Sci. Phila., 1921, pt. 2, pp. 305–435, pls. 16–47 and 48 figs. in text). This work reviews the more recent papers, and forms a complete résumé of the subject. Numerous new species and subspecies are described. The illustrations are unusually fine and the artist, Miss Helen Winchester, deserves great credit in showing so clearly the beautiful sculpturing of the shells.—C. W. J.

The Mollusca collected by the University of Michigan-Walker Expedition in southern Vera Cruz, Mexico. By H. Burrington Baker. Occas. Pap. Mus. Zool. U. of M., No. 106, 1922. Though handicapped by high water, about a dozen species and subspecies were taken in the San Juan River system. The value of the groups *Leptonaias*, *Sphenonaias*, *Actinonaias* and their synonyms is considered at some length, and the following are described as new: *Elliptio* (*Sphenonaias*) *liebmanni cuatotolapamensis*, *Actinonaias* (*Disconaias*) *walkeri*, *Lampsilis rovirosai sanjuanensis* and *Lampsilis ruthveni*. He considers *Lampsilis fimbriata* Frierson a small-river form of *Actinonaias discus* (Lea).[1]

Ampullaria patula catemascensis is a new subspecies which appears to be quite distinct—an unusual condition among Mexican Ampullariidæ.

Among the land shells, the synonymy of some perplexing Helicinidæ is considered, and there is a discussion of the *Guppya-Euconulus* group, with figures of the dentition. *Thysanophora pilsbryi* n. sp. is described, and a key to species of the region is given. *Miraverellia* is a new subgenus for *Averellia sumichrasti* (C. & F.).

The Unionidæ are fully illustrated in series showing variation, changes with age, etc. It is by such careful studies as this that we may hope to get somewhere near an understanding of these perplexing Mexican Unionidæ and their tangled nomenclature. —H. A. P.

[1] By an error of some sort, this name is spelled *disca* on p. 22.

THE NAUTILUS.

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LAND SHELLS OF VANCOUVER ISLAND.

BY H. A. PILSBRY AND C. MONTAGUE COOKE.

During part of July and August one of us (C. M. C.) spent some time at Vancouver Island. Land shells were nowhere found in abundance, and in many places they seemed entirely wanting. Yet not much time was given to the search.

Vancouver Island, about four miles south of Union, in pine forest along road, above a deposit of fossil sea shells. On the ground and under bark. 24 & 25/vii/18.

Epiphragmophora fidelis (Gray).
Polygyra columbiana (Lea).
Polygyra germana vancouverinsulæ P. & C.
Haplotrema vancouverensis (Lea).
Zonitoides arborea (Say).
Striatura milium pugetensis (Dall).
Pristiloma stearnsi (Bland).
Euconulus fulvus (Müll).

Vancouver Island, near lower end of Cameron Lake, in open pine forest above hotel. Most of the specimens under dead bark on the ground. 1–12/viii/18.

Epiphragmophora fidelis (Gray).
Polygyra columbiana (Lea).
Polygyra germana vancouverinsulæ P. & C.
Haplotrema vancouverensis (Lea).

Haplotrema sportella (Gld.).
Zonitoides arborea (Say).
Zonitoides cookei Pils.
Polita hammonis (Strom).
Striatura milium pugetensis (Dall).
Pristiloma stearnsi (Bland).
Euconulus fulvus (Müll).
Punctum pygmæum (Drap.).
Vertigo columbiana Sterki.
Cochlicopa lubrica (Müll).

POLYGYRA GERMANA VANCOUVERINSULÆ n. subsp. The shell is more openly umbilicate than typical *germana* with a decidedly stronger, higher parietal tooth. Hairs of the surface space very delicate and more or less fully deciduous in adults. Height 4.5 diam., 6.8 mm.; 5¼ whorls.

Cameron Lake. Type 44538 A. N. S. P.; paratype in Bishop Museum, Honolulu. Also found about 4 miles south of Union.

DESCRIPTION OF A NEW ZONITOIDES.

BY H. A. PILSBRY.

ZONITOIDES COOKEI n. sp. Fig. 1.

The shell is discoidal, the spire very slightly convex, umbilicus regularly diminishing inward, very nearly one-fourth the

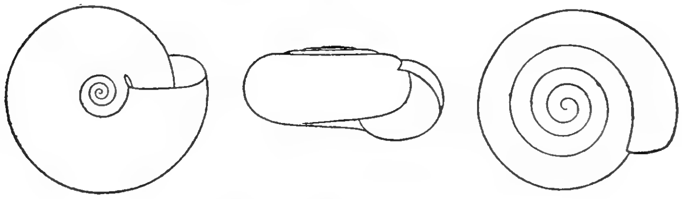


Fig. 1. Zonitoides cookei.

diameter of the shell; whitish, glossy, smoothish, under the microscope showing faint growth lines and on the upper surface an excessively minute, close and shallow spiral striation on the last 2 or 3 whorls. The whorls increase slowly and are rather convex, the suture rather deeply impressed, last whorl rounded peripherally. The aperture is rather narrow, crescentic. Height 1.7, diam. 3.6 mm.; 4½ whorls.

Cameron Lake, Vancouver Island. Type no. 130623 A. N. S. P. Specimens also contained in the Bishop Museum.

This species is distinguished by its very low spire of narrowly coiled whorls, and especially by the narrow aperture. The generic reference is uncertain, as we do not know whether it possesses the *Vitrea* or the *Zonitoides* type of teeth, and the shell characters are not decisive. However, the suture is deeper than in our small species of *Vitrea* or *Polita*. Named for Dr. C. Montague Cooke.

SOME NOTES ON MINUTE PISIDIA.

BY V. STERKI.

Recently Mr. A. W. Stelfox kindly presented me with a few fine specimens of *Pisidium torquatum* Stelfox, with a note saying that they are what B. B. Woodward[1] has described as *parvulum* Clessin. That species is well established and distinct, to judge from Clessin's[2] description and figures, though both somewhat inadequate, and from authentic specimens. From Woodward's description and figures, l. c., it is evident that his *parvulum* is an entirely distinct species, which Stelfox has named *torquatum*. Woodward's specimens were from Denmark and he stated that the species had not been met with in the British Isles, either recent or fossil. That is evidently to be understood of both, *parvulum* Clessin and the one described by him. As stated by Stelfox, his specimens, from England, resemble the Nearctic *P. punctatum*, as to size and shape; they are 1.5 mm. long, well

[1] Catalogue of the British Species of Pisidium in the British Museum, 1913, p. 105. Pls. II, f. 6, IV, f. 8, XVII, fs. 3–6.

[2] Cycladeen, in Küster and Chemnitz, 1879, p. 17, Pl. 1, fs. 17–21.

inflated, mature or very nearly so, and have a slight ridge on each beak. But the hinge is quite different, much like that of *cruciatum* St.,[1] stout, with the plate broad, the principal laminæ ("lateral teeth") massive, and a short ligament. The right cardinal, c 3, is of the same peculiar formation; its posterior part curving downward and apparently forward, merging into the projecting edge of the plate (an equivalent of the hypothetical c 1?), thus forming a well-enclosed groove for the reception of c 2, the left anterior cardinal. The latter is much smaller than in *cruciatum*, and so is c 4. The lamina a I, especially, is short and considerably projecting inward; a III is wanting, as it is in some *cruciatum*, and p III is quite small and rather proximal. These features are in marked contrast to those shown in the figures of "*parvulum*", in Woodward's, l. c., and so far as present evidence shows, the two appear to be distinct species, even of different groups.

For over thirty years[2] *P. cruciatum* has held a unique position among the known species and forms, by its peculiar hinge formation and the shape of its umbonal ridges, which, by the way, are quite constant, unlike those of *P. compressum*, *fallax* and *punctatum*, also *supinum* A. Schmidt and *henslowanum* Sheppard, which are vestigial or wanting in some forms. Probably the species is of an old race, or group, now isolated, and the more it is interesting to know of a related form from east of the Atlantic.

Of other minute Nearctic *Pisidia*, 1.5 to 2.2 or 2.5 mm. long when mature, there are now about a dozen known, well established, most of them distributed over wide areas, and of quite different groups. Temple Prime has described three of them, in 1851.[3] Of about half as many somewhat larger ones there

[1] *P. cruciatum* and *punctatum*, THE NAUTILUS, VIII, pp. 97–100, Pl. II, fs. 1–13 (Jan., 1895).

[2] *P. cruciatum* and *punctatum*, also *fallax*, were first found, or noticed, in 1891, among coarse gravel and sand of the Tuscarawas River, Ohio.

[3] The size given to *P. ferrugineum* (see Mon. Corbiculadæ, p. 71), 4.25 mm. long, is a mistake, or error; of thousands of specimens seen, all are quite small.

are minute forms and subspecies; and some others have been under doubt and scrutiny for years. Large numbers of specimens have been overlooked or thrown away by collectors supposing them to be merely young and of no value. In fact, the young of all are of interest.

Critics have not been friendly to these small forms. To cite one example: Prof. Richard Ellsworth Call[1] says: "The young [of Pisidia] are found in older shells in the spring and again in the fall, and have recently been described in the 'NAUTILUS, an amateur conchological journal, under a number of names." This dictum evidently applies in first order to *P. cruciatum* and *punctatum*.[2] From the figures, any amateur beginner, or any school boy, could see that the mussels were full grown; the same is shown by the hinge. In the second place, their young are also figured on the same plate. In the third place, large numbers of specimens at all stages of growth had been collected and examined for four years before the descriptions were published. Be it added that those two species are as distinct and valid as any in the animal kingdom, now known to be widely distributed, recent and fossil. If a man wants just to condemn, to show his own superiority, he does not want to know facts and shuts his eyes to the plainest evidence.

This, of course, is not a personal matter but one of principle. If, after careful revision and comparison, a species is believed not to be distinct and valid, it is fair to say so and state the reason. But "wholesale" condemning without even an attempt at considering evidence, means undue discrediting of the whole work done on a subject. It is hardly necessary to add that the small and minute forms of *Pisidium* are of as much interest, at least, as the larger ones, with respect to morphology, systematics and distribution.

[1] A Descriptive Illustrated Catalogue of the Mollusca of Indiana, written in 1898, in Indiana, Department of Geology and Natural Resources, Twenty-fourth Annual Report, 1900, p. 437 (also 358).

OBSERVATIONS ON THE GENUS MARGARITANA WITH A NEW SUB-GENUS.

BY L. S. FRIERSON

The type species of this genus, *M. margaritifera*, does not live in waters having any considerable amount of lime in solution, which fact has not perhaps been given its due weight in the explanation of the great gaps in the territory occupied by it, such as almost the whole of the central portion of Northern America.

This unoccupied territory is usually explained upon the theory of the glacial age, but it is hard to understand why the ice-covered regions were not repopulated *pari passu* with the melting of the ice sheets. There are two closely akin species living in America, separated by the space between Pennsylvania and Alabama, and Utah and Louisiana, these being the *margaritifera* and *hembeli.*

The latter species is generally supposed to live in the waters adjacent to New Orleans, since Conrad's original *envois* came from that city, but the collector, Dr. Hale, lived also in Alexandria, near which place the great alluvial deposits of the Red and Mississippi rivers join the sandy, pine clad hills of Louisiana, and from one of the "clear water" creeks flowing out of these hills, the writer has obtained numbers of Conrad's shell, and it is almost certain that this creek is the type locality.

From a similar environment Mr. B. H. Wright obtained the same species in Alabama, i. e., from the lime free creeks of the pine hill section. The Alabama shells are heavily sculptured, but these from Louisiana are often quite smooth, and the resemblance to the type is striking.

Three species occur in Europe, (to which dozens of names have been affixed). These are the *margaritifera*, whose lateral teeth are almost obsolete; the *crassa*, whose laterals are quite well developed, and the *auricularia*, of Spengler, recently rediscovered by Dr. Haas in Spain. The latter appears to be the analogue of *M. hembeli* in being sculptured, and like the latter, grows in the southern portion of the range.

In the Chinese territory three or four species exist, of which however but two are listed as such in the current literature.

The type species has as usual received several names, but preserves its identity remarkably well.

The *Margaritana laosensis* Lea in having well-developed laterals, may be said to be the analogue of the *crassa*.

In this genus also belongs one, certainly, and possibly three or four species which have been placed in other genera, as will be shown.

MARGARITANA MURINA (Heude), 1877.

Unio murinus Heude.

Ptychobranchus murinum Simpson, 1900.

Unio compressus Simpson (*non* Heude), 1900.

That Heude's *Unio murinus* is a member of *Margaritana* is shown in its close agreement in shape, in its color, both of epidermis and nacre; in its obsolete and short lateral teeth, and perhaps most strikingly, in the characteristic elongate-elliptical posterior adductor scars. *Ptychobranchus pfisteri* has differently colored epidermis and nacre; its laterals are well developed, and, as Heude observed (subsequently) its lateral teeth and ligament are of equal length, and the posterior adductor is short and nearly round. Heude states that the beaks of *murinus* are widely and profoundly undulated, whence the species is made the type of the subgenus *Heudeana*.

MARGARITANA SIMPULARIS (Heude), 1884.

Unio simpularis Heude.

Unio modestus Heude, 1877.

Parreysia simpularis Simpson, 1900.

Parreysia modesta Simpson, 1914.

The dimensions of this species given by Heude would indicate quite an inflated shell, whence Simpson placed it tentatively in *Parreysia*, but no errors are at once so common, so difficult of detection, and impossible of correction as those of concrete numbers, while on the other hand the character given by Heude, "*compressed*", allows no compromise. Heude compared his species several times later on, and he states that it resembles the *murinus*, *ect*, and chiefly among other characters, in its obsolete laterals. The species appears to be closely allied to *murinus*, and is probably a variety of it. Heude changed his first name, since that was preoccupied, and this was followed by Simpson in his Synopsis of 1900, but in his Catalogue of 1914 he uses the name *modesta*, on the ground that the *modestus* Fér. not having been described by Férussac, was a *nomen nudum*. Simpson forgot the *Unio modestus* Küster, 1856.

The *decumbens* Lea, is usually listed as a member of *Margaritana*, but Lea's type, which is the single example known, has been carefully inspected by the writer, and it is absolutely nothing more than a pathological specimen of one of the *Unio complanatus* aggregation, and the name should be dropped from lists of valid Naiades.

Specimens before me bearing the name of *Ptychobranchus laevis* Haas, from Saghalien, are unquestionably *Margaritana*, but since they were obtained from a dealer, and I have seen no figure of Haas' species, I hesitate to approximate them, yet they agree with his description very well.

VARIATION IN MOLLUSCA OF THE MADEIRA ISLANDS.

BY T. D. A. COCKERELL.

Boog Watson, in 1892 (Journ. Conch., Vol. VII, no. 1), remarked that the many endemic land snails of the Madeiras were all distinct. "Between themselves there is no swaying of the lines to and fro, they do not bifurcate, they do not pass over from one form into another, they give off no spots maturing into distinct species." In the presence of a large series of these shells it is difficult to see how Watson could have formed such an opinion, as there are in fact numerous "critical" forms. There is also a considerable amount of "individual" or local variation, some examples of which are recorded below. One fact is curious, that no one seems ever to have found a sinistral mutation.

I use the name *Ochthephila* Beck, as it turns out that the genus of Diptera supposed to preoccupy it was called *Ochtiphila.*

Ochthephila (*Tectula*) *bulverii* (Wood) mut. *albescens* nov. Shell greenish-white. Slopes of Pico do Facho, Porto Santo. (A. C. de Naronha.)

Ochthephila (*Discula*) *attrita* (Lowe) mut. *nigra* nov. Shell reddish-black, very dark, with the umbilical region broadly, and the region of the aperture to about 3.5 mm. back of the lip, creamy white; spire obscurely flecked with creamy. South slope of Pico d'Anna Ferreira, Jan. 21, forming a small local colony, but the normal form also present (Cockerell).

Ochthephila (*Discula*) *attrita* race *contracta* nov. Shell small, max. diam. 8.5 to nearly 9 mm.; lip usually very thick, aperture contracted, a heavy callus usually present on parietal wall. I. Baixo, Jan. 22 (Cockerell), and practically the same thing in the vicinity of the Pico do Castello on the main island. All the shells are dead and white, and apparently the race is extinct. It appears to be an ultra-xerophytic form. The character of the base readily distinguishes it from *papilio* Lowe, common on Baixo.

Ochthephila (*Callina*) *rotula* (Lowe) mut. *grisea* nov. Shell pale gray, flecked with creamy white; the albino form. Porto Santo, main island, 1921 (Cockerell). Two shells were found.

Euparypha pisana mut. *rosea* Costa, 1879. Shell pale pink, without evident markings. Locally common in one place north of Villa Baleira, Porto Santo, Jan., 1921 (Cockerell).

Euparypha pisana mut. *coalita* Taylor. Shell black, with slender light bands, my specimen somewhat more melanic than Taylor's figure. This was found in the same vicinity as *rosea*, together with other varieties, and it is evident that the peculiarities of color cannot be ascribed to climatic conditions.

Euparypha pisana mut. *taylori* n. n. (*H. pisana* s. v. *donatii* Taylor, Monog. L. & F. W. Moll. Brit. Is., 1912, pl. xxxi, f. 20). I have exactly this form, which Taylor figures from Portugal, from the south side of the Pico d'Anna Ferreira, Porto Santo, Jan. 11, 1921 (Cockerell). Taylor also figures it as var. *carpiensis*, but it is quite different from true *donatii* or *carpiensis*. Gwyn Jeffreys (Brit. Conchology) reported *H. virgata* from

Madeira, where it certainly does not occur. The present variety may have been taken for it.

Lemniscia calva (Lowe) race *veterna* nov. Shell 11 mm. max. diam., sometimes as small as 9.5 mm. Pleistocene fossil in the beds east of Caniçal, Madeira, common. It is not certain that *calva* belongs to *Lemniscia*. Paiva's *galeata* is congeneric with *calva*. In the Norman collection at the British Museum, specimens of *calva* are labeled *galeata*.

NOTES ON THE NAIAD FAUNA OF THE UPPER MISSISSIPPI RIVER.*

II. The Naiades of the Upper Mississippi Drainage.†

BY N. M. GRIER AND J. F. MUELLER.

While it was the original intention to limit this list to those species actually found in the Mississippi river above its junction with the Ohio, the fullest consideration of the topic has led us to include all species authentically reported from the entire Upper Mississippi Drainage. The larger number of the listed species were collected while the writers were engaged in Mussel Survey and Appraisal work for U. S. Bureau of Fisheries in part of that region during the summer of 1920. The remaining species in the list have been obtained by the rechecking of the available literature dealing with or bearing upon the Naiades of this region as indicated in the accompanying bibliography. Species having an apparently doubtful or accidental record have been omitted. The nomenclature used is that recently formulated by Ortmann and Walker (12), but for convenience there is also added the equivalents of the different species in the synonomy of Simpson. (14)

*Published with permission of the Commissioner of Fisheries, Washington, D. C.

†Contribution from U. S. Biological Station, Fairport, Iowa, and Biological Laboratory Washington and Jefferson College.

Family MARGARITANIDAE Ortmann.

1. *Margaritana monodonta* Say.

Simpson—Illinois and E. Iowa. Similarly reported by Baker (1), and Call (3), from the same regions. We did not find it above this region.

Family UNIONIDAE (D'Orbigny), Ortmann.

Sub-Family UNIONIDAE (Swainson), Ortmann.

2. *Quadrula pustulosa* (Lea).

Simpson—entire Mississippi drainage. Common. Wilson and Danglade (18), St. Croix drainage.

3. *Quadrula pustulosa prasina* (Conrad)=(var. *schoolcraftensis* Lea)

Geiser (5), and Call (3), report this shell from Iowa. We did not encounter it north of there. Reported by Lapham (9), from Fox River.

4. *Quadrula nodulata* (Raf.)=*Quadrula pustulata* (Lea).

Simpson—Mississippi R. and tributaries from E. Iowa south to Louisiana. We did not collect this species. It is found abundantly at Fairport, Iowa in the main river.

5. *Quadrula quadrula* (Raf.)=*Quadrula lachrymosa* (Lea).

Simpson—entire Mississippi drainage. St. Croix drainage. Casually distributed.

6. *Quadrula fragosa* (Con.).

Specimens are known from Iowa City, Iowa, Cedar River, Ia., and from the Spoon, Kaskaskia, Illinois and Mississippi Rivers, Illinois. Closely related to the preceding species. *Vide* Strode (15).

7. *Quadrula verrucosa* (Raf.)=*Tritogonia tuberculata* (Barnes).

Simpson. Mississippi drainage area generally. Red Wing, Minn. Reported from S. Minnesota by Lapham (9), and Call (3). Not common.

8. *Tritogonia nobilis* (Conr.).

Simpson reports this shell from the Red River of the North to Mississippi. We did not collect this shell, although the Bureau of Fisheries has it recorded from L. Pepin.

9. *Quadrula metanevra* (Raf.).

Simpson—Mississippi drainage area except its southern portion. Southern Minnesota (7). Red Wing. Abundant locally.

10. *Quadrula metanevra* var. *wardii* (Lea).

Reported by Simpson from Iowa.

11. *Megalonaias gigantes* (Bar.)=*Quadrula heros* (Say).

Simpson—Mississippi drainage area generally. Rare in L. Pepin and more plentiful above than below it.

12. *Amblema costata* (Raf.)=*Quadrula undulata* (Barnes).

Simpson—Mississippi drainage area generally. Wilson and Danglade (18), St. Croix drainage. Common. Believed by H. W. Clark to be another tributary stream species.

13. *Amblema peruviana* (Lam.)=*Q. plicata* (Say).

Simpson, Upper Mississippi south to Arkansas, etc. Wilson and Danglade (18), St. Croix drainage.

14. *Fusconaja ebenus* (Lea)=*Quadrula ebenus* (Lea).

Simpson, Mississippi drainage area generally, except western portion. Apparently does not go into N. and C. Minnesota. We collected it at Red Wing, Minn. No longer common.

15. *Fusconaja flava* (Raf.)=*Q. rubiginosa* (Lea).

Simpson—entire Mississippi drainage. Wilson add Danglade (18), Red River of the North. A tributary stream species.

16. *Fusconaja undata* (Barnes).

Simpson—entire Upper Mississippi drainage. Var. *trigona* (Lea), seemed especially abundant in L. Pepin. Reported from N. and C. Minnesota. Common.

17. *Cyclonaias tuberculata* (Raf.)=*Q. tuberculata* Raf.

Simpson—Mississippi drainage area generally. This species was formerly more abundant in certain areas of the Upper Mississippi, but is now clammed out. According to Clark this is another headwater, tributary stream species.

18. *Cyclonaias granifera* (Lea)=*Q. granifera* (Lea).

Simpson—northwest to Iowa. Baker (1), found it at McGregor, Iowa. Clark reports this species from L. Pepin to Fairport.

19. *Plethobasus cyphyus* (Raf.)=*Pleurobema aesopus* (Green).

Reported by Grant (6) and Holzinger (7) from Minnesota. We encountered our first specimen of it at the foot of L. Pepin. Comparatively rare and more abundant at present in the sloughs.

20. *Pleurobema cordatum* (Raf.)=*Q. obliqua* (Lea).

Reported by Baker (1) from Iowa. Specific localities are desirable. Probably more southern in distribution. Ortmann considers this species as not specifically different from *Pleurobema coccineum* (Con.).

21. *Pleurobema catillus* (Conr.)=*Q. solida* (Lea).

Simpson, Mississippi R. north to Minnesota. Collected above Red Wing. According to Wilson and Danglade (18) no "Quadrulae" are found in the Mississippi River proper above the falls of St. Anthony, a fact which has a bearing upon the distribution of all mussels of the *Quadrula* type in these regions.

22. *Pleurobema coccineum* (Con.)=*Q. coccineum* (Con.).

Simpson—entire Upper Mississippi drainage. Wilson and Clark, drainage of Red River of the North. We did not encounter it. It is apparently a small tributary species.

(*To be continued.*)

RAMBLES OF A MIDSHIPMAN II.

BY P. S. REMINGTON, JR.

After leaving Guantanamo, Cuba, the squadron headed south for the Panama Canal. We passed within sight of Jamaica but did not stop, much as I should have liked to collect there. For several days we drove steadily on, manoeuvring as we went. It was a most maddening sight to me after we had made a good day's run, to see the Admiral mount the bridge and commence sending up signals for manouvres which would turn us about and start us back toward Cuba. However, schedules are inflexible things in the Navy, and we must not arrive ahead of time.

At length we awoke one morning to see the white-topped mountains of Panama coming in view over the horizon, and already we could see the indigo-blue so characteristic of the Caribbean, beginning to turn gray as we got in closer to shore. In a few more hours we were dropping anchor just inside the breakwater at Colon, and viewed the low buildings and palm-fringed shore with much interest. Alas, before we could go through the Canal we must coal ship, a job which everyone, from skipper down, cordially hates. Everyone turned out in his dirtiest clothes, officers and all, and shoveled down the shutes the never-ending piles of coal that the big cranes dropped on board. It is remarkable how much coal can be stored in a battleship. By noon next day we were through cleaning ship, and the first liberty party went up the Canal to Gatun to examine the locks and the dam. We were also taken to Coco Sola Point and shown the Atlantic defenses of the Canal. Those huge disappearing guns seemed mighty formidable to us.

When word came that we were going through the Big Ditch, all was excitement. I have been through the Canal five times since, but it still holds as much wonder and interest for me as it did the first time, and I should like to go through again. The Gatun locks, which raised us from sea level eighty-two feet to the level of Gatun Lake, are a marvel of engineering skill. It seemed strange to see a whole squadron of battleships steaming through a lake far inland, with forests and hills on either hand and pelicans flying around our boys. There is room for several more squadrons of battleships to anchor also in this great lake, made by the damming of the Chagres River. Culebra Cut, with its sheer walls towering above our fighting tops, held our interest no less than the lake had. By late afternoon we had completed our voyage from the Atlantic to the Pacific, and passed out into the latter to dock at Balboa.

On my first visit to the Canal Zone in 1919 I did not know, unfortunately, that that very efficient collector, Mr. James Zetek, was a resident of the Zone. Consequently my attempts at collecting were not well rewarded. I was also handicapped by the lack of time. We were all taken on an official party to Flamenco Island to see the Pacific defenses, and while there I strayed off to examine the breakwater for shells. What was my delight to find the rocks covered with fine large specimens of *Chlorostoma pellis-serpentis!* Further search revealed some very fine *Planaxis planicostata* and many large-sized *Nerita ornata.* The rocks were paved with large *Chiton stokesii.* The number of specimens I was able to carry was limited to what I could stuff in my pockets, as I had brought no receptacle of any kind and we were in an official party. I managed to bring away a very fair representation, however. That matter proved far less difficult than the business of cleaning them. I finally gave it up, wrapped the shells in paper, and sealed them in tin boxes.

This was all the collecting I was able to get in on my first trip, as we steamed back through the canal the next day, bound for Cuba again.

On my second visit to the Canal Zone the following year, I had the forethought to write to my old correspondent, Mr. E. P. Chace, of Los Angeles, asking if he knew of any collectors in the Canal Zone. At his suggestion I wrote to Mr. James Zetek, who kindly assured me of a warm welcome on my arrival. As we were to spend several days at Balboa, I felt certain of seeing more of the conchological treasures of Panama than I had on my first trip.

My expectations were fully realized. Once more we steamed through Gatun Lake and between the narrow sides of Culebra Cut, and docked again at the now familiar Balboa. As soon as I got shore leave, I called up Mr. Zetek and was told to come right up to his laboratory at the Public Health Department of the Ancon Hospital. I shall always remember the kindness with which he welcomed me and placed the facilities of his laboratory at my disposal. He set aside his work for the day and took me on a collecting trip to Bella Vista, where he has made so many rare finds. Not the least enjoyable part of the trip was our visit to a mangrove swamp, where we found thousands of *Cerithidea montagnei* and *C. pulchra*, together with *Littorina varia* and a fine specimen of *Linatella wiegmanni.* Deep in the mud, we could hear the *Arcas* snap their valves. Soon we came out on the beach where a wealth of species rewarded our search. Here we found three species of *Thais*, four *Anachis*, several *Cerithium*, *Turritella*, *Nerita*, *Litorina*, *Natica*, *Arcularia* *Solen*, *Paphia*, *Anomalocardia*, and many others. We filled our bags till we were weary, and the sun began to get low. Realizing that we had several hours work ahead of us to clean our catch, we hastened back to the laboratory after supper and worked till late.

A rather humorous incident, which always brings a smile when I recall it, took place on my return to the ship. It seems that the Officer of the Deck had orders to open all packages brought aboard to ascertain that no liquor was being smuggled aboard (Panama is as wet as the ocean). Consequently when I came over the gangway with my big box of shells, I was stopped and asked what the package contained. Visions of having my box opened to the vulgar gaze of the laity arose before me, and I desperately sought for means to ward off such a disaster. Finally, I summed up my courage and answered: "Sir, on my honor as a Midshipman, I have no liquor in my possession." The officer smiled and passed me on!

The next day I had the pleasure of taking dinner with Mr. Zetek and his family and enjoyed a meal cooked Panama style. Afterward I spent an enjoyable afternoon inspecting part of Mr. Zetek's collection, and was presented with a large number of his duplicates, making together with what I had collected, a very fair representation of Panamanian fauna. Mr. Zetek's remarks on the history and customs of Panama were highly interesting.

It would be a waste of time to give a list of the species collected at Panama, as Mr. Zetek's list is more complete on that point than mine would be. I refer my readers to that for more complete information.

All too soon we weighed anchor for Honolulu, a sixteen days' run, and rapidly left the jungle-clad hills of Panama behind. I was comforted, however, in my regret at leaving so congenial a country, by the knowledge that we were due to coal again at Balboa on our way back to the States, and that I would have at least one more try at the wonderful shell fauna of Panama. For the present, it was westward ho, and we all settled down to our long voyage toward the alluring isles of hula maidens and *Achatinellas!*

AN INDICATION OF THE VALUE OF ARTIFICIAL PROPAGATION OF PEARLY MUSSELS

BY R. L. BARNEY

Director U. S. Fisheries Biological Station, Fairport, Iowa

In 1913 there was practicalized through the investigations of Drs. George Lefevre and Winterton C. Curtis of the University of Missouri, an artificial method of propagation of fresh-water mussels. The method, based on the peculiar natural history of the mussels—especially on the parasitism of fishes by the embryo mollusks—is artificial only in that it requires the handling of the proper host fishes and the embryo mussels. The artificial propagative method is, indeed, merely assistance lent the natural reproductive processes, but by such assistance the plan results in a thousand fold increase over unaided reproduction. Complying with the requirements set by the natural propagative process of the mussel, the artificial method is simply the collection of a large number of fishes of appropriate species, their temporary confinement in a large receptacle of water, and the introduction into the water of a million or two glochidia (embryo mussels) of the mussel to be propagated. These glochidia are taken directly from the marsupia of a "ripe" gravid female shell. Within perhaps five or ten minutes the fishes so confined are quite heavily parasitized by the glochidia and, with an infection of possible 3,000 or more glochidia,—the amount of parasitism depending on the size of the fish, the temperature of the water, and other factors,—they are liberated into the water of their natural habitat where in due season the fully-matured embryos free themselves of their hosts and, dropping to the bottom, take up life as independent organisms.

This method of propagation has been carried on yearly since 1913 with a view toward repopulating the depleted mussel beds of several streams of the Mississippi drainage and, therewith, to furnish a continual supply of raw material for button manufacture.

During the past fall data have come to hand which suggest, within certain limits, the value of this method of mussel propagation.

In 1913 propagating crews operating on the White River, Arkansas, under the direction of the U. S. Fisheries Biological Laboratory, Fairport, Iowa, liberated in that stream 4,500,000 embryo yellow sand-shells (*Lampsilis anodontoides*) on this species' hosts, the long- and short-nosed gars (*Lepisosteus osseus* and *platostomus*). The following two years there were liberated respectively 743,000 and 309,000 embryos of this mussel in the parasitic condition. After 1917 the propagation of the yellow sand-shell was discontinued because of inability to obtain gravid females of this species at the times when the crews operated on this river. When this work was done, the primary purpose of the propagation was to increase the muckets (*Lampsilis ligamentina*) of the river. This mussel may be propagated during seasons when it is impossible to obtain gravid sand-shells.

Through the kindness of Mr. F. C. Vetter, President of the Hawkeye Pearl Button Company, Muscatine, Iowa, there has been obtained shell-test records of 61 carload shipments of commercial shells from Augusta, Arkansas, on the White River in the vicinity of which town the sand-shell has been propagated. These tests covered shipments received by the company during the period from 1915 to 1821 inclusive. The test records of this company were taken on its own initiative and for its own purposes. Each record represents a single sample or two samples of 100 pounds each of the button shells as they arrived at the cutting plant in Muscatine. The samples were made by a shell-sorter and were taken as an index of the average assortment of shells of the different commercial species in the carloads and on the river bottom from which they came. A record has been kept of the percentage of yellow sand-shells, niggerhead shells (*Quadrula ebenus*), pimplebacks (*Q. pustulosa* and *pustulata*), washboards (*Q. heros* and *plicata*), and of miscellaneous shells, pigtoes (*Q. undata*), mapleleafs (*Q. lachrymosa*), etc.

TABLE I

ARTIFICIAL PROPAGATION OF THE YELLOW SAND-SHELL IN THE WHITE RIVER, ARKANSAS, AND ITS FREQUENCY IN COMMERCIAL SHELL SHIPMENTS FROM AUGUSTA

Year	Artificial propagation with sand-shell glochidia	Carloads	Per cent of yellow sand-shells in commercial shipments	Per cent of niggerhead sand-shells in commercial shipments
1913	4,500,000			
1914	743,000			
1915	309,000	3	[1] 0	[1] 76
1916	34,000	10	[2] 6.1	[2] 59
1917	11,000	4	7.2	56
1918	. . . .	8	9.2	45
1919	. . . .	10	11.6	49
1920	. . . .	10	7.2	55
1921	. . . .	16	6.7	47
Average. . .	. . . .	. . . . .	[3] 7.3	[3] 51.3

Table I shows the extent of propagation of the yellow sand-shell during the period of years considered and the percentage of shells of this species and of niggerheads in carload shipments from Augusta, Arkansas, to the Hawkeye Pearl Button Company, Muscatine, Iowa. These two mussels are the only two species considered inasmuch as the others are of minor importance because of their comparatively much lower frequency and because of their smaller commercial value. Test records were begun by the button manufacturing company in 1915. Records of percentages of shells in shipments previous to this time are not available. Figures representing percentages of yellow sand-shells and niggerhead mussels are the averages of the test records taken during the given years. The 1915 record for

[1] Special shipment of three carloads containing no yellow sand-shells; these were sorted out for foreign shipment.

[2] Figures based on eight carloads; two of the ten carloads of this year were special carloads containing no yellow sand-shells.

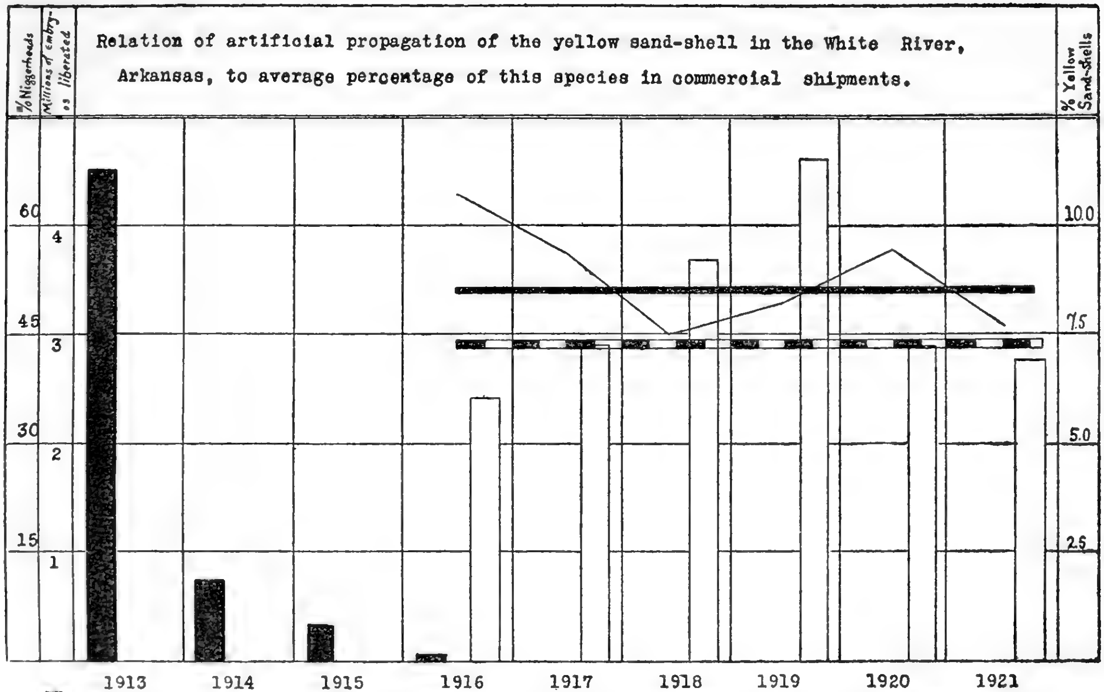
[3] Omitting 1915 and 1916 special shipments.

niggerhead shells covers three shipments of that year of certain special carloads of shells sorted by the clammers to give a higher count of niggerhead shells and thus a better money return. The sand-shells were kept separate for sale to foreign shippers and, therefore, none were included in the shipments. The 1916 record also contained two similar carloads, but these have not been included in the computations.

From table 1 there is noted from 1917 through 1919 a marked increase of yellow sand-shells in carloads shipped from Augusta. This increase is, at its maximum, 4.4 per cent over the percentage of 1916 and 4.3 per cent over the average record of yellow sand-shells in 56 carloads. The increase in sand-shells cannot be due to special fishing and therefore to proportionately lowered frequency of the niggerhead mussel (the original and still the best pearl-button shell) inasmuch as the record for this species shows an increase in frequency of this shell during 1918 and 1919 during the years of marked increase in frequency of the yellow sand-shell. This increase in sand-shells occurred when the niggerhead frequency had been about its average frequency, 51.3 per cent.

The return of the frequency of yellow sand-shells in 1920 and 1921 to about normal percentage, 7.2 and 6.7 per cent respectively (the average being 7.0 per cent), would reasonably be expected in view of the marked decrease in artificial progagation after 1914. If the increase in percentage of yellow sand-shells found in 1918 and 1919 were due to artificial propagation, it would be fairly expected that when artificial propagation was discontinued, there would be, a proper number of years hence, a resultant falling-off in frequency of the mussel in question.

The marked yellow sand-shell increase of 1918 and 1919 is significant coming as it does from four to six years after the artificial propagation of this species in the vicinity from which the shipments here discussed were made. At the average growth-rate of the sand-shell, it requires from four to six years for a mussel of this species to attain salable size. This rate of growth would make an embryo of 1913 a mussel of commercial size in from 1917 to 1919.



Relation of artificial propagation of the yellow sand-shell in the White River, Arkansas, to average percentage of this species in commercial shipments.

Artificial propagation of Yellow Sand-shell. Average percentage of Yellow Sand-shells in commercial shipments. Average frequency of Yellow Sand-shells in carload shipments, 1916-1921 inclusive. ——Average percent. of niggerhead shells in commercial shipments. Average frequency of niggerhead shells in carload shipments, 1916-1921 inclusive.

While no data are at hand indicative of the comparative ages of the shells of the several years' shipments, it is learned from a number of shell buyers on the White River in the vicinity of Augusta and from others acquainted with the shipments here discussed that those of 1918, 1919 and 1920 contained a noticeable increase of shells of relatively young age, the epidermis of which is smooth and unscarred, in contradistinction to the old shells whose umbones are worn and eroded by the long action of the current, soil acids, and moving sand and gravel on the river bottom. On the test-record card of one of the carload shipments of 1920 was written, "Lots of good sand-shells."

It was conversation concerning the quality and age of the shells being obtained from the White River that led to the comparison of the records of artificial infection with the test records of the shipments.

The evident correlation existing, then, between time of artificial propagation, rate of growth and age of attainment of salable size, and noted increase in percentage of the species in question in commercial carload shipments, while not giving conclusive proof of the value of artificial propagation, does suggest the possible significance of this method of restocking the mussel beds of the streams of the Mississippi drainage.

TWO NEW BIVALVES FROM ARGENTINA

BY W. H. DALL

In a recent sending from Doctor Felippone of Montevideo, the following shells appear not to have been described. Both come from Mar de la Plata, Argentina.

PECTEN (CHLAMYS) FELIPPONEI n. sp.

Shell rounded, the adult slightly oblique, rather compressed, polished, scarlet or rosaceus, usually with zigzag irregular streaks of white on the left valve; the ears paler; hinge line straight, the ears rather large, subequal, in the left valve with only incremental sculpture, in the right valve the anterior ear has four or five radial ridges more or less imbricated, and a ctenolium with five short teeth; sculpture of the left valve comprising five obscure flattened radial ribs with the interspaces obscurely radiately striate; there is no microscopic reticulation; on the right valve the ribbing is obsolete; length of shell 38; of hinge-line 28; height 40; diameter 8 mm.

The shell bears some resemblance to Kobelt's figure of *P. danicus* in the Conchylien Cabinet, but is on the whole a remarkably distinct species. The material studied comprises a well-known left valve (U. S. Nat. Mus. Cat. No. 333374) and in Dr. Felippone's collection another (1706) somewhat smaller, and a complete young pair (1709).

MACOMA (PSAMMACOMA) PLATENSIS n. sp.

Shell bluish white, slightly inequivalve, nearly equilateral, the posterior end strongly twisted to the right; periostracum thin, pale, mostly dehiscent; beaks inconspicuous; left valve somewhat more inflated than the right; the anterior end evenly broadly rounded, the posterior end attenuated, gaping, and with a small truncation; the surface except for incremental lines, stronger on the posterior slope, is smooth but not polished; hinge with small almost obsolete cardinals in each valve; pallial sinus deep, rounded, its lower part coincident with the pallial line for about half its length; length of shell 25; of the part anterior to the vertical of the beaks 13; height 11; diameter 7 mm. U. S. Nat. Mus. Cat. No. 333375.

The shell has much the outline of *Macoma derelicta* Bertin, but is more delicate and with no color markings.

REVIEW OF MARINE MOLLUSCA FOUND ABOUT NEW YORK CITY.

BY ARTHUR JACOT.

Having finished collecting in the vicinity of New York City, I find there are several species to add to the lists published in the "NAUTILUS" during 1919 and 1920. Several of these additional species were found in the channel behind or to the north of Long Beach (west end) and more careful search should bring to light still more.

Arca ponderosa Say. Rarely a somewhat worn valve may be picked up on Far Rockaway or Long Beach.

Lyonsia hyalina (Conrad). This was also found at Seaside Beach, S. I. It does not seem to frequent the hard ocean beaches and should be procurable on the north shore of Long Island on clean sand beaches.

Venericardia borealis (Conrad). Also at Long Beach.

Cardium mortoni Conrad. Two valves at Long Beach.

Petricola dactylus Sowerby. One set of valves between South and Midland Beaches. Because of its rarity the habitat relation to *P. pholadiformis* was not determined. From this latter it differs by being much deeper for its length, heavier and stouter, lacking the raised, free scales and having a greater number of transverse riblets.

Tellina tenella (Verrill). One valve at Long Beach also.

Tellina versicolor De Kay. Occasional at Long Beach also.

Macoma balthica (Linné). One valve at Long Beach in north channel. This species prefers to live in mud.

Macoma tenta (Say). One valve at South Beach, S. I.

Donax fossor Say. Mostly at Far Rockaway. Fairly common at one spot.

Donax variabilis Say. Found with the preceding and in equal abundance. This seems to be near the northern limit of this species and the valves are quite small and lack the brilliant colors of specimens from the south. The average length of shells from this region is 14 mm., the average length of shells from North Carolina is 17 mm., and for Florida still longer. The differences do not warrant a subspecific designation as intermediate material can be procured at intermediate localities, the locality record being sufficiently designatory. *D. fossor* shows less local difference than does *D. variabilis.*

Mesodesma arctatum (Conrad). Rare at Far Rockaway and Long Beach.

Corbula contracta Say. Found also at Long Beach.

Pyramidella fusca (C. B. Adams). Also found at Long Beach.

Epitonium humphreysii (Kiener). One specimen in channel north of Long Beach.

Polinices immaculata (Totten). Two fossil-looking specimens thrown up by dredge in Long Beach channel.

Alectrion fretensis (Perkins). I have never collected this species but have seen specimens collected on the north shore of Long Island. It is related to *A. vibex* but is strikingly different being much narrower and less finely sculptured.

Haminea solitaria (Say). Long Branch channel, one specimen.

The total number of forms found is 98 or 99, so that one may say that about a hundred species should be procurable within the limits of Greater New York. The most favorable localities were found to be the sand flats between South and Midland Beaches, S. I., the Prince's Bay Section, S. I., Far Rockaway and Long Beaches, including the channels to the north of those bars. These localities represent five distinct habitats: protected sandy beach, sod bank and marsh, quiet mud flats, ocean sandy beach and channel, respectively. Two habitats have been omitted: rocky (protected or oceanic) and eel-grass bed. For instance *Acmaea* should be found on the north shore of Long Id. from Sea Cliff eastward as well as *Chaetopleura apiculata.*

In collecting two factors should be borne in mind, namely, that species are very partial to certain factors in their environment so that one must collect from as many different kinds of surroundings as possible, and second, that the further one goes from the cities or centers of human habitation the more complete and natural will be each habitat.

NOTES ON SNAILS DESTROYING CREEPERS AND THEIR EGGS.

BY J. HOOPER BOWLES, TACOMA, WASH.

In the vicinity of Tacoma, Pierce County, Washington, the large land snail[1] is to be found in abundance. So far as I have seen they are strictly confined to the mixed fir and oak woods of our prairie districts, which are practically free from under-

[1] The snails referred to are *Epiphragmophora fidelis* Gray, shells of which were received from Mr. Ralph W. Jackson.—EDITORS.

growth of all kinds. These woods are carpeted with a rather long and handsome green moss, making delightful walking for both snails and human beings alike. The snails live most of the time on the oaks, and I have never seen them on any other kind of tree, although there are several other varieties of deciduous trees, besides the innumerable firs.

The California Creeper (*Certhia familiaris occidentalis*) sometimes unfortunately, often selects the loose rolls of bark on these oaks under which to place their nests. The big snails, during their wanderings over the trunks of the trees, very naturally wander at times into a Creeper nest, but as to this being by accident or design it is impossible to say. At all events the results are the same, as the big shell is sure to break one or more of the eggs, the contents of which it eats. Most often several of the five or six eggs that usually make up a set are left uninjured, but, of course, the parent bird in nearly all cases deserts. At times, however, there are more serious results, in case the bird is incubating. These birds are what oologists term "very close sitters" and often have to be removed by force. On such occasions the bird is apt to hug her treasures until it is too late for her to make her escape, and several times I have found the parent dead in the nest with her broken eggs, the abundance of slime on her feathers giving indisputable circumstantial evidence of how she met her violent end. I know of no other species of bird that is molested by these snails, but to an ardent student of birds' eggs the creepers are more than enough.

PUBLICATIONS RECEIVED.

Pupillidæ. By Henry A. Pilsbry. Manual of Conchology, Vols. XXIV–XXVI, 1916–1921. As Dr. Pilsbry states (1916), "The last general work on the group is over forty years old. Meantime the number of genera and species has greatly increased, and taxonomic ideas have changed so radically that the classification and nomenclature . . . bear little resemblance to those of former works." A provisional list of the subfamilies is given (XXIV, p. X), with a few of the leading genera as examples.

Gastrocoptinæ: Gastrocopta, Hypselostoma, Abida.
Pupillinæ: Pupilla, Pupoides.
Pagodininæ: Pagodina, Aspasita.
Acanthinulinæ: Acanthinula.
Vertigininæ: Vertigo, Nesopupa, Truncatellina.
Orculinæ: Orcula, Lauria.
Strobilopsinæ: Strobilops.

The first, second and fifth of these subfamilies are worked up in the three volumes completed. Considering the above statement it appears to be in place to give an account of the principal groups and genera.

Gastrocoptinæ, in Vols. XXIV and XXV, pp. 1–68, with 16 genera and 277 species, in four main divisions:

Gastrocopta group: *Chænaxis* P. & F. (Arizona), *Gibbulina* Beck (S. America), *Gastrocopta* Wollaston, *Bothriopupa* Pilsbry.

Hypselostoma-Boysidia group (Oriental): *Hypselostoma* Benson, *Anauchen* n. g., *Boysidia* Ancey, *Gyliauchen* Pilsbry, n. g.

Aulacospira-Systenostoma group (Oriental, Philippines).

Abida group (Palearctic, S. African): *Fauxulus* Schaufuss, *Odontocyclas* Schlueter, *Sandahlia* Westerlund, *Abida* Leach, *Granopupa* Bœttger; *Chondrina* Reichenbach.

The Gastrocoptinæ are probably the most interesting and most complex of the subfamilies. Naturally we turn our eyes first on *Gastrocopta*, formerly known as *Pupa*,* then as *Leucochilus*, and *Bifidaria*. "*Gastrocopta* approaches more nearly a world-wide distribution than any other genus of the *Pupillidæ*, if we include Europe, where species existed from Oligocene to Pliocene times. . . ." It is a notable fact that there are no recent Gastrocoptas in Europe, while quite a number of species of *Vertigo* and *Pupilla* are identical or closely related in Europe and North America. The many Nearctic species represent several markedly different groups, one of which has been separated as genus *Chænaxis*. It may be noted, by the way, that our *G. armifera* (Say) is the largest of the genus. The 106 (+ some additional) species are grouped geographically, "as this is more convenient than strictly systematic sequence"; and the same plan has been followed with some other genera.

* As most of the *Pupillidæ*; see Vol. XXIV, p. 267.

Related to Gastrocopta are some eastern Asiatic genera, such as *Boysidia* and *Hypselostoma*, with the spires much lower, and somewhat more remotely than those of the fourth group, especially differentiated and diversified, the principally European *Abida*, *Granopupa* and *Chondrina*, with 44, 17, and 43 species respectively. *Abida* was mostly known as *Torquilla*, and so were partly the others, *Chondrina* also as *Modicella*. The author says (p. 263): "It had been planned to have *Abida* and *Chondrina* monographed by a European conchologist, but this proved to be impracticable under existing conditions. . . . To really write a monograph of them, one should give them some years of investigation. . . . It can only be expected of me that the well-established species be properly defined, and a reliable compilation made from the published literature of others. . . ." And that has been done very well, so far as the reviewer is able to judge, having to some extent collected and studied those forms in Europe. The figures are excellent, as can best be appreciated by comparison with those copied (mostly photographically) from European authors.

It is also to be noted that of this whole Palearctic group no members are known from Nearctia, either recent or fossil.

The second subfamily, *Vertigininæ*, in Vols. XXV, p. 68 to XXVI, p. 106, contains about 255 species of 17 genera, 5 of which are known as fossil only, from the European Tertiaries. All are small and minute, and the group is somewhat difficult to define, conchologically. So far as known the animals have no inferior tentacles. Of the principal genus, *Vertigo*, 82 recent species are described, 33 of which are American, 44 Paleartic, 7 from Japan and eastern Asia, and quite a number are cited from the European Tertiary. A number of the European and American species are closely related, and at least *V. pygmæa* Drap. is identical in both faunas. The only other genera represented in America are *Pupisoma* Stoliczka, of the tropical regions of the old and new continents, and *Sterkia* with 7 species of southern California and Mexico.

Of *Nesopupa* Pilsbry there are 60, and *Pronesopupa* Iredale, 13 species from the Pacific Islands. Of special interest is *Lyropupa* Pilsbry, from the Hawaiian Islands, worked up in collaboration with C. Montague Cooke. The 22 accepted species, recent and fossil, have been studied very carefully with respect to their distribution and variation, and we figured on eight plates. *Truncatellina* Lowe, formerly known mostly as *Isthmia*, contains some of the smallest *Pupillidæ*. The 29 described species are distributed over the eastern continents and islands, but unknown from America.

The subfamily *Pupillinæ*, in the rest of Vol. XXVI, has 6 genera, two of which are known as fossil only. Of *Pupoides* Pfeiffer, the 27 species have a wide but discontinuous distribution; 8 of them are American, among them our common *marginatus* Say, and the much discussed *hordaceus* Gabb, from New Mexico and Arizona. *Pupilla* Leach is widely distributed, and the 34 recent species are arranged geographically. At least one, *muscorum* L. is common to both the Palearctic and Nearctic faunas, and is very variable with respect to size and apertural dentition.

The foregoing is a very inadequate sketch of the contents of the three volumes, with about 1050 pages and 107 plates, also a number of text figures. A total of 41 genera, and over 610 species, plus some additional not numbered, means a surprise even for those who have studied the family to some extent. The subject is of exceptional interest with regard to morphology, systematics and distribution, recent and geological. The author has done great work: the arrangement is lucid, the species are generally well defined, there is neither hair-splitting nor lumping; the figures are above praise and will be a great help and inspiration to the student. For years, Dr. Pilsbry has worked out ways of his own in presenting the complex structure of the apertural lamellæ and folds of the *Pupillidæ*.

Is there anything to criticize? By right, a critic ought to know more about the subject under consideration than the author does, in order to do the right thing. There may be differences of opinion on a few minor points, hardly worth mentioning, yet of some importance in using the books.

Vol. XXIV, p. 10 2nd line from bottom, "86–94" should read 86–93. Bottom line, "95–106" should read 94–104.

Page 365 "Pl. 23, figs. 1, 4" should be 1–4.

Page 370, "Pl. 44, figs. 4–8" should be 4, 8.

Vol. XXV, p. 82, 11th line: "parietals" should be *palatals*.

In numerous places in Vol. XXIV, *callus* is spelled "*callous*", probably by a printer's effort for uniformity. The noun and adjective are properly discriminated in the other volumes.

It might be said that there should be a key to the species of every genus and group. But anyone who knows a thing about e. g. *Pupilla* will know that this is practically impossible, on account of the great variation and frequent overlapping of forms. Keys are provided for a majority of the genera. It might also be said that there should be a general list of literature consulted; but the pertinent literature is cited in a condensed way under every head: group, genus, species and form, described.

In conclusion, it is hoped that especially the generic names used in the work will not have to be changed again for a good number of years to come.—V. Sterki.

On Dinocochlea ingens n. gen. et sp., a gigantic gastropod from the Wealden Beds near Hastings. Geological Magazine, LIX, p. 242, 1922. By B. B. Woodward. In a road cutting the presence of certain huge spiral bodies was noticed. On examination were found to be either dextral or sinistral, of many (about 23) slowly increasing whorls, somewhat like an extremely slender Melanian or Turritellid shell. The casts are broken, but indicate a length of about 7 ft. 3 inches, about six times the diameter of the body-whorl. The shell was proportionately very thin. The external moulds in the sandstone were not preserved, so that external characters are unknown. It is certainly remarkable that so huge a fossil escaped notice until now, and that even no probable ancestors or other relatives have been turned up.—H. A. P.

The San Francisco Bay Marine Piling Survey, 2nd Annual Report. Published by the S. F. Bay Marine Piling Committee, San Francisco, Jan., 1922. The present report is mainly occupied with a consideration of the several piling materials and methods of preserving piles and timber. The biological section, by Dr. Charles A. Kofoid and Robert C. Miller, deals with *Teredo* in the Bay in 1921, factors limiting distribution and specific status. The species is identified as *Teredo navalis.* The larvæ were observed to settle from July 20 to Nov. 15, but in 1919–20 the breeding season began several months earlier.

The Journal of Conchology, Vol. 16, No. 9, June, 1922. Notes on the Nomenclature of Hygromia, Helicella, etc. By Hugh Watson, pp. 277–285.

Acanthinula lamellata var. albida and A. harpa near Sweden. By Berthold Sundler, p. 285.

A peculiar form of Hygromia fusca from near Bristol. By D. Baechus, p, 286.

The significance of dominant Enadeniate Helices in Africa. By J. W. Taylor, pp. 288–290.

Two Molluscan Associations in North-east Staffs. By W. W. Alkins, pp. 291–297. (1. *Helix nemoralis* and *H. horsensis*, 2. *Balea perversa* and *Clausilia bidentata.*)

The South Devon race of Hygromia limbata. By H. C. Huggins, pp. 297–301.

On Alopia cyclostoma (Bielz), A. canescens (Charp.) and A. deaniana n. sp. By Rev. Dr. A. H. Cooke, pp. 302–306, pl. 9.

Some Upper Cretaceous Shells of the Rudistid group from Tamaulipas, Mexico. By L. W. Stephenson (Proc. U. S. Nat. Mus., Vol. 61, pp. 1–28, pls. 1–15, 1922). One new genus *Tampsia* and two new species, two new species of the genus Sanvagesia and one new species of the genus Durania are described and figured.

The European Pileworm, A Dangerous Marine Borer in Barnegat Bay, New Jersey. By T. C. Nelson (N. J. Agri. Exp. Sta., Circular 139, 1922). An interesting and pertinent paper on these destructive mollusks. There has been a constant loss from shipworms along the Atlantic coast for years, but apparently no unusual outbreak has occurred before. An investigation however is needed to enable us to realize present conditions. A smaller pamphlet on "Destruction of Piling in Waterfront Structures: Its Prevention," published by the Committee on Marine Piling Investigations of the National Research Council, is also a timely paper on the subject.—C. W. J.

A MONOGRAPH OF THE AMERICAN SHIPWORMS. By Paul Bartsch (U. S. Nat. Mus., Bull. 122, pp. 1–51, pls. 1–37, 1922).

To the conchologists who trusted explicitly the works of Gould and Verrill the paper gives something of a jolt, when they find that three new species have been based on their so-called *Teredo navalis*. We have no reason to doubt that the author is right, for the paper shows a very careful piece of work and just as wonderful things have occurred before. In all some 14 new species are described and figured. The halftone figures of the shells do not show the sculpture in most cases, but this is described in the text. The "ravages by Gould shipworm at Port Tampa," as shown on plates 14 and 15 suggest that possibly the "gribble" (*Limnoria*) might also have aided in the destructive work.—C. W. J.

THE MIOCENE OF NORTHERN COSTA RICA. By A. A. Olsson (Bull. Amer. Paleontology, Vol. 9, pt. 2, Pelecypoda, pp. 171–309, pls. 16–32, June, 1922). About 70 new species and varieties are described and figured, in addition to 75 other species which are redescribed and figured. The work is a valuable addition to our knowledge of the miocene fauna of that region.—C. W. J.

THE STORY OF MOLLUSKS AND OF THE SHELLS THEY LIVE IN. By Margaret G. Sherman (The Newark Museum Association, Newark, N. J., 1919). This is an original and very interesting little publication. The story when cut into paragraphs makes labels for 180 shells. A second edition, referred to as the "expanded pamphlet," have the paragraphs interlined in smaller type, with special description labels. For arranging a popular exhibit in museums and schools, this story would be very useful.—C. W. J.

Variation in Fresh-water Mussels. By Gordon H. Ball (Ecology, Vol. 3, pp. 93–121, 1922). This very exhaustive paper on this interesting subject is based on the large collection in the Carnegie Museum. The variations are shown by plotting and tables, certain variations depending on various ecological conditions. Shells of smaller streams are usually less obese than those of the larger, although there are other factors that determine the degree of obesity. The development of the tubercles as a rule, is also greatest in the larger streams.—C. W. J.

Variation in the Dog Whelk, Thais (Purpura auct.) lapillus. By Harold S. Colton (Ecology, Vol. 3, pp. 146–157, 1922). A study of the variation of the Dog Whelk, constitutes one of the most interesting features of collecting on the New England coast. Dr. Colton's work was confined to Mt. Desert Island, Me., and the immediate vicinity. Specimens from 106 stations seem to indicate that variation in size and shape of the shells is the result of the direct effect of environment, while variation in color and sculpture are due to hereditary factors. More light-colored shells are found on light than on dark environments. The imbricated form is generally associated with mud flats on the shores of Blue Hill Bay, while in exposed situations they are found only in fissures in the rocks. The almost complete absence of *imbricata* in Somes Sound is attributed to a change of sea level in recent times.—C. W. J.

The Auculosae of the Alabama River Drainage. By Calvin Goodrich (Univ, Mich. Mus. Zool., Misc. Pub. No. 7, pp. 1–57, pls. 1–3, 1922). This valuable paper is based on the collection made by the late Herbert H. Smith, between the years 1901 and 1918. After a year's examination of the collection the author feels toward Mr. Smith only the greatest respect for his industry in the field and the keenness of his observations. The Auculosae vary exceedingly, and the author refers to them as "an adaptive family that is constantly struggling with an altering environment." The introductory remarks on the group and its environment, opercula and classification are very interesting. Of the 26 species described and figured, 11 that are new were described by Mr. Smith and one by the author.—C. W. J.

The Mollusca of Dickinson Co., Michigan. By H. B. Baker (Univ. Mich. Mus. Zool., Occasional Papers, No. 111, pp. 1–44, 1921). The habitat studies are very complete; all are numbered, and referred to by numbers in the list of species.

Notes on the Internal Lamellae of Carychium. By Mina L. Winslow (Univ. Mich. Mus. Zool., Occasional Papers, No. 128, pp. 1–16, pls. 1–5, 1922). An interesting study of the lamellae of these small shells, as an aid in determining closely related species.

Experiments in the Culture of Fresh-water Mussels. By Arthur D. Howard (Bull. Bureau Fisheries, Vol. 38, pp. 63–89, 1922). An interesting paper on mussel culture and conservation.

On the Nomenclature of certain North American Naiades. By A. E. Ortmann and Bryant Walker (Occas. Papers of the Mus. of Zool., Univ. of Michigan, No. 112). Much confusion still prevails in the nomenclature of our freshwater mussels. Mainly owing to the uncertainty attending many of Rafinesque's species and genera. Simpson brought some of them into use in his monumental Synopsis of the Naiades; but many more he ignored on account of the notorious obscurity of that author's writings. Subsequent writers have identified many additional Rafinesquian species and genera with varying degrees of certainty. The traditional identifications of some of Lamarck's species of *Unio* have been disputed. These and other cases requiring revision have been fully discussed by Ortmann and Walker in this paper of 75 pages. The paper was criticised in MS. by Pilsbry, whose decisions in cases not agreed upon were accepted. "As now issusd, the paper represents the unanimous opinion of all three of us on questions of nomenclature".

In an article so condensed, and dealing with so many points, it is quite impossible to give a summary. Those interested should obtain copies from the Museum of Zoology, University of Michigan.

The thorough acquaintance of both authors with the subject, their fair and comprehensive consideration of each case, with due reference to the International Rules of Nomenclature, should entitle their conclusions to general acceptance. It is to be hoped that this essay will tead to uniformity in matters of mere nomenclature, so that the energies of our Unio students can be more fully devoted to the many unsolved questions of structure, development and distribution of these most interesting mollusks.

NOTES.

NOTE ON ACMÆA PATINA *Esch.*—Eschscholtz in his Zoological Atlas described *Acmæa scutum* end *A. patina* on the same page and figured both, from Sitka. That the two are specifically identical was recognized by authors of the Carpenterian period, and *A. patina* was selected as the name to be used for the whole. Eschscholtz's figure of this is smaller that that of his *A. scutum*, though as large as many adults. That it is subspecifically distinct from *scutum* seems highly doubtful; I see no evidence whatever for that view. In cases of two names for the same species published at the same time, that selected by the first reviser has precedence, according to Art. 28 of the International Code. The species should therefore be called ACMÆA PATINA, *A. scutum* becoming a synonym.

The small race *A. patina fenestrata* ("Nutt." Reeve, 1885) has been mentioned as *cribraria* Gld. MS. by Carpenter, but *cribraria* was never defined, and the name did not appear in print until long after Reeve had figured *fenestrata*.—H. A. PILSBRY.

NOTE ON CYPRAEA PACIFICA OSTERGAARD.[1]—Upon a recent

[1] The name being preoccupied Dr. Dall has called this species *C. ostergaardi*. See NAUTILUS, Vol. 35, p. 50, 1921.—EDITORS.

trip to the Hawaiian Islands it was my pleasure to meet Dr. J. M. Ostergaard, eminent local biologist, and to inspect three of the type-lot of his Cypraea Pacifica. This species, although dredged in Honolulu Harbor in 1915, was not described until 1920 (NAUTILUS, XXXIII, p. 92). Only five examples were taken and no others have since been obtained. For purposes of reference, it should perhaps be known that one of these is in the collections of the American Academy of Sciences at Philadelphia, one in the Bishop Museum at Honolulu, one in my collection, and the other two in the collection of Dr. O.

This species is a distinct and interesting one, being of a uniform creamy-white color, with small brown dorsal spots; and it is noteworthy that in a community so long settled and "worked" by conchological collectors, both this beautiful novelty and also Mr. Melvill's pretty Cyp. Rashleighana should have escaped discovery until disclosed by dredging operations of recent years. —FRED L. BUTTON.

SUBSCRIBERS N. B.—A person once asked one of the editors if the Pearly Nautilus made a septum each year, and if it died when it ceased making septa. The only ready reply was—you will have to watch it and see. If the present volume (septum 36) of THE NAUTILUS failed to appear, you would certainly say it was dead. We do not know the age of a *Nautilus pompilius* L., or upon what it feeds, but we do know what THE NAUTILUS of Philadelphia and Boston requires. During the past few years the environment of the latter has greatly changed, and it now needs much more of its nutritious food—the "long green", than it used to. When the editors were younger, the little deficit each year was looked upon as a joke, but now the printer's bill reminds us of a huge *Tridacna* (with real teeth), and when it comes rolling in on the spring tides it is enough to crush the life out of any Nautilus—shell or paper. All that is needed now are a few more subscribers and the *prompt payment of subscriptions*, otherwise some day THE NAUTILUS will cease its wanderings over land and sea. Some one else may try again, but always remember what Horace Greeley said about starting a paper.—H. A. P. and C. W. J.

THE NAUTILUS.

Vol. XXXVI JANUARY, 1923. No. 3

THE ANATOMY AND TAXONOMY OF CERTAIN UNIONINAE AND ANODONTINAE FROM THE GULF DRAINAGE.

BY A. E. ORTMANN, PH. D.

The following notes are based largely upon the examination of material of fresh-water mussels, which the Carnegie Museum has received in part from G. H. Clapp, in part from the Alabama Museum of Natural History—it has been collected mostly by H. H. Smith and his assistants, but a few forms have been taken by myself in northern Georgia and Tennessee.

1. Fusconaia succissa (Lea) (1852).

See *Quadrula succissa*, Simpson, Descript. Catal. 1914, p. 867. There is no doubt that *Unio cacao* Lea is a synonym to this.

Choctawhatchee River, near mouth of Gittey's Mill Creek, Geneva Co., Ala. Two specimens (shells only), Victor Hutchinson coll.

Pea River (trib. to Choctawhatchee), Fleming's Mill, Dade Co., Ala. Eight specimens, shells and soft parts (6 males, 2 females), J. A. Burke coll., Nov., 1915.

Structure of the normal, primitive Unionine type. Supra-anal opening present; it is slightly shorter than the anal, and separated from it by a well developed mantle-connection, which is shorter than the supraanal; in the largest male, however, the connection apparently is torn. Anal opening with the inner edge finely crenulated, almost smooth. Branchial opening with strong papillae on inner edge. Palpi of the normal, subfalciform shape, their posterior margins connected for one-third to one-half of their length.

Gills normal; inner lamina of the inner gill free from abdominal sac, except at anterior end. In the female, all four gills are marsupial, with the septa more strongly developed and standing more closely than in the male.

Although the shape of the placentae and the glochidia are unknown, I have no doubt that this is a species of the genus *Fusconaia*, and not of *Quadrula*, for the reason that, in shell characters, it is extremely close to the *F. barnesiana*-group (see Naut. 31, 1917, pp. 58–64), and does not at all resemble the species of *Quadrula*, which all are more or less sculptured. *F. succissa* is very much like the headwaters-form of *barnesiana* (var. *bigbyensis* Lea), it differs, however, in the complete absence of rays, and the peculiar color of the nacre, which is highly iridescent and more or less purplish, often whitish toward the cavity of the shell, darker toward the margin. These tints are unknown in *F. barnesiana.*

The beak-sculpture of *F. succissa* is unknown, but the fact that even in the smallest specimens at hand, with the beaks very little eroded, no sculpture is seen, indicates that it must have been poorly developed, as is characteristic for *Fusconaia.*

In the two largest specimens (males) the gills had that characteristic blackish tint observed in *barnesiana;* for the rest, the soft parts were discolored by the action of the alcohol.

This species is known from the Choctawhatchee system in southern Alabama and western Florida. *F. barnesiana* and its varieties are from the Tennessee-Cumberland drainage; and the third species of this group, *F. ozarkensis* (Call), is from the Ozark Mountains; thus the distribution of the group is markedly discontinuous.

2. Megalonaias triumphans (Wright) (1898).

Quadrula triumphans Simpson, Descr. Cat., 1914, p. 823.

Coosa River, Wilsonville, Shelby Co., Ala. Five males, eight females (soft parts only) and one shell, H. H. Smith coll., June 15, 1914.

Coosa River, Weduska Shoals, Shelby Co., Ala. Two shells, H. H. Smith coll., August, 1913.

Coosa River, Coosa Valley, St. Clair Co., Ala. One shell, H. H. Smith coll.

M. triumphans is the representative of *M. heros* Say in the Coosa River in Alabama, and it may run into *heros* in the Alabama River. At any rate, *heros* is known from Tombigbee River, as reported by Simpson, and confirmed by specimens in the Carnegie Museum (from McIntosh, Washington Co., Ala.). The differences between the two forms are very slight. *M. heros*, as a rule, has the posterior wing of the shell less developed and less elevated, and thus the shell appears more elongated, and the upper and lower margins are more nearly parallel; while *M. triumphans* has a more elevated posterior wing, rendering the shell higher and shorter in outline, with the upper and lower margins diverging.

As is to be expected, *triumphans* also belongs to the genus *Megalonaias*, created by Utterback for *heros* (Amer. Midl. Natural. 4, 1916, p. 41). The essential characters, both of shell and soft parts (as far as our material permits) are seen. Of course, no gravid females being at hand, the charged marsupium and the glochidium is unknown. It deserves special mention that connection of the inner lamina of the inner gill with the abdominal sac is well developed in all of my specimens, and mostly complete, only in a few there are short holes at the posterior end of the foot. In my barren females all four gills are marsupial. In the region of the anal opening all of my specimens are badly injured, and I have been unable to ascertain the presence of a supraanal opening.

3. Amblema perplicata elliotti (Lea) (1856).

Quadrula elliotti, Simpson, 1914, p. 819.

Othcalooga Creek, Calhoun, Gordon Co., Ga. (type locality). Two shells and soft parts of four males and three females, H. H. Smith coll., the former in July, 1914, the latter in July, 1911.

Conasauga River, Whitfield Co., Ga. Shells, H. H. Smith.

Coahulla Creek, Herndon's Mill, Whitfield Co., Ga. Shells, H. H. Smith.

Chattooga River, Cedar Bluff, Cherokee Co., Ala. Shells, H. H. Smith.

The anatomy agrees completely with that of *A. perplicata* (Conrad), as described previously (Ann. Carn. Mus. 8, 1912, p. 247, and NAUT. 28, 1914, p. 21); of course, the gravid condition of the female and the glochidium have not been observed.

Already Simpson is inclined to regard this as a form of *perplicata*, from which it is said to differ in the more decidedly quadrate outline (with the posterior margin almost squarely truncate) in the narrower anterior and higher posterior end (due to the better development of the posterior wing), and in the smaller and less elevated pseudo-cardinals. In my specimens of *elliotti*, I cannot discover any difference whatever in the hinge teeth; but the other characters are noticeable. However, such specimens are found practically all over the range of *perplicata*, from the Alabama system westward. I have material not only from the Coosa-Alabama Rivers, but also from Mississippi, Louisiana, Texas, Arkansas, Oklahoma, Kansas, Missouri and southern Illinois, and everywhere specimens of the *elliotti*-type may turn up. Simpson gives, for the latter, the range: "southern" (apparently misprint for "northern") "Georgia to Texas", but it seems to have a wider distribution, and moreover, the two forms insensibly run into each other. This is preëminently so in the Coosa River, from which I have a number of specimens labeled (by Walker) *perplicata*, which show all possible transitions toward *elliotti*. The latter form, indeed, seems to be, in the upper Coosa system, the prevailing form, and for this reason we should let it stand as a variety of *perplicata*, although elsewhere it is merely an individual variation of *perplicata*.

4. QUADRULA ASPERATA (Lea) (1861).

See *Quadrula pustulosa pernodosa* (Lea), Simpson, 1914, p. 851 (in part).

This is the shell, which represents, in the Alabama system, the *Q. pustulosa* (Lea) of the interior basin. I have quite a number of specimens from the headwaters of the Coosa, down to Wetumpka, Elmore Co., Ala. In the Cahaba, Black Warrior, and Tombigbee drainages, similar, but somewhat different forms turn up; but I propose to restrict myself here to the Coosa-form.

Simpson has united this form with *Q. pustulosa pernodosa*, and Walker, who has identified part of the material at hand, has labeled it thus. However, the original *U. pernodosus* Lea does not come from the Alabama System, but is from "North Carolina", from rivers tributary to the Tennessee, and is nothing but an individual phase of the common *Q. pustulosa* (see Proc. Amer. Philosoph. Soc. 57, 1918, p. 540).

Simpson's diagnosis of *pernodosa* is entirely insufficient: "suborbicular, moderately inflated, pustulous; epidermis yellowish brown"; every word of this fits also the typical *pustulosa*. According to my observations, the Coosa-form is indeed different from the true *pustulosa*. But its chief characters are not found in shape or sculpture, for both are extremely variable, although, in the average, the Coosa-form is more rounded, that is to say, the posterior upper margin is not elevated, and does not form an angle with the posterior margin, but curves down into it very gently and gradually. But such specimens are not infrequent in the interior basin among *pustulosa*. The main difference of the two forms is in the color pattern. Typical *pustulosa* has rays, sometimes obliterated, it is true, in old specimens, but very generally present in younger and well preserved individuals; of these rays, chiefly one in the middle of the disk is noticeable, which is strongly developed, broad, often breaking up into a few large blotches. I have never seen this color pattern in the corresponding Coosa-form, but in its place there are concentric, narrow bands of blackish, dark green, or sometimes brownish color, following the growth rests. Sometimes these band are absent, but there are never rays here.

The name of *pernodosa* cannot be used for this Coosa-form; but there is no doubt that *U. asperatus* Lea stands for it. It originally comes from the Alabama River, Claiborne, Ala., and from the Coosa River, Ala. It should be known as *Quadrula* *asperata* (Lea), and should rank as a *species*, since there are no transitional forms to *pustulosa* known to me, and since also the geographical distribution is different from that of the typical *Q. pustulosa.*

Q. asperata is very variable in the development of the tubercles of the disk. In young specimens they are generally absent, but begin to appear at a certain stage of the growth. Sometimes individuals turn up which have none or only few tubercles at a comparatively advanced age, and such specimens seem to be rather frequent in the headwaters of the Coosa, in northern Georgia. Walker has labeled them *Q. pustulosa kieneriana* (Lea). The same name he has given to the soft parts (without shells) of three specimens from Etowah River, Cartersville, Bartow Co., Ga. (H. H. Smith coll., October 1910). Of these, two were barren females, and in their anatomy they were identical with *Q. pustulosa.*

The question is, whether these specimens are the real *kieneriana*, which Simpson regards as a variety of *pustulosa*, with the diagnosis: "suborbicular, smooth or somewhat nodulous; epidermis ashy brown or greenish brown", and, according to the measurements given, it is smaller than *asperata.* According to this, shells with poorly developed tubercles should be called *kieneriana*, and Walker apparently has acted upon this principle. Yet I think that this is not correct, and that most of the specimens without nodules, or with only a few, chiefly those from the headwaters of the Coosa, are only individual variations of *Q. asperata*, for there is no other difference, and they insensibly pass into each other.

There is in the Coosa a closely allied form to *Q. asperata*, with the same concentric color-bands, which, however has the growth rests standing more closely, and has smaller tubercles. This may be the real *kieneriana.* But I am not in a position to affirm this positively, since my material is too meagre.

5. *Pleurobema georgianum* (Lea) (1841).

Pleurobema georgianum (Lea), Simpson, 1914, p. 792.

Pleurobema favosum (Lea) (1856), Simpson, ibid., p. 798.

Conasauga River, Conasauga, Polk Co., Tenn. Two males, three gravid females with soft parts, A. E. Ortmann coll., May 24, 1915.

Conasauga River, Tennga, Murray Co., Ga. Two shells, H. H. Smith coll., Sept. 15, 1914.

Cowan Creek, Cherokee Co., Ala. One shell, H. H. Smith coll., Novemb. 1910.

Shoal Creek, St. Clair Co., Ala. One male and one female, soft parts only, H. H. Smith coll., Oct. 1914.

The three shells from Tennga, Cowan Creek, and the soft parts from Shoal Creek, were labeled by Walker *Pl. favosum.*

The type-locality of *U. georgianus* is: "Stump Creek, Georgia", which undoubtedly stands for Stamp Creek, near Cartersville, Bartow Co., Ga., in the drainage of Etowah River. No other locality, and only one specimen is known. *U. favosus* is founded upon a number of specimens from Othcalooga Creek, Gordon Co., Ga. (trib. to Oostanaula River, near Calhoun), and also in this case no additional exact localities are known, although Simpson gives: "Alabama system".

I do not entertain any doubt that *U. georgianus* and *favosus* are identical. They come from the same general region, and, according to the material at hand, this species has its home in the headwaters of the Coosa River in northeastern Alabama and northern Georgia. *U. georgianus* is founded upon a rather small specimen (L. 41 mm.), of normal shape, with yellowish brown epidermis, without rays or spots, while the figure of *U. favosus* represents a larger specimen (L. 52 mm.) of the same, regular shape, with the epidermis yellowish green or brownish, and with a row of green spots upon the posterior ridge. These spots, as far as I can see, are the only difference of the two "species", for the rest, they agree completely in color, outline and general shape, and also the diameter is about the same: 39 per cent of the length in *georgianus*, 38 per cent of the length in *favosus*.

My material shows conclusively that the color markings in this species are variable: in the set from Conasauga collected by myself, the epidermis is yellowish or brownish olive; the larger specimens are without spots, the smaller ones have more or less distinct spots on the posterior ridge, and in the smallest they appear as an interrupted broad ray. In the other specimens, collected by Smith, the spots are rather distinct.

The shape of the shell is rather subovate, almost subelliptical in outline. In the larger specimens, however, the lower margin is not very convex, but in part more nearly straight. Very young specimens (from Tennga) are comparatively higher than old ones. In my specimens, the diameter varies from 33 per of the length to 41 per cent, the average being, in specimens from Conasauga, 36 percent, in the others about 39 per cent. The maximum size (male from Conasauga) is: L. 61, H. 40, D. 20 mm. (this is the most compressed individual, D. 33 per cent).

As we shall see below, this is a real *Pleurobema* according to the anatomy. It stands very close to the small-creek-form *Pl. oviforme argenteum* (Lea) of the upper Tennessee region (see: Proc. Amer. Philos. Soc. 57, 1918, p. 552), and the fact, that this latter form is found in tributaries of the Tennessee not far from the Coosa drainage (Chickamauga Creek in Catoosa Co., Ga., and Hiwassee drainage in Tennessee) suggests that there actually is genetic relationship between the two forms, and that *Pl. georgianum* reached the upper Coosa by crossing over the divide from the upper Tennessee (by stream piracy).

Pl. georgianum differs from *Pl. oviforme argenteum* only in the regular, suboval, almost subelliptical outline, while in the latter, the outline generally is subrhomboidal or subtrapezoidal, that is to say, there is a more or less distinct angle between the upper and the posterior margins. The compression of the two forms is nearly the same. In color pattern, they are also much alike, except that the spots, in *argenteum*, are often accompanied by more or less rays upon the disk. However, also in *argenteum*, rays and spots may be entirely absent.

The soft parts from Conasauga agree with those from Shoal Creek. The females of the former locality were gravid with glochidia (May 25). The anatomy is identical with that of *Pl. oviforme argenteum* (Naut. 34, 1921, p. 85). This concerns also color, the soft parts being either whitish or pale orange. The color of the marsupium (placentae) is cream or pale orange, exactly as in the *clava*-group of *Pleurobema* (to which *oviforme* belongs). Glochidia of the usual shape, subelliptical, L. O. 13, H. O. 15 mm., and thus they are slightly smaller than those of the *clava*-group, and also a little higher in proportion to length, but in the latter respect, they agree with specimens of *argenteum* from Chickamauga Creek (see: Naut. l. c.).

6. *Pleurobema hagleri* (Frierson) (1900).

Simpson, 1914, p. 776.

North River, Hagler's Mill, Tuscaloosa Co., Ala. Two shells, H. H. Smith coll.

Valley Creek, Toadvine, Jefferson Co., Ala. Soft parts (without shells) of one male and one barren female, H. H. Smith coll.

Both localities are in the Black Warrior drainage, the first close to the type-locality (Tyner, Tuscaloosa Co.). The specimens have been identified by B. Walker.

Although no gravid females were at hand, the anatomy indicates that this species probably is a *Pleurobema*. The soft parts were discolored by the alcohol.

The affinities of this species are still obscure.

7. *Pleurobema patsaligense* Simpson (1900).

Simpson, 1914, p. 788.

Little Patsaliga Creek, Crenshaw Co., Ala. Two shells, topotypes, C. Goodrich don.

Sandy Creek, Evergreen, Conecuh Co., Ala. twelve shells, H. H. Smith coll.

Choctawatchee River, Blue Springs, Barbour Co., Ala. One shell, and soft parts of ten others (six males and four barren females), H. H. Smith coll.

The single shell from the Choctawhatchee is absolutely identical with the sets from the other two localities in the Escambia drainage, and thus it is shown that this species belongs to both systems.

Concerning the soft parts, the same is to be said as in the case of *Pl. hagleri*, and also its systematic affinities require further elucidation. It should be pointed out, that the shells of these two species (and of others from Alabama) show certain similarities to the genus *Elliptio*: it is not impossible that we have here the intergrading forms between *Elliptio* and *Pleurobema*.

8. *Pleurobema modicum* (Lea) (1857).

Pl. striatum (Lea) (1840), *Pl. modicum* (Lea) (1857), *Pl. amabile* (Lea) (1865), see: Simpson, 1914 p. 794, 795.

All three forms are from the Appalachicola system, the first two from the Chattahootchee River, Columbus, Ga., the last from the upper Flint drainage at Butler, Taylor Co., Ga. I have the following material:

Chattahoochee River, Ga. Two shells, Hartman collection (labeled *striatus*).

Pea River, Fleming's Mill, Dade Co., Ala. Eleven shells, ten of these with soft parts (five males, five barren females), J. A. Burke coll., Nov., 1915 (marked "Pea R., no. 2").

Choctawhatchee River, Blue Springs, Barbour Co., Ala. Soft parts (without shells) of seven males and five barren females, H. H. Smith coll., Oct., 1915 (marked "Choct. R., no. 6, same as Pea R., no. 2").

According to the published descriptions and figures, the differences of these supposed three species may be tabulated as follows:

a_1 Nacre flesh color to purplish. Posterior point of shell near base and lower margin of shell nearly straight.

  $_1$ Shell rather compressed, Dia. 33 to 36 per cent of length. *striatum.*

  b_2 Shell more swollen. Dia. 42 to 45 per cent of length. *modicum.*

a_2 Nacre whitish or yellowish. Posterior point of shell more elevated above base and lower margin more convex. Shell rather swollen. Dia. 41 to 43 per cent of length. *amabile.*

The position of the posterior point of the shell is very variable and unfit to serve as diagnostic character. My two shells from Chattahootchee River, labeled *striatus*, possess the dia. of 40 and 41 per cent, and thus connect *striatum* and *modicum* more closely; I think that there is no doubt that these two are actually identical. Since Walker has shown (Univ. Mich. Miscell. Publ. 6, 1918, p. 183) that *U. striatus* Lea (1840) is preoccupied by *Unio striatus* Goldfuss (1839), *U. modicus* becomes the oldest available name. (*Pl. simpsoni* Vanatta, Pr. Acad. Philad. 1915, p. 559, introduced on account of *Obovaria striata* Rafinesque [1820] is unnecessary.)

My set of shells from the Choctawhatchee drainage (Pea R.) agrees in every particular with *amabile*, except that the shells are slightly less swollen (dia. 37 to 43 per cent, average 38 per cent), thus approaching the *striatum*-type. Thus there remains only one distinguishing character from the Chattahootchee shells, color of nacre. But since the whitish color (*amabile*-type) is also originally from the Chattahoochee drainage, it is safe to place also *amabile* in the synonymy of *modicum*.

In my specimens from Pea River the epidermis is, in the younger ones, tawny or greenish brown, sometimes obscurely rayed. In older ones it is darker, brownish, shading to blackish toward the beaks. Nacre whitish, often stained yellowish in the beak cavity.

According to the soft parts, this seems to be a *Pleurobema*, possessing the structure of this genus, as far as we can judge in the absence of gravid females. But its position within the genus is not yet clear. It is a small species, so far restricted to the Appalachicola and Choctawhatchee systems in S. W. Georgia, S. E. Alabama and probably also West Florida.

9. Lasmigona (Alasminota) holstonia (Lea) (1839).

Alasmidonta holstonia (Lea) and *Al. georgiana* (Lea), Simpson, 1914 pp. 502, 503.

See also: *L.* (*Sulcularia*) *badia* (Raf.), Ortmann, Nautilus Proc. Amer. Philos. Soc. 57, 1918 p. 557; *L.* (*Alasminota*) *holstonia*, Ortmann, Naut. 28, 1914 p. 43, and 34, 1921 p. 87.

This species, common in small streams in the upper Tennessee, has also been reported from the headwaters of the Coosa River, and undoubtedly is present there. This fact again indicates a close connection of the upper Coosa drainage with that of the upper Tennessee. According to material before me, it is widely distributed also in the Coosa drainage, from northern

Georgia down to Talladega and Shelby Cos. in Alabama, and also here it avoids the larger rivers, preferring smaller streams. It should be pointed out that the two ranges are in close contact, since, in the Tennessee drainage, this species is known from South Chickamauga Creek in Catoosa Co., Ga., and from the Hiwassee drainage in Polk Co., Tenn.

I have examined specimens with soft parts from the following localities in the Coosa drainage.

Chattooga River, Trion, Chattooga Co., Ga. Three males and two females. A. E. Ortman coll., May 19, 1915.

Little River (trib. to Chattooga), Cherokee Co., Ala. One male and one female (without shells). H. H. Smith coll.

The structure of these is entirely normal, as described previously.

(*To be continued*)

PROSERPINIDAE.

BY H. BURRINGTON BAKER.

Proserpina Gray (1840). Nude name.

Odontostoma d'Orbigny (1841), not Turton (1829), etc., etc. Type *O. depressa* d'Orbigny (1841), Cuba.

Proserpina "Gray" Sowerby (1842). Type (monotype) *P. nitida* "Gray" Sowerby (1842), Jamaica, Not *Proserpinus* Hübner (1816), Lepidoptera (Verz. bek. Schmet., p. 132).

Ceres Gray (1856). Type *Carocolla eolina* Duclos (1834), Vera Cruz, Mexico.

Proserpinella Bland (1865). Type (monotype) *P. berendti* Bland (1865), Mirador, Mexico.

Cyane H. Adams (1870). Type (monotype) *C. blandiana* H. Adams (1870), Eastern Peru.

Linidiella Jousseaume (1889). Type *Proserpina swifti* Bland (1863), Puerto Cabello, Venezuela.

Despœna R. B. Newton (1891). Substitute for Proserpina; same type.

Chersodespæna Sykes (1901). Type *Despœna cinnamomea* Sykes (1901), between Ayabamba and Santa Rosa, Ecuador.

Staffola Dall (1905). Type *Proserpina derbyi* Dall (1905), subfossil, Rio Chico, Paraguassu, Bahia, Brazil.

A. Shell large, heavy, carinate; externally with riblets above and thickened below. Columellar, parietal and palatal lamella (Mexico). Genus *Ceres*.

A′. Shell smaller, thin, rounded; without definite riblets. Genus *Proserpina*.

B. With distinct, thin, columellar lamella. Subgenus *Proserpina* s. s.

C. Palatal, parietal and columellar lamellæ (Antilles). Section *Proserpina* s. s. (+*Despoena*).

C′. Parietal and columellar lamellæ (Antilles). Section *Despænella* new name (+*Odontostoma*).

C″. Columellar lamella only (Venezuela to Ecuador). Section *Linidiella* (+*Chersodespæna*).

B′. With heavy columellar lamella, appearing as truncation of columellar pillar (South America). Subgenus *Cyane*.

D. Parietal lamella also present (Brazil). Section *Staffola*.

D′. Columellar truncation only (Peru, Bolivia). Section *Cyane* s. s.

B″. Parietal lamella only (Mexico). Subgenus *Proserpinella*.

As will be seen from the above, even if it were decided that *Proserpinus* preoccupied *Proserpina* (Cf. Newton and also Sykes, l. c.), *Despæna* (Despœnidæ) could not be used as a generic term without designation of considerably smaller generic limits than here recognized. Regardless of the size of the genera, *Proserpinellidæ* would become the only appropriate family name.

A CRITIQUE ON PROFESSOR HAROLD HEATH'S CHIORÆRA DALLI, WITH SPECIAL REFERENCE TO THE USE OF THE FOOT IN THE NUDIBRANCHIATE MOLLUSK, MELIBE LEONINA GOULD.

BY H. H. VON WOLD KJERSCHOW AGERSBORG.

(From the Zoological Laboratory, University of Illinois, with Plates II to V.)

The remarkable Nudibranch *Melibe leonina* Gould has recently been described by Professor Chas. H. O'Donoghue, from the Vancouver Island region, under the nomenclature of Gould (1852), the discoverer of the species. Heath (1917) also employs Gould's nomenclature for the genus, but he goes farther than O'Donoghue by naming for it a new species, *Chioræra dalli.* Heath's species was collected off the coast of British Columbia. That is, not far from O'Donoghue's territory, nor, indeed, from that of Gould. The specific description of Heath, as far as it goes, coincides perfectly with that of Gould (1852), Cooper (1863), Fewkes (1889), Bergh (1904), O'Donoghue (1921) and Agersborg (1916, 1919, 1921, 1921*a*, 1922). The only difference lies in his statements in regard to the salivary glands and the tentacles. Microscopic sections of the anterior end of the alimentary canal of Heath's species no doubt will reveal these glands just as in the case of the type species of Gould. These glands, as I have shown before (1922), are very small, and are imbedded in the connective and muscular tissues of the neck, opening into the alimentary tract by minute crypts through the entoderm between the proventriculus and the mouth. Heath does not seem to appreciate Gould's description neither in the Latin nor in the English. It is, therefore, no wonder that Heath makes a new species of Gould's *Melibe leonina.*

Gould's description reads:

"Body limaciform, smooth and of a pearly and whitish colour, finely reticulate with orange. The head is enormously enlarged, with a distinct neck, semiglobose, the oral face flattened. The oral fissure is longitudinal, the lips large, with the true mouth within at the posterior portion; around the edge of the oral disc or cowl is a double series of orange-coloured cirrhi, each of which has an independent motion. On the top of the head are two foliate expansions, destitute of venations, which answer to the true tentacles; on their anterior edge is an opaque whitish papilla, presenting something of a spiral or lamellar structure; they were sometimes wholly retracted within a permanent sheath." P. 310.

Heath's description reads in part:

"*External Features.*—The body (Pl. XI, fig. 1) comprises two distinct divisions, the head and the body proper. The head presents the appearance of a low vault or cowl provided with two dorsal tentacles, two sets of marginal tentacles and on its under surface bears the mouth. Unlike *Chioræra leonina*, the dorsal tentacles are not retractile, and in preserved material are plain, muscular, foliaceous outgrowth. Gould states that the tentacles of *C. leonina* bear on their anterior margins 'an opaque, whitish papilla, presenting something of a spiral or lamellar structure.' Nothing of the kind has been found to exist in the present species.

"The marginal head tentacles form two series, an outer set comprising from fifty to seventy-five large, slender processes, and an inner fringe formed of much smaller outgrowths of approximately double the number. Each of these cirri is provided with a nerve (Pl. XI, fig. 2) and gives evidence of being a tactile organ, though observations along this line were very incomplete.

"The mouth presents the appearance of a longitudinal slit (Pl. XI, fig. 1) placed near the posterior margin of the head, and therefore in close proximity to the anterior margin of the foot. Its posterior border may be said to be formed by the free border of the head, which here forms a deep angle usually devoid of the larger type of tentacle." P. 138.

"*Chioræra dalli* new species.

"Body limaciform, smooth and of a pearly color without definite signs of pigmentation. Head enormously developed, with the mouth near the posterior margin. Dorsal tentacles simple leaf-like expansions without special sheath. Jaws, Radula, and salivary glands wanting." P. 147.

From the above, it is seen the two descriptions agree exactly. The differences which Heath tries to bring out, are based on his failure to understand Gould's description, and also, judging from his own statement, he evidently made very superficial observations of the living animals. In preserved specimens, the whitish papilla is always retracted within a permanent sheath; it is very hard to see in preserved specimens. In living animals, it seems to be very sensitive, although not so sensitive as the oral cirrhi, and, at the least disturbance, it is quickly withdrawn within the tentacular sheath, or stalk. Heath confuses the tentacular papilla, that is the true tentacle, with the foliaceous tentacular stalk. The tentacular stalk is never retracted. And, it was neither claimed by Gould. When this last named author writes: "*Tentaculae cephalicae foliatae, retractiles;*" he means exactly what he says on the same in English: On the top of the head are two foliate expansions, . . . ; on their anterior edge is an opaque, whitish papilla, presenting something of a spiral or lamellar structure; they were sometimes wholly retracted within a permanent sheath." It is clearly indicated by Gould's description that when he speaks of tentacles he includes the opaque, whitish, foliate papillae (one on each tentacle). That is, his "tentacle" stands for a whole; a part of a whole may be retracted within a whole, but the whole may not be retracted within a part of itself. The papilla stands for a part of the tentacle; the tentacle consists of the papilla and the foliate expansion. And, as I have stated above, the true, or real sensory organ, as far as the tentacle is concerned, is the papilla, which, *ipso facto*, is the actual tentacle, or the "rhinophore" of many writers, (*vide*: Agersborg, 1922). The rest of the tentacle, that is, the foliate expansions, is the tentacular sheath. It is only fair to Heath, to state here that the *papilla*, at times, may fall off from the stalk, since it is quite constricted at its base (Figs. 4, 5), but in a large number of specimens as examined by Heath, this should not be the general case. If an entire tentacle is stained in borax carmine, the papilla — completely retracted within the foliate expansion—will stain more deeply than the remainder. This is illustrated in Pl. IV, figure 6. In specimens preserved in alcohol or formaldehyde, the papilla may be overlooked easily. In point of fact, O'Donoghue (1921) claims no "rhinophores," p. 192, for *Chioræra leonina*. This shows that the "papilla" is quite difficult to see. On page 193 he writes: "No structures comparable with the rhinophores of other nudibranches could be found unless the cephalic appendages are their modified representative, which hardly seem probable." This, of course, is an error, and represents a good proof that the living animals, also in this case, were not studied carefully. As stated above, the sensory part of the tentacles is always retracted when the animal is disturbed, and may only be seen when the animal is left at rest in the aquarium. Then, it may become quite conspicuous (Pl. IV fig. 5*a*, *pa.*). O'Donoghue's statement, therefore, in regard to the absence of "rhinophores," indirectly substantiates my claims that Heath is wrong. With these things in mind, it is perfectly evident that Heath's description, as far as quoted, is a duplicate of Gould's. The rest of Heath's paper, as far as accuracy goes, is very similar to the part thus far reviewed. It is not my purpose to go into details here. I only wish to point out some of the main features. Heath's drawings are exceedingly unreliable as they are too diagrammatic (Fig. 6) and do not tally with his text. It is much to be regretted that Heath did not consult the literature. That would have saved him from creating a new species. In this case, there is no new species at all! (*Vide* literature on Nudibranches in general, and *Tethymelibidae* in particular: Agersborg 1916, 1919, 1921, 1921*a*, 1922). As regards Heath's drawings, it is only necessary to refer to his drawing of the tentacles which are represented by a *mere line!* Since the tentacles form one of Heath's basic reasons for creating a new species out of Gould's *Melibe leonina*, they should have been represented by very accurate drawings. That Heath's drawings of the tentacles are both incomplete and inaccurate, are supported by examination of preserved specimens from the vicinity of Heath's type locality. The structural features, as pointed out by Heath, in which his *Chioræra dalli* differs from Gould's *Melibe leonina*, are altogether too trivial, and his drawings too poor (Fig. 6), that I do not think anyone who knows Gould's species can possibly accept the species of Heath. The status of the genus itself is for the first time, to my knowledge, properly set forth by myself (Agersborg, 1921*a*). In this paper, the reasons are given why Gould's *Chioræra* is a synonym of *Melibe* Rang (1829). Several authors, moreover, although without giving a reason, recognize *Chioræra* as a synonym of *Melibe*.

(*Vide*: Tryon, Jr. 1883, p. 382; Fischer 1887, pp. 533–534; Bergh 1892, pp. 1039–1043; 1904, p. 13; 1907–1908, pp. 95–98). O'Donoghue (1921) although he classified *Melibe* under the nomenclature of Gould, states later in a letter to me: "I have quite given up *Chioræra* as a name." This, I am sure, will be the conclusion of every student who studies this subject seriously. In creating a new species, I think, Heath violated good usage among investigators by not familiarizing himself with the literature on the subject with which he dealt.

The species *Melibe leonina* Gould was quite fully described by me in an unpublished Master's thesis (1916), which is in the Library of the University of Washington, Seattle. It is not expected that Heath should know anything about this, but it goes without saying, that students of Zoölogy, nowadays, must consult the literature when they write for publications, lest their contributions to the science may be little less than a stumbling block for subsequent workers.

Heath's record of the swimming habit coincides with Gould's, also with mine (1916, 1919, 1921, 1921*a*, 1922, 1922*a*, 1922*b*). His description of the contents of the stomach and intestines differ. In my specimens, the alimentary tract contained crustaceans of various kinds, and of different sizes (Pl. V, figs. 7, 8, cr.). The food of *Melibe leonina* is crustaceous *per se.* (*vide litteraturae supra et infra*). *Melibe*, however, as I have pointed out elsewhere (1922*b*), is not such an able swimmer as *e. g.*, *Dendronotus giganteus* O'Donoghue.

Heath's reference to egg-bodies or nidosomes by the statement: "Large numbers of eggs were found attached to 'eel grass' and imbedded in gelatinous, spirally-wound folds after the fashion of many nudibranchs," does not agree at all with the nidosome of the Puget Sound species (Pl. II, fig. 2), whose egg-body (*vide:* Agersborg, 1916, 1919, 1921) consists of a broad ribbon (*not* "spirally-wound folds") which folds into a funnel-shaped form when supported in the water owing to one side of the ribbon being shorter than the other, and the shorter side becomes attached to the eel-grass. Heath's "spirally-wound folds" fit better to the nidosome of the "Sea-lemon," *Anisodoris* Bergh (*Anisodoris nobilis* MacFarland), (Pl. II,

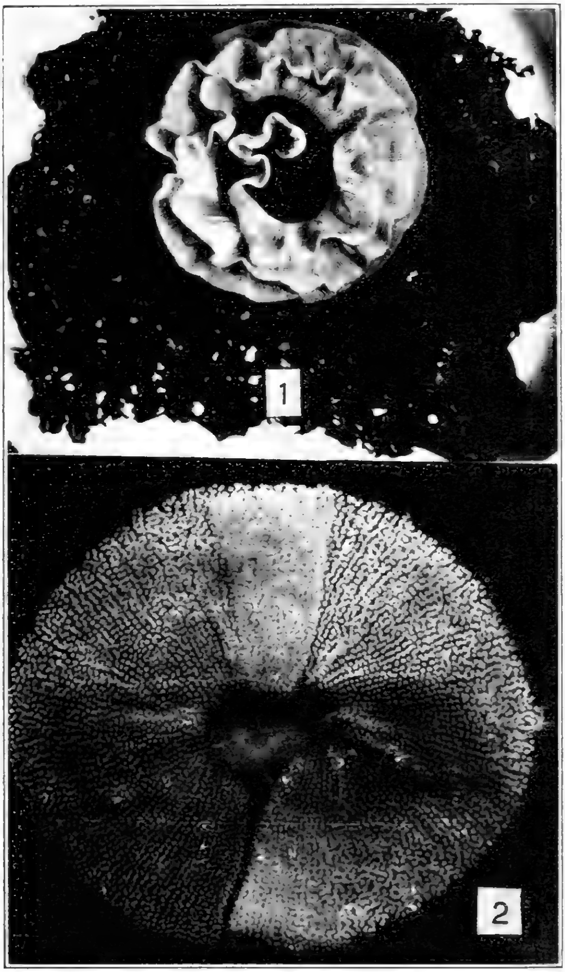


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Fig. 1. Nidosome of *Anisodoris nobilis* deposited on sea-lettuce (*Ulva lactuca*). Photo. by Dr. Sidney E. Johnson.

Fig. 2. Nidosome of *Melibe leonina* deposited on *Zostera marina*. Photo by author.

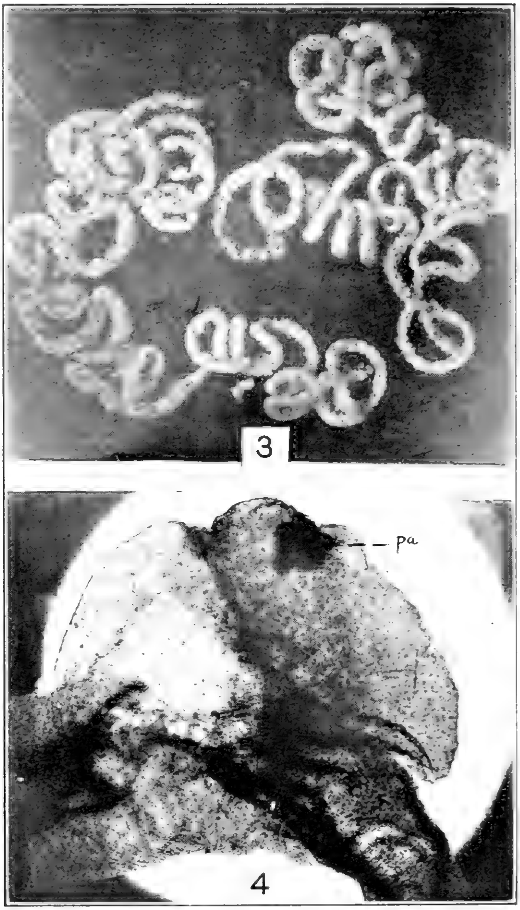

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Fig. 3. Nidosome of *Dendronotus giganteus*. Photo. by author.

Fig. 4. Dorsal tentacle from preserved specimen of *Melibe leonina* showing contracted papilla (*pa*) of Gould, stained with borax carmine, mounted in canada balsam. Photo. by author.

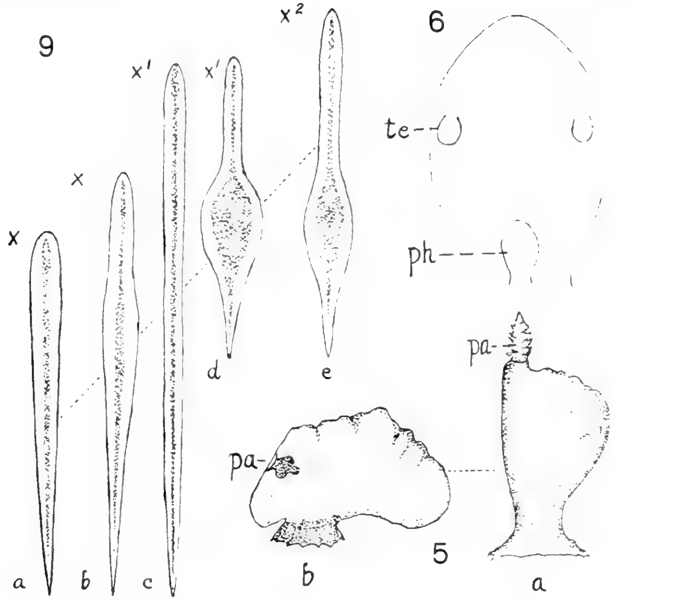

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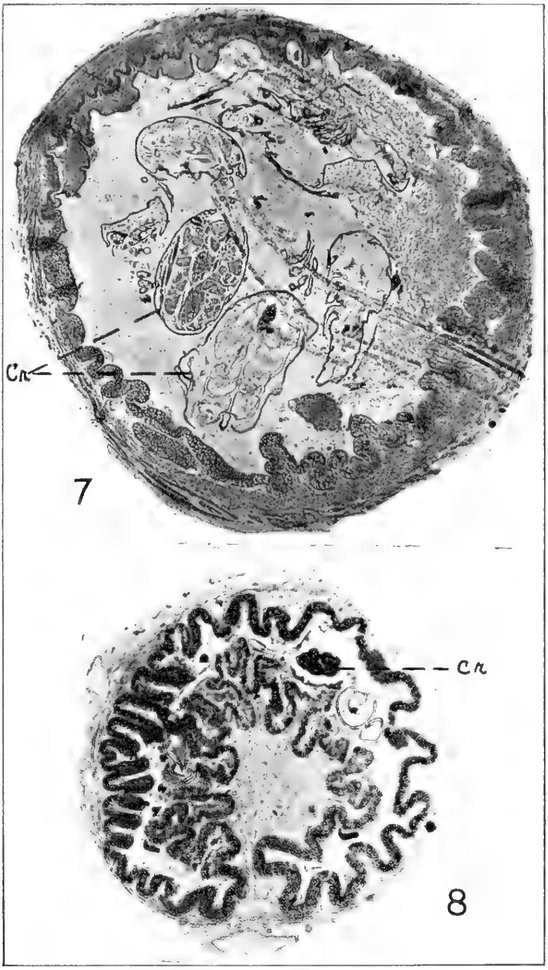
Fig. 5 a. Drawing of dorsal tentacle of *M. leonina* from life, showing the papilla (*pa*) of Gould. b. The same from preserved specimen, seen with the unaided eye.

Fig. 6. Copy of Heath's drawing (pl. 12, f. 6) of the hood of "*Chioraera dalli*", (= *Melibe leonina*). *te*, tentacle (dorsal tentacle). *ph*, pharynx.

Fig. 9. Diagrams illustrating various aspects of the foot of *M. leonina* during "galloping". *a*, normal; *b*, beginning (x) of elongation of the foot; *c*, maximum elongation, x advanced to x^1; *d*, x^1 adheres to substrate, large monotaxic pedal wave passes from anterior to posterior, and posterior end of foot is drawn anteriorly producing at the same time a large swelling on the middle of the body and foot. *e*, second elongation, a new wave sets in from anterior to posterior, repeating the same phenomenon as in *b*, x.



KJERSCHOW AGERSBORG: MELIBE LEONINA ETC.

Fig 7. Microphotograph of a cross-section of the gizzard of *Melibe leonina*; *cr*, sections of crustaceans filling the stomach.

Fig. 8. Microphotograph of the cross-section of the intestine. *cr*., egg-pouches with embryos of crustaceans.

fig. 1). There can be no doubt as to the nature of the nidosome of *Melibe leonina*, as this species deposited two nidosomes in the laboratory during the summer of 1914 (*vide:* Agersborg, 1916, 1919, 1921); these were used as a check for those found in nature at that time, *e. g.*, on the eel-grass (*Zostera marina*), where *Melibe* also were collected. The same kind of nidosomes had been found before by members of the Puget Sound Biological Station, but it was not known to what species it belonged until *Melibe leonina* was seen to deposit the same kind in the laboratory. Closely related species among the *Aeolidia* deposit nidosomes of great similarity: *Aeolidia coronata*, *Hermissenda opalescens*, *Coryphella longicaudata*, etc. (Fig. 3). The extent of the spiral form of a nidosome of this kind depends on two things: (1) on the speed of the egg-mucus flow, and (2) on the speed with which the nudibranch moves during oviposition (Agersborg, 1922*c*). In the light of these facts, I am compelled to doubt, therefore, very much whether Heath's statement in regard to the nidosome of his species is any more valid than his supposed new species. Of course, Heath's inference is only a guess. I have suggested above the only scientific way to identify nidosomes.

O'Donoghue (1921) makes the following statement in regard to *Melibe leonina:*

"There seems little doubt that this species is mainly pelagic for it is found floating freely in the sea during the early months of the year and I have seen it at the end of July and the middle of August. Towards the middle or end of May, however, it comes in to spawn and it is then very plentiful. . . . At this time, the animal is present in hundreds and so constitutes an extremely common form at these two points (on the Zostera beds at the Station and at Mudge Island). Even then, however, it does not creep about on the eel grass but only seems to adhere for the purpose of laying its eggs. In the laboratory too it does not creep on the sides of the aquaria and only rarely clings to them. It has not been observed creeping on anything after the manner of other Nudibranchs and if not entirely a pelagic form like *Phyllirhoe* it is beyond doubt very nearly so and is a most interesting form." P. 194.

Inability to use foot for the purpose of locomotion on the substratum as suggested by O'Donoghue does not hold. *Melibe leonina* though pelagic *at times* is quite able, as we will see, to use the foot in locomotion by the means of creeping. Professor Trevor Kincaid kindly informs me that in the summer of 1917 he found one of the bays of Hoods Canal literally filled with this species—there were an incredible number—"millions of them." The piles under the docks were covered with them. (I am under the impression that Professor Kincaid also stated that *Melibe* was clinging to the piles above low-water mark at low tide; if this be the case, it is the first time on record that this species has been seen alive on dry land; it will be noted, that the body of *Melibe leonina* is so soft and watery that it loses very soon its fluid-contents when left out of water. This is at least true when the animal is lifted out of water and examined on a glass plate). From the same source, I have the corroboration on the point in regard to locomotion: *Melibe leonina* is perfectly able to creep on a solid substratum. I am very much indebted to Professor Kincaid for this point of information, not only because of the unusual nature, *e. g.*, as regards the occurrence of *Melibe* on the piles above low-water mark, and the great abundance in which it appeared; but also, for his statement in regard to the locomotion of *Melibe leonina.*

M. leonina, then, uses its foot for creeping purposes! As shown elsewhere, (Agersborg 1919, 1921, 1922, 1922b) the foot is highly ciliated, and the ciliated ectoderm is innervated with nerve fibres from the nerve-net which is spread throughout the foot. During the summer (1921) while working experimentally on the chemical sense of *M. leonina* (Agersborg 1922a). I had the opportunity to study this species very closely. As stated above, its food consists of small crustaceans of various kinds: copepods, isopods, amphipods, etc., judging from the contents of the alimentary tract (Pl. V, figs. 7. 8). In the laboratory, I fed it on *Caprella* and *Gammarus*, about 20 to 15 mm., long, respectively. The former, although it fastened its claws into the membrane of the mouth of *Melibe*, was nevertheless pushed down into the oesophagus, proventriculus, gizzard, etc. of *Melibe.* The latter was executed in the same way. I also succeeded in feeding it on the muscles of *Cucumaria japonica* Semper. The muscle, however, passed apparently unchanged through the digestive tract and appeared at the anus 36 hours later.

During the study of the pedal locomotion, I again observed its mode of swimming, (*vide*: Agersborg 1916, 1919, 1921, 1922). I have at this time to correct a mistake which appears in my paper (1921) relative to the mode of swimming of *Melibe leonina*. In the Summary, paragraph 3, line 1, it should read according to the MS. and the proofs: "*It swims freely in the water, back upward, or downward.*" Instead of: "It swims freely in the water, backward, upward or downward." The word "*backward*" is wrong. *This change was not authorized by the author!* It introduces an idea which is contrary to facts. Whether an addendum, pointing out this erratum, will appear in the journal in question, I am unable to say. For anyone who may be interested in this subject, I have made the corrections here. Although O'Donoghue thinks *Melibe* is mainly pelagic, it is quite evident, judging from its habitat, that the pelagic habit is periodic at the most, i. e., its recurrence is spasmodic, as I have pointed out before (1916, 1919, 1922*b*). *M. leonina* does not only occur as a pelagic form (1922*d*), but may be found at considerable depths which is perhaps its habitat the greater part of the year. Gould's specimen, 133 mm. long, 17 mm, high, and 32 mm. wide, was dredged at about 5½ meters depth; Cooper's (1963) 70 mm. long, and 17 mm. high, at a depth of 38 meters. Presumably, when it is at the bottom, it crawls *on the bottom* for it has a well developed foot not only for clinging on to sea-weeds but also for actual creeping and, indeed, for "galloping" to use a term employed by previous writers for other forms.

On one occasion as I was trying to feed *Melibe leonina*, it dropped to the bottom of the aquarium and commenced *gliding* along it. I continued the feeding experiment when to my astonishment this nudibranch, *Melibe leonina*, suddenly elongated to nearly twice its normal length, and then shortened to less than half its normal length, showing a method of creeping similar to that described by Parker (1917) for the seahare, *Aplysia californica* Cooper (Pl. IV, fig. 9). When elongating the body, the anterior one third of the foot was lifted above the substratum and then let down; the posterior one third then passed toward the middle of the body which became much wider at the base and along the sides, and then the forward stretching was repeated. This sort of creeping was accomplished by a large muscular wave which passed from the anterior to the posterior, that is, by direct monotaxic waves. In ordinary locomotion (creeping) the cilia of the foot may play an important part because the locomotor waves are almost indiscernible.

This adds one more mollusk to the number recorded by Parker (*vide:* literature, Agersborg, 1922*b*) in which locomotion is effected by rhythmic pedal waves.

Summary.

1. *Melibe leonina* has been found at depths from about 2 meters to about 38 meters; it is littoral; it is pelagic. Its pelagic habit seems to be periodical; it is not pelagic all the year.

2. It swims freely in the water, the back downward or upward.

3. It creeps on the surface film by ciliary action of its highly developed foot.

4. It may remain above low-water mark during low tide (but in shaded places); in one such instance it was found to cover the piles under the dock in one of the bays of Hood's Canal, Washington. Literally millions occurred at this time in this particular bay.

5. It may creep, when disturbed, by producing large direct monotaxic pedal waves, two in number being on the foot at the same time.

6. The cephalic tentacles of *Melibe leonina* (s. *Chioræra* Gould) are highly developed organs (*vide:* Agersborg, 1922, 1922*a*); the sensitive part is represented by a foliate papilla (Gould) situated at the anterior margin and is readily retracted within the tentacular stalks which form a permanent sheath for the papillary organ. This papilla has been called the "rhino-

phore;" whether it be an organ of olfaction or not, it is highly innervated with nerve fibres throughout (*vide:* Agersborg, 1922*a*).

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NOTES ON THE NAIAD FAUNA OF THE UPPER MISSISSIPPI RIVER. *

II. The Naiades of the Upper Mississippi Drainage.†

BY N. M. GRIER AND J. F. MUELLER.

(Continued from page 49.)

23. *Pleurobema pyramidatum* (Lam.)=*Q. pyramidatum* (Lam.) Simpson—north in the Mississippi to Prairie du Chien, Wisconsin. We collected specimens of it in L. Pepin.

24. *Pleurobema clava* (Lam.).

Simpson's records of this species from Minnesota and Iowa are considered doubtful (see Ortmann, 1). It may be present nearer the Ohio. Probably of a tributary type.

25. *Elliptio crassidens* (Lam.)=*Unio crassidens* (Lam.).

Reported by Holzinger (7) from Winona County, Minn.

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†Contribution from U. S. Biological Station, Fairport, Iowa, and Biological Laboratory Washington and Jefferson College.

We also found this species at Red Wing, nearly 80 miles above this point. Absent from L. Pepin; more abundant above that point. Not common.

26. *Elliptio dilatatus* (Raf.)=*Unio gibbosus* (Barnes).

Simpson—entire Mississippi drainage. Apparently clammed out in the vicinity of Red Wing, but abundant in L. Pepin, decreasing in numbers descending the river. Not reported from N. and C. Minnesota.

Sub-Family Anodontinae.

27. *Arcidens confragosus* (Say).

Simpson—Mississippi river and states adjoining it. Reported from Iowa by Baker (1); S. Minnesota by Grant (6). Collected by us near Red Wing. Comparatively rare.

28. *Lasmigona compressa* (Lea)=*Symphynota compressa* (Lea).

Simpson—E. Iowa and Wisconsin. Wilson and Danglade, Mississippi R. above Bemidji and Bemidgi Lake. We did not observe it between Red Wing and La Moille, Minn.

29. *Lasmigona costata* (Raf.)=*S. costata* (Raf.)

Simpson—Upper Mississippi drainage, and St. Lawrence. Wilson and Danglade, Red River of the North. Rare. We secured specimens of this only above L. Pepin.

30. *Lasmigona complanata* (Barnes)=*S. complanata* (Barnes).

Simpson—Upper Mississippi drainage, St. Lawrence. Wilson and Danglade(18), Crow Wing drainage, Minn. Common. A var. *katharinae* (Simpson) is found in the Red River of this North, it may be later found in the Upper Mississippi, although it has not been reported from there as yet.

31. *Anodonta imbecillis* (Say).

Wilson and Danglade (18), L. Minnewaska, Minn. Simpson —entire Mississippi drainage area.

32. *Anodonta grandis* (Say).

Simpson—entire Mississippi River system. By some, it is believed to be a tributary form rarely found in the river. It is often confused with *corpulenta*, Call insisting they are the same species. Var. *benedictensis* (Lea) reported by Wilson and Danglade from L. Minnewaska; var. *gigantea* (Lea) reported by Call; var. *pepiniana* (Lea) reported by Wilson and Danglade from lakes of Crow Wing drainage, Minn. var. *kennicotti* (Lea) by the latter from L. Osakis are all considered by Ortmann as doubtful forms.

33. *Anodonta corpulenta* (Cooper).

Simpson—Upper Mississippi drainage. Wilson and Danglade, St. Croix drainage. In our experience somewhat more abundant than *grandis*.

34. *Anodonta suborbiculata* (Say).

Simpson—Iowa, Illinois and South. Rare in the main river, but somewhat fairly common in the sloughs, especially at Fairport, Iowa.

35. *Anodontoides ferussacianus* (Lea).

Simpson—Upper Mississippi drainage area generally, but as Ortmann, (10) points out its range is more northern. The variety *buchanensis* (Lea) appears to be an old female of *ferussacianus*. It has been reported from the Red River of the North and Crow Wing drainage by Wilson and Danglade. *A. modestus*, reported by the latter from the lakes of the Minnesota River drainage is thought by Ortmann to be a dwarf form of *A. ferussacianus*.

36. *Simpsoniconcha ambigua* (Say)=*Hemilastina ambigua* (Say).

The U. S. Biological Station records this from the Upper Mississippi River at Fairport, Iowa.

37. *Alasmidonta calceola* (Lea).

Simpson—Upper Mississippi drainage. Collected by us near Fountain City, Wis. Rare.

38. *Alasmidonta marginata* (Say).

Simpson—Upper Mississippi and St. Lawrence drainage. Collected by us near Wabasha, Minn. Local in distribution.

39. *Strophitus endentulus* (Say).

Simpson—entire Upper Mississippi drainage. Fairly common. Var. *pavonius* is simply a rayed form of the preceding species, observed according to Mr. H. W. Clark where the water is clearer, and is not entitled to varietal distinction.

Sub Family Lampsilinae

40. *Obliquaria reflexa* (Raf.).

Simpson—Mississippi drainage. Red Wing, Minn. where we collected it apparently represents its northernmost distribution as Wilson and Danglade do not report it from C. and N. Minnesota. Never abundant.

41. *Plagiola lineolata* (Raf.)=*Plagiola securis* (Lea).

Simpson—Upper Mississippi drainage as far south as the Arkansas and Tennessee rivers. Always taken from mussel beds and apparently attains a great age. Abundant locally.

42. *Truncilla truncata* (Raf.)=*Plagiola elegans* (Lea).

Distribution largely that of the preceding species.

43. *Truncilla donaciformis* (Lea)=*Plagiola donaciformis* (Lea).

Distribution largely that of the preceding species.

44. *Leptodea leptodon* (Raf.)=*Lampsilis leptodon* (Raf.).

Simpson—Upper Mississippi drainage south to Tennessee River. Found by Baker, (1), and Pratt, (13) in Iowa, but possibly more abundant toward the Ohio. Not observed, but Mr. Clark reports one dead shell from main river above Fairport, Iowa.

45. *Leptodea fragilis* (Barnes)=*Lampsilis gracilis* (Barnes).

Simpson—entire Mississippi drainage. In our experience more abundant in lower portions of the river.

46. *Proptera alata* (Say)=*Lampsilis alata* (Say).

Simpson—entire Mississippi drainage as far south as Arkansas. Common.

47. *Proptera lævissima* (Lea)=*L. lævissima* (Lea).

Distribution largely that of preceding species. Many specimens were found on sand bars.

48. *Proptera capax* (Green)=*Lampsilis capax* (Green).

The type locality of this species is the falls of St. Anthony, Minn. Holzinger (7) reports it from Winona, Minn., but the consensus of opinion is that it ordinarily does not go much north of Davenport, Iowa.

49. *Obovaria retusa* (Lam.)

The evidence indicates that if this species is present in the

Upper Mississippi drainage, it is restricted to the regions near the Ohio.

50. *Obovaria olivaria* (Raf.)=*Obovaria ellipsis* (Lea).

Simpson—Upper Mississippi drainage as far south as the Arkansas and Tennessee Rivers. Collected by us near Red Wing, Minn. Rare in L. Pepin and as Ortmann (10) indicates, it prefers strong steady currents. More abundant further down stream. Not reported from N. and C. Minnesota.

51. *Actinonaias carinata* (Barnes) =*Lampsilis ligamentina* (Lam.).

Throughout the Upper Mississippi drainage, but rare in L. Pepin. Fairly common. Reported from the Crow Wing drainage by Wilson and Danglade.

52. *Carunculina parva* (Barnes)=*Lampsilis parva* (Barnes).

Lake Pepin. Reported from S. Minnesota by Call, (3). Becomes more common descending the river. Not reported from N. and C. Minnesota.

53. *Ligumia ellipsiformis* (Con.)=*L. ellipsiformis* (Conr.).

Simpson—Upper Mississippi Valley south to 38° latitude. Geiser (5), and Pratt (13), report it from Iowa. We did not collect it north of there, nor does it extend into Central and Northern Minnesota.

53*a*. *Ligumia subrostrata* (Say)=*L. subrostrata* (Say).

Reported by Simpson, (14) as occurring north to latitude 41°. We collected this species near Fountain City, Wis. indicating a more northerly range. Rare. Mr. Clark states it to be fairly common along the edges of the sloughs and that it is often represented by a large form originally described as *Unio mississippiensis.*

54. *Ligumis recta latissima* (Lam.)=*Lampsilis recta* (Lam.).

Common. Extending throughout the Mississippi drainage into N. and C. Minnesota. The typical *recta* is the small Great Lakes form. The typical Mississippi form is that given.

55. *Ligumia iris* (Lea)=*L. iris* (Lea).

Reported by Simpson from the St. Lawrence drainage and the Ohio drainage, Illinois and Wisconsin, indicating its possible occurrence in the Upper Mississippi. Ortmann states this form to probably be the var. *nov-eboraci.*

56. *Lampsilis anodontoides* (Lea).

Not reported from the drainages of N. and C. Minnesota, although Simpson reports it distributed throughout the entire Mississippi drainage. It was found occasionally at points between Red Wing and La Moille, Minn., except in L. Pepin, where its place is apparently taken by the next named species.

57. *Lampsilis fallaciosa* (Smith).

Occasionally species were found within the limits given for the preceding species. More abundant in L. Pepin and quieter waters such as those of the sloughs.

58. *Lampsilis siliquoidea* (Barnes)=*L. luteola* (Lam.).

Simpson—entire Mississippi drainage. Abundant in *L.* Pepin, more so than in other parts of the river. As Ortmann (13) remarks, it prefers "rather quiet water and sandy, muddy bottoms. In these regions it apparently produces a large number of pearls."

59. *Lampsilis fasciola* (Raf.)=*L. multiradiata* (Lea).

Simpson—entire Ohio River drainage. Ortmann reports it from the Illinois River in Illinois. There is thus a fair probability of being found in the lower stretches of the Upper Mississippi River.

60. *Lampsilis ventricosa* (Barnes).

Abundant. Wilson and Danglade (18) report it from the St. Croix, Minn., Crow Wing and Red River of the north drainages. Simpson—entire Mississippi drainage. In connection with this list, it should be remembered that the Crow Wing is the modern representative of the headwaters of the Mississippi.

61. *Lampsilis orbiculata* (Hildreth).

Reported by Baker (1) from McGregor, Iowa. This at present seems to be its most northern record. Rare. It probably intergrades with the next species.

62. *Lampsilis higginsii* (Lea).

This species was collected at Red Wing, Minn., L. Pepin and points near Winona, Wis. Not reported from C. and N. Minnesota. Comparatively rare. The type locality is Muscatine, Iowa. The var. *grandis* does not seem to be clearly distinguished from its parent species.

63. *Dysnomia* (*Truncillopsis*) *triquetra* (Raf.)=*Truncilla triquetra* (Raf.).

Reported from Iowa by Pratt (13) and Witter (19). We collected two specimens in L. Pepin—an expansion of the Mississippi in S. Minnesota. This probably represents the most northerly record. Reported from Fairport, Iowa, by Mr. H. W. Clark.

In conclusion, acknowledgment is made to Dr. A. E. Ortmann, Carnegie Museum, Pittsburgh, Pa., Mr. H. W. Clark, U. S. Biological Station, Fairport, Iowa, and Dr. Bryant Walker, Detroit, Michigan, for criticisms kindly given toward the preparation of this manuscript.

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SILAS C. WHEAT.

Silas C. Wheat, well known to many conchologists, died at Middlebury, Vt., September 1, 1922. Although nearly 70 years of age, he apparently was hale and hearty and enjoying a summer's vacation when he suffered a stroke, dying almost immediately.

Mr. Wheat was born in Franklin, Delaware Co., N. Y., in 1853, where he graduated from the Franklin Academy and then attended the New York University School of Pedagogy, qualifying as a teacher. He taught in New York City, was principal of a school at Madison, N. J., and since 1893 followed his profession in the public schools of Brooklyn, retiring in 1910.

He was one of the founders and at one time president of the Brooklyn Conchological Club, publishing in 1907 the following articles in the Bulletin of the club: "Abnormal Shells;" "Shells in City Gardens and Ponds," and in Science Bulletin, Vol. 2, of the Museum of the Brooklyn Institute, he described *Acmaea fergusoni* and *Urosalpinx cinerea* var. *aitkinae.* In THE NAUTILUS he published "Land Shells from East Shore of Cayuga Lake", "The Genus Elysiella" and a number of notes. His "Report on the Mollusks of New Jersey" for the State Museum at Trenton and a similar one on the "Mollusks of Long Island" for the Brooklyn Institute are still pending publication.—C. W. J.

NOTES.

FERRISS COLLECTION INJURED BY FIRE. We regret to learn that the home and part of the collection of Mr. James H. Ferriss, of Joliet, Ill., was destroyed by fire on November 18. Nearly all of his geological specimens, fresh water shells and ferns were destroyed, but his valuable collection of land shells was saved with little damage. Mr. and Mrs. Ferriss were in the desert region of New Mexico at the time, in company with the senior editor of THE NAUTILUS.

CRENELLA FABA MÜLLER ON THE COAST OF MAINE. This species was determined by Dr. Dall, who says: "This is a northern species described from Greenland and found as far south as the Straits of Belle Isle, and I think Nova Scotia; yours is further south than any previous locality noted." I dredged one live specimen in from 8 to 10 fathoms, outside the Rockland breakwater, August 19, 1922.—N. W. LERMOND.

A CORRECTION. One of our subscribers has called our attention to a discrepancy. The cover pages are all right, Vol. XXXVI, on both the July and October numbers, but on pages 1 and 37 it is Vol. XXXV. Please correct this error.

A Scalariform Specimen of Zonitoides minusculus alachuanus Dall. This interesting example was found among numerous normal specimens in a pile of old brick, at Gainesville, Florida, Jan. 1, 1916. The nucleus and first whorl are normal, then it suddenly becomes scalariform. What caused the whorls to separate is not possible to determine. The shell is 3 mm. in height, while a normal specimen with the same diameter, is less than one.—T. Van Hyning.

Arion hortensis Drap. in Maine. In June while at Bar Harbor, Maine, it was very rainy; the result was that an unusually large number of slugs were seen, varying in color from a bright yellow to brown with the lateral stripe obsolete or wanting. Some were sent to Dr. Pilsbry who says: "I have made colored figures of those sent me, as it is the first time I have seen the real *Arion hortensis* alive. The old records in the catalogues are mainly *Arion circumscriptus* Johnst."

In 1920 I found a very large yellow slug at Bar Harbor, that I took to be *Limax flavus.* It died on my way home so that I could not positively identify it. Although as I remember the specimen it seemed different than the specimens of *A. hortensis*, still I cannot be certain and the record in The Nautilus, Vol. 35, page 134, should be questioned.—C. W. J.

Viviparus japonicus v. Martens from another locality in Boston. This species which was referred to as *V. malleatus* Reeve in The Nautilus, Vol. 29, p. 35, 1915, but which Dr. Bryant Walker considers *V. japonicus*, (see Miscellaneous Publication, No. 6, Mus. of Zool., Univ. Mich., p. 126, 1918) was found in Jamaica Pond, by Harold A. Rehder, July 6, 1922. He revisited the place on September 7, and saw several specimens in much deeper water than they were on the previous occasion. In Sargent's Pond, Brookline, Mass., he found *V. contectoides* W. G. Binney. This species is still abundant in the lake in the Public Garden, Boston, where it was introduced in 1916, see The Nautilus, Vol. 30, p. 72.—C. W. J.

Observations on Landshells of Stanley Park, Vancouver, B. C. Whilst staying in Vancouver this summer for rest and change after eight years' hard work in Hawaii, several trips were taken to Stanley Park for the purpose of collecting any landshells that might be found.

Results, however, were very disappointing, as only four species were found, and these in very small numbers.

No fresh-water species were to be seen although careful search was made.

The two species of Polygyra were usually found upon the leaves of the Skunk Cabbage (*Spathyema foetida*), whilst the Haplotremas were to be found on the ground amongst dead leaves, moss, and rubble. Species found.

Haplotrema vancouverensis (Lea). *Polygyra columbiana* (Lea).

Haplotrema sportella (Gld.). *Polygyra germana* (Gld.).—C. F. Mant.

PUBLICATIONS RECEIVED.

Notes on the Radula of the Helicinidae. By H. B. Baker (Proc. Acad. Nat. Sci., Phila., 1922, pp. 29–67). A valuable and interesting study of the radulae of the American species. Many changes are made to the classification of A. J. Wagner (1905, 1907–1911) based solely on operculum characters, Wagner also disregarded previous writers and the law of priority; of the 36 new groups proposed by him for American Helicinidae, only about 16 can be used. The paper is illustrated by five plates containing 37 figures of radulae.—C. W. J.

The Molluscan Fauna of the Big Vermillion River, Illinois. By Frank C. Baker (Ill. Biol. Monographs, Vol. 7, No. 2, pp, 105–224, 15 pls., 1922). A most interesting faunal paper. An account of the physical feature is followed by chapters on general distribution and systematic discussion of the mollusca; 65 species are recorded of which 36 belong to the Unionidae. The pollution of Salt Fork by sewage is discussed. The illustrations are excellent.—C. W. J.

Pleistocene mollusca from Northwestern and Central Illinois. By Frank C. Baker (Jour. of Geol., Vol. 30, pp. 43–62, 1922). Some supplementary studies to the author's work on "The Life of the Pleistocene."

History of Lymnaea emarginata Say. By Olof O. Nylander (Maine Naturalist, Vol. 2, pp. 74–77, 2 pls., 1922). An account of the rediscovery of this interesting shell.

The Histological structure of the gills of the Najades with special reference to the Histology of the groove along the edge of the inner gill. By Hiram J. Bush (Amer. Midland Nat., Vol. 8, pp. 89–104, 1922). A biological paper of interest in the study of Unionidae.

The Champlain Sea. By Winifred Goldring (N. Y. State Mus. Bull., Nos. 239–240, 1920 (1922), pp. 153–187, pls. 1–3). A paper of special value to a conchologist, as well as a geologist. It shows how marine animals can be divided into groups according to their ability to live in water of various degrees of salinity. *Macoma balthica*, *Yoldia arctica* and *Saxicava arctica* are found in the pleistocene, as far south as Fort Henry and vicinity. At Burlington ten species of marine mollusks are found.—C. W. J.

Journal de Conchyliologie, Vol. 66, No. 4, Oct., 1922. Revision des Carditacea vivants du Muséum National d'histoire Naturelle de Paris. Par Edouard Lamy, pp. 289–368.

Note sur un cone fossile senestre. Par A. Loville, pp. 369–370.

Fossil Chitons of Western North America. By S. S. Berry (Proc. Cal. Acad. Nat. Sci., Vol. XI, 4 Ser., pp. 399–526, pls. 1–6, 1922). This is an excellent paper on a much neglected group. The author believes that the chitons will prove among the best criteria for determining the age and relationships of any of the formations in which they can be found in any number. One new genus, *Oligochiton*, two new species and a new subspecies are described among a total of some 33 species.—C. W. J.

Observations on the Rate of Growth of the Shells of Lake-dwelling fresh-water Mussels. By N. M. Grier (Amer. Midland Nat., Vol. 8, pp. 129–148, Nov., 1922). The age and rate of growth were obtained by counting the lines of growth on each specimen and these are tabulated under each species. Shells grow most rapidly in the earlier years of their lives and none of the shells reported upon had reached an extreme old age. A useful paper in connection with the propagation of these shells.—C. W. J.

Biology and Economic Value of the Sea Mussel, Mytilus edulis. By Irving A. Field (Bull. Bureau of Fisheries, Vol. 38, pp. 127–259, 1922.) A very exhaustive treatise on the anatomy and physiology of the Sea Mussel. Its embryology and growth is fully described and figured. An account of its enemies and parasites, is followed by a chapter on its value as an article of food. The valuable paper ends with an excellent bibliography.—C. W. J.

The Journal of Conchology, Vol. 16. No.10, Oct. 1922.

Some uses of shells in the Belgian Congo. By F. M. Dyke, p. 309.

The Helicoid group Callina, Lowe. Description of a new species. By T. D. A. Cockerell, p. 310.

Three Cephalopods new to Dorset. By T. Edw. Belcher, p. 312.

On Sunetta hians Reeve. By J. R. Le B. Tomlin, p. 312.

On the Association and Non-Association of Helix nemoralis and Helix hortensis. By W. Cartwright, pp. 313–319.

Land and freshwater Mollusca of Winoley in North Wilts. By Douglas Bacchus, pp. 320–323.

Paludestrina confusa in the Waveney Valley. By C. Oldham, p. 324.

Pisidia of Guernsey and Sark. By J. R. Le B. Tomlin, p. 328.

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AN EXPEDITION THAT FAILED.

BY CHARLES T. SIMPSON.

On the morning of the 23d of last January Dr. Edward Mercer, his nephew of the same name, and the writer left Miami in the car of the former for a trip to Northwest Cape Sable on a snail-collecting expedition. The Doctor and I had visited the same general region before, taking in Middle and East capes, running with the auto down to Flamingo and on back along the prairie to a point in the rear of them, then leaving our machine and tramping across a wide, deep swamp over an old trail out to the open beach.

We ran the fifty miles from Miami to the Royal Palm Park in a little over an hour over a beautiful oiled road and then down the Ingraham Highway across the open Everglades towards our destination. This road was not so fine as the first stretch but we made fairly good time over it and reached Flamingo on Florida Bay, a matter of perhaps twenty-five miles more, in about the same time we made the first run. There we were informed that one or more great canals had been cut from the back country and that we could only get to the old deserted clubhouse on the bay shore, a matter of six miles farther. We camped at this building, a ramshackle affair set up eight feet on posts and built by a land company, spreading our beds on the floor of the gallery and making coffee in a pail which we picked up. The other two hunted up a couple of old tin cans to drink out of while I dug a brand-new tin cup out of my bag, and this gave me a sort of social standing not enjoyed by the rest.

In the morning we started afoot along the beach intending to visit East Cape, where there is an extensive grove of coconuts and a considerable area of hammock. Along the low shore and back for a great distance grew a forest of Avicennia or black mangrove and everywhere we found its strange "quills", covering the ground in places. These usually grow straight and sometimes to a height of more than two feet; they may be as large as one's little finger, and they act as pneumatophores or breathers to pump oxygen from the air to the tree. Often they stand so close that they nearly touch, and it is almost impossible to work one's way through them. On the beach they are matted and twisted grotesquely, and thousands of them were thrust through the valves of pelecypod mollusks, Arcas, Tellinas, Cardiums, Labiosas, Loripes and Pholas, while other thousands bore aloft such gastropod shells as Strombus, Melongena, Polinices, Oliva and the like. Many of the bivalve shells are quite thin just below the beaks, and holes are often broken through them at this point as they are dashed about in the sea and on the shore. These with the univalves had been thrown upon beds; the "quills" had pushed their way up and in many cases through the holes of the valves, and into the apertures of the gastropod shells, lifting them on high as they grew up.

Within half a mile of the cape we came to a newly dug canal, thirty feet wide and quite deep, which was carried far out into the shallow bay. Its banks were so steep we could not have climbed out if once we got in and it would have required a long wade in the soft mud to go out around it. The Doctor suggested that as I was taller than he and was the chief conchologist it was up to me to lead the way and I countered by saying that if I was as young as he was I wouldn't hesitate a moment. Then he said "Pshaw, there is only a scrub hammock at East Cape and we were there not long ago; it isn't worth while bothering our heads about it anyhow!" So with this "Sour grapes" observation we turned back and agreed to call it "An Expedition that Failed."

Leaving the club house we drove back over a wide prairie which was skirted by a large number of hammocks. We stopped at one of these and on entering it a most astonishing sight met our eyes. On almost every tree we found a considerable number of young *Oxystyla floridensis* and by standing in a single spot I could count more than I ever saw in all my life. These snails become completely dormant during the dry season, gluing themselves fast to the bark or other smooth surfaces of trees in any place where they can be somewhat concealed.* They are attached by an epiphragm so solidly that the shell will almost always crush without letting go and the only way of removing them without injury is to cut under the whole carefully with a knife. Every knot and depression in the bark, every space between brace roots was covered with these snails. In the forks of limbs, between two nearby trunks or any surface partly screened they were crowded together. A large piece of dead bark had fallen against the trunk of a Jamaica dogwood and on taking it away I saw a space six inches wide and two feet long not only covered but having them two and three deep. A branch a foot or more in diameter had broken from a tree a short distance above the ground and had decayed so that a smooth-sided cavity perhaps eight inches across remained. The inside of it was crammed down as far as I could see in the semi-darkness. I ran a stick down it in order to find any rattlesnakes that might be in it; and hearing no disturbance I carefully thrust my arm down it and found the walls occupied with the snails nearly to the ground. Counting the number on a space six inches square on a nearby tree and making an estimate I concluded that there were at least five hundred specimens in this hollow limb! A very few of these were adult, probably three years old; perhaps five per cent had made a second growth and may have been two years of age but the rest had only formed one black growth-line and were yearlings. Hitherto I

* For an illustration of this see my book "In Lower Florida Wilds," pp. 352, 356.

had only found this snail in limited numbers; now the woods were full of them, the market was glutted; the price at once went down and I hardly considered them worth collecting.

Then I immediately launched a theory. I said that the previous summer and fall had been unusually wet, that the rain had been well distributed, making conditions wonderfully fit for snails, that every Oxystyla egg in the hammock had doubtless hatched and lived. I believed I would find a large number of these snails in every one I might visit and to prove that I was right I went to the next hammock, which was only a few rods away, and found *absolutely nothing.* Not a dead or broken shell, not even a fragment! I visited a third not far away and got a very few Oxystyla and *several dead Liguus.* Then we ran a short distance to a fourth and found a different subspecies of Liguus and *no Oxystylas!* Then I threw my theory on the scrap heap as I had done with many others.

Perhaps it may be well to say something about the remarkable region which composes the extreme lower part of the mainland of Florida and the astonishing distribution of its Liguus. I believe that the land and water of this area are as complicated as they are in any part of the globe, in fact Mr. W. J. Krome who surveyed the whole territory for the Florida East Coast Railway informed me that there were thousands of acres of surface which were neither the one or the other. My experience in exploring a considerable part of it fully agreed with what he told me. Probably none of the natural land is more than two-and-a-half feet above an ordinary high tide and in places it is cut up by channels which vary greatly in width, with mudholes, pools, ponds and lakes. Some of these are fresh during the rainy season, others are brackish during the entire year. Large areas are inundated during the summer and fall that dry up and become mud beds in winter and spring. Land that is a little higher than this is usually covered with mangroves or Avicennias, the latter a large tree, while the drier littoral is overgrown with tropical buttonwood. Here and there the ground is a few inches higher, the result of the decay of rich vegetation, and on such spots hammock growth has sprung up. All the conditions are favorable for getting lost and I have been with at least three persons long resident in the region who became hopelessly confused and for a time were not able to tell where to go. It is a fine place for big diamond rattlesnakes and water moccasins, and one will do well to watch where and how he steps.

I have said that the distribution of the Liguus in this region is astonishing; it is even amazing! At first sight it appears to be haphazard; it would seem as though some giant had strode over the entire region and from a bag of mixed Liguus had sown as a sower would scatter grain. But this is not entirely so. There are certain centers from which a given form or forms seem to be distributed, but one does not observe this at first. The subspecies *lossmanicus* seems to occupy exclusively the island from which it is named and this may be its center of distribution. At Northwest Cape I found *capensis* only; apparently another center and no Oxystyla were found there. At Rogers River *lineolatus*, *roseatus* and *castaneozonatus* occurred and what I take to be *lossmanicus* was brought to me from Harney River. There are two hammocks at Middle Cape, separated by a narrow mangrove swamp. In the northern and smaller one Dr. Mercer and I found *lossmanicus*, *castaneozonatus* and hybrids between the two, *lineolatus* and a fine living *marmoratus*. Across the five-rod swamp in the other hammock are all the forms in the north forest and in addition *matecumbensis* and *eburneus*. East Cape has beautiful *roseatus*, *lineolatus*, *cingulatus* and *eburneus*. In and around Flamingo *matecumbensis* and *eburneus* are abundant, but one hammock may have only one and a second another; and this seems to be the metropolis of both. Near Mr. Roberts' home I found specimens of a large *castaneozonatus* with a broad revolving band running unbroken nearly to the tip of the spire, and this form occurs on the middle of Key Largo and at the west end of Madeira Bay, twenty miles east of Flamingo. *Capensis* occurs in isolated spots; on Jo Kemp's Key, on a long tongue of land in Florida Bay six miles to the eastward, inland four miles northeast of Jo Kemp's Key and in an inland hammock back of Middle Cape. In the vicinity of Madeira Bay a form occurs that is probably *livingstoni*. I could give other instances of broken and scattered distribution in this general region but they are not necessary.

This remarkable dispersal of Liguus and Oxystyla cannot be explained by supposing that the region was once higher than at present and was covered by a continuous growth of hammock, for if this had been the case we would find most of the different forms pretty well distributed over the entire area. In the Lower Keys which once formed a single forest-covered island we find nearly all of the subspecies of *Liguus solidus* in practically every locality. These snails did not crawl from one hammock to the other as they do in pine woods. I have never seen one of them on wet ground and I feel sure that a swamp or any littoral ground is an absolute barrier to their passage. The three capes are connected by low, sandy beach with a deep morass just back of it and any Liguus or Oxystyla which attempted to travel on this sand would become clogged in it before going five feet. The other hammocks between the prairie and swamp which I have mentioned are as completely barred against the passage of tree snails from one to another as if the sea was between them. In the dry season they are dormant and are not gravid; during the time of the rains the ground between the different hammocks is either swampy or under water.

The key to the mystery of distribution consists of one word —*hurricanes!* Hurricanes broke off or washed out the trees on which their progenitors grew in Cuba, these trees were swept into the sea on the great floods produced by them, they have helped to sweep these trees along the Florida Strait and have produced unusually high tides on which they were driven out over and by which they were deposited on our shores. There are a number of forms of Liguus living in Cuba today that are the analogues of subspecies inhabiting our state. Most of these were landed on our Upper Keys and from there migrated across to the mainland of Lower Florida over an old but now destroyed land-bridge. The *castaneozonatus*, *roseatus*, *lineolatus*, *cingulatus*, *matecumbensis* and *marmoratus* of the upper chain are identical with forms on our lower mainland, and *luteus* of these islands is found in the hammocks of the southeast coast. *Capensis* is close to *vacaensis*.

These Liguus were established in the region I have discussed and were dispersed over it by hurricane action. The Bay of Florida is shaped something like a blunt cow's horn, its southern shore being the Florida Keys and the northern one the lower edge of the mainland, while its wide base opens to the west. Whenever, during one of these great storms the wind blows from a westerly direction the water of the sea is driven into the bay with great force and it overflows the entire lower portion of the mainland, *often to a depth of six or seven feet!* Trees growing in this region and bearing Liguus or Oxystyla are broken off or they may be uprooted and with their living freight swept along on the angry flood in any direction, perhaps, sometimes for several miles. The snails are able to cling to the branches on which they live and to stand immersion in water for many hours. Finally when the storm ceases and the water goes down they are landed in a new place, probably a hammock where it is easy for them to crawl off, climb the nearest tree and at once establish a new colony. This will account for the fact that one hammock will have one or more species, the next another lot and a third nearby no Liguus at all. The hurricanes are hit and miss sowers.

VARIATIONS IN GONIOBASIS EDGARIANA LEA.

BY CALVIN GOODRICH.

Caney Fork, Tenn., a branch of the Cumberland river, supplied Lea with several of his types of Pleuroceridae and Anthony with at least two of his. Associated with the early collections from the stream are the names of Sellers, Edgar and Troost which one comes upon frequently in the literature of American freshwater mollusks. A probable fourth visitor to Caney Fork was Safford, who appears to have lived at Lebanon, not far from this river. Wetherby touched at one spot in the drainage in the 1870's. I suspect that I was the next conchologist there, collecting between rains and floods in 1920. The year following, with a merciless sun to contend with instead of high waters, Miss Mina Winslow made an admirable collection. Dr. Ortmann did still more work in the stream in 1922.

Caney Forks drains a section of the western escarpment of the Cumberland mountains. One tributary, Calfkiller river, follows a broad valley at the base of the highlands. Collins river, a second branch of many forks, approaches Walden Ridge toward the southeast and issues in the southwest from the ridge upon whose further side is the Duck river.

The characteristic univalve of the drainage is *Goniobasis edgariana* Lea, ranging closely to *G. laqueata* Say and only remotely, it seems to me, to *G. nassula* Conrad, under which Tryon consigned *edgariana* as a synonym. It is a large shell for the genus, typically striate-plicate, with flattened whorls and a subangular base in immature specimens. Studies of the variations by localities brought out the following facts:

Calfkiller river, at Calfkiller, Putnam County—This is within four or five miles of the beginning of the stream and is apparently the highest spot reached by shell life. Of 580 specimens taken, 85 per cent has the plicate sculpture only. The remaining 15 per cent are plicate-striate. The sculpture ceases when the shell is about half-grown and thereafter consists only of nearly microscopic growth-lines. It is convenient to speak of that appearance as smooth. Only two shells were found with indications of color bands. In respect to color and texture, the shape of the aperture and the form of the outer lip, the shells correspond to typical *edgariana*.

Town creek, a branch of Calfkiller river, near Sparta, White County—Collections made by Miss Winslow, about 325 shells. The typical plicate-striate sculpture is present in 69 per cent. As the shells grow the plicae tend to disappear. In the case of 89 specimens, the last whorl is striate only, in all it is smooth. Both adults and young are included in this count and it might be explained that the sculpture is persistent in nearly all the full-grown examples and wholly absent only in a few. Two shells are plicate without having the revolving striae. Dr. Ortmann's collection at this locality did not differ from Miss Winslow's.

Two shells in my collection labeled simply "Calfkiller river" and a single lot in Dr. Walker's cabinet, similarly designated and carrying Wetherby's identification, *G. caliginosa* Lea, are of this form.

Barren Fork, branch of Collins river, McMinnville, Warren County—Thirteen shells taken by Wetherby. Eleven adult and nearly adult specimens are plicate-striate to the last whorl. Two retain only the revolving striae upon this whorl. These are more nearly like the types, credited to Caney Fork proper, than any *edgariana* from the main stream I have seen outside of the Lea collection. Dr. Ortmann's shells from this place were so like Wetherby's that I have not studied them intensively. An interesting note made by Dr. Ortmann was that the young *edgariana* he found here were in a shallow branch.

Hickory creek, branch of Barren Fork, two miles south of McMinnville—156 shells, almost all adult. Except three, these specimens are plicate-striate from apex to base of last whorl. The three are striate, but not plicate, on the ultimate whorl.

Caney Fork, Riverhill, White County—45 shells taken by Dr. Ortmann. Thirty-seven shells have plicate-striate apex, six are only plicate at the apex; two specimens are so eroded that the sculpture cannot be made out. In the case of 21 examples, the base is more or less distinctly striate; the base in 24 is smooth. None is plicate to the last whorl as is common with the *edgariana* from Barren Fork and Hickory creek. This is a rough, heavy lot, tending apparently to lose the distinctive sculpture of the species.

Caney Fork, below dam at Falls City, Warren County—270 shells taken by Miss Winslow. The specimens plicate-striate to the last whorl amount to 80 per cent, but not one is adult. Even in the instance of the young shells, there is a slight tendency for the plicae to become obsolete. Fourteen are striate on the last whorl, six are smooth. Of the full-grown individuals, 13 are striate to the base, 22 are smooth upon the last whorl. The material of two other lots, collectors unknown, correspond to this form.

Butts creek, DeKalb County—Nineteen shells. Here the plicate-striate sculpture is confined entirely to the early whorls and in one example the apex is striate only. The last whorls of all the shells are smooth. These mollusks seem to be identical with *Melania columella* Lea.

The species occurs also in Stone's river, Rutherford County, Tenn., another tributary of the Cumberland. It has been taken there by Wetherby and Ortmann. The shells are more convex than the Caney Fork forms, the revolving striae are stronger and more persistent, the last whorls of some of the young are rounded rather than subangular. Of 26 shells of a lot in Dr. Walker's collection, 24 are plicate-striate on all whorls. In two specimens, the plicae have disappeared before the last whorl is reached. The Stone's river form corresponds with *Melania corrugata* Lea.

While nearly every colony of *edgariana* varies from other colonies, it does not, as in the case of *Io*, vary with reference to any particular position in the stream. The most elaborately sculptured forms occur in Calfkiller river, presumably after the river stage is reached; in a branch of this stream and in branches of Collins river. A more simple form lives in the headwaters of Calfkiller river and the tendency of the species in Caney Fork at Riverhill and at the falls is toward simplification. That environment has an influence in this matter is not clear, for Barren Fork, at the time I saw it, was swift and rough; Hickory creek, having the same form of *edgariana*, was a slow-moving stream. Conditions in the upper Calfkiller river and those at the falls of Caney Fork would correspond only at a time of freshet.

The habitat in upper Calfkiller river was clear, gently-flowing water, six to eighteen inches deep. The shells occurred in all parts of the stream, upon stones and a small sandbar. In Hickory creek, nearly all *edgariana* were taken from limestone rocks exposed by the channel. While Barren Fork, just below, was on a rampage, Hickory creek had the current of a prairie brook. So I judge it is seldom swift. Dr. Ortmann writes that at Riverhill, the shells occurred "in riffles, on rocks; also in slowly flowing water along banks, on mud." The habitat at McMinnville, he describes as "riffles with coarse gravel; the very small ones were found in a shallow branch among fine gravel." In Town creek, he found the shells "in quiet pools and eddies on mud and sand as well as on ridges of limestone crossing the creek."

The synonymy of this species is:
Melania edgariana Lea, March, 1841.
Melania columella Lea, March, 1841.
Melania caliginosa Lea, March, 1841.
Melania concinna Lea, March, 1841.
Melania corrugata Lea, March, 1841.
Melania rugosa Lea, Dec., 1842.
Melania coricina Anth., Dec., 1850.
Melania sellersiana Lea, 1852.
Goniobasis purpurella Lea, May, 1862.

Pillsbry * has made *M. corrugata* and *rugosa* synonyms of *G. laqueata* Say. As *edgariana* is a sort of robust stepbrother of *laqueata* the transfer I have suggested in the position of the two species is of no great importance.

ASHMUNELLA HEBARDI, A NEW SNAIL FROM THE HACHETA GRANDE MOUNTAINS, NEW MEXICO.

BY H. A. PILSBRY AND E. G. VANATTA.

In his summer campaign for Orthoptera in company with Mr. Rehn, Mr. Morgan Hebard visited the northwestern slope of Hacheta Grande. Ascending in a broad canyon, he found landshells at about 7600 ft. *Holospira crossei* Dall and *Oreohelix hachetana* Pils. do not differ from the specimens already known from about a thousand feet higher, at the summit of the mountain, where one of us collected in 1910. The *Ashmunella* obtained, while related to *A. mearnsi*, is rather conspicuously distinct.

Ashmunella hebardi n. sp. Shell of about the size and color of *A mearnsi*, but differing (1) by the presence of an acute peripheral keel near the top of the whorl, the upper surface of the last 3 whorls nearly flat, the last whorl impressed above the keel; the base strongly convex, (2) the straight parietal callus is much more strongly raised, (3) the surface is distinctly

* Proc. Acad. Nat. Sci., Phila., 1896, p. 499.

though finely striate, the striae partially interrupted forming long granules. The teeth are substantially as in *A. mearnsi.*

Height 5, diam. 14.7 mm.; $5\frac{1}{2}$ whorls.

By its acute keel and minutely roughened surface this form resembles *A. walkeri* Ferr. of the Florida range; but that is a smaller species with weaker sculpture, an adnate parietal callus and a simple parietal lamella. *A. kochi* Clapp of the S. Andraes range is larger, smoother, not acutely carinate, and has not a raised parietal callus.

All of the specimens are dead shells more or less bleached. The amount of granulation visible on these "bones" is variable, especially on the base. Doubtless living shells would show it more strongly, and possibly with cuticular scales. The surface is dull, not glossy as in living *A. mearnsi.* In one example some fine incised spiral lines can be made out on the base.

Type is 131409 A. N. S. P. Paratypes, 6 specimens, No. 131339.

MOLLUSCA FROM THE DREDGING OPERATIONS AT KEWALO HARBOR, HONOLULU, 1921.

BY CHARLES F. MANT.

During several months of last year the Hawaiian Dredging Company was engaged in deepening the small harbor at Kewalo in order to accommodate the Japanese fishing fleet.

The dredged material was pumped through large iron pipes, and discharged upon a piece of waste ground, thus giving a good opportunity for the examination of the molluscan life of this part of the bay.

As often as possible visits were paid to the scene of operations, and many thousands of shells, mainly in a "dead" condition, secured, amongst them species that are rarely if ever found by the ordinary means of collecting, and others that were new to science.

It was quite amusing to notice how that, when one appeared the men, women, and children busy collecting shells, bits of coral, &c. would pass the word around, "Here comes the shell man", and they would crowd up with buckets, tins, and tobacco boxes containing their "finds," and a selection would be made for which a small consideration would be given, both parties being quite satisfied. Some of the people were set to collecting the many minute shells to be found amongst the piles of coral sand, rock, and debris, and in this way a number of most interesting species were discovered.

Over 150 species of mollusca were collected, and Professor Dall of the National Museum has most kindly examined and named many of them.

The following is a list of species gathered by the writer, and from this a good idea of the molluscan life in a limited area of these waters can be obtained.

Alaeocyma thaanumi Dall.
Alcyna kapiolaniae Pils.
  rubra Pse.
  rubra multicolor Dall.
Alectrion hirta Kien.
  ravida A. Ads.
Atys cornuta Pils.
Biforina cingulifera Hds.
  corrugata Hds.
  decorata Pse.
  flammulata Pse.
Bittium boeticum Pils. & Van.
  boeticum unilineatum Pse.
Cassis vibex L.
Cerithium obeliscus Brug.
  lacteum Kien.
Columbella (Alia) moleculina Duclos.
  orphia Duclos.
  urania Duclos.
  varians Sowb.
Conus abbreviatus Nutt.
  catus Hwass.
  hebraeus. L.
  lividus Hwass.
  marmoreus L.
  nussatella L.
  omaria Hwass.
  generalis L.
  pulicarius Hwass.
  quercinus Hwass.
  striatus L.
  textile L.
Coralliophila neritoides Lam.
Cylichna anagogia Dall.
Cymatium pilearis L.
  bracteatus Hds.
  obscurus.
  tuberosus Lam.
Cymatosyrinx mighelsi Dall.
Cypraea caputserpentis L.
  carneola L.
  circicula v. tricornis Jouss.
  helvola L.
  isabella L.
  madagascariensis Gm.

peasei Sowb.
recticulata Mart.
semiplota.
sulcidentata Gray.
talpa L.
tessellata Swain.
Daphnella sandwichensis Pse.
Daphnobela manti n. sp.
Dibaphus edentulus Swain.
Drupa morus Lam.
ricinus L.
tuberculatus Blainv.
Engina idosia Duclos.
Erato sandwichensis Pse.
Iopas sertum Brug.
Liocerithium thaanumi Pils. & Van.
Liotia ednae Dall.
Marginella acaria Dall.
Melanella acicula Gld.
opaca Sby.
pusilla Sby.
Minolia striatula Garrett
Mitra astrica Rve.
aurantia Gm.
auriculoides Rve.
consanguinea Rve.
cophina Gld.
coronata Lam.
ferruginea Lam.
flavescens Rve.
fulva Swain.
lamarcki.
lienardi.
lipara Dall.
litterata Lam.
lugubre Swain.
mitata? Dall.
ostergaardi n. sp.
peasei Sby.
kewaloensis Dall.
tabanula Lam.
thaanumi n. sp.
ticaonica vagans n. sp.
tuberosa Rve.
tusa Rve.
Mitromorpha hawaiiense Dall.
Morula ochrostoma Blainv.
porphyrostoma Rve.
Natica marochiensis.
Niso diomedae Dall.
Oliva sandwichensis.
Otopleura diminuta Dall.
Peristernia chlorostoma Sby.
cf. newcombi A. Ads.
marmorata.
xanthostigmata Dall.
Philbertia luteola Dall.
laysanensis Dall.
mighelsi Iredale.
Planaxis labiosus A. Ads.
Polynices mamilla L.
Pupa alveola Souv.
Pyramidella oahuensis Dall.
sulcata A? Ads.
Ranella (Aspella) ancepts Lam.
pusilla Brod.
Rhizocheilus madreporarum Sby.
Rissoina ambigua Gld.
miltozona Tomlin.
tridentata Mich.
stearnsi Dall.
Subulina metcalfei A. Ads.

Strombus maculatus Nutt.
maculatus var.
samar Dillw.
Terebra albula Mke.
clappi Pils.
crenulata L.
dislocata Say.
inconstans Hds.
lanceata oahuensis n. sp.
langfordi Pils.
lauta Pse.
maculata L.
nodulare Desh.
pertusa Born.
straminea Gray.
Thericium nassoide Sby.
Trifora (Biforina) cingulifera Pse.
Trochus sandwichensis.
Turbo intercostalis Mke.
Turris brevicaudata Rve.
brevicaudata var.
Vexilla turben kanaka Pils.
vexillum Chemn.

A NEW ANODONTOIDES FROM WISCONSIN.

BY FRANK COLLINS BAKER.*

ANODONTOIDES BIRGEI, new species.

Shell rather solid, elongated, cylindrical, inequilateral, inflated; anterior end broadly rounded, posterior end pointed, distinctly biangulate; ventral margin straight or somewhat concave; dorsal margin straight, forming an angle with the posterior end; dorsal margin developing a small but well-marked wing; beaks raised about the hinge line, swollen; beak sculpture as in *A. ferussacianus* but finer, with the bars close together and with a tendency to become double-looped; posterior ridge sharply rounded, very distinct, with a postero-dorsal excavated area: the shell is greatly inflated anterior to this ridge; epidermis yellowish-horn or olive, the rest periods showing as brown concentric bands; surface rayless; hinge edentulous, but reinforced beneath the beaks by swellings representing rudimentary pseudocardinal teeth; the shell beneath the ligament is also thickened; beak cavity shallow; muscle scars faintly impressed; nacre bluish-white, silvery, tinged with salmon or pinkish,

* Contribution from the Museum of Natural History, University of Illinois, No. 27.

especially below the beak cavities. Female shell not as much incurved ventrally as male shell, otherwise there is little difference between the sexes.

Length, 61; height, 30; width, 26 mm. Type.
Length, 58; height, 29; width, 23 mm. Paratype.
Length, 29; height, 17; width, 10 mm. Paratype.
Length, 82; height, 37; one valve.

The animal is similar to that of *Anodontoides ferussacianus.* Mantle connection between anal and supra-anal openings much shorter than anal; anal opening fringed with fine papillæ on the inner edge; labial palpi connected at the base as in *ferussacianus*; inner gills larger than outer gills, especially anteriorly; the inner lamina of the inner gills are free from the abdominal sac as in *ferussaciamus*; outer gills marsupial. Mantle purplish-white, openings edged with brown; gills whitish; foot and abdomen creamy-white. Glochidia similar to those of *ferussacianus buchanensis*, but a trifle smaller; length and width 0.280 mm. The breeding season is probably the same as in *ferussacianus;* gravid specimens examined in middle of August.

Ecology: Shore of a bay exposed to the full force of the waves, buried in sandy-clay or clay bottom, at depths of from two to six feet.

Type locality: Sturgeon Bay, Door County, Wisconsin, west of bridge.

Anodontoides birgei is related to *A. modesta*, having the same form of beak sculpture. It differs markedly, however, in the shape of the shell, being more cylindrical and more inflated, with a well-marked posterior ridge and with the beaks longer. The swelling of the beaks extends downward on the side of the shell, giving it a greatly swollen appearance when viewed from the dorsal margin. Comparisons have been made with *modesta* from Long Lake, near Kalamazoo, Michigan.

This Anodontoides occurs in great abundance on the shores of Sturgeon Bay and has been produced, evidently, by the lake environment. There is some variation in the form of the shell and in the degree of development of the posterior ridge. All have the cylindrical shape when mature, but young and immature individuals are more compressed and have a rounded ridge.

A small form of Anodontoides occurs in a creek, six miles east of Green Bay, which somewhat resembles *birgei*, but this form has the beak sculpture of *ferussacianus* and *buchanensis* and is referable to the latter race.

I take great pleasure in dedicating this interesting species to Dr. Edward A. Birge, President of the University of Wisconsin and Director of the State Geological and Natural History Survey.

DESCRIPTION OF A NEW LYMNAEA FROM YELLOWSTONE PARK.

BY FRANK COLLINS BAKER.*

Lymnaea caperata warthini, new variety.

Shell differing from typical *caperata* in being smaller, more globose with a very short, wide spire; aperture rounder, the inner lip narrower and less reflexed over the narrow umbilical chink; whorls 4–5; sculpture of coarse spiral lines as in the type; color dark chestnut.

Length, 7.0; width, 5.0; aperture length, 4.0; width, 2.3 mm. Topotype.

Length, 6.5; width, 4.0; aperture length, 3.5; width, 2.0 mm. Paratype.

Length, 5.8; width, 4.8; aperture length, 3.5; width, 2.0 mm. Paratype.

This little Lymnaeid differs markedly from the typical form, which is also found in Yellowstone Park (Swan Lake, collected by Berry), in its more globose form, short spire and narrower umbilical region. It was collected by Dr. A. S. Warthin from rocks wet with spray at the foot of the Upper Falls, Canyon of the Yellowstone, in September, 1922. The specimens were submitted to the writer by Mr. S. S. Berry, of Redlands, California, who has been an untiring student in extending our knowledge of the distribution of western mollusks. It is named

* Contribution from the Museum of Natural History, Museum of Illinois, No. 29.

in honor of Dr. Alfred S. Warthin, of the University of Michigan, who collected the specimens. Paratypes are in the collection of S S. Berry (No. 5547) and of the Museum of Zoology, University of Michigan. Types and Paratypes in the Museum of Natural History, University of Illinois.

INHABITANTS OF A NATURAL AQUARIUM.

BY L. S. FRIERSON.

Red River having become choked by vast accumulations of drift-logs in the vicinity of Shrevesport, Louisiana, carried its waters to the Gulf through many side channels, which soon became possessed of high banks (as had the main river), and the lower lands between these channels acquired local names, some as "lakes," others as "bayous".

The drift however, having been cleaned out by the U. S. Government, and the side channels dammed at their heads, most of the lands constituting the Valley of the Red River are now in cultivation, even some of the former navigable lakes being cultivated.

When first explored by the writer, Bayou Pierre even at low water stage was a fairly large stream, and entitled to the name of "river".

The bed of this stream was swarming with millions of mussel shells, comprising nineteen species.

The creeks emptying into Bayou Pierre in this vicinity contained water of very different kind from that of Red River, the latter being heavily charged with gypsum, lime, and in low water stages even salt could be noticed as one of its flavoring materials. But the creek affluents of the river carry quite "soft" waters, and this difference, if not the cause, is at least correlated with a quite different mussel fauna. *Anondonta grandis* is the single species common to both creek and river.

When the head of Bayou Pierre was dammed across, there ensued of course a tremendous mortality in the naiad population, hundreds of acres of hitherto living waters becoming dry lands.

Gradually the Bayou Pierre has become converted from a stream containing the hard water of Red River to one containing the soft waters of the local creeks, and in fact is now only a large creek, going dry during droughts, except in local pools.

Between Red River and Bayou Pierre a low valley was for long known as Brown Lake, but which now is in rapid process of being put into a high state of cultivation.

A rail road, and a hard surfaced public road now traverse its former site. Alongside of the latter a ditch was dug, five feet wide and two feet deep and in the lower part of the lake site this ditch holds water for some time after rains, during which the ditch communicates with Bayou Pierre situated about a mile away.

In such flood times, fish run up these temporary streams, seeking pools in which to lay their eggs, and as these are ofttimes infested with *glochidia* the bottom of the ditch abovementioned becomes sown with young mussels.

It has so happened that the past two years have been unusually wet, and the rains have been quite equably distributed during the year, and hence the ditch in question, in its lower portion of about two hundred feet in length, has been continuously more or less full of water, until the present autumn (1922).

The writer had occasion to walk down this dry ditch and somewhat to his astonishment found hundreds of mussel shells on the bottom, some of which being collected proved of much interest.

A single *Anodonta grandis* was found, almost five inches long, showing a quite rapid growth, for it is impossible that this shell is more than *thirty months* old; most likely its age is only eighteen months.

The most interesting cases however are of the two following shells. The writer, in Nautilus, 1903, showed that *Unio tetralasmus* Say, with its several synonyms and the *Unio declivis* Say with its synonym *geometricus* Lea, were entirely distinct species, differing in shape, size, color of nacre and habitats.

This has been strikingly proven true by the changes in the local conditions outlined above. In the dried bed of Brown

Lake, great numbers of old dead shells of the *A. geometricus* can still be picked up; but in the many years of personal collecting done by the writer, no specimen of *tetralasmus* has ever been found in any Red River water. How interesting it was, then to find that the bottom of the ditch mentioned is teeming with typical *tetralasmus*, and not a single *geometricus* exists, I am sure, in this vicinity.

The latter form is universally held by all writers, inciuding Lea himself, to be a local form of *Unio declivis* Say. The single exception to this reference was Simpson, who in his Catalogue of 1914, cites the figure of *geometricus* given in Nautilus, 1903, Plate III, as being *camptodon* Say!

The population of this local aquarium however contained another surprise. For many years the writer has tried to prove by concrete material, what he was convinced to be true, that *Unio haleianus* Lea was merely an individual variant of *texasensis*; but no material had ever been obtained which could *prove* this *intuition.* Along with the *tetralasmus* in this ditch, the writer found hundreds of *texasensis*, and to his delight, a specimen of extra large size proved to be *typical haleianus!*

Although the bed of this little pond has been dry for the past two months, all of the *tetralasmus* are still living, and quite a number of the *texasensis* are also alive, but the majority are recently dead.

Notwithstanding that this pool of water was very seldom more than one foot deep, it seems to have been an almost ideal habitat for the three species mentioned, so long as the rains lasted.

One of the conditions which rendered this pool an almost *optimum* locality is the fact that being situated in an open commons, there is no shade, not even of weeds, to obstruct the sunshine.

It may not be known to every reader that the paucity of Naiades in the Tropics is thought by those who have collected in those regions to be largely due to the dense shade covering all but the larger streams.

The exploration of this ditch however furnished still another item of interest. As the pool dried up, the exposed *texasensis* began to die, and their valves gaping, the exposed contents were eaten by birds, and the latter not being content with their daily dead, in several cases undertook to expedite the process by pecking holes through their valves. With such force was this done that, in every case noted, *both valves* were punctured at once. Whether this action of these birds is due to *instinct* or to *reason*, the writer being strictly a Naiadologist leaves it to other better equipped observers to decide; merely remarking that this process has been previously observed, and the pecked shells in the writers cabinet now number three, from widely separate localities.

THE ANATOMY AND TAXONOMY OF CERTAIN UNIONINAE AND ANODONTINAE FROM THE GULF DRAINAGE.

BY A. E. ORTMANN, PH. D.

(Continued from page 84.)

Lea and Simpson distinguished from *Lasmigona holstonia* a species, *georgiana* (originally described under the preoccupied name *etowahensis* Lea), chiefly on the ground that the beak sculpture is said to be not double-looped, but concentric, and that the pseudocardinals are single in each valve. This form has been reported from Etowah River, Ga., and also from Tennessee, but so far only the types of Lea (two, according to Simpson) are known. They have badly eroded beaks and rudimentary pseudocardinals. According to my experience such beaks are often seen in *L. holstonia*, and the development of the pseudocardinals is very variable. The posterior (interdental) tooth of the left valve often is very poorly developed, or even absent, and sometimes also the anterior one is obsolete, so that there is only one tooth in each valve, and, in extreme cases, even this tooth may become rather small. Such cases of reduction of the hinge teeth are seen chiefly in older shells, in specimens both from the Coosa and from the Tennessee drainage, but such specimens are always associated with normal ones. Thus I do not entertain the slightest doubt that the

"*Alasmidonta georgiana* (Lea)" is simply a synonym of *Lasmigona holstonia* (Lea).

10. STROPHITUS CONASAUGAENSIS (Lea).[1]

St. connasaugaënsis (Lea) (1857), *St. alabamensis* (Lea) (1861), *St. gesneri* (Lea) (1858), Simpson, 1914 pp. 351–354.

The first form is from Conasauga Creek, Gilmore Co., Ga. (only the very source of the Conasauga, for about a mile, is in Gilmore Co.); *alabamensis* comes from Talladega Creek, Talladega Co., Ala.; *gesneri* from "Uphaupee Cr., below Columbus, Ga." (surely Uphaupee Creek, Macon Co., Ala., tributary of Tallapoosa River (Alabama drainage); it is, however not "below" Columbus, but to the west of it).

In 1900, Simpson has united *alabamensis* with *conasaugaënsis*, but in 1914, he separated them again, expressly stating that the three forms are closely connected and hard to distinguish. He gives the following distribution: *conasaugaënsis*, Alabama River system; for *alabamensis* the additional locality: Shelby Co., Ala.; for *gesneri* also: Swamp Creek, Ala. (an uncertain locality, possibly Swamp Cr., Lowndes Co., Ala., trib. to Alabama River; but there is another Swamp Creek, in Escambia Co., trib. to Escambia River).

Thus these forms are found in the Alabama, Tallapoosa, and Coosa drainages, from southern central Alabama (Lowndes and Macon Cos.) northward to northern Georgia. From this region I have the following material.

Chatooga River, Trion, Chatooga Co., Ga. A dead, broken shell, A. E. Ortmann coll., May 19, 1915.

Conasauga River, Conasauga, Polk Co., Tenn. Three males, two females (with soft parts), A. E. Ortmann coll., May 24, 1915.

Coosa River, Weduska Shoals, Shelby Co., Ala. Three shells, H. H. Smith coll.

All those described shells, and also the specimens at hand, resemble the *Strophitus edentulus* (Say) of the interior basin. They differ from it, however, in the somewhat lighter color of

[1] According to the orthography accepted in the U. S. Topogr. Surv. maps I change thus the original spelling: *connasaugaensis*.

the epidermis, in that of the nacre, which varies from whitish to dull salmon or purplish (the latter color never found in *edentulus*), and chiefly by the better development of the hinge teeth. While the pseudocardinals, in *S. edentulus*, are entirely rudimentary, represented only by gentle swellings or not at all, there is, in this Alabama-form, at least one pseudocardinal in each valve, which may be small, but is generally, well developed, triangular and compressed, or tubercular, knob-like and stumpy. The tooth in the left valve corresponds to the second tooth of the original Anodontine hinge-teeth, for, in rare cases, in front and behind this, traces of a first and third tooth are seen, the third corresponding to the interdental tooth.

M. connasaugaënsis Lea, founded upon a single individual, is of medium size, and rather elevated in the posterior part; *M. alabamensis* Lea, also founded upon a single specimen, is large, and represents the normal condition of this form: it is also somewhat thicker than young shells. *M. gesneri* Lea is founded upon five specimens; the figured one also is large, but less elongated than *alabamensis*, and a little more convex, with darker (brown) epidermis: the nacre is purplish on the margins, and, according to Simpson, the left valve has traces of three pseudocardinals (Lea describes only one).

These three forms easily fall within the range of variation as indicated by my specimens (which surely belong to one species). and I only should add, that I have no specimens as large as *alabamensis* and *gesneri*. My largest, a female from Conasauga, measures: L. 67, H. 49, D. 32 mm. Also none of my specimens has purplish tints in the nacre, but in several of them salmon color is seen.

This species should be known as *Strophitus conasaugaënsis* (Lea) (1857), and it is characterized by the presence of at least one pseudocardinal in each valve, variable in size and shape, to which, in the left valve, sometimes traces of two others (anterior and posterior) are added; by the yellowish-olive color of the epidermis, turning to brown in old shells, and the occasional presence of rays upon the posterior slope.

The same type of shell, as far as it concerns the hinge-teeth, is found in the western section of the Alabama system, in Tombigbee River and its tributaries in western Alabama and eastern Mississippi. These shells are larger, thicker, and more swollen and have a blackish epidermis (in young ones, however, this is lighter, yellowish to greenish olive, but mostly with dark rays and dark concentric bands). They go by the names of *St. spillmani* (Lea) (1858) and *St. tombigbeensis* (Lea) (1858). They undoubtedly represent *conasaugaënsis* in this region, but I cannot tell whether they intergrade with it or not. *S. spillmani* is a longer spell, dark brown, with concentric bands, while *S. tombigeensis* is shorter, with dark epidermis and lighter rays, characters which surely are only individual.

CORRECTION OF THE NAME OF DRILLIA ROSEOBASIS P. AND V.

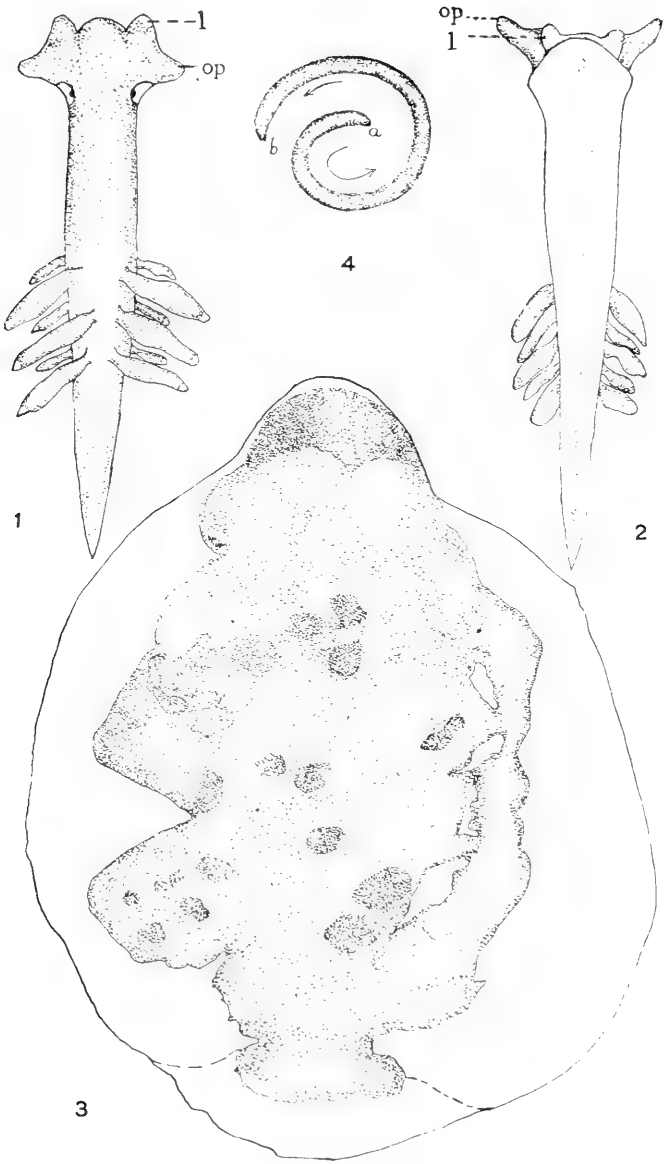
BY H. A. PILSBRY AND E. G. VANATTA.

Drillia roseobasis, from Tagus Cove, Albemarle, Island, Galapagos, was defined by us in Proc. Washington Academy of Sciences IV, 1902, p. 560, pl. 35, fig. 2. We did not know that there was a prior *Pleurotoma (Drillia) roseobasis* of E. A. Smith.* Neither of these species would be a *Drillia* in the modern sense, and as genera are now understood in this family, they would probably not be considered congeneric; but Smith's species has not been figured and is little known. Dr. W. H. Dall, considering the names homonymous, renamed the Galapagos species *Pleurotoma roseotincta*.† Unfortunately, this name cannot be used on account of the prior *Pleurotoma (Clathurella) roseotincta* Montrouzier, 1872.‡ We propose, therefore to rename our Galapagos species *Pleurotoma testudinis*.

* Ann. Mag. Nat. Hist. (6), II, 1888, p. 301. Habitat unknown.

† "*Pleurotoma roseotincta* new name for *roseobasis* Pilsbry, 1902, not of E. A. Smith, 1888." Proc. U. S. Nat. Mus. vol. 54, 1919, p. 333.

‡ Journ. de Conchyl. XX, 1872, p. 361; XXI, 1873, p. 55, and as "*Pleurotoma roseotincta*," t. c. pl. iv, fig. 1.



KJERSCHOW AGERSBORG: A NEW CLADOHEPATIC NUDIBRANCH, OLEA HANSINEËNSIS.

NOTES ON A NEW CLADOHEPATIC NUDIBRANCH FROM FRIDAY HARBOR, WASHINGTON.

H. P. KJERSCHOW AGERSBORG, PH.D.,
Department of Zoology, University of Nebraska.

OLEA (*genus nov.*).

The body is truncate anteriorly, elongate, limaciform, tapering to a point posteriorly. The back is gently arched and smooth, and passes imperceptibly into the sides which are also gently arched, so that the body with the back and sides may be said to arch until they touch the foot from which they are set off. The back bears two rows of papillæ on each side located posteriorly to the middle of the body; those in the dorsal row are larger than those in the ventral; the papillæ of the latter alternate in position with those of the former. The position of the papillæ (Fig. 1) is remarkable from the fact that these organs are clustered into two rows, dorso-laterally, on the middle aspect of the body in the position similar to that of the cerata of *Doris*. The tapering posterior part of the body extends posterior to the base of the last pair of papillæ a distance equal to one-half the length of that part of the body which is anterior of the first pair of papillæ. The heart was seen pulsating just below and between the first anterior papillæ. The anal pore is on the right side, in front of the heart, near the mid-dorsal line. The genital openings are placed antero-laterally near the end of the body. There are two small pigment spots on the dorso-lateral part of the neck where the dorsal margin of the less pigmented border of the neck merges with the darker area of the back. The body is everywhere uniformly ciliated.

A radula is totally absent. There are neither tongue nor jaws.

OLEA HANSINEËNSIS (*sp. nov.*). Plate VI.

Distribution: Puget Sound (Friday Harbor), Washington.

Dimensions: The length of the largest specimen was 13 mm.; the smallest, 7 mm., and the height 2 mm. and 1 mm., respectively.

Color: *Olea hansineënsis* is dark brown in color, very much like *Haminea* Leach, of the *Tectibranchiata;* but the former is studded everywhere with lighter spots of various sizes. In the lamp-light, however, the color changed to a light yellowish brown hue. The tips of the papillæ, the back between the papillæ, the sole of the foot and its dorsal posterior part, and the sides of the head and neck, are lighter than the rest of the body.

Foot: The foot (Fig. 2) is nearly as wide as the body is high. It is convex anteriorly, with papillary prolongations of the antero-lateral angles. Posteriorly it tapers lanceolately to a point. Its surface is uniformly ciliated.

Head: The head is set off from the body by a short but distinct neck. Dorsal tentacles are absent. The oral tentacles are lateral prolongations of the hood, one on each side. Labial parts consist of a rounded lobe on each side, and one median dorsal lobe. The mouth is sub-terminal, vertical; the ventral lip bilobed.

Habitat: These very interesting animals live on the eel-grass (Zostera marina). I never have been able to distinguish them from their environments while in their native habitat because of their resemblance in color to the vegetative (filamentous diatomaceous) growth which together with hydroids fairly cover the fronds of the *Zostera;* but they were detected when brought accidentally into the laboratory along with *Hermissenda opalescens* Cooper, and *Haminea* Leach, commonly found among the eel-grass at Brown Island, Friday Harbor, Washington, in very large numbers, especially the latter. They were dipped up from the eel-grass by means of a gravy-strainer with *Hermissenda* and *Haminea.*

Nidosome: A number of nidosomes were laid in the dish in the laboratory on the second morning after capture, the animals being segregated from other nudibranchs. The nidosome is a simple coiled string (Fig. 4) from 20 to 70 mm. long and 1 mm. in diameter. Oviposition continued for three weeks. The eggs are capsulated, and there is only one egg in each capsule. Cleavage total and spiral. During oviposition the animal crawls in the direction of the arrow (Fig. 4).

Death-feigning was commonly practiced when the animals were disturbed. But they soon resumed active movements on the bottom and along the side of the dish and toward the top of the water. When the water became stale they invariably dropped to the bottom of the dish and lay motionless. This habit is contrary to that of the *Aeolidia* which seek the surface at such times and remain mostly adhering to the surface film. *Olea hansineënsis* comes to the surface when it is feeding (it is constantly nipping at nearly microscopic organisms when at the surface, crawling as it does on the surface film with the back downward) or actively crawling; it never rests on the surface film as the *Aeolidia* do: when it rests it is on the bottom, and often appears to be dead. Shaking the finger-bowl, however, awakens it from its slumber, when it again becomes active.

I am not sure of its exact systematic position until I find opportunity to examine its anatomy more carefully. The liver extends into the papillæ (Fig. 3), and on that account it is, of course, a Cladohepatic form. But the hepatic arborization is not so extensive as *e. g.*, in *Melibe leonina* (Gould), Agersborg (1916, 1919, 1921, 1922, 1923, 1923a). The head of *Olea hansineënsis* resembles that of *Limapontia nigra* Johnston, but unlike this species which has no papillæ, *O. hansineënsis* has two rows of papillæ clustered closely together posterior to the middle of the back, anterior and posterior to which it is perfectly smooth. The position of the anus and other anatomical differences, as *e. g.*, the radula, remove it from this type. The gonads are divided into a number of acini connected by a branching duct-system as in *Doto coronata* Gemlin. Another form to which its head bears resemblance in shape is *Acteonia corrugata* Ald. & Hanc. I cannot find any resemblance in *O. hansineënsis* to any of the numerous types described by Bergh (1879, 1880, 1894, 1904), Cockerell (1901, 1901a, 1902, 1908, 1915), Cockerell and Eliot (1905), Cooper (1862), Eliot (1910), Fewkes (1889), MacFarland (1905), O'Donoghue (1921), Pease (1872), and Stearns (1873). O'Donoghue, to whom I presented a specimen, writes me: " The other one (*O. hansineënsis*) is not known to me and as far as I can find has not been recorded previously from the Pacific Coast of North America." It is quite safe to erect for this type a new genus; it may even be found to deserve family rank. The generic name, which I have proposed, is *Olea* in honor of my sister who for a number of years was a constant source of inspiration to me in my scientific studies in this country; the specific name is *hansineënsis,* in honor of my first, the noblest, and the greatest of all my teachers, my mother.

Only seven specimens in all were collected. The place of collection was from *Zostera marina* in the inner bay of Brown Island, opposite the Laboratory of the Puget Sound Biological Station at Friday Harbor, Washington. In fixing the animals, nearly all the papillæ dropped off. Two specimens, preserved in 5% formaldehyde, were dissected for the purpose of studying the radula, but no trace of such an organ was detected. Four specimens were fixed in Flemming's chromo-osmic-acetic mixture for cytological study. Of these, one is designated as the type, and remains in the collection of the writer. Dr. Chas. H. O'Donoghue, of the University of Manitoba, has one specimen which was preserved in formaldehyde.

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Explanation of Figures, Plate VI.

1. Drawing from life of *Olea hansineënsis* (*gen. et sp. nov.*), dorsal view. L, lateral labial lobe; op, oral tentacles. The eye spots are seen just caudad to the oral tentacles; the dorsal labial lobe is seen between the lateral labial lobes.

2. Drawing from life of *O. hansineënsis*, ventral view. L, lateral labial lobes; op, oral tentacles. Note the ventral labial lobe between the lateral labial lobes just cephalic to the anterior convex border of the foot.

3. Drawing of a large papilla from a preserved specimen to show the hepatic extension into the organ. The outline of the papilla is shown in the line surrounding the stippled area, the hepatic branch. Greatly enlarged.

4. Nidosome. A, beginning; b, end. The arrows indicate the track followed by the animal during oviposition. Enlarged.

EFFORTS TO ACCLIMATIZE ATLANTIC OYSTER AND SOFT CLAM IN THE HAWAIIAN ISLANDS.

BY R. A. COLEMAN,

Agent, U. S. Bureau of Fisheries, San Francisco, California.

An attempt is being made by the Hawaiian Fish and Game Commission with the cooperation of the U. S. Bureau of Fisheries to introduce two highly-prized shellfish, the Atlantic coast oyster, *Ostrea elongata*, and the soft clam, *Mya arenaria*, into Hawaiian waters. Although serious difficulties have been encountered, it is felt that there is ground for hopes of the success of this enterprise.

The first efforts were with the oyster. In May, 1921, five

* Published by permission of the United States Commissioner of Fish and Fisheries.

barrels of Long Island oysters, which had been replanted in Tomales Bay, Cal., were shipped by the U. S. Bureau of Fisheries representative in San Francisco to Mr. H. L. Kelly, Executive Officer of the Hawaiian Fish and Game Commission, Honolulu, who planted them at a site (selected in 1920 by Dr. H. F. Moore, U. S. Deputy Commissioner of Fisheries) in Pearl Harbor, Oahu. There the oysters gave every indication of thriving till they were discovered and destroyed by the native "fishermen," who work over every inch of available bottom. With the oysters sent in the second shipment, May, 1922, therefore, precautions were taken against their loss by this means.

With the clams, as with the oysters, but from an entirely different cause, the first effort at introduction failed. In May, 1922, a shipment of soft clams accompanied that of the oysters and like them was sent in the "chill room" (kept just at freezing point). Unfortunately this method, successful with the oysters, was a complete failure with the soft clams, all of which died and spoiled in transit. To avoid this sort of loss a second shipment of clams was arranged for March 7, 1923, the clams to be frozen and shipped in the "ice house," thence to be thawed under water, a method said to be applicable to this species.

The results of these attempts to ship the soft clam and to introduce both this shellfish and the Atlantic coast oyster are awaited with interest.

PUBLICATIONS RECEIVED.

Notes on the Mollusks of the Colorado Desert. By S. Stillman Berry. Proc. Acad. Nat. Sci. Phila. 1922, pp. 69–99; 3 plates. The introduction to this interesting paper deals with the geography, topography and other characteristics of the desert, the occurrence of land and freshwater shells, and a full bibliography. An account of species collected by Messrs. George Willett, Allyn G. Smith, J. Stanley Ferguson and the author follows: *Micrarionta aquæ-albæ* n. sp., *M. wolcottiana*

Bch., *M. xerophila* n. sp., *M. indioensis* Yates, *M. harperi* Bryant are described or discussed, with several Pupillidæ etc.—H. A. P.

THE EFFECT OF LOW SALINITY ON TEREDO NAVALIS. By Harold Francis Blum, Univ. of Cal., Pub. in Zoology, vol. 22, No. 4, 1922. The work was carried on in San Francisco Bay. "The animal is normally active in salinities as low as 9 parts per 1000, and below this point the activity decreases with decrease in salinity." "Teredos obtain some protection from water of a salinity below the lethal (5 parts in 1000) by stopping the mouth of the burrow with the pallets." "A period of 33 days below 4 parts per 1000 salinity has destroyed 90 per cent of the teredos in piles at Crockett."—H. A. P.

VARIATIONS IN THE SHELL OF TEREDO NAVALIS IN SAN FRANCISCO BAY. By Robert Cunningham Miller, Univ. of Cal., Pub. Zool. vol. 22, plates 13–17. *Teredo navalis* in San Francisco Bay exhibits an extremely wide range of variation, involving practically every feature of the shell. The more salient variations have been correllated with factors of the environment. The local varieties, including *T. beachi* Bartsch, have not been found sufficiently differentiated to warrant their being classed as subspecies, much less as species. This important study is excellently illustrated.—H. A. P.

UPPER MIOCENE LACUSTRINE MOLLUSKS FROM SONOMA COUNTY, CALIFORNIA. By G. Dallas Hanna, Cal. Acad. Sci. (4), vol. 12, pp. 31–41, pl. 1–3, 1923, New species of *Nematurella*, *Sphærium*, *Pisidium*, *Lymnæa* and *Planorbis*, with various old species, are described and figured. *Nematurella* is an Old-World genus new to America; besides *N. euzona* n. sp., Hanna refers *Littorina pittsburgensis* Clark from San Pablo to this genus.

NOTES ON SOME LAND SNAILS OF THE SIERRA NEVADA MOUNTAINS with description of a new species. By G. Dallas Hanna and Emmet Rixford. Cal. Acad. Sci. (4), vol. 12. pp. 43–50, pl. 4, 1923. Material collected by the authors in two trips in Tuolumne, Sacramento and Calaveras Counties, Cal., is here described. *Epiphragmophora circumcarinata* was looked for but not found. *Ammonitella yatesi* Coop. was taken at the type locality, which is fully described. The shell and genitalia are figured, and the relationship with *Polygyrella* demonstrated. Both differ from *Polygyra* by the long spermathecal duct. *Polygyra penitens* n. sp. is a new species from Mormon Island in the Sacramento River, related to *P. roperi* Pils.—H. A. P.

A NEW SPECIES OF CARYCHIUM FROM VANCOUVER ISLAND, B. C. By G. Dallas Hanna. Same volume, pp. 51–53, fig. 1. *C. magnificum* n. sp., from Union Bay. It is 0.2 to 0.4 mm. larger than one of the type lot of *C. occidentale*, and appears to resemble that in shape and internal lamellæ.—H. A. P.

FAUNA FROM THE EOCENE OF WASHINGTON. By Charles E. Weaver and Katharine Van Winkle Palmer. University of Washington Publications in Geology, Vol. 1, No. 3, pp. 1–56, pls. VIII–XII, June, 1922. The paper consists chiefly of descriptions of marine mollusks from Eocene deposits of Washington but a new genus and five new freshwater species are included; to these last, special reference is here directed. The new genus, *Phaenomya*, is stated to be allied to *Corbula* and *Mya*; type species, *Phaenomya vaderensis*, n. sp. from the Eocene of Lewis County, Southern Washington.

Anodonta arnoldi (p. 14) is described without a reference to any other described species. The exterior is figured from a somewhat crushed specimen and seems to have no characters by means of which the reader can distinguish it from well known living species.

Hydrobia pontis (p. 33) is not compared with any other species, and although stated to be abundant at the same locality as the above, a fragment was chosen for figuring. The description states that the whorls are angulated medially but the figure fails to show it. This, and other discrepancies between the discription and figure make the species unrecognizable.

Goniobasis hannibali is described (p. 44) as having sculpture "extremely variable. The extreme form in sculpture has been taken for the type of the species. *Goniobasis olequahensis* (Arnold and Hannibal) represents the smooth type of shell. * * * The collection contains specimens which show transition stages between the two types of shell." The authors give other reasons why the smooth and sculptured shells are the same species. "Many shells have oblique plications on the nuclear whorls which may be absent on the body whorls." It is not understood by what reasoning the new name, *G. hannibali* was justified since only reasons for its union with a described form are given.

On the next page it is stated that Dr. H. A. Pilsbry has determined that *Ambloxis olequahensis* Arnold and Hannibal, belongs to the genus *Goniobasis.* In spite of this the authors describe *Goniobasis oleqwahensis*, new species, immediately below! No explanation of the remarkable system of nomenclature is given.

No type specimens were designated for the 56 new species and four new subspecies; (not 64 new species as stated on page one). The location of the described and figured specimens is not given although this has been generally adopted by most museums for many years. The measurements as given in the text disagree greatly with the statements of enlargement in the explanations of the plates in some cases, as for instance, *Lima packardi* (p. 15).

Attention is called to this paper because it is an example of loose practice which has developed in the study of paleontology in the west during the last fifteen years. If permitted to pass unnoticed, improvement in methods is not likely to be rapid. —G. Dallas Hanna, California Academy of Sciences.

NOTES.

SEPARATES.—Authors desiring reprints of their papers are requested to write the order *on the manuscript.* When given in a separate letter it is likely to be overlooked.

A bill authorizing acceptance by the Government of the $500,-000 marble residence offered by Mrs. John B. Henderson as a home for Vice-Presidents was introduced January 26th by Senator Warren, Republican, Wyoming. The bill provides the residence shall be accepted as a memorial to John B. Henderson, once a Senator from Missouri, and his son, John B. Henderson 2d. Free and unconditional title by the Government is stipulated.—*Phila. Bulletin.*

Dr. Paul Ehrmann has published (S. B. Naturforsch. Ges. Leipzig, 1916–17) an appreciative biographic sketch with portrait of the late HEINRICH SIMROTH (b. 1851, d. Aug. 31, 1916). While Simroth was chiefly known as an investigator of slugs, a field where he held first place, his contributions to Bronn's *Klassen u. Ordnungen des Tierreichs* show wide knowledge of molluscan morphology. In the field of zoogeography he was the chief exponent of the "Pendulation theory," explaining animal and plant distribution and geological climates by the hypothesis of a wide swing in the earth's axis. A bibliography of his scientific writings is given.—H. A. P.

JOSEPH D. MITCHELL, known to many conchologists for his work on Texan shells some years ago, died at his home at Victoria, Texas, Feb. 27, 1922, 72 years of age. Several species of mollusks were named in his honor, such as *Scala mitchelli* Dall and *Unio mitchelli* Simpson. A short sketch by Vernon Bailey with portrait appeared in the Journal of Mammalogy for February, 1923.

PLANORBIS CALODERMA n. sp. The shell is small, rather solid, with about the shape of *Planorbis bicarinatus* Say, having both sides concave, funnel-shaped, but the cavity of the right side is very much narrower than the left, as in that species. Whorls nearly three, rapidly enlarging, the last bluntly angular around the cavity on the left side, rounded on the right side; periphery convex, the greatest convexity near the left side. The aperture is ovate-piriform, oblique. The surface is finely striate, the striae cut by numerous but much more spaced impressed spiral lines. Cuticle buff.

Height 3.2, Diam. 5 mm., type.

Height 2.8, Diam. 5.5 mm., paratype.

Height 2.4, Diam. 5 mm., paratype.

Esmeralda, Guatemala, A. A. Hinkley, 1917. Type and two paratypes No. 45662 A. N. S. P.

This little snail was mentioned in Mr. Hinkley's list in Nautilus, October, 1920, p. 46. It appears to be a diminutive member of the *P. bicarinatus* (*antrosus*) group —H. A. Pilsbry.

Snail Killed by Weed—A specimen of *Polygyra thyroides* Say was taken at Cambridge (Dailsville), Maryland from the spiny seed capsule of a cockle-burr (*Xanthium commune*) upon which the snail had placed its foot and in attempting to withdraw into its shell, the hooked spines had pierced and successfully held the mollusk. In this position it died and was found by the writer. During rainy weather this species often crawls up weeds and small bushes. Their ability to quickly withdraw into the shell covering upon sensing danger is remarkable and often have I tried to arrest this movement but always with negative results. However, the cockle-burr with its sharp, stiff, hooked spines had no trouble in holding the venturesome yet unfortunate mollusk.—Ralph W. Jackson.

Epiphragmophora a Tree Climber—A live *Epiphragmophora fidelis* Gray, was secured by Mr. Alex. Walker from an old nest 35 ft. up in second growth fir woods at Blaine, Oregon. It was taken May 5th, 1922, and is in my collection No. 1254. The height that this specimen was found seemed to merit publication. —Ralph W. Jackson.

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OF CONCHOLOGISTS

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THE NAUTILUS.

Vol. XXXVII JULY, 1923. No. 1

RAMBLES OF A MIDSHIPMAN. III.

BY P. S. REMINGTON, JR.

The second leg of our eighteen-thousand-mile cruise commenced with our departure from Balboa. Nothing untoward occurred to break the even monotony of our run to Honolulu. Very little manoeuvering was done this time, because coal is precious on such a long trip. This was said to be the longest single run ever made by a squadron of battleships, and certainly it seemed an eternity to me, for it was now the turn of our division to serve in the boiler-room and coal-bunkers, and for seventeen mortal days I stoked a boiler. I have already commented on the astonishing amount of coal a battleship can stow away, but this is far less remarkable than the way a boiler can eat it up. Never a cool place, the boiler-room usually showed a temperature of around 130° F. in the latitude of the tropics, and some poor fellow was carried out on deck every watch. Those seventeen days became an era in my life, to be looked back on with wonder and some pride.

However, all things come to an end, and at last we awoke one morning to see the extinct crater of Diamond Head showing up on the horizon. As we steamed up the bay of Honolulu, twenty-two airplanes circled over our tops, dropping aboard "leis", that Hawaiian symbol of welcome. I think that the average American citizen, who is familiar with the Hawaiian Islands chiefly through the popular music which purports to come from there, pictures Honolulu as a grove of native huts in the midst of palm trees with hula maidens dancing around to the music of ukuleles. At leart, I am inevitably asked if I saw any hula dancers on my trip to Honolulu. As a matter of fact Honolulu looks quite like any other American city with its docks, stores and business district, and native Hawaiians are far less plentiful than Japanese. Indeed they are distinctly a rarity, and although I saw one or two princesses at the naval ball, they danced a one-step and not a hula dance. I was told that there are very few real hula dancers left, and that the only good ones were not fit to be seen.

Nevertheless, there is a certain glamour about Honolulu which impresses one at once. The azure blue of the water, the rugged chains of mountains in every direction, the riot of flowers everywhere and the semi-tropical climate made a deep impression on my memory. I still consider Honolulu the most beautiful city I have ever seen, and vowed to return to it some day for a longer visit.

Before the cruise started I had had the forethought to write to Mr. Charles F. Mant of Honolulu, and the "Connecticut" had no sooner docked than he came aboard and enquired for me. By special dispensation I got permission to take dinner ashore and was treated with real Hawaiian hospitality. This last, it should be remarked, is really a substantial thing, for no midshipman could walk fifty yards along the street without being cordially asked to step into a passing automobile. Certainly I had no reason to complain, for the Mants and some Yankee friends took special pains to procure some strawberries and cook a real New England strawberry short-cake which we ate at Waikiki Beach. I shall long remember that evening.

Here, as elsewhere, I lost the opportunity to collect extensively because I was unable to secure shore leave for more than half a day. We were able to plan two trips, however, which are chalked up on my memory along with those at Panama and Cuba. The first was a hike up Mt. Tantalus along the Manoa Cliff Trail. Exchanging my uniform for khaki clothes loaned by Mr. Mant, I set out in company with that gentleman for this trail, a little beyond the city. The view on the way up was superb, and I have never seen such beautiful shades of water as the bay showed. Near shore it was a light blue with a white ring of surf, while further out it merged into a deep purple. Below us in the valleys were the neatly cultivated farms of the Japanese, some of them extended well up the hillsides. Way off to the north were other ranges of hills at which I gazed with longing eyes, for in those valleys were the Achatinellas which I had hoped to collect. They were too far away, however, to be reached in the limited time at my disposal and I had to be satisfied with an inspection of the collections of Mr. Mant and Mr. Emerson. The latter gentleman has, judging by the thousands of specimens in his collection, robbed many of the valleys of Oahu of their entire molluscan fauna. The returns on this hike with Mr. Mant were not great, but very interesting because so different from any other collecting I have ever done. In the axis of large-leaved plants we found *Auriculella diaphana* and *Auriculella castanea*, a few *Amastra turritella*, *Philonesia baldwini*, and *Tornatellides procerulus*. Under the rocks by the roadside were a few *Succinea caduca* and the introduced *Eulota similaris*. In spite of the paucity of the species taken, this hike was one of the most enjoyable I have ever made.

The second trip was a visit to Pearl City near the naval base where we got in a little marine collecting along the west locks. Here we took some fine *Nerita picea*, *Trochus sandwichensis*, *Sistrum faveolatum*, *Litorina scabra*, *Siphonaria normalis*, *Plecorema inaequalis*, *Lasmodonta sandwichensis*, *Mytilus crebristriatus*, *Cytherea lioconcha*, *Tellina rugosa*, and a small *chiton*. Although this represents about all the species I was able to collect in Honolulu, it should be understood that this was due to the fact that I was never able to get sufficient shore leave to make a long trip, so I blame the naval authorities and not the Hawaiian fauna. The species I collected are but a small fraction of the fauna to be found. Mr. Mant kindly made up this deficiency by generously sharing many of his duplicates with me.

A rather humorous incident took place the next day as we were going through the market. Seeing a huge pile of fine

Tapes philippinarum for sale, I enquired of the Jap on guard what was the price of them. Pointing to one of three plates heaped high with the bivalves, he answered "twenty-five cents." When I nodded at the price, he deftly rolled a huge palm leaf into a cornucopia and poured the entire *three* plates into it. My friends laughed heartily at my discomfiture. They would have laughed still more heartily had they seen me at 2 A. M. still cleaning those shells. I kept every one, however, and got them all home.

After a week's delightful stay, we bade farewell to Honolulu and departed amid a shower of flower "leis" from the cordial islanders. I don't think I have ever been so sorry to leave a port. Its charm remains long after the memory of it has dulled.

We were now bound for Seattle, a twelve-day run. Entering the region of the northeast trade winds, we encountered cool weather and several rough days. Work in the boiler room was now a pleasure, but alas I had been shifted to a deck division, for a midshipman must become familiar with every phase of ship life on these practice cruises. So I spent the days scrubbing decks and polishing brightwork until the snow-covered Olympic range came in sight and we steamed up Puget Sound and dropped anchor in Elliot Bay.

Seattle was the one port in which I knew of no shell collector, but as I had a bona-fide brother living there, I was able to get four days' shore leave, which I made the most of, though not conchologically. Our welcome here was very warm also, for the first mail from shore brought a letter of invitation to each midshipman to dinner and a ball given in our honor. The board of commerce had called for volunteers to take care of us and each car was given a number corresponding to the one on the invitation. They even provided us with partners for the ball.

I made one attempt to collect, but the results were so discouraging that I did not try again. I had been told that there was good collecting at Fort Lawton Beach. No one seemed to know where that was, however, and after spending an afternoon in a vain hunt for it, and finding only a few *Acmaea scutum* *patina*, I gave up and enjoyed the more worldly pleasures that my brother offered. Later, after gaining an idea of the Puget Sound fauna through the medium of exchange, I have regretted my inactivity.

Our next port of call was San Francisco where I expected to see that very active collector, Mr. Allyn G. Smith. On my arrival, I was disappointed to find that he was leaving at once for an auto trip through northern California and Oregon, on which he hoped to discover some new things. He did, before he left, recommend a few localities where the collecting might be good and also introduced me to a bit of collecting in his own garden, for the place was overrun with *Helix aspersa*, introduced. On his advice I made a visit to Muir Woods, that home of the big trees, first ascending Mt. Tamalpais on the "crookedest railroad in the world," then down to Muir Woods by gravity car. I had only about a half-hour before the train returned, however, and though I hunted industriously through the redwood thickets, I found only one specimen of *Epiphragmophora infumata*. As this had the epiphragm I think the shells had hidden away through the dry spell. This was the extent of my collecting in San Francisco. I did not get a chance at the marine collecting though I wanted to try Bolinas Bay.

After coaling up once more, we headed south for San Pedro which we soon reached. Here the squadron divided, half going to San Diego, the other half to San Pedro. Fortunately, the flagship stayed at San Pedro. I say "fortunately" because Mr. E. P. Chace, with whom I had been corresponding for many years, lived at Los Angeles and I was planning to pay a visit to him. To further this plan, Mr. Chace wrote me a letter and signed it "Uncle Emory," and I had only to present this to the commander in order to get another forty-eight-hour leave of absence. I felt no compunction in doing this, considering all the fine collecting I had been deprived of through official inhibition.

That visit with "Uncle Emory" is another pleasant memory to add to an eventful cruise. Besides the pleasure of inspecting Mr. Chase's fine collection, we paid a visit to the Southwest Museum, and other points of interest. I had anticipated a taste of the collecting at San Pedro, but was disappointed to learn that the tides were not right. Mr. Chace, however, invited me to collect among his duplicates, which I gratefully did. I am not one of those, however, to whom a shell is only a shell. A specimen means much more to me if I have collected it, and I promised myself another trip to the West Coast sometime in the future.

After a most enjoyable two days at the Chaces', I returned to my ship and soon we were headed for the Panama Canal again. We picked up the rest of the squadron off San Diego and settled down for another long, hot run. Men in the boiler division, "the blackgang", told us that was the hottest run of the cruise. Fortunately I was still in a deck division. Nevertheless, I was glad when we docked at Balboa again where daily showers cool the air a little. I hastened to renew my acquaintance with Mr. Zetek and this time we made a trip to Punta Paitilla, another favorite collecting ground of his. The collecting here was the richest I have ever seen, and I made the most of it. I had hoped to get leave of absence to go to Taboga Island, where Mr. Zetek assured me the collecting is very fine, but I had exhausted my leaves and failed.

With more than regret, I bade a final farewell to Mr. Zetek and his charming family. The regret was lightened, however, by the fact that we were now going *home* and that the next port was Annapolis where a month's leave awaited us. For the last time we steamed through the Canal and regarded the now familiar sights with almost as much interest as we had the first time. We were not to arrive home without incident, though, for midway between Panama and Cuba the "Connecticut" lost both propellers and had to be towed into Guantanamo by a collier. We were transferred at once to the other ships and steamed north to Annapolis.

Although circumstances made it advisable for me to resign from the Navy two months later, I shall always be grateful for the opportunities I had to collect in various parts of the world, brief and unsatisfactory though they were. And I should like to express right here my appreciation for the fact that conchologists are such prime good fellows, no matter where one meets them.

I know that my cruises were made one hundred per cent more interesting for me because of that spirit of "cameraderie" which exists among them. As one of my correspondents expressed it, "I never knew a shell collector who wasn't first-class in every respect."

BOURGUIGNAT'S AMERICAN SPECIES OF ANCYLUS

BY BRYANT WALKER

At different times and in different places Bourguignat described nine new species of *Ancylus* from Mexico, Cuba and South America. He also proposed new names for three species, whose original names were pre-occupied. These were:

Ancylus haldemani for *A. depressus* Hald. (1844) *non* Deshayes (1824).

Ancylus pfeifferi for *A. radiatilis* Pfr. (1852) *non* Morelet (1851).

Ancylus petitianus for *A. obliquus* C. B. Ads. (1850) *non* Broderip and Sowerby (1832). Adams, however, had before that discovered the duplication and renamed his species *A. chittyi* in 1851, so that Bourguignat's name falls into the synonymy.

Of the nine new species described, Bourguignat himself only figured two. Three others have been figured by later authors from specimens in their own or other European collections.

With one exception, *A. charpentierianus*, all of Bourguignat's types are in his collection now in the Museum of Natural History of Geneva, Switzerland.

The great rarity of the species, the lack of figures and the author's well-known proclivity to unduly multiply species upon slight differences have rendered the determination of his species extremely difficult and they have always been a source of perplexity to students of that group.

Some time ago Dr. G. Mermod of the Geneva Museum very kindly sent to me a series of excellent, enlarged photographs of all of the American types in the Bourguignat collection.

This included still more enlarged views of the apices and he added notes of his own examination of the specimens in regard to their apical sculpture. He also sent photographs of Bourguignat's original labels, which accompany the specimens. These photographs, while quite sufficient for examination themselves, are not strong enough for half-tone reproduction and I have accordingly had them redrawn by Miss Mina L. Winslow of the Museum of Zoology of the University of Michigan. These drawings have been very skilfully and accurately done and leave nothing to be desired as reproductions of the original photographs.

These figures add greatly to our knowledge of the several species and are now published to assist students in their identification of the Bourguignat species. I have added such notes from the literature as seemed applicable. As the original descriptions are scattered in various publications not always readily accessible, it had been deemed advisable to reproduce them here for convenient use with the figures.

I. Ancylus chittyi C. B. Ads. Pl. I, figs. 1-4.

Ancylus obliquus C. B. Adams, Ann. Lyc. Nat. Hist. N. Y., 1850, p. 48; Contr. Conch., 1850, pp. 132, 187, *non* Broderip and Sowerby, 1832.

Ancylus chittyi C. B. Adams, Contr. Conch., 1851, p. 204; Fischer, Rev. Cal., 1858, p. 15; Bourguignat, Spic. Mal., 1862, p. 221; Clessin, Conch. Cab., Ancylinen, 1882, p. 54, pl. 8, fig. 10; Maze, J. de Con., XXXI, 1883, p. 29.

Ancylus petitianus Bourguignat, J. de Con., IV, 1853, p. 172, pl. 6, fig. 10; P. Z. S., 1853, p. 85; Amen. Mal., I, 1853, p. 11.

Original description:—"Shell subovate, somewhat arcuate, very convex; translucent, pale horn-color; extremely thin, with microscopic radiating raised lines and less distinct striæ of growth; apex very prominent, elevated, extending very far to one side and posteriorly, and projecting nearly over the margin. Length .075 inch; breadth .05 inch; height .028 inch."

Type locality: Jamaica.

Adams' type was an unique specimen in the Chitty collection now in the British Museum. I am informed by Mr. H. C. Fulton that it was glued to a tablet and has been crushed to pieces so that it is now impossible to make anything of it.

Apparently, however, Bourguignat obtained another specimen, which he figured. There is nothing to show from whom he obtained it. This specimen is of special interest not only because it is the only example of the species ever figured, but also because it extends the range of the South American genus *Hebetancylus* into the West Indias.

In response to an inquiry from me, Dr. Mermod replied: "In regard to the *Ancylus chittyi* (*petitianus*) you ask if the figure given in the Journal de Conchyliologie was made from the original in the Bourguignat collection. You will see in examining the photograph that it is not possible to reply with certainty to the question. The figure in the Journal is quite conventional and does not correspond in all respects with the type, which, however, is unique in the Bourguignat collection." There would, however, seem to be but little doubt that the specimen here figured was the original of the "conventional" figure in the Journal.

The excellent photographs sent by Dr. Mermod leave no doubt as to the systematic position of the species. He states also that the apex is "distinctly radially punctate". It is therefore an *Hebetancylus* and is the first record of that genus in the West Indias. The resemblance to the *Burnupia caffra* (Krss.) from South Africa is very striking.

Clessin's figure is stated to be from an example in the Dohrn Collection, so that at least two specimens have reached Europe in addition to Adams' type.

According to Fischer and Maze (l. c.) it is also found in Guadeloupe. But see, Walker, Naut. XXXIII, 1920, p. 99.

II. Ancylus charpentierianus Bourguignat.

Ancylus charpentierianus Bgt., J. de Con., IV, 1853, p. 173, pl. 6, fig. 12; Clessin, Conch. Cab., Ancylinen, 1882, p. 56, pl. 8, fig. 12.

Original description:—"Anc. testa convexa ac concava;

mucrone dextrorsus obliquo; depressione apicali minutissima, sat rotundata, in verticis extremitate ac paululum ad sinistram versa. Parva, depressa, luteola, intus albido vel luteolo-rosacea, striis radiatis subtiliter ornata; apertura anteriore rotundata, posteriore ovato-subangulata. Long. 5.5; lat. 4.5; alt. 2 mm.''

Type locality: Valparaiso, Chile.

This species is not represented in the Bourguignat Collection, the type having been received from M. Petit de la Saussaye, the then editor of the Journal de Conchyliologie. No details are known of the apical sculpture. Judging from the figure it is probably an *Uncancylus.* Clessin considers the sharp angle of the posterior margin abnormal. The species as described and figured is unusual in the concave outline of the anterior slope towards the margin, but that too may possibly be abnormal.

Clessin's figure is a copy of that of Bourguignat.

III. Ancylus plæarius Bourguignat. Pl. I, figs. 5-8.

Ancylus plæarius Bgt., Spic. Mal., 1862, p. 214; Clessin, Conch. Cab., Ancylinen, 1882, p. 72.

Original description:—''Testa gibboso-depressa, ad latera contracta, elongata, pellucida, fragilima, cornea vel translucida, concentrice vix striatula; antice sinistrorsus-queconvexa; postice dextrorsusque recta; apice postico, obtusissimo, dextrorsus dejecto; depressione apicali rotundata vel saepe lunari, ad partem inferiorem verticis sita; apertura elongata, ad latera coarctata; marginibus lateralibus paululum arcuatis. Longueur 10; hauteur 3 mm.''

Type locality: Lake Baril, Bahia, Brazil.

The author says that he received this shell from Moricand under the MSS. name of *A. moracandi contracta.* As stated by Clessin, it is probably only a narrow form of that species.

Moricandi is the type of *Hebetancylus* Pils. (Proc. A. N. S. P., 1913, p. 671).

Dr. Mermod writes that the ''apex is without granulation''. But a close inspection of his photograph indicates that the apex was apparently somewhat eroded, and if so, the minute apical sculpture would have disappeared.

IV. Ancylus aorus Bourguignat. Pl. I, figs. 9-11.

Ancylus aorus Bgt., Spic. Mal., 1862, p. 216; Clessin, Conch. Cab., Ancylinen, 1882, p. 70.

Original description:—"Testa magna, gibboso-oblonga, pellucida, fragili, cornea, concentrice striatula; antice perconvexa ac concava, postice recta ac concava, sinistrorsus convexa ac concava, dextrorsus concava; apice valde postico, obtusissimo (depressione apicali inconspicua), ad dextram dejecto; apertura oblongo-ovata; marginibus expansis, antice sinistrorseque praesertim dilatatis. Longueur 11; hauteur 3.5 mm."

The author remarks that the *A. aorus* is very close to *A. moricandi*, but differs by its manner of growth, by its shell "excessively swollen and like the back of an ass," by its apex more posterior, very obtuse and more turned to the right, and especially by its aperture, the margins of which are wide, dilated and almost reflected, which is never seen in the true *moricandi*.

Type locality: Environs of San Pedro, Brazil.

Clessin considers it as probably only a variety of *moricandi* with an unusually extended peritreme, which is very likely correct.

As shown by the figure, the apex is too much eroded to show the sculpture.

V. Ancylus plagioxus Bourguignat. Pl. II, figs. 1-3.

Ancylus plagioxus Bgt., Spic. Mal., 1862, p. 217; Clessin, Conch. Cab., Ancylinen, 1882, p. 70.

Original description:—"Testa depresso-ovata, parvula, fragili, cornea, pellucida, concentrice radiatimque argutissime striatula; antice sinistrorsusque convexa; postice dextrorsusque concavo; apice postico, acutissimo, dextrorsus dejecto; depressione apicali oblonga, ad partem superiorem verticis sita; apertura ovata. Longueur 6; hauteur 2 mm."

Type locality, Lake Baril, Bahia, Brazil.

The author remarks that the apex is exceedingly small and very sharp.

Dr. Mermod gives no note on the apical sculpture and none can be detected on the photograph, consequently no assignment to modern groups can be made. It is possible that on critical examination it might prove to be a young *A. moricandi.*

VI. Ancylus saulcyanus Bourguignat. Pl. II, figs. 4-7.

Ancylus saulcyanus Bgt., P. Z. S., 1853, p. 192, pl. 25, figs. 26-33; Spic. Mal., 1862, p. 218; Clessin, Conch. Cab., Ancylinen, 1882, p. 71, pl. 6, fig. 6.

Original description:—"Anc. testa antice convexa, postice paululum concava; apice parvulo, postico, sat obtuso, dextrorsus dejecto, saepe decorticata; depressione apicali rotundata, in verticis extremitate sita. Testa parva, fragili, cornea, concentrice striatula, ac argutissime radiatula, praesertim ad aperturam; apertura ovata. Long. 4-4½ mill., lat. 3, alt. 2."

Type locality: Environs of Porto Cabello, Venezuela.

The author remarks: — "Le test de *l'Ancylus saulcyanus* est d'une taille petite, fragile, d'une coleur corné, et presente des stries d'accroissement assez bien marquées. Lorsqu'on l'examine au microscope, il parait, de plus, radié avec la plus grande delicatesse. Son overture est ovale."

The erosion of the apex as shown by the figure is too great to show any of the apical sculpture, and consequently its exact generic position is uncertain.

The author in the Spic. Mal. (l. c.) differentiates it in detail from *A. raymondi* Bgt. (Algeria), *chittyi* C. B. Ads., *obliquus* B. and S. (Chile), *charpentierianus* Bgt. and *irroratus* Gldg. (St. Vincent).

Clessin's figure is not a copy of that in the P. Z. S., but is a narrower shell, similar, but less dilated anteriorly, the lateral margins being nearly parallel. His dimensions are also different. The source of his specimen is not given. He groups it with *concentricus* d'Orb., *culicoides* d'Orb. and *barilensis* Moric., "from which it differs in the shape of the aperture." The last named is the type of *Uncancylus* Pils. (Pr. A. N. S. P., 1913, p. 671).

Dr. Mermod's larger figure is quite typical, the other is narrower.

VII. ANCYLUS BEAUI Bourguignat. Pl. II, figs. 8-10.

Ancylus beaui Bgt., J. de Con., IV, 1853, p. 176; Spic. Mal., 1862, p. 230; Shuttleworth, Diagn. Neuer Moll., 1854, p. 158; Clessin, Conch. Cab., Ancylinen, 1882, p. 69, pl. 7, fig. 10.

Original description:—"Anc. testa antice parum convexa, postice recta vel concava; apice sat obtuso, postico, excentrico, dextrorsus sito; depressione apicali minutissima, rotundata, in mediana mucrone verticis sita. Parva, depressa, fragili, diaphana, levi, luteola; apertura ovato-elliptica. Long. 4-5 mill.; lat. 2½, 3½ mill.; alt. 2¼ mill.

Var. B. Testa paululum majore, elatiore; apertura elliptica."

Type locality: Marshes of Guadeloupe.

Shuttleworth (l. c.) lists this species from near Luquillo, Porto Rico, with a "?", and remarks that it is wider, more depressed and perhaps thinner than *A. obscurus* Hald.; but also distinct from *A. fuscus* C. B. Ads. Clessin states that the species is in the Berlin Museum as from that locality. It is probable that his figure was drawn from an example in that collection. It agrees fairly well with Bourguignat's type.

Dr. Mermod makes no note on the apical sculpture, as the apex is badly eroded.

Bourguignat in his description says that the shell is smooth, but the photograph, considerably enlarged, shows distinct radial striation.

VIII. ANCYLUS COMPLANATUS Bourguignat. Pl. III, figs. 1-3.

Ancylus complanatus Bgt., Spic. Mal., 1862, p. 231; Clessin, Conch. Cab., Ancylinen, 1882, p. 26.

Original description: — "Testa ovata, fragili, pellucida, vitracea, pallide cornea, laevigata vel sub lenteargutissime concentrice striatula; antice convexa; postice sinistrorsus ac dextrorsus parum convexiuscula; apice obtusissimo, paululum postico ac dextrorso, fere centrali; depressione apicali magna, postico, in extremitate verticis sita; apertura ovata. Longueur 5; hauteur 1½ mm."

Type locality: Cuba.

Dr. Mermod states that no apical sculpture was visible.

IX. Ancylus sallei Bourguignat. Pl. III, figs. 4-6.

Ancylus sallei Bgt., Amen. Mal., II, 1857, p. 32; Spic. Mal., 1862, p. 231; W. G. Binney, L. and F. W. Shells, N. Amer., II, 1865, p. 142; Strebel, Beitr. Kent. Mex. L. and Sussw. Conchylien, 1873, p. 63, pl. 4, fig. 35; Clessin, Conch. Cab., Ancylinen, 1882, p. 25, pl. 6, fig. 9; Fischer and Crosse, Miss. Sci. Mex., Moll., II, 1880, p. 38, pl. XXX, figs. 17-17b; v. Martens, Biol. Cent. Am., Moll., 1899, p. 401.

Original description:—"Testa antice convexa, postice recta vel paululum convexa, sinistrorsus convexa, dextrorsus recta; apice postico, ad dextram dejecto, obtusissimo, nullo. Minuta, fragillima, diaphana, argutissime sub lenteradiatilis, succinea; apertura oblonga. Haut. 1½; Long. 5; Larg. 2 mm."

Type locality: La Laguna Larga de Toxpam, near Cordova, State of Vera Cruz, Mexico.

The author remarks that the apex is so obtuse that its extremity is completely indistinguishable.

Strebel's unique specimen was collected at Vera Cruz, Mexico. He states that the apex is smooth.

Clessin's figure is a copy of that of Strebel and he "has no doubt" of the correctness of the latter's identification.

Fischer and Crosse state that Strebel's specimen is much smaller than the type, but has the characters of the species. But von Martens notes some discrepancies both in the measurements and figures of the Fischer and Crosse and Strebel specimens (assuming apparently that the former's figure was drawn from an authentic example), and infers that "it is not quite certain that the shells obtained by Sallé and Strebel belong to one and the same species."

Both of these figures differ considerably from the type as here figured.

The apex of the type is too much eroded to show the sculpture.

Bourguignat (Spic. Mal., l. c.) states that he has also received the species from Poey, collected in the marshes of Cardenas, Cuba.

X. Ancylus adelinus Bourguignat. Pl. III, figs. 7-9.

Ancylus adelinus Bgt., Spic. Mal., 1862, p. 227; Clessin, Conch. Cab., Ancylinen, 1882, p. 70, pl. 8, fig. 11.

Original description:—"Testa oblonga, fragili, pellucida, vitracea, pallide fusco-cornea, argute concentrice que striatula, ac sub lentestriolis radiantibus minutissime ornata; antice sinistrorsusque convexa; postice dextrorsusque fere recta; apice posticoobtusissimo, sicut caliculato ac dextriorsus dejecto; depressione apicali rotunda, minutissima, in extremitate verticis sita; apertura oblonga. Longueur 5½ mill., hauteur 2½ mill."

Type locality: Cuba.

Clessin lists the species from "Poey and the Dohrn collection," meaning, probably, that it was in the Dohrn collection received from Poey, and his figure was probably drawn from a specimen from that source. It is quite different in shape from the specimens in the Bourguignat collection. There are three of these, which measure: 4.30 x 3.10, 4.08 x 2.98 and 4.03 x 2.79 mm., the proportion of the width to the length being respectively, 72.1%, 73% and 69.2%, with an average of 71.4%.

According to Clessin's figure the proportion of width to height is 48%. That is, the specimen figured by him is proportionately only two-thirds as wide as the specimen of *adelinus* here figured. It is a much narrower shell and the lateral margins are nearly parallel.

There is evidently some mistake here somewhere. But just where it is, or how it occurred, it is now impossible to say. But the discrepancy is too great to render it at all probable that, if accurately drawn, the specimen figured by him is really *adelinus*. Possibly Poey made a mistake in identifying the shell sent to Dohrn as that species.

The specimen here figured is the largest one in the Bourguignat collection.

Dr. Mermod notes that "the apex is distinctly punctate, but not radially." The species is therefore probably an *Hebetancylus.*

Explanation of Plates.

Plate I.

Figs. 1-4. *Ancylus chittyi* C. B. Ads.
(3, apex; 4, surface sculpture.)
" 5-8. *Ancylus plœarius* Bgt.
(5 and 6 different specimens; 8, apex.)
" 9-11. *Ancylus aorus* Bgt. (11, apex.)

Plate II.

" 1-3. *Ancylus plagioxus* Bgt.
" 4-7. *Ancylus saulcyanus* Bgt.
" 8-10. *Ancylus beaui* Bgt.
(Figs. 6 and 9 represent apices.)

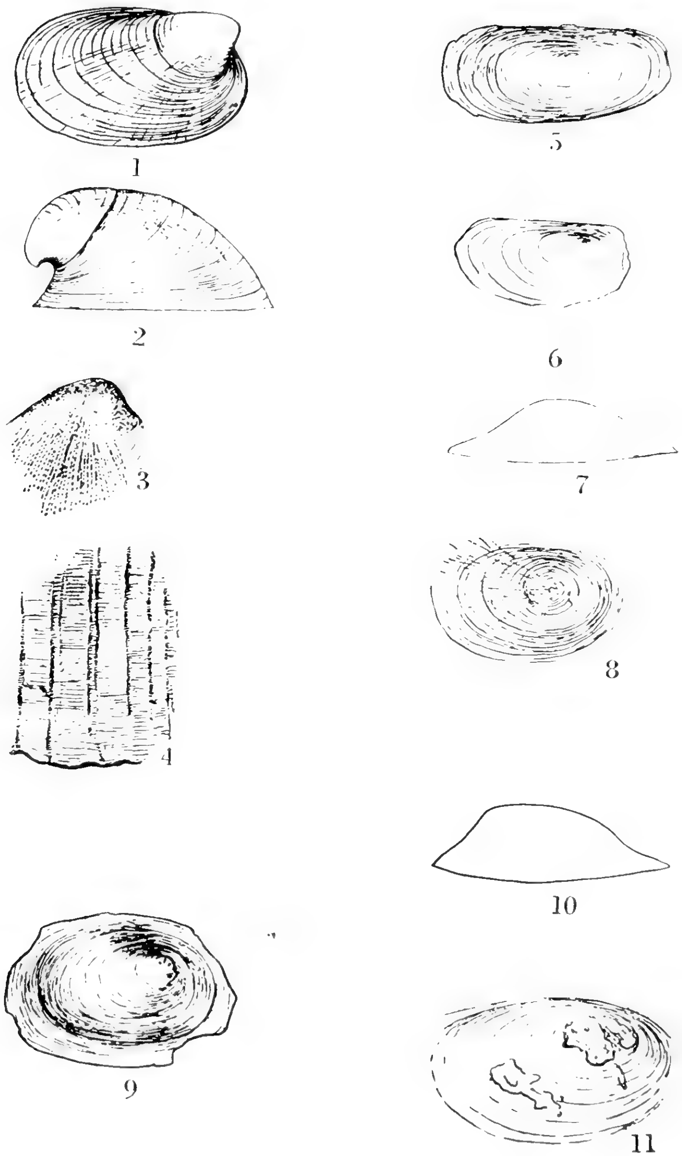
Plate III.

" 1-3. *Ancylus complanatus* Bgt.
" 4-6. *Ancylus sallei* Bgt.
" 7-9. *Ancylus adelinus* Bgt.
(Figs. 3, 6 and 9 are apices.)

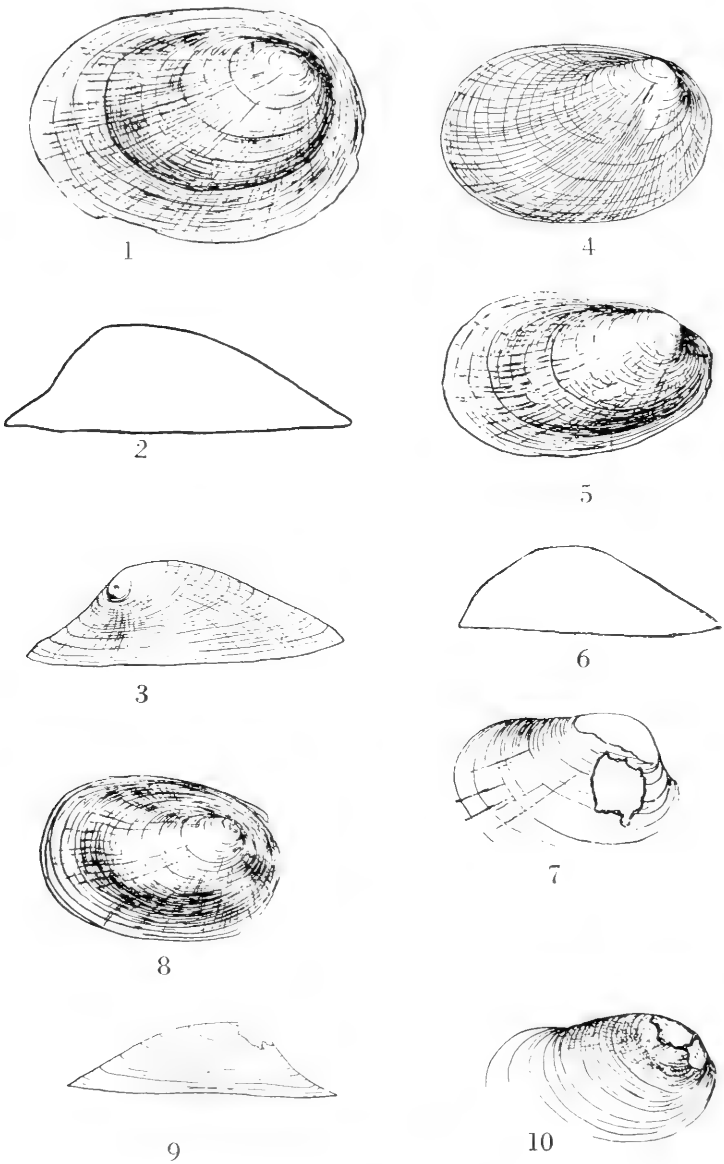
COLORADO PISIDIA

BY V. STERKI

For a number of years, Prof. Junius Henderson has been collecting mollusks in the mountains of Colorado and adjoining states, and in the summer of 1921 has carried through a careful, thorough survey of several counties, such as had not been made anywhere in the State before. The *Sphæriidæ,* nearly 11,000 specimens, mostly of *Pisidium,* were from about seventy stations, mostly at high altitudes, and proved very interesting. There were a surprisingly large number of species and forms. Those from every station had been left



WALKER: BOURGUIGNAT'S AMERICAN ANCYLI



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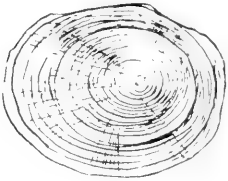

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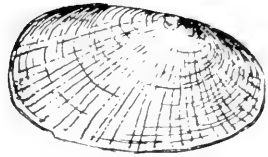

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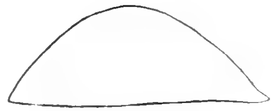

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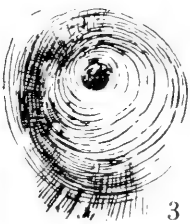

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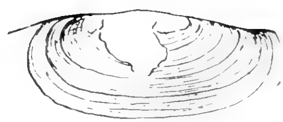

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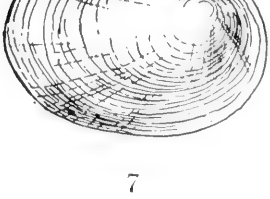

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WALKER: BOURGUIGNAT'S AMERICAN ANCYLI.

mixed up as collected, just what is needed for studying the several species, their interrelations and variation.

In this article some new species are described, and added is a list of the others found in the state, with a few pertinent notes on systematics, variation and distribution. As Prof. Henderson expects to publish a list of the mollusca of the Rocky Mountain States, localities are cited here only in a few instances. The numbers of lots cited are those of the special *Sphæriidæ* collection in the Carnegie Museum; and for the new species it is understood that cotypes are in the collection of Prof. Henderson, Univ. of Colorado.

New Species.

Pisidium coloradense, n. sp.—Mussel subequipartite, subtriangular, barely or not oblique, medium inflated; beaks slightly behind the middle, narrow and slightly prominent, somewhat flattened around the center and with a slightly marked crest (wanting in some specimens); dorsal margin short, curved; supero-anterior slope slightly or barely marked, anterior end rounded or subangular; posterior margin subtruncate obliquely outward, marked off from the dorsal by a slight, rounded angle more marked in younger specimens than in old; ventral margin moderately curved; surface dull to slightly glossy, microscopically rugulose, with fine, crowded, subregular, somewhat sharp riblets and a few slightly marked rest-lines; color whitish, periostracum thin, shell opaque; hinge rather long, curved-angular, rather stout, plate rather short and broad with the inferior edge projecting; cardinals rather long; c3 curved to angular, mostly emarginate in the middle, its posterior end slightly bifid with the shanks again connate at the end and merging into the projecting plate edge, inclosing a deep excavation below; c2 rather large, with base curved, the free edge forming a regular semicircle or nearly so; c4 oblique, rather long, and so is its edge; laminæ rather long, aI rather massive, its cusp near the middle, pointed, with the slopes gradual and about equal; aIII 1/4 to 1/3 the length of aI; pI with cusp slightly pointed, not abrupt, pIII 1/3–1/2 as long as pIII; aII with apex pointed, slopes rather abrupt, the distal one more so, pII similar, smaller; ligament medium long, rather thick.

Long. 5.4, alt. 4.7, diam. 3.3 mm., the largest ex. on hand.

Long. 4.5, alt. 3.8, diam. 2.6 mm.; others, may be not full grown.

Hab.: Small rivulet east of Boulder, Colo.; there were over 150 specimens in the lot, rather uniform; no other Pisidia. Types No. 9844, C. M.

The species is evidently of the *compressum* group, as evidenced by its shape, surface sculpture and hinge, but distinct from that species: different from all its many forms.

Pisidium probum, n. sp.—Mussel slightly elongate, subtriangular, somewhat inequipartite, medium inflated, beaks somewhat posterior, rather broad, rounded, slightly or not mamillar, moderately projecting, dorsal margin short, curved, not marked off by angles, supero-anterior slope slightly marked in adolescent, barely so in full-grown exs., in which the anterior end is more broadly rounded; posterior margin subtruncate to rounded, ventral rather well and regularly rounded; surface somewhat glossy with the striæ fine, crowded, irregular and somewhat sharp, and a few rest-lines; color straw or light yellowish to corneous; shell subtranslucent, rather thin; hinge curved, rather slight, plate moderately broad with the lower edge somewhat projecting; cardinals well above the edge: c3 medium curved, with its posterior end bifid, and a distinct excavation below; c2 rather long with base curved to angular, apex more or less pointed; c4 oblique, rather long, curved; both c2 and c4 well projecting; lamellæ: aI not much projecting inward, its cusp about in the middle, pointed with slopes moderately steep, aIII about 1/3 the length of aI; pI and pIII similar; aII and pII with cusps pointed, more abrupt; ligament moderately long and thick.

Long. 5, alt. 4.3, diam. 3.3 mm. (largest).

Long. 4.6, alt. 4, diam. 2.6 mm.

Hab.: Roaring Fork, above Aspen, Pitkin Co., Colo., collected July, 1917. There were hundreds of specimens in the lot, from young to old, and rather uniform; no other *P.*—Types No. 9693, C. M.

This species is different from all described and appears not to be closely related to any other. In outlines it is somewhat like *coloradense,* though not of that group; differs by the much broader beaks, the surface sculpture and appearance, and the hinge which is somewhat characteristic but shows some variation. Most of the specimens are of rather dark color, apparently browned in drying.

PISIDIUM LUCIDUM, n. sp.—Mussel slightly elongate, subequipartite, not oblique, short oval to subelliptical without any angles, well to strongly inflate; beaks slightly or barely posterior, rounded, somewhat mamillar, moderately projecting; dorsal margin short; surface polished with very fine, crowded, irregular striæ; color light to darker corneous to grayish or brownish, often with narrow, irregular lighter zones; usually a few rest-lines; shell thin, transparent to translucent and even apparently opaque; hinge moderately long and stout, plate somewhat broad, cardinals well up on it: c3 rather short, strongly curved, often somewhat emarginate in the middle, its posterior end bifid; c2 small, short, with base curved, apex rounded; c4 oblique, mostly longer than c2, slightly to strongly curved; laminæ: aI rather long and stout, cusp about in the middle, pointed with the slopes rather steep, aIII short and small; pI rather short, with cusp similar, pIII $\frac{1}{3}$–$\frac{1}{2}$ the length of pI; aII with cusp short, pointed, proximal slope rather steep, distal abrupt, pII similar; ligament medium long and thick.

Long. 4.5, alt. 4, diam. 2.7 mm. ("typical" form).

Long. 6, alt. 5.2, diam. 4.2 mm. (large form from other place).

Hab.: Quite a number of places, rivulets, small beaver ponds, etc., at least at some "among dense plant growth," mostly at high altitudes; evidently abundant: from most stations there were hundreds, altogether more than 2300. Those taken for types were from a roadside pool at Buena Vista, Chaffee Co., Colo., collected in July, 1917; No. 9691, C. M.—Also seen from other states.

This is evidently an undescribed species, the affinities of which are under doubt. It is peculiar by its shape, size, the transparent (or translucent) shell and the hinge, especially the cardinals. It is somewhat variable, and at least from one station there are rather different forms. From its size and appearance it might be taken for a lake form.

Pisidium mirum, n. sp. — Mussel subequipartite, oval to elliptical, strongly and evenly inflate; beaks little posterior, broad, rounded, slightly or moderately projecting; surface glossy with slight, shallow, irregular striæ and a few rest-lines, color white to straw, in some forms light grayish or corneous, shell rather thin, opaque or translucent; hinge short, moderately stout, plate medium broad; cardinals small, short: c3 slightly curved to nearly straight, its posterior part markedly short, bifid; c2 rather high up on the plate, with base straight or nearly so, somewhat oblique, abrupt, strongly curved upward, apex rounded or subtruncate; c4 slightly oblique and curved, extending forward over ½–⅔ of c2, much less projecting than c2; laminæ short, rather stout: aI close to the cardinal, strongly projecting inward, its cusp about in the middle, pointed, with slopes about equally steep, aIII about ¼–⅓ the length of aI; pI with well-marked cusp, quite abrupt distally, pIII small; aII and pII with cusps quite short and abrupt; ligament short, rather thick.

Long. 4.4, alt. 3.7, diam. 3.2 mm. (of 9834).

Long. 4.2, alt. 3.7, diam. 3.4 mm., from other place.

Hab.: Lakes and ponds, quite a number of stations, with over 200 specimens seen, mostly from the vicinity of Silver Lake; types No. 9834, C. M. The typical form is somewhat like short *P. roperi* St., also like small *ovum*, but on close examination the two are quite different and distinct. The species is rather variable, though from every station the mussels are rather uniform; there are forms with the beaks narrower and more prominent, the surface is rougher, and the color corneous, and they appear to be of a distinct species.

Pisidium hendersoni, n. sp. — Mussel small, inequipartite, medium inflate; beaks somewhat posterior, broad, rounded to flattened, moderately projecting; dorsal margin little curved, bounded by angles, supero-anterior slope somewhat marked, rather short, anterior end rounded angular, posterior margin subtruncate, inferior moderately curved; surface dullish or slightly glossy, very finely microscopically rugulose, striæ very fine, crowded, barely noticeable over the beaks, slightly coarser towards the margins; color whitish to straw, shell thin, opaque; hinge moderately curved, very slight, plate quite narrow; cardinals small: c3 slightly curved, its posterior end somewhat thicker and slightly bifid, c2 on or close to the plate edge, short, straight, with apex rounded, c4 quite small and short, with its position somewhat variable; laminæ slight: aI with cusp somewhat distal, pointed, not abrupt, pI more distal with cusp small, aIII about 1/3 the length of aI, pIII 1/3–2/3 the length of pI; aII with cusp distal, pointed, quite abrupt distally, pII less so; ligament rather long, occupying nearly the whole "width" of the plate.

Long. 3.2, alt. 2.8, diam. 2.1 mm.

Hab.: Upper Forest Lake, at timber line, northwest of Tolland, Boulder Co., among coarse gravel; there were about 200 specimens in the lot, with no other Pisidium. Types No. 9775, C. M.

The mussels are rather uniform, yet with some significant differences: some examples have the beaks flattened, even to form ridges; the hinges, especially the cardinals, show differences in details. This is a rather peculiar species, apparently not closely related to any other, and dedicated to its discoverer.

List of Additional Species.

Pisidium compressum Prime, scarce, from few places, rather different forms.

P. variabile Prime, frequent, from about ten stations; markedly different forms: some much like eastern, others quite small, with narrow beaks; nothing like the very large forms from Washington.

P. occidentale Newcomb, somewhat scarce and apparently not characteristic.

P. *huachucanum* Pilsbry & Ferriss (not a form of *abditum!* apparently nearer *occidentale*); several places but apparently rather scarce.

P. *roperi* Sterki, rather frequent, as in Montana; much like eastern forms.

P. *pusillum* (Gmelin) Jenyns, apparently: just like specimens from England, etc. Not noted before as Nearctic; probably to be looked for in the North (specimens from northern Indiana are apparently identical). Diamond Lake, near Eldora, at alt. 10,960 ft.; apparently also: Lower Los Lagos, Rollinsville.

P. *ovum* Sterki, frequent, from a number of places; generally somewhat smaller than those from Montana.

P. *marci* St., apparently the same as the originals from Utah, though of somewhat different appearance; from quite a number of stations and different forms, with respect to shape, size and color.

P. *lermondi* Sterki, in a slough above Minturn, Eagle Co.; just like specimens from New England, Ontario and Michigan.

P. *milium* Held, from two stations, fine, characteristic specimens.

P. *imbecille* Sterki, in a creek above Wolcott; over a hundred examples.

P. *abortivum* Sterki, near Silver Lake; appears to be widely distributed in the West.

P. *rotundatum* Prime, several stations, rather different forms, some not characteristic, and under doubt.

P. *parvulum* Clessin—apparently, from a number of stations; also seen from Montana and Washington. At least some of them are just like European *parvulum;* not previously noted as Nearctic.

P. *costatum* Sterki, from a small Forest Lake, northwest of Tolland. Apparently identical with the fossil mussel from marl deposits in Maine, Michigan and Illinois, known since 1895, with the ribs slighter. Now seen for the first time as recent.

P. *ventricosum* Prime, or nearest to that; somewhat different forms. From quite a number of lakes.

NOTE ON LYMNÆA HEMPHILLIANA (BAKER) *

BY G. DALLAS HANNA

Limnæa reflexa hemphilliana BAKER, Nautilus, Vol. 18, 1904, p. 11.

Galba reflexa hemphilliana (BAKER), Chicago Acad. Sci. Special Publ. No. 3, 1911, p. 342, pl. 36, figs. 19-20.

This species was described from two specimens in the collection of Dr. Bryant Walker; and they had been collected by Henry Hemphill in Lake Albert Lea, Freeborn County, Minnesota. When the monograph of North American Lymnæidæ was published in 1911 no additional material had been studied and Baker stated, "A good series of this race is a desideratum."

An examination of the Hemphill Collection, now in the California Academy of Sciences, shows that the original lot consists of 28 specimens. These were segregated as to size and minor variation in accordance with the custom of the collector into seven lots, numbered 6742-6745 and 6748-6750. The specimens conform reasonably close to Dr. Baker's description and figures. It does not appear that intergradation can be shown with certainty with *reflexa;* therefore subspecific relationship might better not be inferred. The following measurements will aid in the determination of the species:

Altitude	*Diameter*	*Altitude of aperture*	*Catalogue number*
35.8	14.3	16.	6743
38.	14.2	18.8	
39.6	15.9	18.4	
38.	15.	18.3	
34.1	13.3	18.1	6744
33.6	14.8	17.3	
30.9	14.1	16.9	
30.4	13.2	16.4	

* Published by permission of the California Academy of Sciences.

Altitude	*Diameter*	*Altitude of aperture*	*Catalogue number*
29.1	11.6	15.1	6745
29.6	11.9	13.8	
27.	11.6	13.5	
24.4	10.1	11.6	
29.	11.2	13.	6748
28.3	11.1	12.1	
29.5	11.5	13.	
25.1	10.7	12.8	
29.	12.1	14.1	6749
31.2	12.4	14.2	
28.	11.8	13.2	
25.	10.	11.4	
25.	10.2	12.	6750
22.6	9.8	11.3	
23.3	9.3	11.	
20.8	8.7	10.6	
34.2	14.3	16.	6742
34.8	15.1	16.7	
33.2	14.3	17.1	
25.	10.8	11.1	

Hemphill associated the species with *umbrosa* = *elodes* (vide Baker) and *zebra* = *exilis*, but the resemblance is superficial. He collected a set of specimens in the same lake which he referred definitely to the last species, and apparently with correctness. They measure:

Altitude	*Diameter*	*Altitude of aperture*	*Catalogue number*
29.5	10.5	13.9	6751
28.8	9.8	12.7	
22.3	8.2	10.5	

It will be seen that the measurements do not intergrade with those of *hemphilliana*. The latter seems closest to *lanceata* Gould, but has a greater diameter and longer aperture. and the same characters separate it from *reflexa* and *exilis*.

This note is written not only to call attention to *L. hemp-*

hilliana but to a wealth of similar material in the great collection which Hemphill assembled. He seems to have distributed duplicates rather sparingly and these were selected from his poorer specimens. His field work resulted in the discovery of a great number of new species, many of which are represented only by a few known specimens, as in the case of this *Lymnæa*. In almost every case, however, he retained a good series of his best specimens for his own collection. This is now available for legitimate study and research in the California Academy of Sciences.

PLEISTOCENE FRESHWATER MOLLUSKS FROM NORTH CENTRAL TEXAS

BY G. DALLAS HANNA

Through the kindness of Dr. J. A. Udden, Director of the Bureau of Economic Geology and Technology of the University of Texas, I have recently had the opportunity to study interesting and well-preserved freshwater fossil mollusks from Wilbarger County, North Central Texas. The material was collected by Mr. E. B. Stiles, Petroleum Geologist.

Locality 1. *Pomatiopsis lapidaria* (Say).
The fossils came from greenish white clay covered by 20 feet of sandy shale; one mile north of Pease River, 4½ miles N. E. of Vernon, Wilbarger County, Texas; elevation 1214 feet; Sec. 25, Blk. 12.

Locality 2. *Planorbis trivolvis* Say.
Physa gyrina Say.
Lymnæa catascopium (Say).
Lymnæa palustris (Muller)
The fossils came from greenish clay directly overlying Permian rocks; south bluff of Red River, N. E. Cor. Sec. 42, Blk. 12, north of Vernon, Wilbarger County, Texas; elevation 1210 feet.

The formation from which these shells came is a Pleistocene lake deposit of very considerable extent which has been named "Seymour beds" by Cummins.[1] Vertebrate fossils have been found in it but this appears to be the first record of mollusks.[2] Several of the species are of decidedly northern habitat at the present time and the finding of them in Texas goes further to show the southward extension of the Hudsonian fauna during the Pleistocene.[3]

ON THE IDENTITY OF SAXIDOMUS BREVISIPHONATUS CARPENTER

BY J. R. LE B. TOMLIN

In 1902, in his "Synopsis of the Family *Veneridæ*,"[4] Dall wrote that this species had never been collected since it was described from the Vancouver region.[5]

As a matter of fact, Carpenter says: "Hab.: ? Vancouver, ? Japan (Mrs. Cuming). The shell was sent me as from Dr. Forbes' Vancouver collections and is so quoted in the British Association Report for 1863, p. 607, but Mr. Cuming subsequently stated his belief that it came from Japan."

Mr. Cuming's belief was perfectly correct. Whilst overhauling the *Veneridæ* in the British Museum recently I came across the specimen described by Carpenter, its identity being established by pencilling both on the back of the tablet and on the inner side of the valves of the shell. It is in poor condition and somewhat imperfect, but recognizable at a glance as *Macrocallista chishimana* Pilsbry.[6]

1 Cummins, W. F., *Fourth Ann. Rept., Pt. 1, Geol. Survey,* 1892 [1893], pp. 181-190.

2 See Gordon, *U. S. Geol. Survey, Water Supply Paper,* 317, 1913, pp. 30-31, 58-59.

3 See "A Pleistocene Molluscan Fauna from Phillips County, Kansas," *Univ. Kansas Sci. Bull.,* Vol. VII, No. 3, 1913, in which a similar southward extension of land snails is discussed by Hanna & Johnston.

4 *Pr. U. S. Nat. Mus.,* xxvi, 408.

5 *Pr. Z. S. 1865,* 203.

6 *Pr. Ac. N. Sc. Philada. 1905,* p. 118.

SOME SLUGS FROM MEXICO

BY T. D. A. COCKERELL,
University of Colorado.

I am indebted to Dr. Paul Bartsch for permission to examine some slugs which were recently sent to the National Museum by Dr. A. L. Herrera, Director de Estudios Biologicos, Mexico City.

LIMAX FLAVUS Linnaeus.

City of Mexico; numerous specimens of this European species, which is new to Mexico. The specimens belong to the common form in which the dark markings are dark grey or black. This is the variety *colubrinus* Pini, 1876, originally described from Esino in Lombardy, and said to be yellow, the mantle and back broadly and irregularly maculate with black, the black and yellow about equal in amount. Pini considered this different from var. *maculatus* Moquin-Tandon, which he also found at Esino, for whereas the pale areas of *colubrinus* are yellow (colorless in alcohol), those of *maculatus* are brown or brownish. The latter variety has been beautifully figured in colors by Taylor,[1] and as the name given by Moquin-Tandon is preoccupied, it has been renamed *nigromaculatus* Cockerell.[2] As a matter of fact these differences are unimportant, and Taylor classes both forms as phases or subvarieties of var. *umbrosus* Philippi, 1844.

The term *Limax maculatus* seems first to have been used by Nunneley in Trans. Phil. and Lit. Soc. Leeds, vol. 1 (1837), p. 46. Taylor, singularly enough, cites this in the synonymy of both *Limax maximus* and *L. flavus.* I am indebted to Dr. Bartsch for a copy of Nunneley's description, which indicates a slug "of a reddish brown color, with four longitudinal stripes of black, more or less continuous down the body. . . . The shield is irregularly spotted with black." This agrees

[1] Monograph, *Land and Fresh Water Mollusca British Isles,* part 11 (1905), pl. x, f. 9.

[2] *Science Gossip,* 1893, p. 25.

with Taylor's figure of *L. maximus* var. *tigris* Adams ms., Taylor, which must be called *L. maximus* var. *maculatus* (Nunneley). This has priority over var. *maculatus* Picard, 1840, which is a different form. Picard's slug is identical with var. *cellarius*, but this name cannot be credited to d'Argenville, who published before 1758.

Agriolimax species.

Desierto de los Leones, one specimen in formalin, collected by Dr. Herrera. About 11 mm. long as preserved, very dark plumbeous, without markings; sole whitish, with the lateral areas pale grey. Jaw with a very strongly developed central projection, as in *A. laevis* (Müller). Median teeth with short ectocones, agreeing with Strebel's figure of *A. berendti* Strebel. Inner laterals tricuspid, with ectocone distinct but endocone forming a right angle with base of mesocone, and in the outer laterals becoming obsolete. Marginals with a thornlike outer process or ectocone, recalling *A. pallidus* Schrenk, as figured by Lessona and Pollonera.

It is impossible to describe this slug from the material before me, but fresh and abundant material may show it to be a new species, the marginal teeth being apparently distinctive. The color agrees with Crosse and Fischer's *A. guatemalensis*, "caeruleonigricans, discus [sole] pallidus," but the teeth do not agree. It is quite possible that the slug is *A. stenurus* Strebel, described from East Mexico, and generally placed in the synonymy of *A. laevis*. Certainly, however, it is not *laevis*.

ON THE FRESHWATER SHELLS OF MONROE, CONNECTICUT.

BY ARTHUR P. JACOT

The present paper is a companion to the report on the land shells of this region published in the Nautilus in April, 1919 (vol. 32, no. 4). The town of Monroe is divided into two drainage areas by a major ridge running from southeast to northwest. Monroe center is situated on the crest of this ridge. On the northeast slope is the Boy's Half Way and the Half Way Rivers (brooks), both of which drain directly into the Housatonic River. The former is poor in shells and fish while the latter is considerably richer. The drainage on the southwest slope is larger and forms part of much longer streams which also drain into the Housatonic River or Long Island Sound. This section was not carefully studied.

The five stations at which collections were made are (1) Cargyle's Pond, a small, artificial, water-lily pond on the Boy's Half Way; (2) the brook running into the pond about 200 yards above the pond, on shallow sandy riffles (few or no shells were found below the pond); (3) one of the ends of a branch of the Half Way, a small, clear, woodland brook; (4) an upland swamp described in the former article; (5) that part of the Housatonic River forming part of the town line. Many of the collections in the river were made about Zoar Bridge. This locality, however, has been entirely wiped out and conditions entirely changed by the construction of a large dam one mile below the bridge, flooding the country back for some ten miles. The conditions below this dam, as at Otter Rock, are still the same. Less than a mile below Otter Rock are the head waters of another flooded area caused by the dam at Shelton. Thus are our wild, swift rivers being changed into expanses of quiet water and certain types of habitat becoming more and more difficult of access.

The Sphaeriidæ have very kindly been identified by V. Sterki. Grateful acknowledgment is also due C. W. Johnson for encouragement and advice.

Strophitus edentulus (Say). Uncommon at 5 in deep, quiet water.

Strophitus undulatus (Say). Data lost.

Anodonta cataracta Say. Uncommon at 5 in deep, quiet water.

Alasmidonta undulata (Say). Fairly common at 5 in shallow water, among stones.

Alasmidonta marginata (Say). Fairly common at 5 in deep, quiet water.

Unio complanatus (Dillwyn). At 5 and in streams southwest of center.

Sphaerium sulcatum (Lam.). Farmhill River and tributaries (southwest of center).

Sphaerium "somewhat like *striatinum*," undescribed. Fairly common at 5 in sand rift, behind large boulders in swift, shallow water where bed is covered with stone and rocks. Also reported from Maine by Sterki.

Musculium partumeium (Say). Uncommon, probably at 1.

Musculium securis (Prime). Common at 1.

Pisidium abditum Haldeman (2 forms). Common at 3, some in sand rifts, some in mud or silt rifts.

Pisidium aequilaterale (Prime). Common at 1, occasional at 2.

Pisidium "somewhat like *fallax* Sterki". In company with *Sphærium* (not *striatinum*).

Pisidium griseolum Sterki. Rare at 2.

Pisidium monas Sterki "apparently". Rare at 3.

Pisidium occidentale Prime. A few young in a marshy pool at head of Cargyle's Pond.

Pisidium punctatum Sterki. Rare at 3 in mud rifts.

Pisidium punctatum simplex Sterki. Rare at 2 in sandy rifts.

Pisidium streatori Sterki. Common at 4.

Pisidium subrotundum Sterki. Uncommon, in company with *P. occidentale.*

Pisidium variabile Prime. Uncommon at 1 and a smaller form at 2. This latter with a much larger quantity of *P. æquilaterale* were found distending the stomach of two or three Bullheads or Catfish (*Ameiurus nebulosus* Le Sueur) taken from the pond.

Amnicola limosa (Say). Common at 5, on *Potamogeton* in quiet water, also at 1.

Lyogurus pupoidea (Gould). Locality uncertain.

Physo heterostropha (Say). Several at 5, eroded at tip.

Physa ancillaria Say. Large and fine at 5 on *Potamogeton* in swift water, also at 3 on weed culms.

Aplexa hypnorum (Linné). Fairly common at 4, but small.

Pseudosuccinea columella (Say). Occasional at 1.

Pseudosuccinea columella chalybea (Gould). Rare in marshy pool at head of Cargyle's Pond.

Galba obrussa (Say). Occasional at 5.

Planorbis antrosus Conrad. Common at 1, also at 2, on weeds under road bridge.

Planorbis (*Menetus*) *exacuous* Say. Occasional at 4.

Planorbis (*Gyraulus*) *deflectus* Say. Common at 5 on *Potamogeton* preferably where there is a slight current.

Segmentina armigera (Say). Rare at 4.

Ancylus fuscus C. B. Adams. Common at 1.
Ancylus rivularis Say. Abundant at 5, on *Potamogeton*, preferably where there is current, strong or weak.

Careful search was made for *Pomatiopsis lapidaria* (Say) along the Housatonic to its mouth but none were found.

A NEW DEEP WATER LYONSIELLA

BY W. H. DALL

Lyonsiella magnifica n. sp.

Shell large, thin, pearly, subquadrate, equivalve, very inequilateral, beaks low and small, prosocoelous; posterior end produced, rounded, posterior slope somewhat convexly arched; anterior slope rapidly descending, abruptly rounded; basal margin nearly straight; hinge edentulous, the internal ligament long, narrow, parallel with the hinge line; outer surface polished under a pale olive periostracum, with an almost microscopic sculpture of radial rows of very minute pustules; the radii are equal, equally distributed, and average three or four to a millimeter, when measured transversely. Length of shell, 25; anterior end beyond the vertical from the beaks, 4; height, 17; diameter, 14 mm. U. S. Nat. Mus. Cat. No. 266802.

Off Cape San Lucas, Lower California, in 63 fathoms, mud and gravel; U. S. Str. Albatross, Dr. Paul Bartsch directing collections.

This is probably the largest species of the genus.

THE STATUS OF TEREDO BEACHI AND TEREDO NAVALIS

BY PAUL BARTSCH

I have so far refrained from commenting on the efforts of Professor Kofoid and his students to discredit the validity of my *Teredo beachi*. A review in the Nautilus for April, 1923, on page 140, of Robert Cunningham Miller's paper on the "Variations in the Shell of Teredo Navalis in San Francisco Bay," University of California Publications in Zoology, vol. 22, no. 2, pp. 293-328, bears the following statement, which is a slightly abbreviated rendition of Miller's statement on page 25 (317): "The local varieties, including *T. beachi* Bartsch, have not been found sufficiently differentiated to warrant their being classed as subspecies, much less as species."

This, I feel, makes it necessary for me to protest lest my silence be construed as concurrence in the opinion of my West Coast critics.

The paper in question is a beautiful intensive study of *Teredo beachi* Bartsch, and barring the summary, in which the systematic status of this species is discussed, a splendid piece of work. It is unfortunate that the author in question, as well as Professor Kofoid himself, has not made an equally intensive study of the European *Teredo navalis*, which I have been unable to find in American waters, before publishing this summary, for I am certain that had they so done, they themselves would have become acquainted with the characters that differentiate the *navalis* group from the *Teredo morsei* group, to which *Teredo beachi* belongs.

In *Teredo navalis*, the denticles on the anterior median area have but a single cusp. In the *Teredo morsei* group, they are multicuspid. That at once differentiates the two groups, and there are hosts of other characters that separate the members of these groups into specific or subspecific elements.

The only member of the *navalis* group that I have found so far in American waters is the New England shipworm, *Teredo novangliae* Bartsch. All the other true *Teredos* seen belong to the *morsei* group, both on the East and the West Coast of America.

BERMUDA SHELLS

BY E. G. VANATTA

Early in 1922 Mr. Hiram Hoyt collected samples of leaf-mould on four islands not mentioned in my paper on Bermuda Shells in the Proceedings of the Academy of Natural

Sciences of Philadelphia, 1910, pages 664-672. The following species of land shells were picked from this material:

St. David's Island

Helicella ventricosa Drap.
Eulota similaris Fér.
Polygyra plana Dkr.
Thysanophora selenina Gld.
Gastrocopta rupicola Say
Gastrocopta p. hordeacella Pils.
Obeliscus swiftianus Pfr.
Rumina decollata L.
Poecilozonites bermudensis Pfr.
Zonitoides minuscula Binn.
Milax (shell only)
Succinea barbadensis Guild.
Carychium bermudensis Gul.
Helicina convexa Pfr.

Paget Island

Helicella ventricosa Drap.
Eulota similaris Fér.
Polygyra plana Dkr.
Thysanophora hypolepta Shutt.
Gastrocopta rupicola Say
Gastrocopta p. hordeacella Pils.
Zonitoides minuscula Binn.
Milax (shell only)
Succinea barbadensis Guild.
Helicina convexa Pfr.

Cooper's Island

Helicella ventricosa Drap.
Eulota similaris Fér.
Polygyra plana Dkr.
Thysanophora selenina Gld.
Thysanophora hypolepta Shutt.
Gastrocopta rupicola Say
Gastrocopta p. hordeacella Pils.
Zonitoides minuscula Binn.
Carychium bermudensis Gul.
Helicina convexa Pfr.

Ireland Island

Helicella ventricosa Drap.
Eulota similaris Fér.
Polygyra plana Dkr.
Gastrocopta rupicola Say
Gastrocopta barbadensis Pfr.
Gastrocopta p. hordeacella Pils.
Rumina decollata L.
Zonitoides minuscula Binn.

NOTES.

Note on Fenella, Obtortio and Alabina.—Hedley in 1899 proposed for *Rissoa pyrrhacme* Melvill and Standen, which he supposed to belong to *Fenella* A. Adams (a preoccupied name) the genus *Obtortio* and gave an excellent figure of the shell and its nucleus, the latter marked by strong axial ribbing. An examination of specimens of Adams' typical species (from Japan) received from him many years ago, shows that it and the Californian species have a nucleus beginning smooth and later developing spiral sculpture. The difference is sufficient to separate the two groups of which the Japanese and Californian species will continue to bear the name *Alabina* (Dall, 1902).—Wm. H. Dall.

Introduced Species of Lymnæa in Southern California. —I have taken *Lymnæa columella* Say and *Lymnæa auricularia* (Linne) from a pond in Exposition Park, Los Angeles, also from a park at Beverly Hills, Cal. Mr. Allen, a local dealer in aquatic plants and goldfish, states that the latter occurs in a number of aquaria and ornamental ponds in this vicinity. They have doubtless been introduced and distributed with lily bulbs. Mr. Allen informs me that *L. auricularia* occurred in his ponds about three years ago and has been a common occupant since. These two species first came to my notice over a year ago. To my knowledge they have not been previously reported from the western states. — Wendell O. Gregg, M.D.

We regret to record the death of Frederic William Harmer, which occurred April 11, 1923. He was in his 88th year. Mr. Harmer was the author of the monograph on the Pliocene Mollusca of Great Britain, published by the Palaeontographical Society, the last part appearing in 1919.

Correction.—In the last issue of The Nautilus, page 137, the following should be inserted:—Fewkes, J. Walter. 1889. New Invertebrata from the Coast of California, pp. 45-46. Printed for the author. Boston. The citation referred to Fewkes should read:—McFarland, F. M.

Nomenclature of Certain Species of Chrysodomus and Calliostoma. — For over twenty years I have been using spare time in making a card catalogue of every name that I could find which has been applied to any shell from the West

Coast of both Americas, using all literature accessible. I have added references to all articles containing figures or descriptive matter which could be used in the diagnosis of these shells, with localities; also references to all local lists of shells which extended the known range. Thanks to the enormous synonymy, which has led to interminable cross references, the number of cards has reached about 12,000 and there is still much to be done.

During my oriental trip from 1913 to 1915 nothing was done, and since my return, bad eyes have prevented me from prosecuting the work. For a few months I have been at it again with renewed zest. A duplication of names and a duplicate description of the same shell which I have recently found seems to need correction.

In the Proc. Nat. Mus., Vol. 14, 1891, p. 188, Dr. Dall describes *Chrysodomus* (*Sipho*) *hypolispus* n. sp., from near Bering Island in 45 fathoms. This species appears in his Bulletin of the Nat. Mus. 112, p. 96, as *Colus* (*Latisipho*) *hypolispus* Dall, 1891. In the Proc. Nat. Mus. for 1920 (issued in 1919), Vol. 56, p. 324, again appears *Chrysodomus hypolispus* n. sp., evidently a different shell, taken by the Albatross in the Japan Sea in 325 fathoms. As I can find no new name proposed for this shell, I propose that it be called *Chrysodomus kelseyi*, new name.

In the Bulletin of the Southern California Academy of Sciences, Vol. 14, No. 8, p. 118, 1905, Mrs. Williamson describes *Calliostoma canaliculatum parvum* n. var. This is our common form of *C. canaliculatum* Martyn, the typical form being rather rare about San Diego. In the Proc. Nat. Mus. for 1920 (issued in 1919), Vol. 56, p. 360, Dr. Dall gives a brief description of the same variety, basing his description on typical specimens from San Diego, under the name *Calliostoma canaliculatum*, new variety *nebulosum*, which name must pass into synonymy.

I wish to add that I would be pleased if my catalogue could be made useful to anyone working on West Coast shells, and I will be glad to furnish data to anyone desiring them.

FRED BAKER.

POINT LOMA, CAL., Oct. 10, 1922.

THE TYPE OF PLOTIA 'BOLTEN'. — *Plotia,* of the *Museum Boltenianum,* compiled by P. F. Roeding, p. 95, was one of those happy inspirations which should rejoice the hearts of the revivers of Bolten. It contained species referable to the genera *Melanoides, Faunus, Liguus, Pyramidella, Dorsanum,* and several *nomima nuda.* Brot in 1874 mentioned *Melania spinulosa* Lam. as type, but this species was not in Bolton's (Roeding's) list. In order to get rid of the name in the nomenclature of melanians (*Thiaridæ*), we here designate *Plotia lineata* the type.—H. A. PILSBRY and J. BEQUAERT.

Dr. Pilsbry sailed from Vancouver, June 29, for Australia, as a delegate representing the Academy of Natural Sciences at the Second Conference of the Pan-Pacific Scientific Congress, to meet in Melbourne and Sydney, August 13 to Sept. 3.

PLANORBIS IMMUNIS n. n.—In 1918 (Memorias do Instituto Oswaldo Cruz, X, p. 70) I described a new species from Rio de Janeiro, Brazil, as *Planorbis confusus.* I have since learned that that name had already been used by Rochebrune in 1881 for a Chinese species. I would therefore change the name of the Brazilian species to *Planorbis immunis.* — DR. ADOLPHO LUTZ.

To celebrate the eighty-fifth birthday of Professor Edward S. Morse, some twenty members of the Boston Malacological Club visited him at the Peabody Museum in Salem on June the 18th, to congratulate him and wish him years of useful work in the future. The visitors were headed by the President of the Club, Mr. Arthur F. Gray, who at an appropriate moment presented Professor Morse with a silver pitcher and tray suitably inscribed, giving at the same time a brief review of some of Professor Morse's work begun in 1856. It was a most enjoyable day for all present.

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PARTIAL LIST OF THE MOLLUSCAN FAUNA OF CATALINA ISLAND

BY A. M. STRONG

Early in July, 1921, during a week of very low tides, the writer made a collecting trip to the Isthmus, Catalina Island, California, in company with Mr. C. E. White of Los Angeles. The result was very satisfactory and the trip was repeated again the following year with equally good results. A number of rare shells were collected as well as some which have not been previously reported from this district, and several hundred specimens secured of an *Odostomia* which proved to be undescribed.

Catilina is one of a chain of islands off the coast of southern California. It lies about 20 miles from the mainland and is included in Los Angeles County. The island, about 21 miles long and 8 miles wide at the widest place, has all the appearance of the summit of a sunken mountain range, and it is commonly considered that at one time it was part of the Coast Range of Central California. Except where the canyons meet the sea, forming coves, with short beaches, the entire island is mountainous. The drop in the ocean floor is nearly as abrupt as that of the land, in some places a depth of 600 feet being reached within half a mile of shore. There are no sand beaches on the island; most of the shore line is sheer rock. At a few places there are bluffs with broken rock at their foot; and at the back of the coves, many of which on the lee side of the island are well protected, the short stretches of beach are composed of shingle or small pebbles.

At the Isthmus conditions are a little different from those on the balance of the island. Here Catalina Harbor on the ocean side is an almost landlocked bay a mile or more in depth by half a mile in width, while exactly opposite it Isthmus Cove cuts deeply into the coast line on the land side. The two are separated by a gentle roll of land a half a mile in width. The topography is the same as occurs at a low saddle or pass in a mountain range. Both bays are comparatively shallow and have a considerable protected shore line. While there is no sand beach there are some small areas of mud flats and flat lying reefs of loose rock.

Collecting conditions were ideal. Mine host Gregg of the Isthmus Camp, ably seconded by Mrs. Gregg, furnished us with a comfortable tent-house and boat and equipment, coupled with genuine old-time California cooking and no complaint at irregular hours. Collecting was done in several different ways. The extreme low tides occurring very early in the morning, daylight found us on the rock reefs. After a late breakfast the balance of the morning was spent dredging the bays or examining the kelp fields lying just off the points. The afternoons were usually spent working along the loose rock reefs where there were a few small tide-pools. We found that most of the bottom of the bays was covered with a thick growth of moss, making dredging impossible. However, a few small patches of clear sandy mud were located, and these were alive with small shells. While the number of species found in these patches was not very large, some few rare shells were obtained and numbers of specimens of four species seldom seen on the main land. The kelp beds were not very productive, only three species being secured from them. The best collecting was found among the loose rocks on the reefs along the bay shores. During our stay a number of abalones were speared for us in from 10 to 15 feet of water. These were taken home and all the moss and other growth carefully scraped off them. After drying this moss it was carefully examined for small shells. From the abalones secured this year the moss yielded over 600 specimens of some 30 species. A number of these were not found under any other conditions.

Our collecting was mainly confined to the more rare species and those not commonly found on the mainland. At the same time we tried to keep a record of everything seen among the more common shells and so have as complete a record as possible of the molluscan fauna of that particular locality. The accompanying list is by no means complete; no dredging was done in over 20 feet of water, and it is known that many other species are to be found in the deeper water off the island. The limited time spent on the work, less than two weeks in all, would make it extremely unlikely that the full list of the shore species was obtained. However it is believed that the list is fairly representative of the fauna. The two bays are separated by sixteen miles of shore line and one is on the exposed side of the island while the other is protected from all but occasional storms. A number of species were found only in one bay or the other. The principal reason for this seemed to be different conditions along the limited extent of shore line worked over, and no attempt was made to keep separate lists for the two bays.

The majority of the species on the list were collected or were collectable in large numbers. A few, particularly among the dredged material, were represented by one or two specimens only and in a few other cases dead shells on the beach or picked up by Mrs. Gregg after storms were all that were seen. No attempt was made to secure quantitative results. Many mollusks live in colonies or travel in schools. The finding of a few strays would seem to indicate the presence of limited numbers only, while collecting at some different season or the examination of some overlooked point nearby would show them present in large numbers. To secure quantitative results of any value requires detailed collecting extended over a long period of time. The most noticable difference between collecting at the Isthmus and at similar places on the mainland was the scarcity of limpets and chitons, both in number of species and in number of individuals, the apparent absence of *Acanthina*, and the wealth of material among the smaller species.

The principal value of lists such as this one lies in the information to be secured for the study of the distribution of the fauna by comparison with similar lists from other localities. In the NAUTILUS, Vol. 31, page 103, Mr. E. P. Chace gives a list of nearly 100 species that were collected at Anaheim Bay, a point on the mainland some 30 miles from the Isthmus. Comparing the two lists shows but 24 species which are on both. In the Anaheim Bay list, shells inhabiting sandy shores and muddy bays predominate while our Catalina list those inhabiting rocky coasts. Packard in his Molluscan Fauna from San Francisco Bay (Univ. of Cal., Pub. in Zoology, Vol. 14, No. 2) lists 194 species and varieties from San Francisco Bay, the Farallone Islands and dredged between the Islands and the mainland. This list contains 34 species which are on the Anaheim Bay list and 24 species that we found at Catalina. Only 10 species are common to all three lists. The comparison would seem to indicate a closer relation of the mainland fauna at Anaheim Bay to the more northern fauna at San Francisco than is the case with the island fauna at Catalina.

Another and probably better method of comparing faunas from different localities is by means of the prevailing direction of the known ranges. The Catalina list may be divided as follows; 20 species, or 12 per cent of a limited local known range; 43 species or 28 per cent, with an approximately equal range to the north and to the south; 26 species, or 17 per cent, whose range to the north by latitude is twice or more than that to the south; 66 species, or 43 per cent, whose range to the south by latitude is twice or more than that to the north. The Anaheim Bay list shows 3 per cent local, 32 per cent of equal range, 23 per cent with a northern range, and 41 per cent with a southern range. The San Francisco list has 13 per cent local or with uncertain range, 19 per cent with equal range, 40 per cent with a northern range, and 28 per cent with a southern range. This comparison shows the Catalina and Anahein Bay lists to be equally southern in their characteristics, while the San Francisco list is distinctly northern.

The list of species and varieties collected, 155 in all, follows:

Solemya (Petrasma) panamensis Dall *a*
Philobrya setosa Cpr. *a*
Ostrea palmula Cpr. *a*
Pecten (Plagioctenium) circularis aequisulcatus Cpr.
Hinnites giganteus Gray
Lima (Mantellum) dehiscens Conr.
Mytilus californianus Conr.
Mytilus adamsianus Dunker.
Mytilus multiformis Cpr. *a*
Modiolus (Gregariella) opifex Say *a*
Septifer bifurcatus Rve.
Crenella decussata Montagu. *a*
Lyonsia gouldi Dall *a*
Cardita subquadrata Cpr.
Milneri kelseyi Dall
Chama pellucida Sby.
Diplodonta orbella Gould
Phacoides (Callucina) californica Conr.
Phacoides (Parvilucina) tenuisculpta Cpr. *a*
Lasaea rubra Mont. *a*
Cardium (Fragum) biangulatum Sby.
Cardium (Laevicardium) substriatum Conr.
Transennella tantilla Gould *a*
Pitaria newcombiana Gabb
Chione succincta Val.
Psephidia lordi Baird *a*
Psephidia salmonea Cpr. *a*
Cooperella subdiaphana Cpr.
Tellina (Angulus) carpenteri Dall *a*
Tellina (Oudardia) buttoni Dall *a*
Semele pacifica, Dall *a*
Cumingia lamellosa Sby.
Psammobia californicus Conr.
Tagelus californianus Conr.
Cryptomya californica Conr.
Acteocina culcitella Gld. *a*
Bullaria gouldiana Pils.
Haminaea virescens Sby.
Pleurobranchus digneti Roch.
Gadina reticulata Sby.
Conus californicus Hinds
Mangilia pulchrior Dall *a*
Mangilia tersa Dall *a*
Cytharella merita Hinds *a*
? Daphnella fuscoligata Dall *a*
Olivella biplicata Sby.
Marginella regularis Cpr. *a*
Marginella (Hyalina) californica Tomlin
Cystiscus politulus Dall *a*
Merovia pyriformis Cpr. *a*
Strigatella (Atrimitra) idæ Melvill
Strigatella (Atrimitra) catalinae Dall
Mitromorphia filosa Cpr.
Fusinus kobelti Dall
Fusinus luteopictus Dall
Macron lividus A. Adams
Alectrion (Schizopyga) perpinguis Hinds
Alectrion (Schizopyga) mendica Gould
Alectrion (Schizopyga) cooperi Forbes
Anachis penicillata Cpr. *a*

Columbella (Alia) carinata Hinds
Columbella (Alia) hypodra Dall *a*
Amphissa versicolor Dall *a*
Murex (Triremis) gemma Sby.
Purpura nuttallii Conr.
Tritonalia circumtexta Stearns
Tritonalia interfossa Cpr.
Tritonalia gracillima Stearns *a*
Tritonalia foveolata Hinds
Epitonium (Opalia) crenimarginata Dall
Epitonium (Nitidoscala) tinctum Cpr.
Ianthina exigua Lamarck
Pyramidella (Longchaeus) adamsi Cpr.
Turbonilla (Chemnitzia) kelseyi Bartsch *b*
Turbonilla (Mormula) pentalopha D. & B. *b*
Odostomia (Chrysallida) helga D. & B. *b*
Odostomia (Chrysallida) pulcia D. & B. *b*
Odostomia (Chrysallida) catalinensis Bartsch *b*
Odostomia (Chrysallida) clementina D. & B. *b*
Odostomia (Chrysallida) cincta Cpr. *b*
Odostomia (Ividella) pedroana D. & B. *b*
Odostomia (Ividella) navisa D. & B. *b*
Odostomia (Miralda) aepynota D. & B. *b*
Odostomia (Evalina) americana D. & B. *b*
Odostomia (Evalea) tenuisculpta Cpr. *b*
Odostomia (Evalea) phanella D. & B. *b*
Odostomia (Evalea) strongi Bartsch *b*
Odostomia (Amaura) subturrita D. & B.
Cypraea spadicea Swains.
Trivia solandri Gray
Erato columbella Mke.
Trifora pedroana Bartsch *b*
Selia montereyensis Bartsch *b*
Cerithiopsis (Cerithiopsidella) antefilosa Bartsch *b*
Cerithiopsis (Cerithiopsis) oxys Bartsch *b*
Bittium (Lirobittium) interfossa Cpr. *b*
Bittium (Lirobittium) attenuatum Cpr. *b*
Bursa californica Hinds
Caecum dalli Bartsch *b*
Caecum californicum Dall *b*
Fartulum orcutti Dall *b*
Aletes squamigerus Cpr.
Petaloconchus montereyensis Dall *a*
Vermiculum anellum Morch *a*
Spiroglyphus lituellus Morch *a*
Littorina planaxis Pil.
Littorina (Melaraphe) scutulata Gould
Lacuna unifasciata Cpr. *a*
Lacuna marmorata Dall *a*
Iselica fenestrata Cpr. *a*

Diala marmorea Cpr. *a*
Barleeia subtenuis Cpr. *a*
Barleeia haliotiphila Cpr. *b*
Barleeia californica Bartsch *b*
Alvania aequisculpta Keep *b*
Alvania cosmia Bartsch *b*
Amphithalamus inclusus Cpr. *b*
Rissoina kelseyi D. & B. *b*
Rissoina dalli Bartsch *b*
Syncera translucens Cpr. *b*
Truncatella stimpsoni Stearns *a*
Capulus californicus Dall *a*
Hipponix antiquatus Linn
Hipponix tumens Cpr.
Crepidula onyx Sby.
Crepidula (Crepipatella) lingulata Gld.
Crepidula (Ianicus) nummerius Gld.
Polinices (Neverita) recluziana alta Dall *a*
Acmaea limatula Morch
Acmaea scabra Gld.
Acmaea paleacea Gld.
Phasianella pulloidea Cpr. *a*
Phasianella (Eulithidum) typicum Dall *a*
Astraea (Pomaulax) undosus Wood
Leptothyra carpenteri Pils.
Leptothyra bacula Cpr.
Liotia fenestrata Cpr. *a*
Liotia acuticostata Cpr. *a*
Norrissia norrisii Sby.
Tegula (Chlorostoma) gallina Fbs.
Tegula (Chlorostoma) gallina umbilicatum Dall *a*
Tegula (Omphalius) aurotinctus Fbs.
Tegula (Omphalius) ligulatus Mke.
Calliostoma splendens Cpr.
Margarites (Lirularia) parcipicta Cpr. *a*
Haliotis cracherodii Leach
Haliotis fulgens Phil.
Haliotis corrugata Gray
Fissurella volcana Rve.
Fissurella volcana crucifera Dall
Megathura crenulata Sby.
Megatebennus bimaculatus Dall
Cyanoplax hartwegii Cpr. *c*
Ischnochiton (Lepidozona) pectinulatus Cpr. *c*
Ischnochiton (Lepidozona) asthenes Berry *c*
Acanthochitona avicula Cpr. *c*

a Specimens identified by Dr. Wm. H. Dall.
b Specimens identified by Dr. Paul Bartsch.
c Specimens identified by Dr. S. Stillman Berry.

F. C. MEUSCHEN IN THE ZOOPHYLACIUM GRONOVIANUM

Explanatory Note

BY WILLIAM HEALEY DALL

The work of Gronovius[1] although published long after the introduction of the Linnean system of nomenclature, had no specific names, merely diagnoses of species under named genera, consisting of a few lines of description. After the death of the author the last fascicule of the work was edited by Meuschen who supplied a list of specific names in the Linnean sense, as stated in the preface by Boddaert, arranged alphabetically and referring to Gronovius' species by their serial numbers. If one wants to find the Meuschenian name for a particular diagnosis one has to go over the entire list until the serial number catches the eye, as the names are alphabetically arranged and the serial numbers not arranged at all.

On account of this inconvenience and of the inaccessibility of the work for the average student it seemed worth while to list the names, many of which are earlier than those of Gmelin (1791–2), so that preoccupied specific names might be eliminated without the labor now required.

It should be noted that there are many misprints in the Meuschen index, some omissions, and several incorrect spellings; the latter are herein indicated by cross references. Most names identical with those proposed by Linnaeus in the 10th and 12th editions of the Systema Naturae are here omitted, and with few exceptions only the new names proposed by Meuschen and taking date of 1781 are catalogued. Much confusion has been caused by assigning an erroneously early date for the part of Gmelin's edition of the *Systema* which contains the mollusks. This cannot date earlier than 1791, and it is not impossible that a large part of it was not published until 1792. One not

[1] Zoophylacii / Gronoviani / fasciculus tertius / exhibens / Vermes / Mollusca, testacea / et Zoophyta. / Laur. Theodorus Gronovius; Lugduni Batavorum; fasc. III, Vermes testacea; folio, 1781, pp. 250–352, pl. XVIII–XIX; Index by Meuschen, 5 pages not numbered.

infrequently finds a name of Gmelin's referred to 1788, which is the date of publication of one of the earlier volumes of the series, but not of the volume containing the Testacea.

Some years ago after a hasty examination of a defective copy of this work, I ventured the opinion that it was not binomial in the Linnean sense and should only be quoted historically. A recent opportunity of consulting a copy of this extremely rare volume containing Meuschen's Index has convinced me that this conclusion was erroneous. The preface states that the index is prepared on the Linnean system. There are in a list of 280 species only seven trinomials, two of which are taken from Linnaeus, and of those under *Voluta* three which have the name *Mitra* intercalated, presumably in a subgeneric sense, as is done by Linnaeus in his tenth edition.[1]

I am therefore somewhat regretfully obliged to consider that the names in the index must be considered valid. Only one generic name, *Amphiperas*, is introduced, but a number of specific names in more or less common use will be affected. In the Museum Geversianum, 1787, Meuschen proposes a system of Molluscan classification which is distinctly his own and not Linnean, partly polynomial and the names put in the plural. The other groups, vertebrates and insects, were binominally treated.

His octavo Index of the Museum Gronovianum, 1778, I have not seen, but it is cited by Sherborn in the Index Animalium as containing new species, though rejected by most authors who have examined it.

Binomial Specific Names Applied by Meuschen to the Nameless Species of Gronovius' Zoophylacium, 1781.

(Alphabetically Arranged.)

Species.	*Genus.*	*Serial No.*	*Page.*
achatina	(Helix)	1558	334
aculeatus	(Cardium)	1121	265
admiralis	(Conus)	1234	284
albida	(Venus)	1148	270
albumen	(Buccinum)	1377	308

[1] Cf. *Voluta Mitra episcopalis*, Syst. Nat. ed. X, p. 732, No. 363.

THE MARINE SHELLS OF SANIBEL, FLORIDA

BY WILLIAM J. CLENCH

Late in the summer of 1921, a trip was undertaken to Sanibel Island, Florida, for the purpose of collecting mollusks. Arriving there the second week in August, collecting was carried on until the middle of September.

This cresent-shaped island is located on the west coast of Florida, about 130 miles north of Key West and two miles from the mouth of the Caloosahatchee River. It is sixteen miles long and five miles wide near the center. The eastern end of the island runs out to a narrow point, at the extremity of which is located the Sanibel light-house. The north-west portion is somewhat broader and is separated from Captiva Island to the north by a shallow strait known as Blind Pass.

Mollusks were found along the entire beach fronting on the Gulf and were especially abundant near the light-house, where the sand bars were much wider and longer. Collections were also made at Clam Bayou, a small shallow bay opening into Blind Pass, and at Tarpon Bay, a large bay on the north side of the island. Tarpon Bay, with the exception of a narrow outlet, is surrounded by a mangrove swamp, and all species listed as from Tarpon Bay include this swamp area, as well.

Many shells formerly common on Sanibel have disappeared, while others have become quite rare. The abundance of shells on the island, especially the larger and more showy species, attracts many tourist-collectors during the winter season, for the purpose of collecting. This might in part explain the paucity of many of these forms that were abundant a few years ago. It is quite probable that the shifting of many sand bars and the destruction of portions of the beach by wave action which has taken place in the last few years has also aided in decreasing the shell fauna. Examples of this are *Oliva sayana* and *Strombus pugilis*, at one time very common but now found but occasionally.

There were many species, however, which were very abundant along the entire beach, such as *Terebra dislocata* and *Donax variabilis.* The former was the most common of all the beach species and at low tide the exposed bars were covered with a network of their irregular tracks, the animals themselves being partially buried in the sand. The *Donax* was found in patches eight to ten feet wide, the location of which could easily be determined from a distance by the groups of shore birds feeding upon them. Dead specimens of *Cardium robustum* were found in abundance along high-water mark, and occasional living specimens on the outer sand bars.

In the vicinity of Tarpon Bay, *Litorina angulifera* was very common on the roots and lower branches of the mangrove. *Melampus bulloides* and *M. coffeus gundlachi* were collected in the thickets bordering the bay, and in the bay proper *Cerithium minimum* with the two varieties *nigrescens* and *septemstriatum* were usually found on exposed sand flats and in all shallow water, especially on submerged palmetto logs. *Busycon perversus* and *Melongena corona* occurred on both the beach and bay sides of the island, the beach forms being lightly marked and heavy, the bay forms usually covered with marine growths and of a lighter weight. Large clusters of the "coon" oyster, *Ostrea virginica*, covered the air roots of the mangrove trees and the wharf pilings. These "tree oysters" as they are sometimes called, presented a striking appearance at low tide when they were exposed to view.

Following is a list of the marine mollusks collected on the Island. I am indebted to Mr. C. W. Johnson and Mr. W. F. Clapp who have kindly aided me in identifying the material.

Tarpon Bay

Ostrea virginica Gmel. On mangrove roots, wharf pilings.
Plicatula gibbosa Dall. Rare.
Pecten gibbus irridians Lam. Not common.
Parastarte triquetra Conr. Valves only. Dredged in sand.
Codakia orbiculata Mont. Rare. Single valves only.
Anomalocardia cuneimeris Conr. Valves only. Sand and mud.
Transennela stimpsoni Dall. One single valve.
Cyrena floridana Conr. Many single valves.
Phacoides floridana Conr. Common. Sand.
Tellina tampaensis Conr. Common.
Macoma constricta Conr. Rare. Sand and mud.
Lyonsia floridana Conr. Rare.
Actaeon punctostriatus C. B. Ad. Common, sand.
Tornatina canaliculata Say. Dead, sand and mud.
Melampus coffeus gundlachi Pfr. Common, grass and thickets about bay.
Melampus bulloides Mont. Rare, found with M. gundlachi.
Mangilia stellata Stearns. Common, sand and mud.
Olivella mutica Say. Common, sand.
Marginella apicina Menke. Rather common, sand.
Fasciolaria tulipa Linn. Rare, sand flats.
Fasciolaria distans Lam. Common, sand flats.
Busycon perversus Linn. Common, sand flats. (Also found on Gulf side).
Busycon pyrum Dill. Rare. Sand flats.
Melongena corona Gmel. Sand flats. (Also on Gulf side).
Alectrion vibex Say. Sand and mud, common.
Muricidea floridana Conr. Dead, sand and mud. Rare.
? *Pyramidula producta* C. B. Ad. Rare. Sand.
? *Pyramidula fusca* C. B. Ad. Rare, sand and mud.
Bittium varium Pfr. Common, sand and mud.
Cerithium muscarum Say. Common, sand flats.
Cerithium minimum Gmel. Common, sand flats.
Cerithium minimum nigrescens Menke. Very abundant, sand flats.
Cerithium minimum septemstriatum Say. Common, sand flats.
Cerithidea scalariformis Say. Not common, mangrove swamp.
Cerithidea turrita Stearns. Common, sand flats.
Modulus flordianus Conr. Common, sand and mud.

Litorina angulifera Lam. Very common, on mangrove trees.
Crepidula glauca Say. Common, on sea-grass.

BEACH

Anomia simplex d,Orb. Dead, common.
Pecten exasperatus Sowb. Dead, very common.
Pinna muricata Linn. Dead, high-water mark.
Pinna seminuda Lam. Dead, not common.
Mytilus exustus Linn. Not common, attached to king crabs.
Modiolus tulipus Lam. Only one specimen found at high-water line.
Arca ponderosa Say. Attached to sea-weed.
Arca floridana Conr. Not common, attached to sea-weed.
Arca occidentalis Phil. Rare, sand bars.
Cardita floridana Conr. Common.
Chama arcinella Linn. Rare, low-water.
Cardium robustum Sol. Common, sand bars at low-water.
Cardium isocardia Linn. Not common, low-water.
Liocardium serratum Linn. Few single valves at low-water.
Chione cancellata Linn. Dead, common along beach.
Macrocallista maculata Linn. Single valves only.
Macrocallista gigantea Linn. Rare, sand bars.
Dosinia elegans Conr. Common, along high-water line.
Donax variabilis Say. Very common, near low-water line.
Tellina lineata Turt. Rare, dead on beach.
Spisula solidissima similis Say. Common on sand bars.
Raeta canaliculata Say. Dead, common along high-water line.
Bullaria occidentalis C. B. Ad. Rare.
Terebra dislocata Say. Very common on sand bars.
Conus proteus Hwass. Rare, Low-water line.
Conus pealii Green. Dead, high-water line.
Conus floridanus Gabb. Dead, high-water line.
Cancellaria reticulata Linn. Not common, low-water line.
Oliva sayana Rve. Rare, sand bars.
Fasciolaria gigantea Kiener. Common, low-water line.
Canthus tinctus Conr. Dead, inhabited by hermit crabs.
Murex rufus Lam. Rare, low-water line.
Murex pomum Gmel. Not common, sand bars.
Epitonium angulatum Say. A single specimen at low-water line.
Pyrula papyratia Say. Dead, along high-water line.
Strombus pugilis Linn, Not common, sand bars.
Vermicularia spirata Phil. A few dead specimens near light-house.
Crepidula fornicata Linn. Common, on other shells, king crabs, etc.

Crepidula plana Say. In aperture of dead *Polinices duplicata* Say.
Natica canrena Lam. Rare, sand bars.
Polinices duplicata Say. Common on sand bars.
Sigaretus perspectivus Say. Not common, sand bars.
Turbo castaneus Gmel. Rare, low-water line.
Fissuridea alternata Say. Dead, low-water line.

Clam Bayou

Venus campechiensis Gmel. Common.
Barnea costata Linn. Not common, buried in sand and mud.

These two species were peculiar to this part of the island as far as I was able to ascertain. All other species that were found here were also found at Tarpon Bay. A single fragment of *Voluta junonia* Hwass. was found on the beach near this locality.

NOTES ON THE ANATOMY AND TAXONOMY OF CERTAIN LAMPSILINAE FROM THE GULF DRAINAGE

BY A. E. ORTMANN, PH. D.

1. Ptychobranchus greeni (Conrad) (1834); Ptychobranchus foremanianum (Lea) (1842); Ptychobranchus trinacrum (Lea) (1861).

Simpson (1914, pp. 336–338) gives these as separate species, but he unites (and rightly so) *woodwardianus* Lea (1857) and *velatus* Conrad (1853) with *foremanianus*, and *simplex* Lea (1845) and *flavescens* Lea (1845) with *greeni*.

The three species admitted by Simpson belong to the Alabama drainage, and the first (*greeni*) is reported from Black Warrior River, the two others from the Coosa River. Simpson points out the possible identity of *trinacrus* with *foremanianus*. He distinguishes *greeni* by being smaller and more delicate, and having a more nearly elliptical outline.

It is impossible for me to see in *trinacrus* anything but an individual variation of *foremanianus*, chiefly, since shells similar to this have never been found subsequently. The characters given for *greeni* can be recognized in most cases, and, in addition, I should say that *greeni*, from the Black Warrior River, has the rays poorly developed, and has no blotches, while *foremanianum*, from the Coosa, has more distinct rays and blotches.

Specimens from Cahaba River approach *greeni* in shape and color markings, yet the latter are often more distinct, showing rays, but without forming blotches.

Thus there are two types of *Ptychobranchus* in the Alabama system, the one belonging to the Black Warrior and Cahaba, the other to the Coosa, but they are not sharply separated. Many Coosa specimens have poorly developed rays and no blotches; the shape is very variable, not always triangular; and, on the other hand, there are specimens in the Cahaba, and also in the Black Warrior, which have more distinct rays, and others which are smewhat triangular. Thus I think it is best to regard these forms as local varieties of the same species, which should bear the name: *Ptychobranchus greeni* (Conrad) (1834). The typical form is found in Black Warrior and Cahaba Rivers, while the variety, *Pt. greeni formanianum* (Lea) (1842) represents this in the Coosa River.[1]

Anatomy. Already Lea has described and figured the marsupium and glochidium of *U. woodwardianus* and *foremanianus.* The marsupium places these forms undoubtedly into the genus *Ptychobranchus* (see: Ortman, Ann. Carnegie Mus. 8, 1912, p. 308). I have material of the soft parts from the following localities.

Coosa River, Wilsonville, Shelby Co., Ala.—1 gravid female (without shell), H. H. Smith coll., Nov. 4, 1911.

Chatooga River, Cedar Bluff, Cherokee Co., Ala.—1 gravid female (without shell), H. H. Smith coll., Nov. 1910.

Black Warrior River, Walker Co., Ala.—6 gravid females (without shells), H. H. Smith coll., Oct. 15, 1912.

The first two localities undoubtedly represent the *foremani-*

[1] Ball (Ecology 3, 1922, p. 112) distinguishes, in the Black Warrior River, a third form: *Ptychobranchus greeni flavescens,* which apparently should be regarded as the compressed headwaters-form of *greeni.*

anum-type, the last typical *greeni*, since many *shells* are at hand from a number of localities in the various drainages, showing the shell-characters as described above. Glochidia were present in all soft parts, except one of *greeni*, and thus the breeding season apparently begins in autumn.

No unusual features are shown in the soft parts. It should be mentioned, however, that the inner lamina of the inner gills is, in one specimen, entirely connected with the abdominal sac, while in the others it is more or less free behind: the maximum is about one half of the length of the abdominal sac. The number of folds of the marsupium varies according to the size of the individual, from 8 to 12. I do not observe any dark pigment on the edge of the marsupium, but the material has been a long time in alcohol. The placentae are the usual shape and quite solid. Glochidium subovate, without hooks, higher than long, L. 0.15, H. 0.18 mm: thus they are somewhat smaller than those of *Pt. fasciolare* (Raf.).

The genus Medionidus in the Alabama drainage.

Medionidus conradicus (Lea) (1934), common in the headwaters of the Cumberland and Tennessee drainages (see: *M. plateolus* (Raf.) Ortman, Proc. Amer. Philos. Soc. 57, 1918, p. 575), has been reported also from the Alabama system, but according to my observations, this is incorrect. The genus is represented, there, indeed, but by different forms, which may be distinguished as follows.

a_1 Color rays not reticulated or spotted, but straight and continuous, the finer ones sometimes wavy. Corrugations of posterior slope rather fine. *M. conradicus*

a_2 Color rays reticulated or interrupted, spotted. Corrugations of posterior slope coarser.

- b_1 Rays poorly developed, forming, over the whole surface, a painting of a reticulated character. No distinct posterior ridge. Posterior end of shell not pointed. Nacre bluish. *M. parvulus*
- b_2 Rays better developed, rather broad, but also composed of reticulations, or interrupted. Posterior ridge distinct. Posterior end of shell pointed. Nacre often of reddish or salmon color. *M. acutissimus*

2. Medionidus parvulus (Lea) (1860).

Simpson, Descr. Cat. 1914, p. 248.

Type-locality: Coosa River, Ala., and "Chattanooga, Ga." (surely Chattooga River, Ga. is meant). Simpson adds: Swamp Creek, northwest Ga. (tributary to Conasauga River, in Whitfield Co., Ga.).

The Carnegie Museum possesses 15 specimens of this species. Exact localities are recorded for the following.

Cahaba River, Lily Shoals, Bibb Co., Ala.—5 spec., R. E. Call coll.

Coosa River, Weduska Shoals, Shelby Co., Ala.—1 spec., H. H. Smith coll.

Coosa River, near Upper Clear Creek, Talladega Co., Ala., H. H. Smith coll.—1 spec.

Coosa River, Riverside, St. Clair Co., Ala.—1 spec., H. H. Smith coll.

Choccolocco Creek, Jackson Shoals, Talladega Co., Ala.—1 spec., H. H. Smith coll.

Conasauga River, Conasauga, Polk Co., Tenn.—2 gravid females (with soft parts), A. E. Ortmann coll., May 24, 1915.

M. parvulus is a *M. conradicus* with the painting of a reticulate character, the rays not or poorly developed, and the corrugations of the posterior slope somewhat coarser. Lea (Obs. 11, 1867) has described the soft parts, and also the glochidium. According to him, the marsupium has 10 ovisacs, is located in the middle of the outer gill, occupying one third of its length. The inner gills are free from the abdominal sac over half of its length, and the posterior half of the mantle-margin is crenulated. The glochidium is "elongate pouch shaped".

According to my two females, the anatomy is practically identical with that of *M. conradicus* (Ann. Car. Mus. 8, 1912, p. 335; Naut. 28, 1915, p. 142; Naut. 34, 1921, p. 90). Inner lamina of inner gills connected with abdominal sac anteriorly for about half of its length. Papillae of mantle margin small, with exception of 1 or 2 anterior ones, which are remarkably long and subcylindrical. Marsupium larger or smaller, depending on size of shell, located near the middle of the gill, number of ovisacs up to 20. Color of soft parts the same as in *M. conradicus* (blackish), of marsupium white, with no pigment on edge. Glochidium: L. 0.19, H. 0.25 mm., thus corresponding to the minimum measurements known in *conradicus.* Shape the same, subspatulate.

3. MEDIONIDUS ACUTISSIMUS (Lea) (1831).
Simpson, 1914, p. 251. A synonym is *U. rubellinus* Lea (1857), which represents an old shell, while *acutissimus* is young.

The *type-locality* for *acutissimus* is the Alabama River, and it has been reported (by Conrad) also from Black Warrior River, Erie, Greene Co., Ala. (I was unable to locate a place of that name). *U. rubellinus* is from Othcalooga Creek, Gordon Co., Ga.

I have 16 specimens with the following exact localities.

Sipsey River, Texas, Marion Co., Ala.—3 spec., H. H. Smith coll.

Cahaba River, Gurnee, Shelby Co., Ala.—1 spec., H. H. Smith.

Coosa River, Weduska Shoals, Shelby Co., Ala.—2 spec., H. H. Smith coll.

Talladega Creek, Talladega Co., Ala.—4 specimens, Hartman collection.

Choccolocco Creek, Jackson Shoals, Talladega Co., Ala.—1 spec., H. H. Smith.

Chattooga Creek, Trion, Chatooga Co., Ga.—2 males, 1 gravid (discharging) female, (all with soft parts), A. E. Ortmann coll., May 19, 1915.

(*To be continued*)

A KEY TO THE FAMILY TEREBRIDAE *

BY PAUL BARTSCH

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In working up the Terebridae of the Mazatlantic faunal area, it was found desirable to subject the entire family to a critical examination, and the large collections in the United States National Museum have furnished some rather interesting information. Believing that the superspecific data obtained will prove of use to students of this family, I have cast these in the form of a key.

Two genera are recognized in the present synopsis : namely, *Terebra*, which is characterized by the possession of a single columellar fold or twist and *Myurella*, in which two folds are present. The rest of the names may be considered as subgenera.

It is interesting to find that all the names heretofore proposed have a status in this new arrangement excepting *Impages* E. A. Smith, which is not considered sufficiently distinct from *Hastula* H. & A. Adams to merit retention.

Columella with one fold . . . . TEREBRA
  Subsutural groove absent.
    Summit of the whorls appressed.
      Axis pervious . . . . Mazatlania
      Axis not pervious.
        Shell nodulose . . . . Spineoterebra
        Shell not nodulose. . . . . Hastula
    Summit of the whorls not appressed.
      Summit of the whorls narrowly shouldered.
        Whorls nodulose . . . . Fusoterebra
        Whorls not nodulose . . . . Acuminea
  Subsutural groove present.
    Spiral sculpture consisting of subsutural groove only.
      Axial ribs present on all whorls.
        Axial ribs strong.
          Subsutural groove cutting both ribs and intercostal spaces . . . . Diplomeriza
          Subsutural groove cutting intercostal spaces only . . . . Punctoterebra
        Axial ribs reduced to mere nodules . . . . . Noditerebra
      Axial ribs not present on all the whorls.
        Axial ribs present on early whorls only.
          Subsutural groove present on all whorls.
            Shell subulate . . . . Subula
            Shell not subulate.
              Shell of Cerithoid form. . . . . . Abretiella
          Subsutural groove not present on all whorls.
            Subsutural groove present on early whorl only . . . . Oxymeris

Spiral sculpture not consisting of subsutural groove only.
Spiral sculpture consisting of subsutural groove and other grooves.
Spiral sculpture present on all whorls.
Axial ribs present on all whorls . . . . . Strioterebra
Axial ribs not present on all whorls.
Axial ribs present on early whorls only.
Subsutural cord nodulose on all whorls. . . . . Triplostephoma
Subsutural cord nodulose on early whorls only.
Spiral lines punctate . . . . . Terebrina
Spiral lines not punctate. . . . Perirhoe
Spiral sculpture absent on the later whorls . . . . Terebra
Columella with two folds . . . . MYURELLA
Spiral sculpture consisting of subsutural groove only.
Axial ribs strongly developed on all whorls . . . . . . Myurellisca
Axial ribs not strongly developed on all whorls.
Axial ribs evanescent on the later turns . . . . . . Myurellina
Spiral sculpture consisting of subsutural groove and spiral striations . . . . Myurella

Considerable time was required running down references to names and verifying type designations. To save future students of this task a chronologically arranged list of names supplying this information is here appended.

1799 *Terebra* (Bruguiere) Lamarck, Prodome, p.171. Type *Terebra subulata* Linne.

1817 *Subula* Schumacher, Ess. Nouv. Syst., p. 233. Type *Terebra dimidiata* Linne.

1844 *Myurella* Hinds, Sowerby's Thes. Conch., pp. 170, 171. Type *Terebra myuros* Lamarck.

1853 *Hastula* H. & A. Adams, Gen. Rec. Moll., vol. 1, p. 225. Type *Terebra strigillata* Lamarck + *Impages* E. A. Smith, 1873, Ann. Mag. Nat. Hist., ser. 4, vol. 11, p. 263. Type *Terebra coerulescens* Lamarck.

1891 *Strioterebrum* Sacco, Moll. Piemonte Liguria, p. 33. Type *Terebra basteroti* Nyst.

1891 *Spineoterebra* Sacco, Moll. Piemonte Liguria, p. 58. Type *Terebra spinulosa* Doderlein.

1891 *Fusoterebra* Sacco, Moll. Piemonte Liguria, p. 59. Type *Fusus terebrina* Bonelli.

1896 *Noditerebra* Cossmann, Ess. Pal. Comp., pp. 47, 51, pl. 4, f. 21. Type *Terebra geniculata* Tate.

1900 *Mazatlania* Dall, Nautilus, vol. 14, p. 44 = *Euryta* H. & A. Adams, 1853, Gen. Rec. Moll., p. 225, not *Euryta* Gistel, 1848, Naturg. Thier., p. 8. Type *Terebra aciculata* Lamarck.

1903 *Oxomeris* Dall, Proc. U. S. Nat. Mus., vol. 26, p. 951 = *Acus* Gray, 1847, Proc. Zool. Soc. London, p. 139, not *Acus* Edwards, 1771, in M. Catescy Carol. II, p. 30. Type *Terebra maculata* Lamarck.

1908 *Perirhoe* Dall, Nautilus, vol. 21, pp. 124, 125. Type *Terebra circumcincta* Deshayes.

1908 *Triplostephanus* Dall, Nautilus, vol. 21, pp. 124, 125. Type *Terebra triseriata* Gray.

1908 *Acuminea* Dall, Nautilus, vol. 21, pp. 124, 125. Type *Terebra lanceata* Linne.

1919 *Diplomeriza* Dall, Nautilus, vol. 33, p. 32 = *Duplicaria* Dall, 1908, Nautilus, vol. 21, pp. 124, 125, not *Duplicaria* Rafinesque, 1833, Atlantic Journ., p. 165. Type *Terebra duplicata* Lamarck as now restricted.

Names here proposed:

Abretiella Dall, new name = *Abretia* H. & A. Adams, 1853, Gen. Rec. Moll., vol. 1, p. 235, not *Abretia* Rafinesque, 1814, Spec. Sci. Giorn. Encic. Scicili, p. 154. This name has been applied to this subgenus in Dr. Dall's manuscript on the Mollusks of Hawaii and should be credited to him.

Terebrina new subgenus. Type *Terebra* (*Terebrina*) *cingulifera* Lamarck.

Punctoterebra new subgenus. Type *Terebra* (*Punctoterebra*) *nitida* Hinds.

Myurellisca new subgenus. Type *Terebra* (*Myurellisca*) *duplicatoides* Bartsch, described below.

Myurellina new subgenus. Type *Myurella* (*Myurellina*) *ornata* Gray.

MYURELLA (MYURELLISCA) DUPLICATOIDES new species.

= *Terebra duplicata* of authors in part.

Shell moderately large, chestnut brown, with a light peripheral zone and a light acute basal fasciole. Nuclear whorls decollated in all our specimens. Postnuclear whorls flattened, narrowly shouldered at the summit, marked by rather strong, very regular axial ribs, of which twelve occur upon the third, fourteen upon the fourth to sixth, sixteen upon the seventh to ninth, eighteen upon the tenth to twelfth, twenty upon the thirteenth, twenty-two upon the fourteenth, twenty-four upon the fifteenth to seventeenth, twenty-six upon the eighteenth and twenty-eight upon the last whorl. The whorls are cut by a deep sulcus about one-third of the distance between the summit and suture, anterior to the summit which not only divides the ribs at this point, but also cuts into the substance of the shell in the intercostal spaces, and forms a false suture. Periphery of the last whorl rounded. Base short, rounded, marked by the continuations of the axial ribs, which extend to the strong, acute and slightly reflected basal fasciole. The portion anterior to the basal fasciole is marked by strong lines of growth. Aperture elongate ovate, decidedly channeled anteriorily; posterior angle acute; outer lip thin; inner lip forming a slight callus, which is appressed to the columella and extends on the parietal wall. In a sectioned specimen the columella is found to have a strong anterior fold and a little less strong posterior fold.

The type, Cat. No. 348285, U. S. N. M., comes from Ceylon. It has lost the nucleus and probably the first postnuclear whorls. The eighteen whorls remaining measure: length, 55.3 mm.; diameter, 10.8 mm.

This is the dark-colored *Terebra duplicata* of authors subsequent to Linne. The parallelism in external sculpture of this and *Terebra duplicata* Linne has caused it to be misidentified in the past. On sectioning it is found that all the dark-colored forms have the biplicate columella, while *duplicata* has only a single fold.

LAND SHELLS FROM FLORIDA

BY E. G. VANATTA

The following species of land shells were picked from leafmould collected in seven counties in Florida.

I wish to thank the four gentlemen, whose names are mentioned in connection with the stations listed below, for presenting the material to the Academy of Natural Sciences of Philadelphia.

One specimen of *Pupoides modicus* (Gld.), which with 6 whorls has the great length of 5.3 mm., was found on La Costa Island. Although Mr. Moore sent several lots from this island, collected at various times, only this one large specimen was found, the remainder being of the usual size.

The list from "The Devils Mill Hopper," a sink hole about 8 miles from Gainesville, is based upon material collected upon several visits to the spot made by Messrs. Clark and Van Hyning. The *Gastrocopta pentodon* (Say) found there have the extra parietal lamella as figured in the NAUTILUS, Vol. XIX, pl. 7, fig. 32, and the *Gastrocopta contracta peninsularis* Pils. have the inward continuation of the parietal lamella "detached" as mentioned in the Manual of Conchology, Vol. 24, page 24. This and *Carychium exiguum* (Say) were very numerous in the leafmould.

The *Cerion incanum* (Binn.) from Sugar-loaf Key, collected by Mr. Clark, are all small like typical *C. incanum*, however they have the shape of var. *saccharimeta* Bl.

St. Augustine, Ancient Cemetery, St. Johns Co., collected by Mr. James B. Clark.

Gastrocopta rupicola (Say).
Gastrocopta pellucida hordeacella (Pils.).
Pupoides modicus (Gld).
Pupisoma minus (Pils.).
Zonitoides minuscula (Binn.).

The Devils Mill Hopper, eight miles from Gainesville, Alachua County, collected by Mr. James B. Clark and Mr. T. Van Hyning.

Gastrocopta pentodon (Say).
Gastrocopta contracta peninsularis Pils.
Gastrocopta corticaria (Say).
Vertigo ovata Say.
Vertigo oscariana St.
Vertigo milium Gld.
Pupisoma dioscoricola (Ad.)
Pupisoma minus Pils.
Strobilops strebeli aenea Pils.
Strobilops floridana Pils.
Strobilops hubbardi Br.
Polita indentata (Say).
Polita dalliana ('Simps' Pils.).
Striatura milium (Mrse).
Guppya sterkii (Dall).
Euconulus chersinus (Say).
Zonitoides arborea (Say).
Zonitoides minuscula Binn.
Agriolimax campestris (Bn.). Shell only.
Helicodiscus parallelus (Say).
Succinea avara Say.
Carychium exiguum Say.

Little Gasparilla Island, De Soto Co., collected by Mr. Clarence B. Moore.

Truncatella caibæensis succinea Ad.
Truncatella bilabiata Pfr.
Succinea floridana Pils.

Clearwater Key, Pinellas Co., collected by Mr. J. B. Clark.

Truncatella caribæensis 'Sby.' Rve.
Truncatella c. succinea Ad.
Truncatella bilabiata Pfr.
Polygyra cereolus (Muhl.).
Polygyra cereolus carpenteriana (Bld.).

Near Clearwater, Pinellas Co., collected by Mr. J. B. Clark.

Oligyra orbiculata Say.
Praticolella jejuna (Say).
Polygyra pustula (Fér.).
Polita indentata (Say).
Zonitoides arborea (Say).
Zonitoides minuscula (Bn.).
Succinea campestris Say.

Pinellas Park, Pinellas Co., collected by Mr. J. B. Clark.

Polygyra c. carpenteriana (Bld.).
Polygyra uvulifera (Shutt.).
Zonitoides arborea (Say).

Safety Harbor, N. W. part of Old Tampa Bay, Pinellas Co., collected by Mr. J. B. Clark.

Oligyra orbiculata Say.
Polygyra c. carpenteriana (Bld.).
Polygyra pustula (Fér.).
Zonitoides arborea (Say).

Near St. Petersburg, Pinellas Co., collected by Mr. J. B. Clark.

Oligyra orbiculata Say.
Truncatella caribæensis 'Sby.' Rve.
Truncatella c. succinea Ad.
Truncatella bilabiata Pfr.
Polygyra c. carpenteriana (Bld.).
Polygyra pustula (Fér.).
Gastrocopta pentodon (Say).
Gastrocopta c. peninsularis Pils.
Gastrocopta p. hordeacella (Pils.).
Gastrocopta rupicola (Say).
Strobilops floridana Pils.

Euglandina rosea (Fér.).
Polita indentata (Say).
Polita dalliana ('Simps.' Pils.)
Guppya gundlachi (Pfr.).
Guppya sterkii (Dall).
Zonitoides arborea (Say).
Zonitoides minuscula (Binn.).
Zonitoides singleyana (Pils.).

Ballast Point, Hilsborough Co., collected by Mr. J. B. Clark.

Oligyra orbiculata Say.
Praticolella jejuna (Say).
Polygyra c. carpenteriana (Bld.).
Polygyra uvulifera (Shutt.).
Gastrocopta c. peninsularis Pils.
Gastrocopta rupicola (Say).
Strobilops s. aenea Pils.
Euglandina rosea (Fér.).

Indian Hill, Hillsborough Co., collected by Mr. Clarence B. Moore.

Oligyra orbiculata Say.
Gastrocopta c. peninsularis Pils.
Gastrocopta p. hordeacella (Pils.).
Gastrocopta rupicola (Say).
Guppya gundlachi (Pfr.).
Zonitoides minuscula (Binn.).

North end of Captiva Island, Lee Co., collected by Mr. C. B. Moore.

Truncatella c. succinea Ad.
Truncatella bilabiata Pfr.
Thysanophora plagioptycha (Shutt.).
Pupoides modicus (Gld.).
Gastrocopta rupicola (Say).
Gastrocopta p. hordeacella (Pils.).
Pupisoma dioscoricola (Ad.).
Polita dalliana ('Simps.' Pils.)
Zonitoides minuscula (Binn.).
Zonitoides singleyana (Pils.).

Dog Key, Lee Co., collected by Mr. C. B. Moore.

Polygyra c. carpenteriana (Bld.).
Gastrocopta rupicola (Say).
Gastrocopta p. hordeacella (Pils.).
Guppya gundlachi (Pfr.).
Zonitoides minuscula (Binn.).
Zonitoides singleyana (Pils.).

Estero Island, Lee Co., collected by Mr. Clarence B. Moore.

Polygyra c. carpenteriana (Bld.).
Pupoides modicus (Gld.).
Gastrocopta rupicola (Say).
Guppya gundlachi (Pfr.).
Zonitoides minuscula (Binn.).
Zonitoides singleyana (Pils.).

Goodland Point, Lee Co., collected by Mr. Clarence B. Moore.

Pupoides modicus (Gld.).
Gastrocopta rupicola (Say).
Gastrocopta p. hordeacella (Pils.).

Gopher Key near Big Hickory Pass, Lee Co., collected by Mr. C. B. Moore.

Truncatella caribæensis 'Sby.' Rve.
Polygyra c. carpenteriana (Bld.).
Gastrocopta rupicola (Say).
Gastrocopta p. hordeacella (Pils.).

Horr's Island, Lee Co., collected by Mr. C. B. Moore.

Oligyra orbiculata Say.
Praticolella jejuna (Say).
Drymaeus multilineatus (Say).
Zonitoides minuscula (Binn.).

South end of La Costa Island, Lee Co., collected by Mr. C. B. Moore.

Truncatella c. succinea Ad.
Truncatella bilabiata Pfr.
Polygyra c. carpenteriana (Bld.)
Pupoides modicus (Gld.).
Gastrocopta rupicola (Say).
Gastrocopta p. hordeacella (Pils.).
Strobilops hubbardi (Brown).
Polita dalliana ('Simps.' (Pils.).
Guppya gundlachi (Pfr.).
Zonitoides minuscula alachuana (Dall.).

La Parita, Black Island, Lee Co., collected by Mr. C. B. Moore.

Truncatella caribæensis 'Sby.' Rve.
Truncatella bilabiata Pfr.
Polygyra c. carpenteriana (Bld.).
Pupoides modicus (Gld.).
Gastrocopta rupicola (Say).
Gastrocopta p. hordeacella (Pils.).
Vertigo milium Gld.
Guppya gundlachi (Pfr.)

Mondonga Island, Lee Co., collected by Mr. Clarence B. Moore.

Truncatella caribæensis 'Sby.' Rve.
Truncatella bilabiata Pfr.
Thysanophora plagioptycha (Shutt.).
Polygyra c. carpenteriana (Bld.).
Polygyra pustula (Fér.).
Pupoides modicus (Gld.).
Gastrocopta c. peninsularis Pils.
Gastrocopta pentodon (Say).
Gastrocopta rupicola (Say).
Gastrocopta p. hordeacella (Pils.).
Polita dalliana ('Simps.' Pils.).
Zonitoides minuscula (Binn.).

Starvation Key, Lee Co., collected by Mr. C. B. Moore.

Truncatella caribæensis 'Sby.' Rve.
Truncatella c. succinea Ad.
Truncatella bilabiata Pfr.

Polygyra septemvolva volvoxis (Pfr.).
Gastrocopta rupicola (Say).
Gastrocopta p. hordeacella (Pils.).
Zonitoides singleyana (Pils.).

House Hammock, Monroe Co., collected by Mr. C. B. Moore.

Oligyra orbiculata Say.
Polygyra c. carpenteriana (Bld.).
Thysanophora selenina (Gld.).
Thysanophora plagioptycha (Shutt.).
Gastrocopta rupicola Say.
Guppya gundlachi (Pfr.).
Zonitoides arborea (Say).
Zonitoides m. alachuana (Dall).

Key West, Monroe Co., collected by Mr. J. B. Clark.

Drymaeus multilineatus (Say).

Little Hammock, Monroe Co., collected by Mr. C. B. Moore

Oligyra orbiculata Say.
Thysanophora plagioptycha (Shutt.).
Gastrocopta c. peninsularis Pils.
Gastrocopta rupicola (Say).
Pupisoma dioscoricola (Ad.).
Euconulus chersinus (Say).
Guppya gundlachi (Pfr.).
Zonitoides arborea (Say).
Zonitoides minuscula (Binn.).

West end of Long Island, near Snake Creek, Monroe Co., collected by Mr. Morgan Hebard.

Chandropoma dentatum (Say).
Oligyra orbiculata Say.
Lucidella tantila (Pils.).
Truncatella bilabiata Pfr.
Thysanophora selenina (Gld.)
Thysanophora inaguensis (Weinl.).
Thysanophora plagioptycha (Shutt.).
Pupisoma dioscoricola (Ad.).
Varicella gracillima floridana Pils.
Polita dalliana ('Simps.' Pils.).
Guppya gundlachi (Pfr.).

Sugar-loaf Key, Monroe Co., collected by Mr. J. B. Clark.

Cerion incanum (Binn.) near var. *saccharimeta* (Bl.).
Succinea floridana Pils.

NOTES

Lima hughi new name. My attention has been called to the fact that *Lima (Callolima) smithi* Bartsch, Proc. U. S. Nat. Mus., Vol. 45, 1913, pp. 236, 306, pls. 12, 13, which I there described from the Philippine Islands and named for Dr. Hugh M. Smith, is preoccupied by *Lima smithi* Sowerby, Proc. Zool. Soc. London, p. 207, pl. 11, f. 12, a Japanese species.

I take pleasure in bestowing Dr. Smith's first name, Hugh, upon the same shell with the same type. It may therefore be known as *Lima (Callolima) hughi.*—Paul Bartsch.

It is announced that a Civil list pension of £100 has been granted to Lieut.-Col. Henry Haversham Godwin-Austen "in recognition of his services to science and to the nation."

Col. Godwin-Austen, who resides at Nore, Godalming, on July 6th last completed his eighty-ninth year, and is now in his 90th. He comes of an old and well-known Surrey family, members of which were benefactors of the Guildford Royal Grammar School.

Col. Godwin-Austen himself has had an interesting career, some particulars of which have at different times appeared in the "Surrey Advertiser." It is seventy-two years since he was gazetted to the 24th Regiment of Foot, and he went to India in 1852, taking five months on the journey in a little barque of 590 tons.

The Colonel spent twenty-five years in India, and during the larger part of that time he was engaged in survey work, for which he was later awarded the Royal Geographical Society's founders medal. He did much mountaineering, and in one of his ascents, that of Rupshu, he reached a height of 20,600 feet. This peak in the Himalayas was afterwards named after him.

Col. Godwin-Austen devoted many years to an important work on "The Land and Freshwater Mollusca of India," and a few years ago the Asiatic Society of Bengal awarded him the Barclay memorial medal for his work on biology.

Court Rules Mussel is not a Wild Animal. The fresh-water mussel of the Mississippi valley, from whose shell is manufactured pearl buttons, is the property of the owner of the land through which flow the non-navigable streams of its habitat, the Supreme Court held.

The controversy attracted wide attention because of its importance in the button industry, and brought into court such questions as whether the mussel was a "wild" animal. Justice Holmes, in deciding the case, said mussels should not be classed with wild birds and fish which move beyond the jurisdiction of the owner of the land.

The lower court held that fishermen taking mussels from non-navigable streams could be prosecuted as trespassers, and the owner of the land through which the stream flowed could recover damages from whose who purchased shells from trespassers. This judgment was affirmed by the Supreme Court in principle.—*Boston Herald.*

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THE JOURNAL OF CONCHOLOGY, Vol. 17, No. 1, Jan. 1923. The Edible Molluscs of British Isles, By E. W. Swanton. pp. 9-18. Mollusca from the Belgian Congo. (11) By G. C. Spence. pp. 19–24, and pp. 201–233.

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Cochlicopa lubrica monst. sinistrorsum Westl. By J. W. Taylor. p. 33.

Patella depressa Pennant. By J. R. le B. Tomlin. p. 34.

Variation of Ena obscura. By W. E. Alkins. pp. 35–38.

Vitrina marcida Gould. By T. D. A. Cockerell. p. 39.

On South African Marine Mollusca with description of several new species. By J. R. le B. Tomlin. pp. 40–52.

Observations on the Land Mollusca of the coasts bordering on Bristol Channel. By J. Davy Dean. pp. 57–60.

An attempt to pair a dextral with a sinistral Limnaea pereger. By Lionel E. Adams. pp. 61–62.

Notes on British Mollusca. By Alan Gardiner. p. 63.

PROCEEDINGS OF THE MALACOLOGICAL SOCIETY OF LONDON. Vol. 25, March, 1923. On the Anatomical Characteristics of British Pisidia. By Nils Hj. Odhner. pp. 155-161, pl. 3.

Descriptions of twenty-one species of Turridæ from various localities, in the collection of Mr. E. R. Sykes. By James Cosmo Melvill. pp. 162-171, pls. 4 and 5.

On the date of publication of Charpentier's "Catalogue des Mollusques Terrestres et Fluviatiles de la Suisse.'' By Prof. Dr. Jules Favre. p. 172.

Note on the capture of Spirula alive. Prepared by B. B. Woodward. p. 173.

Molluscan Life on the South Dogger Bank. By Guy C. Robson. pp. 174-178.

Notes on New Zealand Pelecypods. By W. R. B. Oliver. pp. 179-188.

An Index to ''A Classification of the American Operculate Land Mollusks of the Family Annulariidæ.'' Compiled by Hugh C. Fulton. pp. 189-194.

List of British Nudibranchiate Mollusca. By Tom Iredale and Chas. H. O'Donoghue. pp. 195-200.

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The Holocene non-Marine Mollusca of England. By A. S. Kennard. pp. 241–259.

Notes on the genus Stenochiton and the discovery and recognition of the type of Blainville's Chiton longicymba in Stenochiton juloides Adams and Angas. By Edwin Ashby. pp. 260–264.

JOURNAL DE CONCHYLIOLOGIE. Vol. 67, No. 3, Mar., 1923. Mitrides de la Nouvelle-Calédonie et de ses dépendances. Par Ph. Dantzenberg et L.-J. Bouge. pp. 179–259, pl. II.

Description d'un Eulimidé nouveau provenant de Lifon. Par Ph. Dantzenberg. p. 260.

De la durée de la vie chez l' *Helix spiriplana* Oliv. Par L. Vignal. p. 262.

THE GLORY OF THE SEA. By Roy Waldo Miner. Natural History, Vol. 22, pp. 325–328, 1923. A most interesting account of this rare shell—*Conus gloria-maris*, a specimen of which was recently obtained by the American Museum of Natural History, from Mr. Walter F. Webb. This specimen was formerly in the noted collection of the late Mrs. S. T. Williams of Chicago. There are only twelve or fourteen specimens of this species known, of which three, according to the writer, are in the United States.—C. W. J.

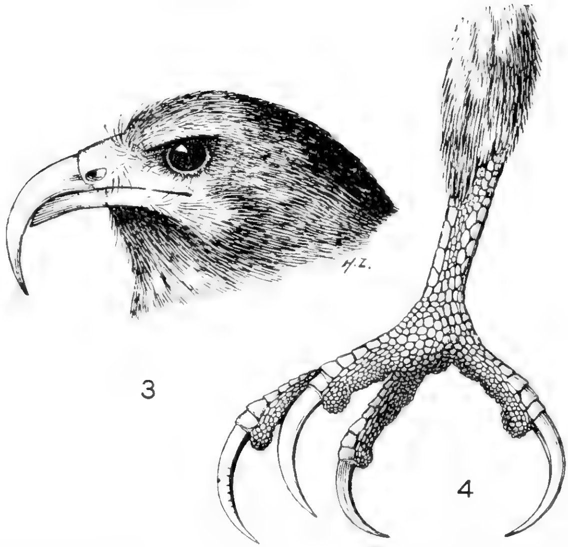


Fig. 3, *Rostrhamus sociabilis*. Head showing curved bill on which *Ampullarius* is spiked.
Fig. 4, Right foot. Both two-thirds natural size.

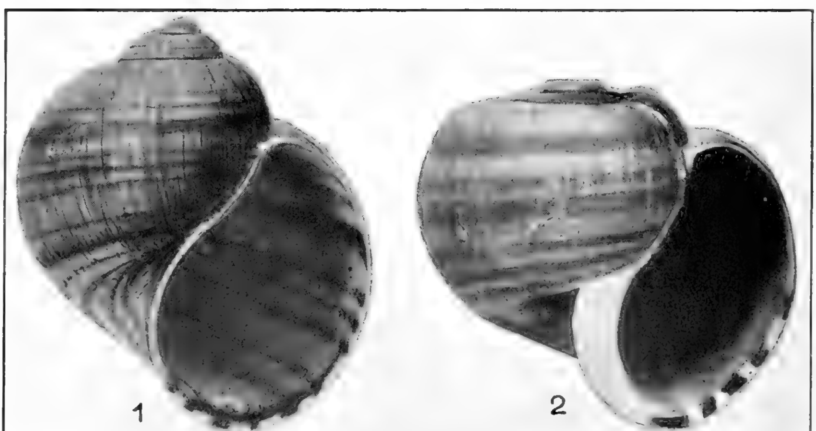


Fig. 1, *Ampullarius dolioides* (Reeve)
Fig. 2, *Ampullarius gevesensis* (Deshayes)

LANG: AMPULLARIUS AND ROSTRHAMUS

THE NAUTILUS.

Vol. XXXVII JANUARY, 1924. No. 3

AMPULLARIUS AND ROSTRHAMUS AT GEORGETOWN, BRITISH GUIANA

BY HERBERT LANG

When in Georgetown, British Guiana, I visited the densely crowded heron rookery in the Botanical Garden. It occupies an island in one of the many canals and is covered with a jungle about fifty feet high. Associated with the herons, chiefly of two species,—the little Blue Heron (*Florida cærulea*) and the Black-crowned Night Heron (*Nycticorax nævius*),—is a colony of about twenty Snail-hawks (*Rostrhamus sociabilis*), also known as Hook-bill Hawks or Everglade Kites. Herons and hawks are completely indifferent to each other. The hawks prefer the lofty outer branches, towering palms and larger trees nearby as perching sites while they feed on mollusks, a most interesting performance, as I had occasion to observe.

The Snail-hawk is rather graceful and slender, of dusky brown appearance, with fairly long wings and slightly emarginate tail. The peculiar, slender bill stands out conspicuously beyond the feathered portion of the relatively small head. The highly specialized upper bill forms a strongly arched, nearly semicircular hook, the cutting edges, generally sharp in birds of prey, being dull near the base and completely effaced toward the tip; a ridge running far forward on the palatal side of the bill adds considerably to its strength at the weakest point of the curve. Upon the long, downward bent, slightly blunt tip a snail's body is easily impaled. No active part in the peculiar feeding process is taken by the rather weak mandible, though the gape is commensurately wide to accommodate easily such cumbersome, slimy food. The bare portion at the base of the bill includes the large cere, the anterior parts about the eye, and a strip along the mandible. These naked spaces about the bill undoubtedly save the feathers from being smeared with the slime that mollusks emit so profusely during their struggles. The bare condition of the lower portion of the feet and the lengthened, excessively acute claws are well adapted to catching hold of snails among the water-plants and firmly clutching the slippery, smooth shell. To believe that the Snail-hawk has to dig or pull these mollusks from the mud, as is generally stated, is probably incorrect. At least at Georgetown this is not the case.

As might be expected *Rostrhamus* is thoroughly acquainted with the habits of the snail which forms its favorite food. It has little difficulty in securing such prey and none whatever in removing the mollusk from its fragile shell, which is left absolutely intact. At Georgetown two species of *Ampullarius* are extremely common though only one serves as the principal, if not exclusive, food supply of the Snail-hawk.

There is not the slightest possibility of *Rostrhamus* inserting its bill between the operculum and the shell proper, nor is it probable that the hawk can pierce the brownish, horny operculum, which though thin and flexible is nevertheless extremely tough. All who have handled live *Ampullarius* know that at the slightest disturbance they withdraw quickly into their shell, securely closing the aperture with the operculum. Any further molestation, such as an attempt to pull out the operculum, causes them to emit a slimy fluid, from between the supple edges of the operculum and the nacreous inner wall of the shell. With the forcing out of this surplus slime, space is gained inside the shell allowing further contraction of the animal. Gradually the mollusk pulls the operculum so far inside as to be completely out of reach of even the hooked beak of the hawk. When the snail is thus fully withdrawn the pliable edges of the operculum turn slightly up and out on the narrower tube establishing a closing edge several millimeters wide. Of course the elimination of slimy matter and forceful pulling inside of the operculum are also protective adaptations against other enemies than the Snail-hawk and moreover probably help meet such climatic conditions as continued drought.

Generally after being taken from its watery medium *Ampullarius* attempts to explore the surroundings, coming out of the shell and on dry ground crawling for about thirty feet. But from time to time the animal withdraws and having emitted all apparently available slime eventually shuts up tightly. Some of these snails I brought from British Guiana to New York in an ordinary cardboard box. By accident on board ship they were exposed for several days to the heat of a radiator and later in New York to the northern cold of March. Over thirty days they were thus out of water, yet a number of them survived. In their own habitat *Ampullarius* probably could withstand a drought of several months, a sufficient period in the tropics to tide them over into the rainy season should the swamps they inhabit dry out. When placed in an aquarium they excrete so excessive an amount of slime that the water becomes opaque and needs to be changed often.

A. dolioides Reeve * is brownish green, with globose spire and relatively small umbilicus. For breathing purposes it comes near or slightly above the surface and is then easily taken by *Rostrhamus*. *A. gevesensis* Deshayes * has numerous light brown, sometimes conspicuous bands and a more flattened spire. The umbilicus is relatively large, whereas the aperture in adults is smaller and more roundish than in the foregoing species. It lives in the mud, apparently without coming to the surface for air, which may be obtained through an extensible siphon. In any case it is not caught by the Snail-hawk, though extremely numerous in the canals right below the habitual perching trees of these birds. In fact in going over at least 2000 empty shells dropped by *Rostrhamus* we secured only two of *A. gevesensis*. And these might have been accidentally pro-

* The scientific names of the shells were kindly determined by Dr. H. A. Pilsbry, of the Philadelphia Academy of Natural Sciences.

cured by the hawks, for as portions of the many canals are cleared, shells of course are often brought to the surface. Far from making use of the abundance of *A. gevesensis* at the rookery, the hawks fly off a considerable distance to other swamps which according to the natives contain slightly brackish water where *A. dolioides* occurs.

Remarkable it seems that the hawks adjust their feeding time to late afternoon when the snails are wont to move about more frequently than during the hours of the sun's greatest glare. These birds, I was told, slowly fly over the swamps, often just high enough to be out of reach of the vegetation and slow up but little when swooping down for the shell, which is caught in the claws of one foot. Though Quelch, as cited by Chubb,[1] did not realize that he observed how the shells were actually taken, he gives an exact account of the procedure: "While settling down to roost by the creek-side, this species [*Rostrhamus sociabilis*] will be noticed darting down and skimming for short distances almost on the surface of the water, as though catching insects. . . ." At the season I visited the rookery, the *Rhostrahamus* had no young, but usually flew back home with their prey just the same. It is absolutely necessary for them to have an opportunity to perch to remove the mollusk from the shell. Time and patience are then given full play, and as many as ten may be seen in the branches at once awaiting the opportune moment. Every new arrival is greeted with the oft-repeated harsh call "Kor-ee-ee-a-Koree-a."

The hawks then perch on one foot and with the other quietly hold the snail in such a manner that it can emerge from the shell. The birds make no attempt whatever to extract it by force, but watch for the voluntary extension of the animal beyond the aperture of the shell. With that propitious moment comes the next step in the drama. Quick as a flash the hawk's bill pierces the snail apparently back of the operculum. It happens so rapidly that one is not able to clearly follow the operation. As a further step the snail, now spiked upon the beak, is instantly pushed up to the middle of the upper bill

[1] The Birds of British Guiana. Vol. I, p. 2[illegible]6, London, 1916.

from which it stands off like a bump as big as a large walnut. Then begins a second wait. Gradually the mollusk's muscles relax. A few minutes later the Snail-hawk vigorously shakes its head and before even the light, empty shell has reached the grassy ground *Rostrhamus* has swallowed its victim, operculum and all. It would be necessary to shoot a few of these birds just after the snail is spiked or swallowed to ascertain at what point it is actually pierced. It is certainly always done in the same fashion, for the fragile shell is never injured, not even the tender edges of the aperture. As the mollusk of course exerts its full power of muscular contraction the bill, evidently inserted behind the operculum, is caught between the operculum and the wall of the whorl about opposite the middle of the edge of the aperture.

Empty *Ampullarius* shells lying in the grass on the damp soil disintegrate rapidly. A considerable amount of moisture and even decayed vegetable detritus accumulates in some which happen to fall with the aperture turned up. These become the favorite home of a small gray slug (*Omalonyx*). Its thin, transparent, scale-like shell has so slight an attachment to the overlapping fold on the dorsal side that it is cast off when the slug is placed in strong alcohol. The empty *Ampullarius* shells evidently present ideal living conditions and also a certain amount of protection for this slug, as I did not find it anywhere else.

THE POST-GLACIAL DISPERSAL OF MOLLUSCA IN THE SOUTHERN ROCKY MOUNTAINS

BY JUNIUS HENDERSON

The presence of mollusks of various species in nearly all of the ponds and lakes of the southern Rockies, up to and above timber line, and of land snails in the aspen groves and other favorable stations in the glaciated areas, raises interesting questions as to the method of dispersal of mollusks, especially of the fresh-water species. During the glacial epoch glaciers formed all along the crests of the higher mountain ranges of Colorado and extended down the various gulches from five to sixty miles. Their retreat has been very recent, geologically speaking—so recent, in fact, that there are within the state considerably more than a dozen of them still active, several of which are close to lakes from which we obtained some of the mollusks herein discussed. There is every reason to believe that the divides separating the glaciated gulches were covered with snow the year round. In their retreat these glaciers left hundreds of lakes and ponds, chiefly morainal, many of them completely isolated by rock or morainal barriers, so that no aquatic animals can gain access to them by following streams. In 1920, assisted by Dr. Francis Ramaley and Mr. Harl S Kittle, I examined about sixty lakes, ponds, sloughs, etc., in the glaciated area at the heads of North Boulder, South Boulder and Middle Boulder drainage, in the Silver Lake, Tolland and Eldora districts, Colorado, mostly fram 9,000 to 11,000 feet above sea level. Baker (Bull. Amer. Mus. Nat. Hist., XLI, pp. 527–539, 1919) published an account of a small collection of mollusks obtained in the Tolland district by Professor Frank Smith, and Cockerell (NAUTILUS, XXV, pp. 58–59, 1911) published a list of land snails from the same district. In our work in 1920 we found *Pisidium* at almost every station, even above 11,000 feet. Dr. Sterki's recent account (NAUTILUS, XXXVII, pp. 16–22, 1923), of this material makes it unnecessary to record the species here. Neither *Sphaerium* nor Naiades have been found here or anywhere else at high altitudes in the mountains of Colorado. In addition to the *Pisidia* we found the following fresh-water mollusks:

Musculium rykholti (Normand). Three ponds near Eldora, middle Teller Lake near Tolland, and lagoon near Los Lagos.

Musculium raymondi (J. G. Cooper). Lake south of Silver Lake.

Lymnaea palustris Muller. Smartweed Lake, Los Lagos and pond east of Eldora.

Lymnaea caperata Say. Lagoon near Los Lagos.

Planorbis exacuus lenticularis Lea. Eldora and Columbine Lakes.

Planorbis similaris Baker. Smartweed Lake (type locality), East Lake, Los Lagos and pond south of Silver Lake (altitude 10,550 feet).

Planorbis trivolvis Say. Smartweed Lake, Los Lagos and pond at Tolland. Baker recorded a single specimen from Smartweed Lake under the name *P. plexata* Ingersoll. A comparison of a good series from that lake and Los Lagos with *P. trivolvis* from many other localities fails to disclose any constant character separating our material from typical *trivolvis.*

Planorbis umbilicatellus Cockerell. Lake Eldora and three neighboring lakes.

Planorbis vermicularis Gould. Lily Lake, near Lake Eldora.

Physa smithiana Baker. Upper Teller Lake (type locality).

Physa virgata Gould (*traskii* Lea). Smartweed Lake.

We also obtained the following land snails:

Aspen groves near Tolland—*Agriolimax campestris* (Binney), *A. c. montana* (Ingersoll), *Cochlicopa lubrica* (Müller), *Columella alticola* (Ingersoll), *Euconulus fulvus alaskensis* Pilsbry, *Gonyodiscus shimeki cockerelli* (Pilsbry), *Polita hammonis* (Ström.), *Punctum rel. conspectum* (Bland), *Pupilla blandi* Morse, *Pupilla hebes* Ancey, *Succinea avara* Say, *Vallonia gracilicosta* Reinh., *V. costata montana* Sterki, *Vertigo concinnula* (Cockerell), *Vitrina alaskana* Dall, *Zonitoides arborea* Say. Aspen and narrow-leafed cottonwood groves near Eldora—*Agriolimax campestris, Euconulus f. alaskensis, Gonyodiscus s. cockerelli, Polita hammonis, Pupilla blandi, Thysanophora ingersolli* (Bland), *Vallonia cyclophorella* Ancey, *Vertigo concinnula, Vitrina alaskana, Zonitoides arborea.* Aspen groves at New University camp near Silver Lake—*Agriolimax campestris, Euconulus f. alaskensis, Gonyodiscus s. cockerelli, Punctum rel. conspectum, Vertigo modesta, Vitrina alaskana.*

As a rule the land snails are not found much above 9,500 feet, and at that altitude the aspens give way to pure coniferous forests, but we found *Vitrina* occasionally up to timber line under shrubs.

In 1923, accompanied by Mr. John P. Byram, I did intensive collecting in another glaciated area on Grand Mesa, from 9,000 to 11,000 feet above sea level, about 125 miles southwest of

Tolland. Here again we found *Pisidium* in almost every lake and pond, *Musculium* in two or three, and *Lymnaea*, *Physa* and *Planorbis* much more generally distributed than in the other region. The largest *Planorbis* I have seen in Colorado, up to thirty millimeters in diameter, were found here. This material has not yet been worked up, so no list of species can be given.

Obviously there were no mollusks in these glaciated areas when the region was covered with snow and ice the year round. They have been distributed by some agency or agencies, not of their own volition, since the disappearance of the glaciers. The land-snail colonies are separated from one another and from like colonies in the non-glaciated areas by wide stretches of territory unfavorable to their migration. *Oreohelix*, widely distributed at favorable stations throughout the Rockies, is not known to have bridged the gap at all in the Tolland and Eldora districts, but three examples have been found on Mount Audubon, near Silver Lake, at timber line. On the other hand, the small species, which could easily have been brought in clinging to the feathers of birds, are found wherever suitable covering exists. The aquatic forms could not have migrated to these high lakes and ponds of their own volition, because the small streams leading up from the plains are all mountain torrents, wholly devoid of mollusks from the lower edge of the glaciated areas to the edge of the plains. Furthermore, the lakes totally isolated from drainage except by seepage contain mollusks.

It is definitely known that aquatic mollusks have been carried alive long distances by water birds and shore birds, and it seems to me that is the most likely method of dispersal in the glaciated areas of the mountains. True, it would require a very large number of such accidents to have brought in so many species and to have distributed them to so many lakes. As they are found in practically all the lakes in the two large areas examined, it is fair to suppose they are also found in the hundreds of other glacial lakes throughout the mountains. When one considers the vast multitude of birds passing through in migration twice a year and the annual post-nesting migrations of certain species from plains to mountains, it is seen that there have been plenty of opportunities for numerous such accidents.

Also, once having gotten a foothold in a given area, they could easily have been carried from lake to lake over the short intervening distances in the fur and clinging to the feet of various mammals, especially beaver, bear, mink, otter and others which regularly or occasionally take to the water or wade in the edges of the lakes. As so many of the lakes have no connection with streams except by slow seepage through their moraines, and contain no fishes, it is evident that the mollusks could not have been introduced by clinging to fishes. Furthermore, the fish route would not account for the numerous colonies of land snails, while the bird and mammal route would.

Instances of very recent introduction of aquatic mollusks into small ponds are known in the Rocky Mountain region. On a high divide in Wyoming I found a small pool recently made by throwing an earth dam across a small, dry run, to catch the storm water for cattle. It was already inhabited by *Lymnaea bulimoides cockerelli*, which could only have been brought in by birds or some other such agency. In the shifting sandhills of eastern Colorado we have found *Lymnaea* and *Physa* in several ponds entirely surrounded by great sand hills. As the sand shifts rapidly and constantly, they could not have been there many years, certainly not centuries and could not have been brought in along drainage lines. Numerous other such cases are known. The most plausible method of their introduction I have been able to think of in the years spent in observing these facts is by clinging to the feathers of birds and hair of mammals, and this method seems consistent with all the facts and inconsistent with none.

NOTES ON THE DONAX OF CALIFORNIA

BY A. M. STRONG

The first description of a Donax from California was that of *Donax californicus* Conrad, 1837. This was followed by Dr. Gould's *D. obesa* 1851, collected by Lieut. Green at San Diego, and *D. flexuosus* 1857, from Col. Jewett's Santa Barbara collection. A number of species from Mazatlan, Acapulco and Panama were also described by the early writers.

Carpenter in the British Association Report, 1856, p. 229, lists from Col. Jewett's Santa Barbara collection the following species; *D. rostratus* C. B. Adams,=*culminatus* B. M. Cat., No. 37 ; *D. californicus* Conrad ; *D. gracilis* Hanley ; and *D. flexuosus* Gould. From Lieut. Green's collection from San Diego he lists, p. 232, *D. californicus* Conrad,=*D. laevigata* Deshayes; *D. abruptus* Gould,=*D. californicus* Conrad, var. ; and *D. californicus* Conrad, var. In another place he lists from California, p. 287, *D. conradii* Deshayes,+*D. californicus* Desh. ms. *non* Conr. In his final table he only lists from Upper California the following ; *D. flexuosus*, *D. californicus*, *D. rostratus* and *D. gracilis.*

During Dr. Carpenter's visit to the United States he examined in detail the specimens collected by Col. Jewett and Lieut. Green and in his Supplementary Report, 1863, p. 536, he only lists from Santa Barbara *D. californicus* and *D. flexuosus*; *D. rostratus* being listed from Acapulco and *D. gracilis* from Panama. He states the *D. abruptus* from San Diego should be *D. obesus* Gould, and adds from the collection of Major Rich *D. californicus* from Monterey. In the final table in the Report, p. 640 he reduces the California list to *D. californicus* Conr. (*non* Desh)= D. *obesus* Gould, (*non* Desh.) and *D. flexuosus* Gould. To these he adds *D. navicula* Sowerby, from the southern fauna.

In the Mazatlan Catalogue, 1857, Dr. Carpenter mentions some of the names used for the California shells as follows ; under No. 75, *D. punctatostriata* Hanley, he gives?=*flexuosus* Gould's plates, and under No. 76, *D. conradi* Desh., gives+*D. californicus* Conr. teste Desh., adding "The *D. californicus,* teste Nuttall, whose shells were the basis of Conrad's description, is very different from the shell so named by Deshayes in the Br. Mus. and Col. Cuming."

In 1900 Dr. Dall in the Transactions of the Wagner Free Institute of Science, vol, 3, part 5, p. 968, points out that the shell identified as *D. navicula* by Carpenter is the true *D. californica* of Conrad and he applies the name *D. laevigata* Desh. to the shell considered to be *D. californicus* by Carpenter=*obesa* Gould. Finally in 1919, finding that *laevigata* Desh., could not be used, Dr. Dall suggests the new name *D. gouldii* Dall for this species. In the same connection he states that the specimens on which Dr. Gould based his description of *D. flexuosus* are identical with the West Indian *D. striata* Linne, and are undoubtedly a case of mixed locality labels.

This reduces the recognized species of Donax from California to two, variously given as follows:

DONAX CALIFORNICA Conrad, 1837. Journ. Acad. Nat. Sci., Phila., vol. 7, p. 254. Bull. U. S. Nat. Mus. No. 112, p. 49.

D. navicula Sby., Cpr. Brit. Ass'n. Rep't. 1863, p. 640.

D. flexuosus Gld., Cooper, 7th Ann. Rep't Cal. St. Min., p. 238.

D. flexuosus Gld., Williamson, Proc. U. S. Nat. Mus., vol. 15, p. 186.

D. flexuosus Gld. Keep, West Coast Shells, ed. 1892, p. 192.

D. californicus Conr., Dall, Trans. Wagner Inst. Vol. 3, p. 968.

D. californicus Conr., Arnold, Pal. San Pedro, p. 170.

D. californicus Conr., Keep, West Coast Shells, ed. 1911, p. 88.

D. californicus Conr., Fish Bull. No. 4, Cal. Fish and Game Com. p. 47.

DONAX GOULDII Dall, 1919. Bull. U. S. Nat. Mus., No. 112, p. 49. Boston Journ. Nat. Hist., vol. 6, p. 394 as D. obesus, Gould.

D. californicus Conr., Cpr. Brit. Ass'n Rep't 1863, p. 640.

D. californicus Conr., Cooper, 7th. Ann. Rep't Cal. St. Min. p. 238.

D. californicus Conr., Williamson, Proc. U. S. Nat. Mus., vol. 15, p. 186.

D. californicus Conr., Keep, West Coast Shells, ed. 1892, p. 192.

D. laevigata Desh., Dall. Trans. Wagner Inst., vol. 3, p. 969.

D. laevigata Desh., Arnold, Pal. San Pedro, p. 170.

D. laevigata Desh., Keep, West Coast Shells, ed. 1911, p. 87.

D. laevigata Desh., Fish Bull. No. 4, Cal. Fish and Game Com., p. 47.

Donax punctatostriata Hanley, and *Donax conradi* Desh., both common in the Gulf of California fauna, have been reported from California in published lists. I am unable to find any record to support this among the California collectors. It seems probable that the records were either based on old identifications following Carpenter's statements of the synonymy, *D. conradi* equaling *D. californicus* as used by Deshayes and *D. punctatostriata* equaling *D. flexuosus* Gould, or on valves off boats coming up from the lower coast, as has proven to be the case in several instances. Unless an authentic record of living specimens from California points can be found, both species should be stricken from the California lists. Both Carpenter's record of *Donax gouldii* Dall from Monterey and Dall's from San Louis Obispo County need further verification. It does not seem probable that the species will be found living north of Point Conception.

AMPHIDROMUS VIRESCENS (SWAINSON)

BY BRYANT WALKER

This species was originally described by Swainson as "*Bulimus virescens*" (*Bulimus citrinus* var.?) in the Appendix to the "Catalogue of the Rare and Valuable Shells which formed the celebrated collection of the late Mrs. Bligh," 1822, App. p. 13. The description is as follows:—"Shell obovate, green, variegated with yellow; spire conic, slightly thickened, obtuse; the volutions depressed on the suture and generally reversed; inner lip obsolete; umbilicus open". He further states:—"The same uncertainty exists with regard to this shell, as the last, viz. whether it should be considered as a variety, or as a distinct species, from *B. citrinus* (Zool. Ill., pl. 42). I have seen many specimens, but not one where the inner lip was developed on the upper part, that is, between the umbilicus and the top of the outer lip. If this character be found constant, it should, I conceive, be taken as a good and sound *specific* distinction;

and more than one writer has made it, in other instances, of *generic* importance. In the two varieties of *Bulimus citrinus* (here figured from this collection), and in numerous others which I have inspected, the inner lip is entire, much thickened, and dilated over the umbilicus, which is thus hid in mature age".

Subsequently (Zool. Ills., III, 1822–3, pl. 166, fig. 1) he figured the species as a variety of *Bulimus citrinus* and remarks: The beautiful shells here selected as a further illustration of the Citron Bulimus not only show the great variability of the species, but clearly prove that *B. virescens* is, as I suspected, only a variety of *B. citrinus*. In the shell at fig. I, the upper part of the inner lip (like that described in the Bligh Appendix), is entirely wanting; although it bears, in every respect, the appearance of a full-grown shell; the umbilicus likewise is open; but in the shell at fig. 2 and 3 the inner lip is quite perfect, and consequently folds over the umbilicus; thus the connection between the green and yellow varieties is completely established."

In the second edition of the Exotic Conchology (1846, p. 37) the original description from the Bligh Catalogue with the remarks considerably abbreviated is reproduced.

Since that time the species has been practically lost sight of, which seems rather strange in view of Swainson's statement that he had seen "many specimens". It seems to have escaped the attention of both Pfeiffer and Mousson. It is not mentioned by v. Martens in his "Ost-Asien" and, indeed, he bestows the name on a variety of *Amphidromus furcillatus*. It is not quoted by Fulton in his paper on *Amphidromus* in the Ann. and Mag. of Nat. Hist. (1896). Pilsbry (Man. of Con., XIII, 1900, p. 171) with some doubt referred it to *A. comes* Pfr.

In the account of my copy of Martyn's Universal Conchologist (Naut., XXXII, 1918, p. 80) I mentioned the fact that plate 116 was duplicated and represented two color forms of a sinistral *Amphidromus* that I could not assign to any of the species figured in the Manual of Conchology.

A year or two later in a miscellaneous lot of *Amphidromi* received from the Museum of Natural History of Geneva, Switzerland, as *A. perversus* L. from "Java et les iles de la Soude", were two specimens which were evidently the same species as that figured by Martyn. The existence of these shells made it desirable to ascertain the correct specific name. On sending them to Dr. Pilsbry, he identified them as being without much doubt the *Bulimus virescens* of Swainson

According to the printed index in the "Conchologist," plate 116 represented *Limax tiara* from Barbadoes and according to Pilsbry (Man. of Con., IX, p. 189) that is the well known *Polymita versicolor* Born. In the written index to my copy plate 116 is listed as *Bulimus* ——. Dr. Pilsbry informs me that in Chenu's reprint of the Conchologist plate 116 is the *Polymita*, and on inquiry I ascertained that in all of the three other copies in this country in the libraries of Leland Stanford Junior University, the Boston Society of Natural History and the Philadelphia Academy plate 116 represents that species. This would seem to make it clear that the *Polymita* was the species originally represented on plate 116 and to settle the question as to the availability of the name of "*tiara*" for the *Amphidromus.* The explanation for the discrepancy is probably to be found in the fact stated by Quaritch in a recent catalogue (1923, No. 378) that "evidently Martyn only completed copies to order" and as stated in my paper (l. c. p. 32) "everything in the make-up of this copy seems to indicate that it must have been one of the latest copies issued and was made up of such plates as were then on hand". Presumably there being no available copy of the original plate 116, the duplicate plates of the *Amphidromus* were inserted to take its place.

This leaves Martyn's species without a name unless it is the *Bulimus virescens* of Swainson. I have no doubt but that is the fact and that Swainson's species should be recognized as a valid one. As shown on plate V, a comparison of the several figures of Swainson and Martyn and the specimens in my collection make it clear that all belong to the same species, which is characterized by being umbilicated, with no callous deposit on the parietal wall and having a thin, expanded lip. The coloration as usual in the genus is variable. No two of the specimens are exactly alike. They all agree, however, in having the dark band on the upper whorls and in the dark interior of the aperture. Swainson's type was "green, variegated with yellow". His figure in the Zoological Illustrations has the apical whorls a light yellow with a purplish spiral band, which does not appear on the body-whorl, which is a darker yellow with green longitudinal streaks. Martyn's figures are the most highly colored. The figure on plate 116 (plate V, fig. 2) has the upper whorls a dusky yellow with a band of brownish yellow bordered with red on the apical whorls and reddish brown on the intermediate ones. The body-whorl is green with some yellowish longitudinal stripes and numerous darker green spiral bands. That on plate 116 *bis* (plate V, fig. 3) has the ground color and the bands on the upper whorls lighter in color and the intermediate whorl has the band composed of blotches of green, reddish-brown and yellow. The body-whorl has a subsutural band of yellow with a narrow light-bluish band in the center; this is bordered by a very narrow reddish-brown band, reddish-yellow below, which appears as a peripheral band, but which curiously enough is not shown at all on the figure of the dorsal side. Below the upper brown band the body whorl is green with darker longitudinal stripes.

In my specimens, the smaller (fig. 4) has the apical whorls white with a reddish-brown band; the intermediate whorl has three such bands at first, a narrow subsutural band, which fades out before reaching a narrow reddish-brown varix (which does not appear in the figure), a narrow, rather indefinite, peripheral band and below it a broader one, which coalesces with it just before reaching the varix, from which it is separated by a longitudinal streak of yellow; beyond the varix the upper part of the whorl is at first a light yellowish-white; below this the ground color is a reddish-brown with faint indications of the spiral bands at first and then is overlaid, apparently, by a bluish-green and yellow longitudinal striping; a second varix then appears bordered on each side by yellow, which reaches the aperture where the lip is first appressed to the body-whorl; beyond that the remainder of the body-whorl is dark reddish-brown, running into a dark purple towards the lip, but is separated from the lip, which is white on both sides, by a bright yellow streak. The lip itself is thin, expanded and sharp-edged. The other specimen (fig. 5) is a little larger and evidently a worn shell, but the general system of coloration is about the same. These shells measure:

Fig. 4, Alt. 45, diam. 23 mm.
Fig. 5, Alt. 48, diam. 26.5 mm.

The synonymy of the species is as follows:

Bulimus virescens Swainson, Catalogue of the rare and valuable shells which formed the celebrated collection of the late Mrs. Bligh, 1822, Appendix p. 13. Exotic Conchology (edition 2), 1841, p. 37.

Bulimus citrinus var. *virescens* Swainson, Zool. Illustr., III, 1822–3, pl. 166, fig. 1.

Bulimus sp. Martyn, Universal Conchologist (Walker copy), 1822?, plates 116 and 116 *bis*.

Amphidromus comes? Pilsbry, Man of Con., XIII, 1900, p. 30.

Amphidromus sp.? Walker, Naut. XXXII, 1918, p. 30.

I am indebted to Mr. E. G. Vanatta for the data in regard to the Bligh Catalogue and to Miss Mina L. Winslow of the Museum of Zoology, Univ. of Mich., for the photographs reproduced in the remaining figures.

Explanation of Plate V

Fig. 1. *Bulimus citrinus virescens* Sw., from the Zool. Illustr.

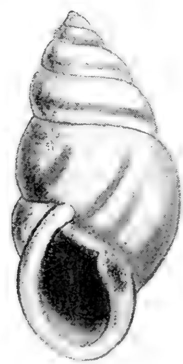
2. *Bulimus* sp. from pl. 116, Martyn's Universal Conchologist.

3. *Bulimus* sp. from pl. 116 bis, Martyn's Universal Conchologist.

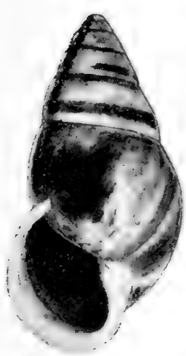
4 and 5. *Amphidromus virescens* Sw., Walker collection No. 59795.

2

3



1



4

5

WALKER: AMPHIDROMUS VIRESCENS [SWAINSON]

NEW LAND OPERCULATES FROM THE DUTCH LEEWARD ISLANDS

BY H. BURRINGTON BAKER

During the summer of 1922 the University of Michigan Museum of Zoölogy sent me to the Dutch Leeward Islands to collect molluscs, amphibians and ants. With the assistance of an additional grant from the Zoölogical Laboratory of the University of Pennsylvania, I was able to spend fourteen weeks in a rather detailed study of the islands of Curaçao, Klein-Curaçao, Aruba, Bonaire, and Klein-Bonaire. The molluscan fauna of these is rather poor in genera, but rich in specific and subspecific diversity, and in number of individuals.

The following brief, specific descriptions will be amplified and illustrated in a future paper, which will be published by the University of Michigan Museum of Zoölogy.

Helicinidae.

Stoastomops walkeri, new genus and species.

Shell depressed turbinate; reddish in color. Altitude, 2.14 mm.; major diameter, 2.34 mm. Whorls 4½, markedly convex. Growth wrinkles pronounced, irregular. Spiral sculpture of numerous, fine thread-riblets, more obscure on the base of the shell. Umbilicus narrowly rimate. Aperture subbasal, reniform. Peristome simple, sharp, incomplete; columellar wall with whitish callus which ends abruptly in a distinct emargination just above the basal angle. Operculum very similar to that in *Pyrgodomus*, a subgenus of *Eutrochatella*. Radula similar to that of *Stoastoma*, but both A and B centrals have 2 to 3, stout, aculeate cusps; C-central tricuspid; D-lateral with only two very heavy cusps.

This monotypic genus combines, to a remarkable degree, the shell of *Pyrgodomus* with the radula of *Stoastoma*. Type locality: Montagne, Bonaire.

Pomatiasidae.

Cistulopsinae, new subfamily.

In "Das Gebiss der Schnecken" (Vol. I, p. 75, fig. v–1), Troschel pointed out that the radula of the one of the Cuban species differed from several other American members of this family in the possession of tricuspid centrals and first laterals. He followed Sowerby (Thes., fig. xxxi, 283, 284) and Pfeiffer (1852; Mon. Pneum. viv.) in the identification of the peculiar species as *Cyclostoma candeana* Orbigny, but Pfeiffer showed later (Mon. Pneum., Suppl. I, p. 132) that it was actually *C. illustre* Poey. This important radular difference was recently contradicted by Henderson and Bartsch (1920; P. U. S. Nat. Museum, LVIII, pp. 54–55).

During the examination of the present collection I was surprised to find that the radula of *Cistula raveni* Crosse has tricuspid centrals and 7-cusped inner laterals. Both the centrals and the inner laterals have a large middle cusp with a smaller one on either side, but each inner lateral, in addition, has two minute serrations on either side of the blade of the main cusp, near its base. The outer laterals and marginals are somewhat similar to those of *Tudora*, and do not differ radically from many of the other species of American Pomatiasidae. These radular differences are sufficient grounds for the establishment of a new genus, Cistulops, with the monotype *Cistula raveni* Crosse (1872; J. de C. XX, 159), from Curaçao.

This led to the examination of the radulae of 62 species of American Pomatiasidae, but definitely multicuspid centrals and inner laterals were only found in one other species, *Cyclostoma illustre* Poey.* The radulae of my specimens of this last species agree quite well with Troschel's figure, already quoted, although I differentiate two small cusps (instead of one) on either side of the middle cusp of the rhachidian central. As Troschel pointed out that this was sufficient basis for generic separation, the new genus, Troschelvindex, with the monotype *Cyclostoma illustre* Poey (1857; Mem. Cuba II, p. 33) from Habana, Cuba (A. N. S. P. no. 129153), is here proposed.

Cyclostoma incultum Poey, *C. perplicatum* "Gundlach" Pfr.,

*A. N. S. P. no. 129153; 2 specimens from Colon Cemetery, Habana, Cuba; J. P. Clark, 1921. A. N. S. P. no. 13759; 2 specimens from Cuba; Swift Collection. I wish to express my gratitude to Prof. Carlos de la Torre, for his verification of these identifications. He tells me that the first lot represents a somewhat larger form that occurs around Habana, while the second lot is quite typical and probably came from near Matanzas.

C. largillierti Pfr., and *C. decussata* Lam., all placed by Henderson and Bartsch in their "group of *Annularia illustris*", have fundamentally unicuspid centrals and inner laterals. In addition, the growth ribs of these species are gathered into tufts at the suture, while the sutural crenulations of *T. illustris* are the enlarged ends of individual ribs.

Largely on the basis of the supposed agreement amongst all of the American Pomatiasidae, in the possession of unicuspid centrals and inner laterals, Henderson and Bartsch separated the New World species from their Old World relatives. The subfamily Cistulopsinae is now proposed for the inclusion of these two unconformable genera, *Cistulops* and *Troschelvindex*. The remainder of the American cyclostomates, as far as examined, can be retained in the family "Annulariidae," as defined by Henderson and Bartsch, although, personally, I can see no necessity for the division of the Pomatiasidae into smaller families.

However, the term Annulariidae itself cannot be used in this connection. *Annularia* Schumacher (1817, Essai Nouv. Syst. Hab. Vers. Test., pp. 60, 196) contains two species, *A. aurantiaca* and *A. fimbriata*, both of Schumacher. Each is founded on figures in Chemnitz, and the first is apparently close to *Cyclophorus volvulus* (Müller). The second is described by the citation: "Turbo lyncina Lin. Chemn. 9, sect. 2, pag. 54. Tab. 123, fig. 1060, Littr. a". This cannot be construed as a quotation of *Turbo lincina* Lin. (1758, Syst. X, 765) and *A. fimbriata* Schumacher must be restricted to the figure in Chemnitz, which certainly does not represent the Linnaean species. In fact, this figure totally defies recognition, although Pfeiffer (1852, Mon. Pneum. Viv., 159) identified it, with doubt, as *Cyclostoma fimbriatulum* Sowerby. As a result, Dall's (1905, Proc. Malac. Soc. London, VI, 208) choice of *Turbo lincina* Lin. as the type of *Annularia* is impossible; the only identifiable species of the genus, *Annularia aurantiaca*, is now chosen as its type; and *Annularia* passes into the synonymy of *Cyclophorus* Montfort (1810, Conch. Syst. II, 290).

For these reasons the Jamaican group which has temporarily been known as *Annularia* must revert to its classical generic title, *Choanopoma* Pfr. (1847, Zeit. Mal., 47), type *Turbo lincina* Lin. (1758). The "Annulariidae" of Henderson and Bartsch may take the name of any of their other subfamilies; Chondropominae would perhaps be most appropriate. Both the Cistulopsinae and the Chondropominae (in this broad sense) agree in the deep pectination of the marginal teeth of the radula.

The two genera of the Cistulopsinae are separated from each other by their opercula, even more markedly than by their radula. That of *Cistulops* consists almost entirely of the chondroid plate, although a few, calcareous granules ornament its outer surface; while that of *Troschelvindex* has an incomplete, but distinct, calcareous portion, which consists of growth lamellae, cemented, at their distal edges, into a poorly developed, calcareous plate. The external surface of this last plate is almost parallel to the chondroid one, but each whorl of the former is slightly narrower than the underlying portion of the latter, so that the appearance of the entire operculum is somewhat similar to that in the genus *Choanopoma*. For reasons that I hope to discuss in a future paper, I am inclined to believe that the operculum of *Troschelvindex* represents the most primitive type in the American Pomatiasidae.

CHONDROPOMINAE.

TUDORA MACULATA, new species.

Shell elongate-conic, thin; brownish with darker bands, usually broken into rows of flammulations. Altitude (4 whorls): 8.8 mm.; major diameter: 4.5 mm.; aperture: 2.3 mm. Whorls $6\frac{1}{2}$ (usually 4 retained); cylindrical; last whorl descending, solute and slightly tangential. Growth sculpture of crowded, regular, low, rounded threads; spiral sculpture microscopic, of widely spaced threadlets. Umbilicus small. Aperture circular. Peristome sharp, simple, continuous. Operculum with subcentral nucleus; chondroid plate inconspicuous, concave internally; calcareous portion thick, with channeled perimeter; external surface (calcareous plate) distinctly convex and marked by fairly prominent growth-wrinkles.

Type locality: Montagne, Bonaire. I had originally intended to name this very distinct, little species for Dr. H. A. Pilsbry, but recently found that lot number 13761, in the collection of the Academy of Natural Sciences of Philadelphia, is certainly the same form. This set is labeled: "*Cistula maculata* Bland, Buen Ayre, W. I." I can find no reference to these shells in the literature, but think it safer to introduce Bland's appellation. The superficial resemblance of this species to the young of *Cistulops raveni* probably deterred its description.

TUDORA RUPIS, new species.

Shell similar to *T. aurantia* (Wood), but smaller and thinner. Altitude (5¼ whorls): 14.0 mm.; major diameter: 7.6 mm.; altitude of aperture: 6.2 mm.; diameter of aperture: 5.2 mm. Whorls about 9 (4½ usually retained), not markedly convex. Growth-sculpture of quite regular, but usually obscure, low, rounded cords. Spiral sculpture of prominent, rounded ridges. which are rarely surmounted or broken by the growth-sculpture, Umbilicus rimate. Aperture ovate, with the long axis quite oblique to that of the shell. Peristome sharp, incomplete; rather abruptly expanded on the palatal and basal walls; lobate at parietal angle and auriculate at basal; very slightly expanded in the columellar region. Operculum similar to that of *T. aurantia*, but with much thinner calcareous portion.

Type locality: base of northern escarpment of the Tafelberg of Santa Barbara, southern Curaçao.

TUDORA MUSKUSI, new species.

Shell similar to *T. aurantia*, but heavier. Altitude (5 whorls): 15.8 mm.; major diameter: 8.9 mm.; altitude of aperture: 6.3 mm.; diameter of aperture: 5.6 mm. Whorls about 8½ (usually 5 retained). Growth sculpture of widely-spaced, very prominent and heavy, angular costae, with a few, obsolescent cords between them; very similar to *T. costata* ("Menke" Pfr.; 1846, Zeit. Mal., 47; Chemn. II, fig. ix-9,10). Spiral sculpture of almost obsolete, rounded thickenings, which are usually evident only as undulating buttresses along the sides of the growth costae; towards the umbilicus they become much more prominent. Umbilicus rimate. Aperture small, almost circular, with long axis inclined at about 45° to that of shell. Peristome sharp, incomplete; not expanded at parietal angle and with upper palatal wall slightly emarginate; slight expansion of lower and palatal and basal regions terminates abruptly just beyond the slightly auriculate basal angle; columellar wall scarcely expanded. Operculum similar to *T. rupis.*

Type locality: top of shore cliffs, Knip Baai, northern Curaçao. This species has a much more nearly circular aperture than has *T. costata*, the habitat of which is still unknown. I do not believe that *T. costata* occurs in the Dutch Leeward Islands, as none of the thousands of specimens examined shows any tendency to approach its strikingly elongate aperture.

TUDORA PILSBRYI, new species.

Shell much thinner and more depressed than *T. megacheilos* (Potiez et Michaud). Altitude ($3\frac{3}{4}$ whorls): 16.0 mm.; major diameter: 12.4 mm.; altitude of aperture: 9.1 mm.; diameter of aperture: 8.9 mm. Whorls about 7 (usually $3\frac{1}{2}$ retained); very convexly rounded and with deeply impressed sutures. Growth sculpture of regular, compressed riblets, which are quite closely spaced but are narrower than their interspaces. Spiral sculpture of numerous, regular, compressed, angular riblets, which are heavier and slightly higher than the growth riblets; intersections developed as prominent, sharp, pyramidal cusps. Umbilicus much larger than in *T. megacheilos.* Inner outline of aperture almost circular. Peristome roughly triangular and markedly undulate; parietal angle lobate; upper palatal wall markedly emarginate; lower palatal wall extensively developed but scarcely expanded; basal wall abruptly expanded; basal angle flattened; columellar wall auriculate below. Operculum similar to that of *T. megacheilos*, but deeply concave externally.

Type locality: base of northern escarpment of the Tafelberg of Santa Barbara, southern Curaçao.

TUDORA FOSSOR, new species.

Shell more elongate and thinner than *T. megacheilos.* Altitude (complete): 13.0 mm.; major diameter: 7.5 mm.; altitude of aperture: 5 9 mm.; diameter of aperture: 5.5 mm. Whorls 6 (usually $3\frac{1}{2}$ retained); the diameter increases uniformly from the first to the last, while in *T. megacheilos* the latter whorls enlarge more rapidly than do the earlier ones. Sculpture similar to that of *T. pilsbryi*, but growth riblets more compressed and intersectional cusps more lanceolate in outline. Umbilicus and aperture smaller than in *T. megacheilos.* Peristome similar to the latter species, but with less extensively expanded columellar wall, slighter palatal emargination and thinner internal callus. External surface of the operculum more concave than in *T. megacheilos*, but much less so than in *T. pilsbryi.*

Type locality: valley between Seroes Palomba and Baha Hoendoe, northern Curaçao. This is the only *Tudora* from Aruba, on which island two subspecies occur.

ON THE NAIADES OF LONG ISLAND, N. Y.

BY N. M. GRIER, PH. D.
Dartmouth College, Hanover, N. H.

The following species are cited as occurring in this region: *Elliptio complanatus* Dillwyn (1). Described as being moderately abundant at Riverhead. *Anodonta implicata* Say (2, 3). Found in lakes at Prospect Park, Brooklyn, and at Baisely's Lake, Jamaica South. *Anodonta cataracta* Say (3), from Kissena Park Lake, Flushing. The writer notes the occurrence of this species at Lake Ronkonkema, a glacial kettle-hole lake near the center of the island, where it seems fairly common. This species is widely distributed over the Atlantic slope. A number of specimens were transferred to St. John's Lake, Cold Spring Harbor, in August 1923, where their further progress may be noted.

Ortmann remarks of the close relationship of *cataracta* and *implicata*, the latter differing from the former only by a thickening of the shell along its lower margin, a distinction hardly noticeable in young shells. *Anodonta* sp. are usually thin shelled under any condition of environment. Their ready adaptation to the lime-free waters of Long Island is thus easily understood. *E. complanatus* is a puzzling species due to the large number of variants representing it. While it is described as having a moderately thick shell, yet a form of it with shell so soft as to be easily indented with the finger, has been reported from a soft-water lake in Maine (4). This would seem to indicate similar adaptability as the *Anodontas*. All are members of the depauperate Atlantic Coast Fauna, having been reported from New England by Johnson (5), and being found further south. The fair probability is their introduction on Long Island, one way or another through the agency of birds.

A similarly curious distribution is reported for *A. cataracta* from the Tennessee drainage. This shell is not found in the Upper Tennessee drainage above Chattanooga except at a small pond near Knoxville, and at Wartburg on the Emory River. Yet it is abundant in the adjacent Cumberland river. Here again transportation by birds is the most plausible factor to invoke to account for its presence in the pond at Knoxville, inasmuch as it is absent from the main river. Finally with regard to Long Island shells, it is undoubtedly true that other species can be transported similarly, but it is possible that the chemical composition of the water has favored the species cited.

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A LIST OF MOLLUSKS FROM INTERVALE, N. H.

BY HARALD A. REHDER

Following is a list of mollusks collected at Intervale, New Hampshire, during the last few years. Shells from this region, and the White Mountains in general, are not very common, and it is hoped this list will prove interesting. The land shells were largely collected in the woods on the side of Mt. Bartlett. Mr. Charles W. Johnson aided in naming the land shells, and the only Musculium was kindly determined by Dr. V. Sterki.

Polygyra albolabris (Say).

Dead and faded specimens were fairly common. Living shells, mostly young, were found on several occasions.

Polygyra fraterna (Say).

One live specimen found under damp leaves.

Pyramidula alternata (Say).

One live shell found in the sap hole of a maple.

Pyramidula cronkhitei anthonyi Pils.

Several living specimens from leaf mould.

Zonitoides arborea (Say).

One specimen from leaf mould. Found in company with the following two species.

Vitrea hammonis (Strom).

Three specimens.

Vitrea indentata (Say).

One specimen. This is believed to be a new record for New Hampshire, the previous northernmost record for New England having been from Cape Elizabeth, Maine.

Anodonta cataracta Say.

Four specimens collected in a small brook flowing into the Saco River. This stream, at the time of collecting, was partly dried up, forming several pools. Many more were seen, one of which measured about 6½ inches in length.

Musculium rykoltii (Normand).

The first record for New Hampshire. Many specimens of this species were found in the same brook as that in which the preceding species was found.

Planorbis antrosus Conr.

Several specimens found along with the preceding species.

NOTE ON THE DISCOVERY OF ORYGOCERAS IN THE IDAHO TERTIARIES

BY WILLIAM HEALEY DALL *

In 1902 the Croatian paleontologist Brusina published an atlas of engravings illustrating the remarkable fresh-water fauna of the Tertiaries of Dalmatia, Serbia, Croatia and Bosnia. This includes some unique forms not represented in the recent fauna, and known from no other region, many of them so different from anything now known from fresh water as to seem almost incredible.

In 1909 Mr. A. A. Hinkley obtained in the state of San

* By permission of the Director of the U. S. Geological Survey

Luis Potosi, from the Panuco river system some amnicoline shells which were recognized by Dr. Pilsbry as closely related to some of Brusina's genera, and who described them under the names of *Emmericiella* and *Pterides* (NAUTILUS, XXIII, pp. 45–49, pl. 5). It is not certain that these bleached specimens represent living species.

The U. S. Geological Survey recently received from Prof. F. A. Thomson a chunk of rock collected from Castle Creek, Owyhee Co., Idaho, from strata regarded by Meek, C. A. White, and Gabb as Miocene, which was submitted to the writer for examination. The matrix consisted of rather large rounded sand grains strongly cemented together and containing numerous fresh-water shells, *Sphaerium*, *Pompholyx*, and *Melania turneri* Gabb, among the most conspicuous. A close examination disclosed specimens of at least three species of Brusina's genus *Orygoceras* (1882), a remarkable tubular shell recalling the Caecid genus *Parastrophia*, but less arcuate, more slender and with a more involved nucleus.

The matrix is so flinty and the minute shells so extremely fragile, that several were lost in the endeavor to extricate them, but at least three species were recognized; one smooth, resembling Brusina's *O. corniculum*, one twisted, like his *O. fistula*, and a third laterally carinate somewhat like *O. enemopsis* Brusina, but more slender and with a crenate apex. A single specimen like *Pterides rhabdus* Pilsbry, but with the aperture concealed, a tricarinate *Pyrgula* and a shell somewhat like *Lithoglyphus fuchsi* Brusina, were also noted.

In this connection attention may be called to some fossils from a shaly deposit on the Rio Carboneras falling into a tributary of Lake Isabal, Guatemala, recently received; among others they comprise a large *Cyrenoida* , and a shell obviously a typical *Tryonia*, but which if found in Serbia would doubtless be referred to *Prososthenia* Neumayr.

This relation between our fresh-water Tertiaries and those of southeastern Europe is extremely interesting and calls for further investigation.

NOTES ON THE ANATOMY AND TAXONOMY OF CERTAIN LAMPSILINAE FROM THE GULF DRAINAGE

BY A. E. ORTMANN, PH. D.

(*Continued from page 60*)

MEDIONIDUS ACUTISSIMUS (Lea).

Also this species differs from *M. conradicus* in the reticulated painting and the coarser corrugations of the posterior slope. It differs from *M. parvulus* by the fact that the rays are more frequently present and rather broad (but also composed of reticulations). From both, *conradicus* and *parvulus*, it is distinguished by more prominent posterior ridge and pointed posterior end. The nacre is very frequently of a reddish or salmon color.

The soft parts have been described by Lea (under *U. rubellinus*, Obs. 6. 1858). He reports that the marsupium occupies nearly the whole length of the outer gill, with a wide reddish-brown border on the edge. The inner lamina of the inner gill is free nearly half of the length of the abdominal sac.

In my specimens I have found that the inner lamina of the inner gills is free for about one-half of the abdominal sac (more or less). In the gravid female, there are 2 to 4 long papillae on the mantle-edge in the same position as in the other species. These papillae are cylindro-conical in shape. The marsupium is large, yet it does not occupy the whole gill, but a large section in the middle of it, leaving non-marsupial a more considerable portion anteriorly, and a smaller portion posteriorly (it is quite probable that it is smaller in younger specimens). The number of ovisacs on the left side is at least 22 (with some posterior ones discharged); on the right side, they are hard to count, since they are largely discharged, but probably there were still more of them. Also my specimen has the margin of the marsupium broadly colored with brown pigment. Color of soft parts rather light: the black of *conradicus* and *parvulus* being replaced by brown.

Glochidium of the same shape as that of the other species, but larger: L. 0.26 to 0.27, H. 0.32 to 0.33 mm.

Thus the anatomical investigation furnishes in the larger marsupium with brown edge, in the prevailing brown, not black, pigment of the soft parts, and in the larger glochidia additional specific characters for *M. acutissimus.* The latter, in its affinities, if more remote from *conradicus*, while *parvulus* stands very close to this.

4. Caruncullina paula (Lea) (1840).
Simpson, 1914, p. 159.

Choctawhatchee River, Blue Springs, Barbour Co., Ala.—soft parts of 4 males and 5 barren females, H. H. Smith coll., Oct., 1915.

The anatomy of these specimens agrees in all respects with that of *C. parva* (Barn.) (see: Ann. Carn. Mus. 8, 1912, p. 338, and Naut. 28, 1915, p. 129). In one of my specimens, a female, the supraanal opening is closed, in the others open. There is some blackish pigment at the edge of the marsupium. The caruncle is white or brownish.

These specimens have been identified (as *Lampsilis paula*) by B. Walker, but since I do not possess the shells, I cannot exactly say what Walker understood by this name. However, specimens in the Carnegie Museum from various sources, among them two thus labeled, received from the Alabama Museum (from Chattahoochee River, Columbus, Muscogee Co., Ga.), hardly differ from *C. parva* (Barnes). They do not have the cloth-like epidermis seen in the typical *parva*, and young shells are not so black, but more greenish, with lighter concentric bands. Further, the female is more distinctly swollen and dilated in the postbasal region. But these characters occasionally may turn up in *C. parva*, chiefly in southwestern (Arkansas) material.

5. Caruncullina mœsta (Lea) (1841).
Toxolasma lividum (Raf.) Ortman, Proc. Amer. Philos. Soc. 57, 1918, p. 573; *Car. mœsta* Ortmann, Naut. 34, 1921, p. 89.
U. corvunculus Lea, 1868.

Othcalooga Creek, Calhoun, Gordon Co., Ga.—a number of shells, and soft parts of one gravid female, H. H. Smith coll., July, 1913.

Choccolocco Creek, White Plains, Calhoun Co., Ala.—1 barren female with soft parts, H. H. Smith coll., July 31, 1915.

All these specimens were labeled *corvunculus* by Walker. I have pointed out, that the shell named *corvunculus* cannot be distinguished from *T. lividum* (=*C. mœsta*) of the upper Tennessee drainage, and also the soft parts do not differ from specimens from East Tennessee and the Ozarks (NAUT. 34, 1921, p. 89). Also the glochidia are the same.

My specimen with glochidia was collected in July, which confirms the late end of the breeding season observed in other instances in this species.

This is one of the species indicating the close connection of the Alabama-fauna with that of the Tennessee. *C. mœsta* is found in the Cumberland-Tennessee drainages and in the Ozarks, and its variety *glans* (Lea) in the central basin, south to Arkansas, but not on the Gulf plain. But the typical *mœsta* is present again (under the name of *corvunculus*) in the Alabama drainage, chiefly in the headwaters. It should be mentioned, in this connection, that *glans* has been reported by Simpson (1914, p. 154) from Etowah River, Ga.: there is no doubt, in my opinion, that this refers to *mœsta*.

6. MICROMYA NEBULOSA (Conrad) (1834).

Ortmann, Proc. Amer. Philos. Soc. 57, 1918, p. 577.

This is a common species in the Cumberland and Tennessee drainages, and is very variable. But it is also found in the Alabama drainage, and in the Chattahootchee system in Georgia. In fact, its *type-locality* is in the headwaters of the Black Warrior River in Alabama ("mountainous regions of Alabama, in the Black Warrior River").

The following synonyms founded upon specimens from this region have been ascertained previously (l. c.).

U. radians Lea (1857). Probably a rather normal female, with wide rays. Nacre white or rose. Othcalooga Creek (near Calhoun), Gordon Co., Ga. (tributary to Oostanaula, headwaters of Coosa).

U. jonesi Lea (1859). Normal female, with narrow rays.

Nacre white or salmon. Euharlee Creek, Bartow Co., Ga. (tributary of Etowah River, headwaters of Coosa).

U. sparus Lea (1868). A normal male with well developed rays. Nacre salmon. Swamp Creek, Whitfield Co., Ga. (tributary to Conasauga River, south of Dalton, headwaters of Coosa).

U. linguaeformis Lea (1860). A male, with poorly developed rays, but normal in shape. Columbus, Ga. (Chattahoochee drainage; also reported from French Broad River in Tennessee).

U. simus Lea (1838). A male with strongly developed rays, originally described from Cumberland River, but reported by Simpson (1914, p. 124) also from Othcalooga Creek Gordon Co., Ga.

To these, however, should be added the following synonyms.

U. plancus Lea (1860). Already Simpson (1914, p. 125) suspects that this is only a form of *nebulosus*. The figure represents a male, and it is a rather short *nebulosus*, with rays well-developed. Such specimens are not at all rare. Coosa River, Wetumpka, Elmore Co., Ala.

U. difficilis Lea (1868). Made a synonym of *plancus* by Simpson. The figured specimen is a small, rather shoot male, with few rays. Swamp Creek, Whitfield Co., Ga. (also given from headwaters of Holston River, Washington Co., Va.).

I have before me a rather large number of this species from the Coosa drainage, from Conasauga River in Polk Co., Tenn., from Swamp Creek, Whitfield Co., Ga. (type-locality of *sparus* and *difficilis*), from Cowan Creek, Cherokee Co., Ala., Little Wills Creek and Green Creek, Etowah Co., Ala.; Shoal Creek, St. Clair Co., Ala.; Choccolocco Creek, Talladega Co., Ala.; and Spring Creek, near Kewatchee Springs, Shelby Co., Ala. I have also material from the Cahaba River, in Bibb Co., Ala.

All this material shows that *M. nebulosa* is widely distributed in this region, and that the Alabama-form cannot be distinguished from that of the Tennessee. In Conasauga River, at Conasauga, Polk Co., Tenn., I collected myself 2 males and 1 gravid female (discharging glochidia, May 24, 1915). The anatomical characters are those of *M. nebulosa*, and also the glochidia are identical.

The presence, in this case of the identical species, both in the upper Tennessee and the Alabama drainages should be particularly noted, since this type of shell, although it extends (as *M. iris*) westward to the Ozarks, and northward all over the Mississippi and Ohio drainages, is not found to the southward and southwestward. Thus a connection of the Alabama range with that of the interior basin by way of the costal plain and up the Mississippi valley is excluded, and we must assume that this species managed to get across the divide between the Alabama and the Tennessee. It also should be noted that this species has been recorded from the Chattahoochee (*linguaeformis*). Simpson gives also Wolfsville, Union Co., N. Car. This is in the Catawba-Wateree drainage, far away from the rest of the range, and appears as rather doubtful.

7. MICROMYA VIBEX (Conrad) (1834).
Simpson, 1914, p. 136.

A species widely distributed in the Gulf drainage from Mississippi to Georgia, with a variety (*nigrina* Lea) in Florida. It is closely allied, in the shell characters, to *M. nebulosa*, but generally more elongate, with very well developed rays, which usually are wide and stand rather crowded, although they may be absent on the anterior part of the shell. The rays are not "wavy", as Simpson describes them, but rather interrupted, spot-like, but not always so. On account of the crowded character of the rays, the general color of the epidermis appears rather dark, dark green to blackish. The nacre is mostly white, rarely reddish. The shell grows to a larger size than that of *M. nebulosa*; the posterior expansion of the female is of about the same character. The synonyms given by Simpson surely belong here; they are: *U. exiguus* Lea (1840); *U. stagnalis* Conrad (1849); *U. rutilans* Lea (1856); *U. subellipsis* Lea (1856).

I have material from the Tombigbee, Sipsey, and Black Warrior River systems, from the Cahaba and Coosa drainages, up to Murray Co., Ga. and Polk Co., Tenn.; from the Escambia and Choctawhatchee drainages in southern Alabama and from the Chattahoochee in Georgia. Soft parts are at hand from the following localities.

Conasauga River, Conasauga, Polk Co., Tenn.—2 males and 1 young female, A. E. Ortmann coll., May 24, 1915.

Little River (trib. to Chattooga), Cherokee Co., Ala.—1 young male, 1 gravid female (glochidia), H. H. Smith coll., Octob., 1915.

Choccolocco Creek, White Plains, Calhoun Co., Ala.—1 male, 1 female, H. H. Smith coll., July 31, 1915.

Choctawhatchee River, Blue Springs, Barbour Co., Ala—1 barren and 1 gravid female (glochidia), H. H. Smith coll., the former May 11, the latter Octob., 1915.

The specimens from the Choctawhatchee were labeled by Walker: *vibex* var.? I do not have the shells of them. But other specimens with shells from the Choctawhatchee drainage, thus labeled, are surely *vibex*, differing only by more or less purplish shades in the nacre, thus forming a transition to the var. *nigrina*, known from Florida. Whatever they are, the soft parts do not differ from those of *vibex*.

I have described (Ann. Carnegie Mus. 8, 1912, p. 340) the barren female of *M. vibex nigrina* (Lea). The mantle margin of the typical *vibex* essentially agrees with this. There are about 12 (or more, in *nigrina* 10) cylindro-conical papillae, of large or medium size, which are somewhat distant from each other, with a few smaller ones anterior to them. In young females, the larger papillae are nearly the same size; in the larger ones, they are more irregular, and stand at irregular intervals, and the posterior part of the mantle-edge may be without them; but a group of 6 to 8 large papillae in its anterior part is evident.

The marsupium is of the normal Lampsiline type; the number of ovisacs varies with age, from a few up to 25 or 30. The edge of the marsupium has blackish pigment.

Anal opening separated from the supraanal by a moderate mantle-connection. The anal has crenulations, the branchial opening has papillae. Inner lamina of inner gills connected with abdominal sac. Palpi with posterior margins connected at base only. The male has a few, small, and distant, rudimentary papillae on the mantle edge. Color of soft parts whitish, anal and branchial openings with black pigment, and a streak of this runs forward along the mantle-margin. Papillae of female blackish-brown.

Glochidium subspatulate, of similar shape to that of the *iris-* and *lienosa*-groups, and closely agreeing with it in dimensions, L. 0.21, H. 0.27 mm.

Thus the anatomy bears out the relationship of this species to *M. nebulosa* and *M. iris*, and we should regard *M. vibex* as at least closely allied to *nebulosa*, from which it may have descended. The slight irregularity in the papillae of the mantle-edge, in size as well as in their distance from each other, is transitional towards forms like *lienosa*, and thus *M. vibex* may present, to a degree, a connection between the *iris-* and *lienosa*-groups.

It should be pointed out that we thus have, in the Alabama system, two species representing the form *nebulosa* of the Tennessee-drainage: an identical one, *nebulosa*, and a closely allied, but different one, *vibex*. For the latter, of course, the same should be said with regard to its origin, as to the former. However, *vibex* being distinct from *nebulosa*, we are to conclude that the conditions which brought about its distribution prevailed at least twice, at different times during the geological and geographical history of this region. There was an older connection of the waters, permitting a first immigration of the *nebulosa*-stock into the Alabama-system. This stock changed in the course of time into *vibex*, and reached a wider distribution upon the coastal plain (as far as Florida). A second immigration took place later, and the *nebulosa*-stock which then reached the Alabama-drainage did not have time enough to change its characters, and remained more geographically restricted (to the Alabama and Chattahoochee systems, chiefly in the headwaters).

(*To be continued*)

NOTES

Succinea avara Say, from the tar pits of California. The University of California possesses a very large collection of bones of birds and mammals which have been taken from the asphalt pits of Rancho la Brea, Los Angeles County, California. The cleaning processes through which the material goes consist in part of boiling in a vat of gasoline. Much of the bitumen goes into solution and foreign material settles to the bottom as a sludge. This consists chiefly of sand which has been thrown into the tar lake throughout its existence.

Such an excellent trap as this pit has been for birds and mammals would be expected to be equally successful for land snails but so far as the writer is aware they have never been recorded from there. It is therefore a pleasure to be able to announce the discovery of a single shell of *Succinea* in those Pleistocene deposits. The specimen was found by Mr. Clarence Ryan inside one of the numerous wolf skulls taken out some years ago, and was submitted to me by professor Bruce L. Clark.

The shell cannot be distinguished from specimens which have been found living in numerous places in the Pacific Coast States and which are usually identified as *S. avara* Say. Whether careful study would show that this species is so wide spread as has been reported or if the Pacific Coast specimens belong to a different form cannot be stated at this time.—G. Dallas Hanna.

Parviterebra. Dr. Bartsch has omitted one important name from his Key to the Terebridae (supra, pp. 60–64). This is the genus *Parviterebra* of Pilsbry, Proc. Acad. Nat. Sci., Philadelphia, lvi, p. 5, founded on the Japanese species *paucivolvis* Pils.

It is a small but very distinct Indian Ocean group, superficially akin to *Mazatlania*, and includes *thyraea* Metwill from the Persian Gulf and *separanda* Tomlin from South Africa.—J. R. le B. Tomlin.

PUBLICATIONS RECEIVED.

The Mollusca collected by the University of Michigan—Williamson Expedition in Venezuela. By H. B. Baker (Occasional Papers, Museum Zool. Univ. Mich., no. 137, pp. 1–5, July, 1923). Part one treats of the shells of Curaçao and part two of the terrestrial operculates of Venezuela. Keys including all the species of the region are given, and eight new species and subspecies are described and figured.

The Genus Sculptaria Pfeiffer, with Description of Three New Species. By Henry C. Burnup (Annals Natal Mus., Vol. 5, pt. 1, pp. 1–4, pls. 1 and 2, 1923).

Mollusques Terrestris et Fluviatiles de Syrie. Par Louis Germain (Voyage Zoologique d'Henri Gadeau de Kerville en Syrie (Avril–Juin, 1908). Vol. 2, 523 pages, 1921; Vol. 3, 242 pages, 23 plates, 1922). Volume 2 contains the Gasteropods and volume 3 the Pelecypods and plates. With a complete bibliography and fully illustrated it is a most exhaustive work on the molluscan fauna of that region.

Mollusca of the Southwestern States.—XI. By Henry A. Pilsbry and James H. Ferriss (Proc. Acad. Nat. Sci. Phila., Vol. 75, 1923, pp. 47–103, pls. 1–8, 12 figures in text). This latest addition to the series of papers by the same authors dealing with the snails of the great American desert is one of the most valuable of all. It is divided into four parts, the first two of which deal with collecting stations in various mountain ranges in Arizona and the known faunas of each are brought down to date. Part III gives voluminous notes on many species old and new. A great deal of information is given on the anatomy of *Sonorella*, and five full plates of drawings illustrate the genitalia of the various species discussed. A Mexican species of *Bulimulus* is added to the Arizona fauna. Six new species and nine new subspecies are described in the paper. The last part is devoted to a clearing up of the uncertainty which has surrounded *Micrarionta rowelli* (Newcomb) for almost sixty years. The type specimen is illustrated; a new species found with it is described as *M. newcombi* and the type locality of both is fixed at Tinajas Altas, Gila Mountains, Arizona.

It is quite evident that Messrs. Pilsbry and Ferriss are paving the way for one of the most monumental zoogeographic studies ever attempted in North America. Their final results will have a far-reaching importance in the study of zoology and taxonomy and perhaps in geology as well. The vast amount of detailed work involved can scarcely be appreciated by one who has not attempted such an undertaking, in at least a small way. The handling of such large series of specimens and records would be a fruitful source of error in untrained hands. But that these gentlemen are equal to their responsibilities is shown by a careful check and cross check of the first several pages. A single error was detected, and that typographical; *thyroides* is spelled *thyroidus* on page 51 line two.—G. Dallas Hanna, California Academy of Sciences.

Proceedings of the Malacological Society of London (Vol. 15, pl. 4, Oct. 1923). On the External Characters of Sinum planulatum. By G. C. Robson, pp. 268 and 269.

Masculine Deficiencies in the British Vertigininae. By Hugh Watson, pp. 270–280.

The Presence of a Sub-cerebral Commissure in the Orthurethra. By Hugh Watson, pp. 280–283.

The Anatomy and General affinities of Ochthephila (=Geomitra) turricula Lowe. By Hugh Watson, pp. 283–293, pl. 6.

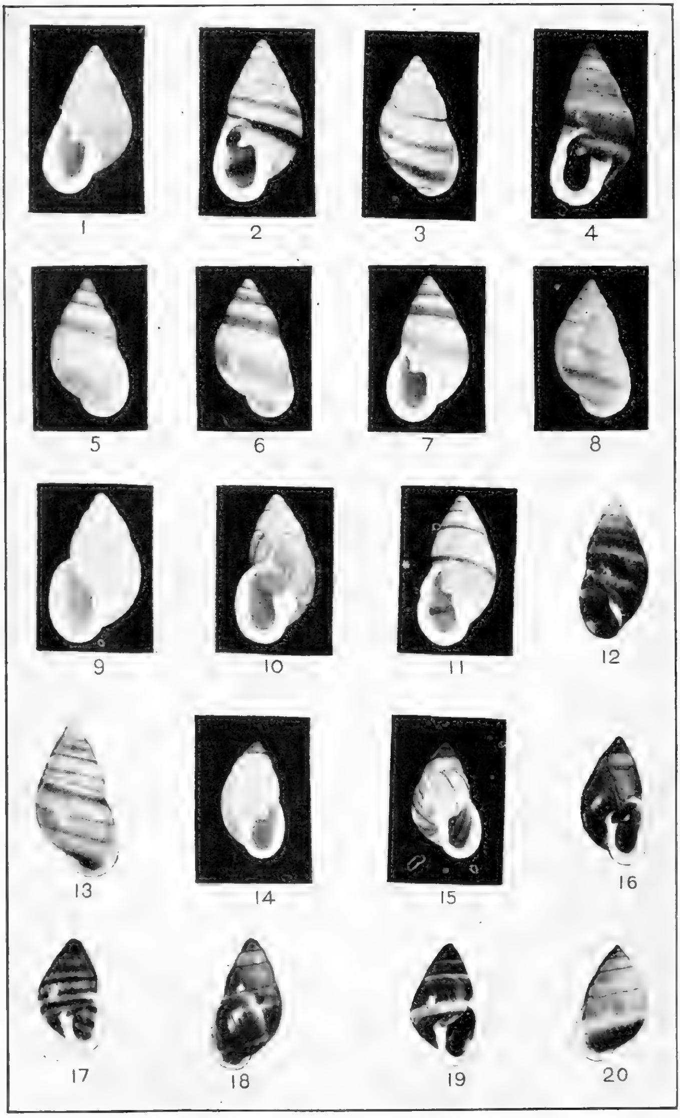
On the British species of Truncatellina. By A. S. Kennard and B. B. Woodward, pp. 294–298.

Note on the Nomenclature and Systematic Arrangement of the Clausiliidae. By A. S. Kennard and B. B. Woodward, pp. 298–308.

On Turris (Surcula) macella nom. nov. for T. macilenta Melv., nom. preocc. By J. Cosmo Melvill, p. 309.

Some Synonyms in the Veneridae. By J. R. le B. Tomlin, pp. 310–313.

The Morphology of the Nudibranch Genus Hancockia. By F. M. MacFarland (Jour. Morphology, Vol. 38, pp. 65–104, pls. 1–6, 1923).



CRAMPTON: PARTULA FROM MOOREA, SOCIETY ISLANDS

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NEW AND SIGNIFICANT SPECIES OF PARTULA FROM MOOREA, SOCIETY ISLANDS

BY HENRY EDWARD CRAMPTON

The present writer has been engaged for some years in an intensive study of the distribution, variation, and evolutionary relationships of the land gastropods belonging to the genus *Partula*. The species dwelling in the Society Islands have received the most attention on account of their number and variety; the known species of the genus number a little over a hundred, and more than fifty of these occur only in the group specified. All of the islands inhabited by the genus, from Tahiti to Borabora, have been explored during one or more journeys, and the volume on the Tahitian species has been published[1]. Field studies have also been prosecuted in the Cook, Samoan, Tongan, and the Mariana Islands, and a volume on the species of the last-named group has been completed and is shortly to appear.

The island geographically proximate to Tahiti is Moorea, about twenty miles distant, where collections amounting to over forty thousand specimens have been secured in the course of five field trips, from 1907 to 1923. The detailed study of this wealth of material is progressing rapidly with results that entirely confirm the general conclusions of the Tahitian research,

[1] Carnegie Institution of Washington, Publication No. 228, 1917.

while in addition abundant evidences have been discovered that the differentiation of more than one parental stock into diverse products is a contemporaneous process. Any further statement of the essential facts in the last connection must await the preparation of the complete account of the Moorean species, including the details of their distribution and the quantitative data of their variation.

The purpose of the present article is to place on record certain new species that are so noteworthy as to merit immediate attention. The general point of greatest interest is that they were unknown to Garrett, who resided many years in the Society Islands, and whose circumstantial account of the land gastropods of that group [1] reveals his intimate knowledge of the organisms and of their localized situations. Garrett's descriptions of the Moorean snails show that he explored the island with great care, yet the new species herein described must have escaped his notice on account of the peculiar circumstances of their occurrence. Having corroborated the records of the species of Tahiti, Raiatea, Tahaa, Huaheine, and Borabora, it was a real surprise to the present author to find novel forms in Moorea which are not mentioned in the literature, and which are entirely absent from the extensive collections made by Garrett, now distributed in the museums of Honolulu, Philadelphia, Washington, Cambridge, and Pittsburg.

Three of the new species are sinistral, thus agreeing with *P. mooreana*, which is dextral only in the case of rare, newly-discovered mutations, and also with numerous local associations of *P. suturalis*. Hence the island of Moorea supports more reversed species of the genus than are known to occur elsewhere throughout its entire range. The fourth novel species is predominately dextral, although exceedingly rare sinistral mutants have been found.

PARTULA TOHIVEANA, new species. Plate VI, figures 1–4.

Shell large, sinistral, elongate-conic, and perforate. Whorls 5 to 5½, with flattened profile at the apex, becoming more convex with further growth; suture slightly impressed in most ex-

[1] Journ. Acad. Nat. Sciences, Philadelphia, Vol. IX, part I, 1884.

amples. The middle area of the last whorl is flattened or even indented immediately outside of the lip. Columella straight. The dense, finely-sculptured lines of the younger whorls disappear toward the body-whorl which is therefore smooth and shining in undecorticated specimens.

Aperture elongated, with its long axis inclined away from the columellar axis. Lip rounded or slightly beveled, thickened inwardly, sharply angled at the columellar insertion, and dentated near its outer insertion; the toothed appearance is accentuated by the sudden narrowing of the outer peristome toward its junction with the last whorl. A thin, shining callus spreads over the body-whorl between the two insertions of the lip. A parietal tooth is well developed almost universally.

Colors: (*a*) corneous yellow or light corneous-brown, with or without darker coloring of the apical whorls, and in some specimens with sparse darker transverse lines (Plate VI, fig. 1); (*b*) similar in ground color and with two, sometimes four, vaguely-defined revolving bands of chocolate-brown (Plate VI, figs. 2, 3); (*c*) with a revolving median zone of chocolate-brown upon the usual background (Plate VI, fig. 4). The lip is white, smooth, and shining.

The shells of half-grown individuals have the outer wall plainly angled, although this feature disappears on the later-formed whorls. The embryonic young are always unbanded, either white or faintly corneous, with or without a colored tip. The bands of fasciated adults appear only in post-embryonic life, and they seem to be relics of an antecedent dark general color. Embryonic capsule impregnated with calcareous substance so as to be opaque.

Dimensions as follows:

Length 17.4–23.7 mm., average 21.68 mm.

Width 10.1–13.7 mm., average 12.08 mm.

Length of aperture 8.9–12.5 mm., average 11.06 mm.

Width of aperture 6.7–9.3 mm., average 7.98 mm.

Proportions of shell 49.5–60.5 per cent, average 55.65 per cent.

Proportions of aperture 65.5–78.5 per cent, average 72.04 per cent.

Proportions of aperture-length to shell-length 47.5–55.5 per cent, average 50.95 per cent.

Habitat: Moorea, Society Islands; lower slopes of Mt. Tohivea.

This species presents several features of special interest. In the first place, in the writer's experience it exists only in a very limited area of bush on the lower northern slopes of Mt. Tohivea, which is the dominating mountain of the island. In July of 1923 a few hundred specimens of various ages were taken in an area not more than four hundred yards in lateral extent, between 700 feet and 900 feet above sea level. Despite the fact that the natives of Moorea, as elsewhere in the Society Islands, are collectors of shells to be made into necklaces and wreaths, the new species was entirely unknown to them.

Intrinsic noteworthy features are the roundly dentated outer lip, and the simple conical contour of the youngest whorls, in which characters *P. tohiveana* resembles the dextral species *P. dentifera* and *P. formosa* that live in the island of Raiatea, more than a hundred miles to the west-northwest of Moorea. The resemblances in these distinctive qualities suggest that the Moorea and Raiatea forms displaying them are descended from a common ancestral stock, comprising animals of both coils like *P. otaheitana* and *P. suturalis* as they exist today, and which ranged over a larger body of land connecting the two islands in former ages. At the northwestern end of this former land, where Raiatea remains, the present derivatives have retained the dextral coil, while at the eastern end, which is now the separated island of Moorea, the animals are reversed. Under the geographic and other circumstances, *P. tohiveana* cannot be a direct product of Raiatean ancestry; and it is equally clear that the Raiatea species with the characteristics in question are not the descendants of direct migrants from Moorea.

PARTULA OLYMPIA, new species. Plate VI, figures 5–8.

Shell sinistral, ovate-conic, more compact than in *P. tohiveana;* compressly perforate. Whorls 5 to 5¼, convex throughout, suture of the body-whorl impressed. The middle part of the last whorl is depressed just before it meets the flaring lip, as in *tohiveana.* Columella twisted slightly,—a feature more evident in adolescent than in adult shells. The spiral sculpturing continues from the youngest whorls to the very edge of the lip.

Aperture elliptical, axis parallel to the columellar axis. Lip rounded or slightly beveled, thickened inwardly, broad at its columellar insertion and narrowed toward its outer insertion, but not so markedly as in *tohiveana.* A shining callus occurs between the two insertions, finely pitted under the lens. A parietal tooth occurs in all but a few of the shells, but it is not prominent.

Colors: (*a*) uniform fleshy corneous; (*b*) uniform medium brown; (*c*) same in basis, with a median band of brown on the whorls of the spire only (Plate VI, fig. 5); (*d*) similar in ground-color, with a vague median band of brown which extends over the body whorl as well as on the upper coils (Plate VI, figs. 6, 7); (*e*) ground color as before, with two revolving bands of brown, weak and vaguely defined (Plate VI, fig. 8). The lip is white.

The outer wall of the adolescent shell displays a median angle. The revolving colors of fasciated individuals appear on the embryonic shell, in which respect they differ from the bands of deeper tint in *tohiveana.* The embryonic capsule is opaque.

Dimensions of thirty-one measurable shells as follows:

Length 17.7–20.4 mm., average 18.94 mm.

Width 10.3–11.9 mm., average 10.99 mm.

Length of aperture 9.1–10.9 mm., average 9.99 mm.

Width of aperture 6.7–8.1 mm., average 7.43 mm.

Proportions of shell 53.5–62.5 per cent, average 58.14 per cent.

Proportions of aperture 70.5–80.5 per cent, average 74.37 per cent.

Proportions of aperture length to shell length 49.5–56.5 per cent, average 53.63 per cent.

Habitat: Moorea, Society Islands: inner slopes of Mt. Mouaputa at high levels.

On first inspection the present species appears to be very close to *P. tohiveana,* but on further study it proves to be clearly distinct. The two species are alike in sinistral coil, narrowed outer insertion of the lip, depressed median body-whorl outside of the lip, and in the general coloration of certain subordinate classes. But *P. olympia* differs in its more compact form, straighter aperture, convex apical whorls, its delicate sculpturing throughout the whole shell, and in the earliest possible appearance of the revolving bands when they occur. Hence *P. olympia* is no nearer to *tohiveana* than it is to the far more abundant *P. mooreana* of the same island.

Less than a hundred examples of all ages have been taken. They were discovered in 1919 in a restricted area of forest about 900 feet above sea-level, on the inward or northern slopes of Mt. Mouaputa. This mountain stands about two miles from Mt. Tohivea with which it is connected by a portion of the ancient wall of the huge central crater of the island. The forests are virtually continuous between the localities of *olympia* and *tohiveana*, but no sinistral snails belonging to these or to any other species were found in the intervening territory. The natives had never found the type, so far as could be ascertained; the specific name is conferred because they believe that the mountain of Mouaputa is the dwelling-place of invisible supernatural beings.

Partula dendroica, new species. Plate VI, figures 9–13.

Shell sinistral, oblong-conic, compressly perforate. Whorls 5¼ to 5½, slightly convex, the last conspicuously slender. Suture impressed, more markedly on the last whorls. Columella sinuous. Surface shining and generally smooth, as if polished; spiral sculpturing weak, and obsolescent on the last whorl.

Aperture oval, not inclined. Lip rounded, slightly thickened within, channeled at its columellar junction, and evenly curving to the neighborhood of its outer insertion where it turns inward more abruptly. The callus over the body-whorl is very thin. Parietal tooth entirely wanting, or very weakly developed in a small percentage of the specimens.

The color classes are clearly differentiated, as follows: (*a*) uniform light straw-yellow, with slightly darkened tip as a rule

(Plate VI, fig. 9); (*b*) uniform yellowish-brown, or brown (Plate VI, fig. 10); (*c*) yellowish-brown, with a single median band of deep brown, sharply defined on all excepting the youngest of the whorls (Plate VI, fig. 11); (*d*) like the foregoing in ground-color, with a broad median zone of deep brown color (Plate VI, fig. 12); (*e*) yellowish-brown or brown, with four revolving bands of deeper brown, one near the suture, one near the base, and two intermediate (Plate VI, fig. 13).

The metaneanic whorls are not angled as in *tohiveana* and *olympia*. Fasciation begins with the embryonic stages. The embryonic capsule is opaque.

Dimensions of the entire series of adult shells in hand, eighty-six in all, as follows:

Length 18.9–23 4 mm., average 20.45 mm.

Width 10.3–12.5 mm., average 11.29 mm.

Length of aperture 9.9–11.7 mm., average 10.74 mm.

Width of aperture 7.1–8.9 mm., average 8.06 mm.

Proportions of shell 46.5–61.5 per cent, average 55.17 per cent.

Proportions of aperture 66.5–81.5 per cent, average 75.00 per cent.

Proportions of aperture-length to shell-length 46.5–58.5 per cent, average 52.44 per cent.

Habitat: Moorea, Society Islands; southern and southwestern aspects of Mt. Rotui, at high levels.

This species was first discovered in 1909, when it was supposed to be a local variant of *P. suturalis* Pfeiffer, which it resembles in some features. While *P. dendroica* and *P. suturalis* may be connected through a common remote ancestry, there can be no question that the differences they now exhibit justify their separation as distinct species.

Mt. Rotui is a lofty mass of volcanic rock situated between the two bays of Faatoai or Opunohu and Paopao which indent the northern side of Moorea. It is interpretable as a sector of an original crater which has long been disconnected from the semicircle comprising the high peaks of Mt. Tohivea and Mouaputa, where the previously-described species occur. The areas where *P. dendroica* was found lie in a zone of dense vegetation on the abrupt southern slopes of Mt. Rotui. The snails live on the high shrubs and trees, and are rarely taken on the plants of lower growth where *P. tæniata* and other species are found. The specific name is given on account of the tree-dwelling habits of the species. Probably the habits in question and the local occurrence of the species are responsible for Garrett's failure to discover *dendroica*.

From seven points within the inhabited area, representative collections have been secured which comprise more than two hundred individuals of adult and adolescent growth. The several associations differ much as regards the number *and* relative frequencies of their component color-classes. In brief, *P. dendroica* surpasses *P. tohiveana* and *P. olympia* in its geographical extension and in its local differentiation, although it falls far short of the other species of Moorea in both of these respects.

Partula mirabilis, new species. Plate VI, figures 14–20.

Shell dextral (reversed in rare mutations); ovate-conic to elongate-conic, openly or compressly perforate. Whorls 5, slightly convex, the body-whorl flattened toward the lip; suture of the last whorl impressed. The surface is sculptured throughout, but the lines are fewer on the larger whorls, which are shining and generally smooth except in decorticated specimens.

Aperture narrowed, elongated, almost oblong in general outline. Lip sharply beveled, thin, and smooth. A thin, roughened callus spreads between the insertions of the lip. Parietal tooth present in almost all instances, but it is seldom prominent.

Colors: (*a*) corneous fleshy, apex pale brown (Plate VI, fig. 14); (*b*) pale brown, with deeper brown transverse strigations (Plate VI, fig. 15), (*c*) corneous brown, with darker brown, ruddy, or rose-brown spire; (*d*) deep chocolate brown or seal brown, the spire usually lighter (Plate VI, fig. 16); (*e*) light brown, with three revolving bands of deeper brown color, and usually with sutural and basal clouding (Plate VI, fig. 17); (*f*) encircled by a broad zone of deep brown color, which is separated from the brown sutural and basal areas by narrow corneous lines, often with an asymetrical revolving corneous line through the median line itself (Plate VI, fig. 18); (*g*) deep seal-brown in general, with a revolving corneous zone toward the base and just within the suture of the upper whorls (Plate VI, fig. 19); (*h*) brown, save for a median revolving area which is corneous (Plate VI, fig. 20). The lip is white in the lighter-colored classes, and stained with brown or purplish-brown in the darker divisions.

Embryonic young are either brown of various shades, or they are clearly girdled by a central zone of darker color; the latter condition develops into the several forms of final adult fasciation. The egg capsule is opaque.

Dimensions are here given as the extreme measures of the few hundred shells already analyzed, as follows:

Length 14.1–18.6 mm.

Width 8.3–10.7 mm.

Length of aperture 7.5–10.1 mm.

Width of aperture 5.1–7.1 mm.

Proportions of shell 51.5–65.5 per cent.

Proportions of aperture 61.5–79.5 per cent.

Proportions of aperture length to shell length 46.5–59.5 per cent.

Habitat: Moorea, Society Islands: several subordinate localities within the central crater valley of Opunohu, and in some adjacent areas.

This species receives its name in recognition of certain remarkable features of its intrinsic nature and distribution. In the first connection, the notable point is its striking differentiation in the characteristics of coloration; no less than eight color-classes can be distinguished, and some of these are not duplicated in any other species of the Society Islands. These color-classes vary in number and relative abundance in the several local associations, which therefore present very different aspects even in neighboring valleys. The aperture is exceptionally narrow for a species of *Partula*, while the beveled nature of the lip is another distinctive feature.

It seems certain that Garrett possessed no examples of this species, for nothing of the kind is mentioned in his writings or in his correspondence with Hartman and others, and the species is entirely lacking in the abundant series of shells sent by Garrett to conchologists. Yet at the present time the total area of its occupation extends over some miles of territory, in which the animals occur in greater numbers at the higher levels. From the observations of the present writer during the years from 1907 to 1923, it is certain that the species has spread into this wider territory from a central region that must have been so small in Garrett's time as to escape the scrutiny of that careful explorer and observer; in short, the condition of *P. mirabilis* some decades ago must have been like that of *P. tohiveana* and *P. olympia* at the present time, although *mirabilis* has extended its range and it has differentiated into diverse colonial associations as the other species have not as yet.

The full statement of the structural qualities and color-characteristics of *mirabilis* must await the complete analysis of the material now in hand, which comprises several thousand individuals. The data given in the foregoing account sufficiently define the species and indicate its noteworthy features.

Explanation of Plate VI

Figs. 1–4. *Partula tohiveana*, new species.
Figs. 5–8. *Partula olympia*, new species.
Figs. 9–13. *Partula dendroica*, new species.
Figs. 14–20. *Partula mirabilis*, new species.

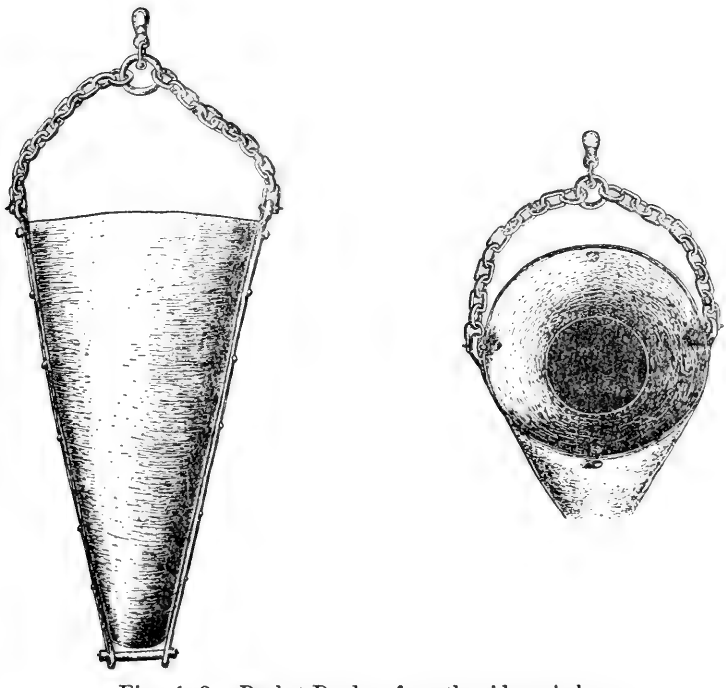
A BUCKET DREDGE

BY CHARLES HEDLEY

I suppose that all zoologists who have worked in water deeper than a hundred fathoms have found trouble with their gear. Especially is this the case with people who, like myself, began to dredge without tuition or any help from experienced men. Sometimes a dredge returns without a spoonful of shells, although the polished metal certifies that it has been rubbed on the bottom. A dredge that goes overboard so neatly may return with the tail wrapped in the mouth or the wire rope may be twisted and tangled.

After many such disappointments, the writer planned to construct a fool-proof dredge, which should never fail to go down straight, to fill properly and finally to deliver a profitable load on deck. The instrument here described has fulfilled these requirements, working admirably in rough, very rough, weather.

FIG. 1 FIG. 2



Figs. 1, 2. Bucket Dredge, from the side and above.

Several American friends to whom I related my experiences have asked for particulars. In the hope that the usefulness of this tool may be extended, I now offer to the readers of the "NAUTILUS" a sketch and description of my bucket dredge.

The dredge, which weighs altogether about forty pounds, is made of a sheet of 2-mm. steel rolled in a cone, 1000 mm. long, 410 mm. in diameter at the wide end and 100 mm. at the narrow end. This cone is stiffened by side straps of flat bar steel 7 mm. thick and 40 mm. wide. These project 50 mm. beyond the small end to hold a 12-mm. bolt; outside this bolt and between the side straps is a "distance piece" which serves the double purpose of holding the side straps apart and of carrying a dredge or tangles. At the wide end the side straps project 50 mm. and are thickened into 18-mm. shoulders in order to carry the shackle bolt. A substantial chain attached to the latter serves to swing the dredge. The aperture of the dredge is choked with a cone-shaped flange, a moveable basin diaphragm, with an orifice of 200 mm. in diameter and set back 120 mm. within the periphery. By the rim it is fastened to the dredge with four nuts and bolts. The object of the flange is to save the contents from being washed out by swirling eddies as the dredge ascends.

One point that I stress for the zoologist, who is not an engineer, is the need for a strong swivel-link to be placed above the bucket. A bucket sent down to deep water without a swivel will not come home but will spin till the rope screws off and breaks.

For emptying the dredge the flange is removed and the sand or mud dug out with a trowel, the contents may be bagged up to take ashore. But if the voyage is a long one the catch can be treated aboard. For this I carry sieves small enough to be manipulated in an ordinary ship's bucket. These are 200 mm. in diameter, 100 mm. deep and have a wire net of 20 meshes to the inch. Finally when the mud is washed out, the product of the sieves can be tied up in small canvas bags, holding a couple of pounds or so, and dried in the engine room.

NOTES ON MARINE MOLLUSKS FROM PERU AND ECUADOR

BY A. A. OLSSON

In the course of geologic studies in Peru, opportunity was occasionally found for the collection of marine mollusks from the beaches along the northwest coast. Although these collections have not as yet been fully studied, it is believed that this preliminary account and list of the more common or otherwise interesting species may be of value. The collections begin to the south at Bayover on the south side of the Bay of Sechura and continue northward nearly to the mouth of the Tumbez river. Collections were also made at several localities on the Santa Elena peninsula of Ecuador and are included. Dall's excellent Checklist of the Peruvian Marine Mollusks has been most useful as an aid in the identification and as a guide during collecting. To this list, can be added several species and definite Peruvian locality records for several more. Species not previously known from Peruvian localities are indicated with a *.

Most of the shells contained in the collections belong to species characteristic of the Panaman faunal province, whose southern limit and border with the Peruvian province, has been variously placed as the Gulf of Guayaquil, Paita and Punta Aguja. No sharp and fast line can of course be drawn and, in the general border region of the two provinces, a certain intermingling and overlapping of the two faunas will occur. Apparently, it would seem that Punta Parinas, the most westerly point of the South-American continent, forms the most natural line that can be drawn between the two provinces, although many of the Panaman species extend beyond into the warm, protected bays of Paita and Sechura. It is at or near Punta Parinas, where the cold Peruvian or Humboldt current finally leaves the coast in a more westerly swing out into the open Pacific. The rather large list of marine mollusks collected at Negritos (near Parinas) is the result of very persistent collecting during several months of residence and does not represent the usual species found each day on the beach. The common fauna of Parinas is rather a limited one, in which the *Tivela planulata* Broderip and Sowerby, is the most common and characteristic species. Among the seaweed-covered rocks exposed at low tide, are found in abundance, the *Thais biserialis* Blainville, *T. peruensis* Dall, *T. chocolata* Duclos, many Chitons, Acmaeas and an occasional *Turbo magnificus* Jonas, and *Acanthina muricata* Broderip. Going north up the coast from Parinas, we can note a progressive warming of the waters with shells becoming continually more abundant and varied. Lobitos about 15 miles north of Parinas, generally offers good collecting and at Restin and Punta Cabo Blanco still further north, mollusks have become quite abundant.

The abundance and varied character of the molluscan fauna in any locality, depends very largely upon the nature of the coast line. A long stretch of sandy beach such as that which extends south from Punta Parinas to the mouth of the Chira river, is generally devoid of much interest. Such beaches in northwestern Peru are characterized by the abundance of a few species, such as *Tivela planulata* Broderip and Sowerby, *Donax punctatostriatus* Hanley, *Olivella columellaris* Sowerby and rare shells of *Periploma planiuscula* Sowerby, *Lima pacifica* Orbigny, *Raeta undulata* Gould and *Pyrula decussata* Wood. A coast bordered by submerged rocks and ledges, as a rule offers the most favorable places for collecting. The wholly or partially submerged rocks support a large fauna mainly of gastropods; while shell-drift often very rich in the smaller and less known species, is allowed to accumulate along the sandy beaches. The coast of the Santa Elena peninsula at Salinas, is of this kind, the scene of some of the early collecting of Cuming and the type locality for many species.

Many interesting species were collected from old Indian graves which are found abundantly along certain parts of the Peruvian coast. These Indian graves are generally thickly covered with shells which for the most part, belong to the common species of the coast. Occasionally however many interesting species may be found, which are very rare on the present beaches. They include such shells as the various species of *Cancellaria*, the *Northia northiae* Gray, *Solenosteira anomala* Reeve and *Thais kiosquiformis* Duclos.

The localities represented by the collections are the following.

Ecuador: On the Santa Elena peninsula, at Salinas, Colonche and Playas.

Peru: North, Mal Paso to Zorritos. Zorritos to Boca de Pan. Mancora to Punta Verde. Punta Cabo Blanco. Lobitos. Negritos (Parinas). Paita. Bayover (Bay of Sechura).

Bullaria aspersa A. Adams. Negritos, Lobitos, Mancora. Salinas.

**Umbraculum* sp. A broken specimen which measured fully

75 mm. in length when complete was collected at Mancora. It is probably the *U. ovalis* Carpenter of the Bay of Panama.

Terebra strigata Sowerby. Common, Paita, Negritos, Lobitos, Mancora, Salinas.

Conus monilifer Sowerby. Lobitos.

Conus purpurascens Broderip. Mancora.

Cancellaria cassidiformis Sowerby. Common on Indian graves near Negritos, Que. Mancora; living at Mancora.

Cancellaria chrysostoma Sowerby. Locally common, Negritos, Lobitos, Mancora, Salinas.

**Cancellaria cumingiana* Petit. Often common on Indian graves. Living at Lobitos and Mancora.

Cancellaria clavatula Sowerby. Lobitos.

Cancellaria obesa Sowerby. Indian graves, Mancora.

Cancellaria tesselata Sowerby. Mancora.

Oliva angulata Lamarck. Zorritos.

Oliva kaleontina Duclos. Negritos, Lobitos, Mancora.

Oliva peruviana Lamarck. Negritos, Lobitos, Mancora, 1 specimen at Salinas.

Oliva spicata Bolton var. *pindarina* Duclos. Salinas.

Olivella columellaris Sowerby. Very common along the entire northwest coast, Salinas.

Olivella semistriata Gray. Zorritos.

Marginella curta Sowerby. Paita, Negritos, Lobitos, Mancora, Zorritos, Salinas.

**Vasum caestus* Broderip. Rare, Negritos.

Solenosteira fusiformis Blainville. Negritos, Lobitos, Salinas. Also on Indian graves near Mancora.

**Solenosteira anomala* Reeve. From Indian graves between Mancora and Punta Sal.

**Cantharus distortus* Gray. Common, Negritos, Mancora, Zorritos, Salinas.

Cantharus elegans Gray. Lobitos, Mancora, Zorritos, Salinas.

**Cantharus gemmatus* Reeve. Lobitos, Mancora, Salinas.

**Cantharus ringens* Reeve. Lobitos, Mancora, Salinas.

**Engina contracta* Reeve. Negritos.

**Northia northiae* Gray. From Indian graves near Mancora.

**Leucozonia cingulata* Wood. Mancora, Salinas.

Columbella fuscata Sowerby. Lobitos, Mancora.

Columbella major Sowerby. Lobitos, Mancora, Salinas.

Columbella paytensis Lesson. Lobitos, Mancora, Salinas.

Columbella strombiformis Lamarck. Salinas.

Anachis fluctuata Sowerby. Mancora.

**Strombina recurva* Sowerby. Lobitos, Mancora, Salinas.

**Murex nigrescens* Sowerby. Mancora, Salinas.

**Eupleura muriciformis* Broderip. Negritos, Lobitos.

Thais biserialis Blainville. Common, Paita, Negritos, Lobitos, Mancora, Salinas.

Thais callaoensis Gray. Negritos, Lobitos, Mancora, Salinas.

Thais chocolata Duclos. Negritos, Lobitos.

Thais crassa Blainville. Salinas.

Thais kiosquiformis Duclos. Indian graves near Mancora, Colonche (common).

Thais peruensis Dall. Negritos, Lobitos.

Thais triangularis Blainville. Mancora living and on Indian graves, Salinas.

Acanthina brevidentata Mawe. Negritos, Lobitos, Mancora, Salinas.

**Acanthina muricata* Broderip. Negritos, Lobitos, Mancora, Salinas.

**Distortio constrictus* Broderip. Negritos, Lobitos, Mancora, Salinas.

**Cymatium gibbosum* Broderip. Negritos, Lobitos, Mancora.

**Cymatium lignarium* Broderip. Negritos, Mancora, Salinas.

Bursa sp. My specimens are all broken but they appear closest to the *B. rugosa* Sowerby from Manila, according to Sowerby's figure (Con. Ill., fig. 7).

**Cassidea abbreviata* Lamark. Lobitos, Mancora, Salinas.

Malea ringens Swainson, Occasional, Bayover, Negritos, Lobitos, Mancora, Salinas.

**Pyrula decussata* Wood. Negritos, Lobitos, Zorritos.

**Simnia rufa* Sowerby. Negritos.

**Cyphoma emarginata* Sowerby. Negritos, Mancora.

**Levenia coarctata* Gray. Mancora, Salinas.

**Morum tuberculosum* Sowerby. Mancora.

Cypraea annettae Dall. Negritos, Lobitos, Mancora, Zorritos.

Cypraea arabicula Lamarck. Lobitos, Mancora, Salinas.

Cypraea exanthema Linnaeus. Occasional along the whole coast.

Cypraea nigropunctata Gray. Lobitos.

Trivia pacifica Gray. Salinas.

Trivia radians Lamarck. Common, Negritos, Lobitos, Mancora, Salinas.

**Trivia sanguinea* Gray. Negritos, Lobitos, Mancora, Salinas.

Erato scabriuscula Gray. Mancora.

Cerithium adustum Kiener. Salinas.

Cerithium maculosum Kiener. Salinas.

Serpulorbis squamigerus Carpenter. Lebitos, Salinas.

Turritella goniostoma Valenciennes. Generally common, Bayover, Paita, Negritos, Lobitos, Mancora, Salinas.

Architectonica granulata Lamark. Generally large and common, Negritos, Lobitos, Mancora.

Cheilea equestris Linnaeus. Salinas.

Calyptraea mamillaris Broderip. Salinas.

Crucibulum imbricatum Sowerby. This and the next are very common species along the Peruvian coast. Bayover, Paita, Negritos, Lobitos, Mancora, Salinas.

Crucibulum spinosum Sowerby. Same localities as the last.

Crepidula aculeata Gmelin. Very common along the entire coast.

Crepidula crepidula Linnaeus. Zorritos.

Crepidula incurva Broderip. Lobitos, Mancora.

Crepidula onyx Sowerby. Salinas.

Crepidula squama Broderip. Negritos, Lobitos, Mancora, Salinas.

Hipponix barbata Sowerby. Salinas.

**Natica broderipiana* Reclus. Negritos, Lobitos, Zorritos, Salinas.

Natica elenae Reclus. 1 specimen from Salinas.

Natica unifasciata Lamarck. Colonche.

Polinices uber Valenciennes. On Indian graves and living along the coast, Paita, Negritos, Lobitos, Salinas.

Polinices cora Orbigny ? Negritos.

Neverita glauca Humboldt. Negritos, Lobitos.

Sinum concavum Lamarck. Negritos, Mancora.

Sinum n. sp. This species belongs to the group of *S. perspectivus* Say, but is somewhat less depressed. From *S. debilis* Gould they differ in being larger, slightly less depressed, a smaller mouth and a little, higher spire. The nucleus is stained brown. I have specimens from Panama (Bucaru) and from Salinas, Ecuador.

Turbo magnificus Jonas. Bayover, Negritos, Lobitos.

Turbo (*Callopoma*) *saxosus* Wood. Salinas.

Astraea (*Uvanilla*) *buschii* Philippi. Zorritos, Salinas.

Tegula melaleuca Jonas. Lobitos.

Tegula panamensis Philippi. Lobitos.

Tegula smithii Tapparone-Canefri. Lobitos.

**Tegula viridula* Gmelin. Mancora.

Calliostoma fonkii Philippi. Negritos, Lobitos, Mancora, Salinas.

Fissurella crassa Lamarck. Negritos.

Fissurella (*Cremides*) *asperella* Sowerby. Negritos, Lobitos.

Fissurella (*Cremides*) *virescens* Sowerby. Salinas.

Fissuridea alta C. B. Adams. Negritos.

Fissuridea inaequalis Sowerby. Negritos, Lobitos, Zorritos.

Nucula exigua Sowerby. Common at Salinas.

Leda elenensis Sowerby. Common at Salinas.

**Leda* (*Adrana*) *crenifera* Sowerby? Mancora, Boca de Pan, Salinas.

Arca pacifica Sowerby. Negritos, Lobitos, Zorritos, Salinas.

Arca lithodomus Sowerby. 1 small, right valve was sorted out of shell-drift collected at Salinas.

Arca (*Noetia*) *reversa* Sowerby. Mancora, quite common at Zorritos, Salinas.

**Arca* (*Noetia*) *olssoni* Sheldon and Maury. Negritos, Salinas. The Peruvian specimens are somewhat larger than the Panama examples.

**Arca* (*Barbatia*) *lurida* Sowerby. A single left valve was collected at each of the following localities: Zorritos, Salinas. The type specimen was collected by Cuming from Santa Elena, probably in the vicinity of Salinas.

Arca (*Barbatia*) *reeveana* Orbigny. Quite typical examples. Lobitos, Zorritos, Salinas.

**Arca (Barbatia) reeveana* var. *lasperlensis* Sheldon and Maury. Several specimens, Zorritos, Salinas.

Arca (Barbatia) gradata Broderip and Sowerby. Negritos, Lobitos, Salinas.

**Arca (Barbatia) illota* Sowerby. Lobitos, Salinas.

Arca (Barbatia) solida Sowerby. Negritos, Lobitos, Salinas.

**Arca (Scapharca) emarginata* Sowerby. Paita, Negritos, Zorritos.

Arca (Scapharca) aviculoides Reeve. Salinas.

Arca (Scapharca) tuberculosa Sowerby. Very common along the entire coast and much used for food.

**Arca (Scapharca) obesa* Sowerby. Negritos, Zorritos, Salinas.

Arca (Scapharca) formosa Sowerby. Not common, Salinas, Zorritos.

Arca (Scapharca) grandis Broderip and Sowerby. Very common as a Pleistocene fossil in the Peruvian tablazos. Zorritos.

**Arca (Scapharca) nux* Sowerby. Common, Negritos, Lobitos, Zorritos, Salinas.

**Arca (Scapharca) aequatorialis* Orbigny. Zorritos.

Arca (Scapharca) labiata Sowerby. Colonche, rare on Indian mounds in Que. Seca.

Glycymeris chemnitzii Dall. Salinas.

Glycymeris inaequalis Sowerby. Bayover, Negritos, Lobitos, Mancora, Zorritos, Salinas.

**Glycymeris maculata* Broderip. Zorritos.

Pinna sp. Fragments of a large species from Bayover.

Pteria peruviana Reeve. The shells of the Peruvian Pearl Oyster are at times found in considerable abundance on the beach at Negritos. They were also common at Boca de Pan. Shells were also collected at Paita and Salinas.

Ostrea columbiensis Hanley. Jorritos.

Ostrea megodon Hanley. Paita, Negritos, Lobitos. This is a very common Pleistocene fossil in the Peruvian tablazos.

Pecten dentatus Sowerby. Lobitos, Salinas.

Pecten purpuratus Lamarck. Bayover, a common Pleistocene fossil.

**Pecten subnodosus* Sowerby. Negritos, Mancora, Salinas.

Pecten tumbezensis Orbigny. Paita, Negritos, Lobitos, Jorritos, Salinas.

Pecten ventricosus Sowerby. Negritos, Lobitos, Mancora, Zorritos, Salinas.

**Spondylus crassisquama* Lamarck. Negritos, frequently dug up from Indian graves.

Lima pacifica Orbigny. Negritos, Lobitos, Mancora.

Anomia adamas Gray. Common, Paita, Negritos, Lobitos, Mancora.

Anomia peruviana Orbigny. Somewhat less common than the last, Paita, Negritos, Lobitos. The *Placunanomia cumingii* Broderip occurs rarely as a Pleistocene fossil in the Peruvian tablazos, so that it is probably living along the present coast.

**Periploma planiuscula* Sowerby. Negritos, Lobitos, Mancora.

Cyathdonta undulata Conrad. Typical right valve was collected at Salinas.

**Cyathodonta* sp. Several broken specimens of another species were collected at Boca de Pan. In this species the concentric undulations become obsolete ventrally. The submicroscopic radial pustules seen on the surface of *undulata* are lacking.

Crassatellites gibbosus Sowerby. Mancora, Zorritos, Salinas.

**Carditamera radiata* Sowerby. Negritos, Mancora, Zorritos, Salinas.

**Venericardia cuvieri* Broderip. A right and a left valve belonging to 2 individuals were collected on the beach near Zorritos. The larger, a right valve measures, height 62 mm., length 66 mm.

**Chama corrugata* Broderip. Negritos.

Phacoides fenestratus Hinds. Salinas.

**Codakia galapagana* Dall. Boca de Pan, Zorritos, Salinas.

**Divaricella eburnea* Reeve. Mancora, Salinas.

Cardium senticosum Sowerby. Fairly common, Negritos, Lobitos, Mancora, Zorritos, Salinas.

Cardium procerum Sowerby. Common, Negritos, Lobitos, Mancora, Zorritos, Salinas.

**Cardium graniferum* Broderip and Sowerby. Zorritos, Salinas.

Cardium obovale Sowerby. Salinas.

Cardium magnificum Deshayes. Mancora, Zorritos, Salinas.

**Cardium aspersum* Sowerby. Lobitos, Mancora, Salinas.

Cardium elenense Sowerby. Salinas.

Dosinia dunkeri Philippi. Zorritos.

Tivela planulata Broderip and Sowerby. This is one of the most common shells on the beach at Lobitos and Negritos. It becomes very rare further north.

Macrocallista aurantiaca Sowerby. Salinas.

Macrocallista pannosa Sowerby. Boca de Pan.

Macrocallista squalida Sowerby. Salinas, Mancora.

Pitaria circinata Born. Mancora, Salinas.

Pitaria concinna Sowerby. Rather common, Negritos, Lobitos, Zorritos, Salinas.

Pitaria lupanaria Lesson. Quite common, Negritos, Lobitos, Mancora, Zorritos, Salinas.

**Antigona multicostata* Sowerby. Punta Verde, Salinas.

Chione compta Broderip. Quite common at Bayover, a common Pleistocene fossil.

Chione gnidia Broderip and Sowerby. Salinas.

**Chione amathusia* Philippi. Mancora, Zorritos, Salinas.

Chione (Timoclea) asperrima Sowerby. Colonche, Salinas.

Chione (Timoclea) columbiensis Sowerby. Rather common, Negritos, Lobitos, Mancora, Zorritos.

Anomalocardia subrugosa Sowerby. Bayover.

Venerupsis oblonga Lamarck. Common, Paita, Negritos, Lobitos.

Tellina crystallina Wood. Salinas, fine large specimens.

Tellina rubescens Hamley. Salinas.

**Macoma aurora* Hamley. Boca de Pan, Salinas.

Metis exvavata Sowerby. Mancora, Salinas.

Semele corrugata Sowerby. Bayover, Negritos, Lobitos, Mancora.

**Semele lenticularis* Sowerby. Mancora, Salinas.

**Semele proxima* C. B. Adams. Negritos, Lobitos, Zorritos.

Cumingia lamellosa Sowerby. Lobitos.

Cumingia mutica Sowerby. Boca de Pan.

Sanguinolaria hanleyi Bertin. Lobitos, Mancora, Salinas.

Tagelus dombeyi Lamarck. Bayover, Paita, Negritos.

**Tagelus ?* This may be the *Solecurtus violaceus* Sowerby. It is occasionally fairly abundant on certain parts of the beach at Negritos.

**Donax gracillis* Hanley. Negritos, Lobitos, Zorritos, Salinas.

Donax punctatostriatus Hanley. Very common on all sandy beaches. Paita, Negritos, Zorritos, Salinas.

Iphigenia altior Sowerby. Salinas, Colonche.

Mactra (*Mactrotoma*) *velata* Philippi. Rather common, Paita, Bayover, Negritos, Lobitos, etc., Salinas.

**Mactra* (*Mactrotoma*) *augusta* Deshayes. Rare, Zorritos, Salinas.

Mactra (*Mactrotoma*) *californica* Conrad. Fairly common at Salinas.

Mactra (*Mactrella*) *clisea* Dall. 1 specimen from Salinas.

**Mactra* (*Mactrella*) *exoleta* Gray. Boca de Pan, Playas.

**Mactra* (*Mactrella*) *elegans* Sowerby. Rare, Zorritos, Playas, Salinas.

Mulinia pallida Broderip and Sowerby. Common, Paita, Negritos, Lobitos, etc., Salinas.

**Labiosa* (*Raeta*) *undulata* Gould. Occasional on the beach but generally broken. Negritos, Lobitos, Mancora.

**Cryptomya californica* Conrad. Paita, Negritos (fairly common), Lobitos, Salinas.

Pholas chiloensis Molina. Paita, Negritos, Lobitos.

Barnea pacifica Stearns. Paita, Lobitos.

A NEW ZONITID SNAIL FROM SOUTHERN CALIFORNIA

BY S. STILLMAN BERRY, REDLANDS, CALIFORNIA

Several years ago Mr. George Willett sent me a single specimen of a small land snail of the group now known as *Polita*, which did not appear referable to any of the western species hitherto named. Since then enough additional material has come to hand from collections by Mr. Willett and by Mr. and Mrs. Emery P. Chace so that it seems fairly safe to describe it.

Polita gabrielina new species. Fig. 3.

Description: Shell small, thin, whitish horn color, translucent. Whorls 4½ to 5, regularly enlarging, smooth, except for the very weak and indistinct incremental lines; surface highly polished, with a waxy luster. Suture distinct, slightly impressed; spire scarcely elevated; base convex, umbilicate, the umbilicus narrow, being contained in the adult shell diameter

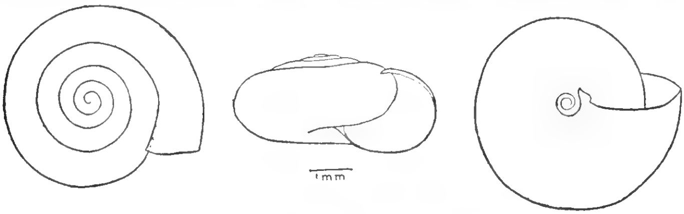


FIG. 3. *Polita gabrielina,* new species.

about $8\frac{1}{2}$ to $9\frac{1}{2}$ times, but deep and permeable; periphery smoothly rounded. Aperture oval, oblique, very slightly descending, the lip sharp and only a little reflected at the umbilicus.

MEASUREMENTS.

	Above Camp Baldy	Camp Estelle		
		Type	Paratype	Paratype
	mm.	mm.	mm.	mm.
Greater diameter	4.8	4.3	3.6	3.2
Lesser diameter	4.4	4.0	3.2	2.9
Altitude	2.5	2.2	2.0	1.7
Diameter umbilicus . . .	0.5	0.5	0.36	0.43
Number of whorls . .	5	$4\frac{1}{2}$	$4\frac{1}{2}$	4

Type: Cat. No. 5033 Berry Collection; paratype in collection of Academy of Natural Sciences of Philadelphia.

Type locality; Alt. 5,100–5,200 ft., near Camp Estelle, Upper San Antonio Canyon, San Gabriel Mountains, California; E. P. and E. M. Chace, June 2, 1920; 3 specimens.

Additional localities: Specimens of the same species are before me from other localities as follows:

Alt. 5,500 ft., Icehouse Canyon, San Gabriel Mts., California (from a wood rat's nest); George Willett, Oct. 3, 1918; 1 dead shell.

Above Camp Baldy, San Antonio Canyon, San Gabriel Mts., California; E. P. and E. M. Chace, 1919; 1 dead shell.

Bear Canyon, San Gabriel Mts., California; E. P. and E. M. Chace, June, 1920; 1 specimen.

Alt. 3,200 ft., Glenn Ranch, North Fork of Lytle Creek, San Gabriel Mts., California; E. P. Chace, Dec. 27, 1920; two living specimens.

Remarks: The western Politas are so little understood, and even those already named so incompletely worked out in the literature, that it becomes a matter of no small difficulty to allocate new material satisfactorily. Before venturing to apply a new name to the present specimens therefore, I have been at no small pains to compare them directly with either specimens or available published descriptions of all the other western species of the genus known to me. In the case of such conspicuously diverse species as *indentata* (Say), *binneyana* (Morse), *diegoensis* (Hemphill), *shepardi* (Hemphill), and *chersinella* (Dall),—this last perhaps only doubtfully a *Polita*,—no special keenness of discrimination seems required, but the remaining species have given a little more trouble. I would not have been surprised to find the Sierran *whitneyi* (Newcomb) fairly near, but this is said to be "smoky horn color" and to have a wide "perspective umbilicus" similar to that of *Gonyodiscus striatellus*. From the little *P. johnsoni* (Dall) of the Puget Sound region, our specimens differ both in their immensely larger size and their perforate umbilicus. *Subrupicola* (Dall) and the similar *spelaea* (Dall) are also possible near relations, but throughout are compared by their author to *indentata*, to which they are said to be "precisely similar" in umbilical characters, a statement which could hardly be made of the present species.

The station of *P. gabrielina* is peculiar, as the species has thus far been discovered only among loosely piled debris in quite dry situations; altogether different from those sought by most other Southern California mountain snails, and no other mollusks have yet been noted in association with it. For a *Polita* it is a very pretty species, its pale hue and waxen polish adding much to its attractiveness.

A NEW ALASKAN PUNCTURELLA

BY WM. H. DALL

PUNCTURELLA EYERDAMI, new species.

Shell small, conic, elevated, whitish, the apex recurved with the foramen somewhat in front of it; apart from the apical curve the anterior and posterior slopes are about equal, the anterior slightly convex, the posterior straight; from the apex radiate faintly elevated lines to the basal margin which they do not crenulate; between these are numerous radiating rows of minute punctures, which in combination with the moderately conspicuous incremental rugosities give the surface a sagrinate appearance under the lens. The basal outline is evenly oval, the interior polished white, the septum reaching about one third of the way toward the base, without props. Length, 8; height, 5.5; diameter, 6 mm. U. S. Nat. Mus., Cat. No. 360136.

Drier Bay, off Knight Island, Prince William Sound, Alaska. Walter Eyerdam.

No other punctate species is known from the coast, and this one cannot be mistaken for any other West American form if closely examined.

ON TRIODOPSIS HARFORDIANA W. G. B.

BY H. A. PILSBRY

"*Triodopsis harfordiana* J. G. Cooper" was described and figured by W. G. Binney in Terrestrial Mollusks vol. v, 1878, p. 309, fig. 203. He thought that the species was the same described by J. G. Cooper in 1870 as *Dædalochila harfordiana*, to which he incorrectly refers as "*Helix harfordiana* J. G. Cooper."

In Man. Amer. Land Shells, 1885, p. 114, Binney substituted new figures, drawn from Cooper's type specimen, but reprinted his own former description. Here he called the species *Polygyra harfordiana* J. G. Cooper, and repeated the earlier erroneous reference to Cooper's description. On page 119 he reprinted his 1878 figures of "*Triodopsis harfordiana*" as one of the (nameless) forms of *Mesodon devius.* This amounted to refering his *description* to one species, his *figures* of the same specimen to another. In 1886, Bull. M. C. Z. XIII, No. 2, p. 37, Binney reclaimed *Triodopsis harfordiana* as a distinct species, giving new description and figures.

Recognizing the distinctness of the two shells named *harfordiana* by Cooper and by Binney, Tryon in September, 1887 (Man. of Conch. III, p. 146), proposed the new name *Helix salmonensis* for *Triodopsis harfordiana* W. G. Binney.

Still later, C. F. Ancey proposed the new name *Helix commutanda* for Binney's *T. harfordiana* (Conchol. Exch. II, December, 1887, p. 79).

The synonymy of these species will therefore stand thus:

POLYGYRELLA (POLYGYROIDEA) HARFORDIANA (J. G. Cooper).

Dædalochila harfordiana J. G. Cooper, Amer. Journ. Conch. V, p. 196, pl. 17, fig. 8.

Helix harfordiana J. G. C., Tryon, Man. Conch. III, 1887, p. 130, pl. 27, figs. 55–57.

Polygyra harfordiana J. G. C., W. G. Binney, Man. Amer. Land Shells, 1885, p. 114, fig. 81, not the description.

Helix (Polygyrella) harfordiana Cooper, Pilsbry, Proc. A. N. S. Phila., 1890, p. 200, pl. 5, figs. 12, 13, 14. Also reprinted in NAUTILUS V, 1891, p. 40.

Polygyrella harfordiana (J. G. Cooper), Pilsbry, Man. Conch. IX, p. 80

Big Trees, Fresno Co., California, at 6500 feet elevation, W. G. W. Harford.

The unique type of this snail has been figured by the writer. It has been referred to *Polygyrella*, but while it agrees with that genus in texture, general form and unexpanded lip, it differs by lacking internal teeth, and by having a tridentate aperture. The new subgenus *Polygyroidea* is here proposed for it.

This is one of the rarest Californian land shells. It does not appear to have been collected since the original find.

POLYGYRA (TRIODOPSIS) SALMONENSIS (Tryon)

Triodopsis harfordiana J. G. Cooper, W. G. Binney, Terr. Moll. V, 1778, p. 309, fig. 203 (not *Dædalochila harfordiana* J. G. Cooper).

Polygyra harfordiana J. G. Cooper, W. G. Binney, Man.

Amer. Land Shells, 1885, p. 114, description only; not the figures.

Mesodon devius var. W. G. B., op. cit., p. 119, fig. 88.

Triodopsis harfordiana W. G. Binney, Bull. M. C. Z. XIII, pt. 2, p. 37, pl. 1, figs. 6, 7.

Helix salmonensis Tryon, Man. of Conch. III, p. 147 (Sept. 2, 1887).

Helix commutanda Ancey. Conchologists' Exchange, II, p. 79 (December, 1887).

Salmon River Mountains, Idaho, collected by Henry Hemphill.

Binney's figured holotype is no. 11116 A. N. S. P. This specimen becomes also type of *salmonensis* and *commutanda.*

Tryon also proposed the new name *Helix binominata* for *Triodopsis hemphilli* W. G. Binney; but as the latter was not a homonym, as he supposed, that change was superfluous.

INTERESTING FACTS IN THE HISTORY OF UNIO ORBICULATUS HILDRETH AND U. ABRUPTUS SAY

BY L. S. FRIERSON

Under the name of *Unio orbiculatus* Hildreth Dr. R. E. Call minutely described the *Unio abruptus* Say in the Mollusca of Indiana (1900), and figured the latter on plate 50 of the same work. Dr. Call observed (*Ibid.*, p. 493), that Hildreth and the "earlier naturalists" seemed to have considered his species as closely akin to the short and thick variety of the *Unio ligamentinus* Lamarck found in the Ohio.

Notwithstanding that perhaps almost every student of the North American naiades would agree with the above, there are involved in it no less than three separate errors. Firstly, Hildreth knew nothing of the *Unio crassus* Say, but only knew the quite different conception of "*crassus*" had by *Mr. Barnes!* Secondly, the "earlier naturalists" did not consider Hildreth's species as being at all closely related to either the *crassus* of Say nor to that of Barnes!

With one accord, Say, Conrad, Ferussac (and other lesser lights), placed Hildreth's species in the synonymy of the *Unio subrotunda* Rafinesque. Dr. Lea, who was ever on the alert to save his own names, rescued his name of *Unio circulus* by placing Hildreth's *orbiculatus* in the synonymy of the closely allied *Unio torsus* Rafinesque, in his first list of American Unio (1829).

But Say died in 1834, and two years later Dr. Lea issued his first Synopsis of the Naiades (1836), and in this work he changed his placement of Hildreth's species, giving it as the antecedent of *Unio abruptus* Say.

Because of the absence of Say, and the practical inaccessibility of Hildreth's description, the last, *but by no means the best,* guess of Lea has been accepted ever since.

In the work cited of Call (p. 493) the description given by Hildreth was said to be "repeated", but by some miscue, perhaps the most important portions of the original were omitted in the reprint!

The writer will not undertake to copy Hildreth's description, since the greater part of it applies as well to any Unio, but will merely cite a few of the original criteria, showing how impossible its identification as being the *Unio abruptus* Say is. Since Hildreth (in common with Barnes and others) mistook the "anterior for the posterior", such portions of his observations as embrace this conception will be changed to suit modern usage.

"Shell nearly round; inflated; length 2.5, altitude 2.5, diameter 1.75." The critical student will note that the above corresponds *exactly* with some specimens of the ("*U. torsus*"), modern *Obovaria retusa* Lamarck, but absolutely not with any *Unio abruptus* Say thus far recorded!

"Posterior lunule broad heart shaped". Here again we have a feature often to be seen in the *retusa*, but a "broad heart shaped" posterior view of the *abruptus* has yet to be seen. It might be well to note also, that the above observation carries with it the implicit statement, that the beaks of the species are "*incurved*"—a feature often seen in *retusa* but scarcely in the other.

"Beaks somewhat prominent; projecting forward". It is scarcely worth while calling the attention of the reader to the direction in which the above observation leans.

"Cardinal teeth elevated, angulated, deeply sulcated". As to the cardinal teeth of "*abruptus*", Call himself (ibid. page 492) writes that they are "nearly smooth", in which he is correct. Those of the "*retusa*", the reader may prove by inspection of several, are in fact, remarkably "sulcated".

"Nacre flesh color, and very iridescent with purple and violet". Such coloring in the *abruptus* has never been seen by the writer, but applies very well to some specimens of the *retusa*. The nacre of the latter is generally said to be "deep purple", but it is sometimes white, and sometimes with a blush of pink; especially when young.

An attentive reading of Hildreth's description will show that his shell was correctly placed by the earlier naturalists—for it must be remembered that the several species called *subrotunda*, *torsus* etc., might have been lumped together by them. Say at any rate never mentioned the *torsus* or *retusa* in any of his writings.

Whether Hildreth's species be the *subrotunda* or the *retusa* is merely of academic interest; the facts which interest us being that it is absolutely *not* Say's species, *Unio abruptus;* and the latter name, after resting in the synonymy for almost a hundred years, must be used as the valid name of what has been incorrectly called *Unio orbiculatus* Hildreth.

GAYLE, LOUISIANA.

NOTES ON THE ANATOMY AND TAXONOMY OF CERTAIN LAMPSILINAE FROM THE GULF DRAINAGE

BY A. E. ORTMANN, PH. D.

(*Continued from page 105*)

8. MICROMYA VANUXEMENSIS UMBRANS (Lea) (1857).

See: *Lampsilis propria* and *umbrans=vanuxemensis*, Simpson, 1914, p. 105 and 103.

E. vanuxemensis, of the Cumberland-Tennessee-system, has also been reported from the upper Coosa drainage. The following accepted synonyms are from this region.

U. umbrans (=*umbrosus*), Lea, 1857. A typical female in shape, with dark brown epidermis and dark purple nacre.—Othcalooga Creek, Gordon Co., Ga.

U. tenebricus Lea, 1857. The figure represents a male, with dark brown epidermis and purple or salmon nacre.—Etowah River, Ga.

U. fabaceus Lea, 1861. A male, not full grown. Epidermis dark brown, nacre purplish and salmon near the margin.—Oostanaula River, Ga.

Another, very closely allied form, has been reported from this region: *U. proprius* Lea (1865). Simpson (p. 104) suspects that it may be only a smaller and paler form of *vanuxemensis*. It originally comes from Lafayette, Walker Co., Ga. (headwaters of Chattooga River). But, remarkably enough, Simpson gives it also from Clinch River, Va. Now, in the upper Tennessee region, occasional specimens of *vanuxemensis* turn up which are lighter in color of the epidermis and nacre, and, if they are also small, they would very well agree with *proprius*. But in this region, they form only an individual variation, and a very rare one.

In the Coosa drainage, specimens with lighter color of epidermis and nacre prevail, as is shown by the rich material from this region before me. But they are by no means smaller than the normal *vanuxemensis*. There are specimens fully as large as the general run of *vanuxemensis* in the upper Tennessee, although, exactly as in the latter, they seem to remain uniformly smaller in certain creeks. On the other hand, with regard to the color of the epidermis and nacre, there are, in the Coosa drainage, specimens fully as dark as the normal *vanuxemensis*, but such specimens are rare, and, if found, are mostly associated with lighter ones. From many places, only the light form is at hand. As a rule, old and worn specimens are the ones which incline toward the darker tints. Thus we have the following conditions: in the Tennessee-drainage, there is a dark form, the typical *vanuxemensis*, which rarely shows an inclination to become lighter; in the Coosa drainage, there is a light form, which sometimes shows an inclination to become darker. The light shells from the Tennessee cannot be distinguished from the normal Coosa-form; and the dark shells of the latter cannot be told apart from the normal Tennessee-form. These are exactly the conditions which are required for the separation of these forms as varieties of *one* species.

The normal form of the Coosa has been called *U. proprius* Lea (1865). However, also *umbrans, tenebricus,* and *fabaceus* belong to this stock, the oldest name being *umbrans* Lea (1857) (has only page precedence over *tenebricus*). Unfortunately, this name, founded upon two females only, stands for the dark phase of the Coosa-form, and the same is true also for *tenebricus* and *fabaceus.* But they cannot be separated upon this ground from the lighter form (*proprius*); they are simply individual variations of it.

I have two males from Othcalooga Creek, which are topotypes of *umbrans,* and they have the epidermis olive-brown near the beaks, but lighter (light brown) upon the sides. In the larger, the nacre has that beautiful, characteristic salmon tint of the Coosa-form; the smaller is pale salmon inside, whitish on the margin. Already Lea says, that there is a "disposition to yellowness" on the sides. Thus I have no doubt that he had only two unusually dark specimens before him.

The name of the Coosa-form should be: *Micromya vanuxemensis umbrans* (Lea) (1857), with the synonyms: *U. tenebricus* Lea (1857); *U. falaceus* (1861); *U. proprius* Lea (1865).

I have investigated the anatomy of the following material.

Conasauga River, Conasauga, Polk Co., Tenn.—1 barren, 2 gravid females (with glochidia), A. E. Ortmann coll., May 24, 1915,

Shoal Creek, St. Clair Co., Ala.—1 male, 2 gravid females (with glochidia), H. H. Smith coll., Oct., 1914.

Morgan Creek, Shelby Co., Ala.—5 males, 2 barren females, H. H. Smith coll., July 3, 1914.

The structure of the soft parts is absolutely identical with that of the typical *vanuxemensis* (see: Ann. Carn. Mus. 8, 1912, p. 342; NAUT. 1915, p. 65; 34, 1921, p. 91). Also here the glochidia vary a little in size: L. 0.21 to 0.23, H. 0.27 to 0.30 mm.

Attention should again be directed to the geographical distribution. This species is found, first, in the Cumberland-Tennessee drainages; then there is an Alabama-form closely allied to it, so that it can be separated only as a variety, indicating that it must have reached the Coosa-drainage by crossing over from the Tennessee. The complete absence of this type of shell from the Mississippi valley, the coastal plain, and the lower parts of the Alabama-system, renders the idea impossible that it might have come from those parts, migrating from West to East.

9. Micromya lienosa concestator (Lea) (1857).
See: Simpson, 1914, p. 100 and 102.

Simpson admits the close affnity of *concestator* to *lienosa*, and says that *lienosa* differs in being larger and solider, in being darker and not quite so shining. It is said to be found from the Mississippi and lower Ohio drainage to southwestern Georgia, with the type-locality in southern Alabama, while *concestator* is said to be distributed from North Carolina to Louisiana, and possibly Texas. *M. lienosa* thus would be more western and northern, *M. concestator* more southern and eastern, the two forms overlapping in the Gulf drainage.

Examining my material, which comes from nearly the whole range of these two forms (Ga., Ala., Miss., La., Ark., Ky., and Ind.) I am able to verify these differences at least to a certain degree, but surely size and solidity do not hold good. Specimens from the West, indeed, generally are rather black in color, but I observe the same color in specimens from the Choctawhatchee drainage in southeastern Alabama and from the Chattahoochee in Georgia. Individuals with more brownish epidermis, and then often with more distinct rays, it is true, are more abundant towards the East, but in Alabama they are often associated with and grade into more blackish forms, so that no sharp line can be drawn.

These conditions make it impossible to distinguish the two forms as *species*. The best we can do is to separate them as *varieties*, and to call the more eastern, brownish form: *Micromya lienosa concestator*. But we must remember that there will be cases where it is hard to decide to which form a particular specimen may belong.

Among a number of specimens received from the Alabama Museum and labeled by Walker, it is very evident that this difficulty was encountered. Of specimens labeled *concestator*, I have soft parts from the following localities.

Choctawhatchee River, Blue Springs, Barbour Co., Ala.—2 males, H. H. Smith coll., May 11, 1915.

East Choctawhatchee River, Dale Co., Ala.—1 male, 1 gravid female (glochidia), J. A. Burke coll., Nov., 1915.

The anatomical structure of these is identical with that of *M. lienosa* as described previously (Ann. Carnegie Mus. 8, 1912, p. 340, and NAUT. 30, 1916, p. 55). Also the glochidia are of the same shape and size (see: ibid. 1912, pl. 20, f. 5).

10. LAMPSILIS CLAIBORNENSIS OBTUSA (Lea) (1840). (Synonym of L. *claibornensis*, according to Simpson, 1914, p. 70).

From the Choctawhatchee drainage I have 5 shells labeled *Lampsilis obtusa* by Walker. They fully agree with Lea's description of this form, and H. H. Smith remarks: "Simpson makes this a synonym of *claibornensis*: I should call it a good subspecies anyway".

These specimens differ from *claibornensis* in having a more delicate shell and the color of the posterior slope, which is dark brown (or dark greenish in young shells), contrasting with the yellowish of the rest, and produced by the confluence of the indistinct rays. This form might be, indeed, a local race of *claibornensis,* belonging to the Choctawhatchee and Chattahoochee Rivers, or even a species taking its place in these parts; the final decision depends, however, on the investigation of more material.

The affinity of this form to *claibornensis* is clearly shown in its anatomy. I have received the following soft parts.

Choctawhatchee River, Blue Springs, Barbour Co., Ala.—1 gravid female (with glochidia) (without the shell), H. H. Smith coll., May 11, 1915.

Pea River, 4 miles N. of Elamville, Barbour Co., Ala.—2 young males (shells and soft parts) J. A. Burke coll., Nov., 1915.

The gravid female has the anatomy agreeing with that of *L. claibornensis* (and that of *L. siliquoidea,* for that matter) (see: Ann. Carn. Mus. 8, 1912, pp. 348, 349). The "large dark papillae below the branchial opening", described by Lea (1863, p. 406) for *obtusus,* undoubtedly refers to the "flap", the projecting anterior portion of the inner edge of the mantle in front of the branchial. The glochidia have also been described and figured by Lea (1858, p. 46, pl. 5, f. 1), and their measurements given as: L. 0.192, H. 0.256. I found them to agree with those of *claibornensis*: L. 0.21, H. 0.27 mm.

11. LAMPSILIS EXCAVATA (Lea) (1857).
See: Simpson, 1914, p. 41.

When I described the anatomy of this species (Ann. Carn. Mus. 8, 1912, p. 352), I did not have any females. The glochidia were known then from the description and figure given by Lea (1874, pl. 21, f. 6). I have now the following soft parts.

Forks of the Black Warrior River, Walker Co., Ala.—1 gravid female, H. H. Smith coll., Oct. 15, 1912.

This female shows the mantle flap developed exactly as in *L. ovata* (Say) (and related forms); posteriorly, it is lamellar with almost smooth edge (only with traces of crenulations); anteriorly, it projects in the shape of a lacerated lobe. On the inside, there is a black-brown streak.

The glochidia are subovate, of the same shape as in *L. ovata*, L. 0.20 to 0.21, H. 0.24 to 0.25 mm. This differs from the dimensions given by me previously for *L. ovata* and *L. ovata ventricosa* (as: L. 0.24 to 25, H. 0.28 to 0.29). *These latter dimensions, however, are a mistake.* Subsequent measurements of my old material have shown that the figures are the same as in *L. excavata*. Also the glochidia of *L. ovata satura*, L. 0.22, H. 0.25 (NAUT. 30, 1916, p. 56) agree with these. Already Surber (Bur. Fisher, doc. no. 771, 1912, p. 9) has correctly given the dimensions of the glochidia of *L. ovata ventricosa* as: 0.205 × 0.255, and of *L. satura* (ibid. no. 813, 1915, p. 6) as: 0.205 × 0.245 mm.

12. LAMPSILIS CLARKIANA (Lea) (1852).
Synonyms: *Unio clarkianus* Lea (1852); *U. spilmani* Lea (1861); *U. gerhardti* Lea (1862). (Simpson, 1914, pp. 53, 54, makes the first two synonyns, while he has the third as a separate species).

The *type-locality* of *U. clarkianus* is said to be Williamsport, Maury Co., Tenn. (on Duck River), but there is no doubt that this is a mistake. Lea gives also: Georgia *or* Alabama, and Simpson specifies: Cahaba and Black Warrior Rivers, Ala.

U. spillmani is from "Luxpalila Creek" (=Lookapallila or Floating Turtle Creek), near Columbus, Lowndes Co., Miss. (Tombigbee drainage), and *U. gerhardti* is given from "Chattanooga, Ga.", which probably means Chattooga River, Ga. (trib. to Coosa). In addition, Simpson gives for this: Shorter, Macon Co., Ala. (Tallapoosa drainage). Thus these forms seem to be widely distributed over the Tombigbee-Alabama system.

All these forms resemble each other in general shape, and differ only in color of epidermis and nacre. Simpson has already united the first two; but I have no doubt that also *gerhardti* is the same shell. This differs only by the generally lighter, yellowish, color of the epidermis, with poorly developed rays, while the others are yellowish, brownish or blackish, with or without rays. A specimen collected by myself in Chattooga River is to be regarded as a *topotype* of *gerhardti*, and closely resembles this form. But I cannot sharply distinguish it from others before me, which resemble the darker *clarkianus*-type, because there are all transitions.

This species is analogous to *L. ovata ventricosa* (Barnes) of the interior basin. The color of the epidermis varies a good deal, from yellowish (chiefly in younger shells) to brownish. sometimes quite dark brown. Rays may be absent or present, narrower or wider. The nacre is whitish, often tinted salmon in the cavity. It is a rather compressed shell, and resembles, in shape, the male of *L. ovata ventricosa*, but is slightly more elongated. The greatest difference from the latter, however, is found in the postbasal expansion of the female, which, in *clarkiana*, is much less developed, and situated more anteriorly, so that the female shell is not subtruncated posteriorly, but produced into a point. The male and female shells are comparatively little differentiated, so that it is hard to tell them apart; there is a gentle projection in the postbasal region of the female, but this does not reach, by any means, the proportions seen in *ventricosa*.

I have the following material:

Conasauga River, Conasauga, Polk Co., Tenn.—1 female, with soft parts, coll. by myself, May 24, 1915.

Chattooga River, Trion, Chattooga Co., Ga.—1 gravid female (with eggs), coll. by myself, May 19, 1915.

Beaver Creek, St. Clair Co., Ala.—1 specimen, probably male, H. H. Smith coll. (identified by Walker as *clarkiana*).

Coosa River, Coosa Valley, St. Clair Co., Ala.—1 spec., young, H. H. Smith coll. (identified by Walker as *clarkiana*).

Choccolocco Creek, Jackson Shoals, Talladega Co., Ala.—1 spec., young, H. H. Smith coll. (identified by Walker as *clarkiana*).

Talladega, Talladega Co., Ala.—1 spec., probably male, Hartman collection (originally labeled *spillmani*).

Sipsey River, Elrod, Tuscaloosa Co., Ala.—2 spec., probably females, H. H. Smith coll. (labeled by Walker *clarkiana*).

Buttahatchee River, Hamilton, Marion Co., Ala.—7 spec., at least 2 females among them, H. H. Smith coll. (labeled by Walker *clarkiana*).

It should be noted that all specimens from the Tombigbee drainage have more brownish epidermis (lighter or darker), while yellowish epidermis prevails in shells from the Coosa system, yet a few of the latter are also brownish.

Of the two females I collected with soft parts, the one taken on May 19 in Chattooga River has eggs, but not glochidia. This would indicate the beginning of the breeding season in the spring, and is *entirely abnormal.* But it is known that also in other cases the breeding season becomes irregular in the southern states.

The anatomy agrees with that of *L. ovata ventricosa*, *excavata*, and related forms. The mantle flap is similar to that of these forms, with a free lobe anteriorly, not very distinct in my specimens, since it is contracted by the action of the alcohol, but several large teeth or lacerations are seen. The edge of the posterior part of the flap is nearly smooth, with a few indistinct crenulations. Also the color on the inside is normal: brownish, with a black longitudinal streak, but, on account of the contracted condition, I cannot recognize that peculiar eye-spot. There is no question that this species belongs in the *ovata*-group of *Lampsilis*.