THE

NAUTILUS

A QUARTERLY JOURNAL
DEVOTED TO THE INTERESTS
OF CONCHOLOGISTS

VOL. XXXV

JULY, 1921, to APRIL, 1922

EDITORS AND PUBLISHERS

HENRY A. PILSBRY

Curator of the Department of Mollusca, Academy of Natural Sciences
PHILADELPHIA

CHARLES W. JOHNSON

Curator of the Boston Society of Natural History
BOSTON

INDEX

TO

THE NAUTILUS, XXXV.

INDEX TO TITLES, GENERA AND SPECIES.

INDEX TO AUTHORS.

THE NAUTILUS.

Vol. XXXV JULY, 1921. No. 1

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, re-

corded 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 con-

firmation. 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 5½, 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

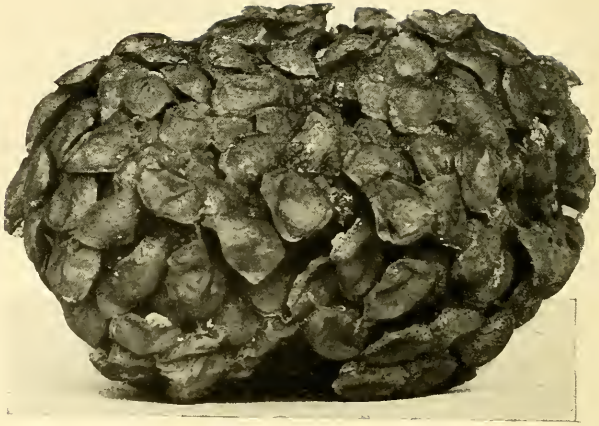
anatomy of Hawaiian land snails at the Academy of Natural Sciences of Philadelphia for the past nine months, has returned to Honolulu. He expects to resume his studies in Philadelphia next September.

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.

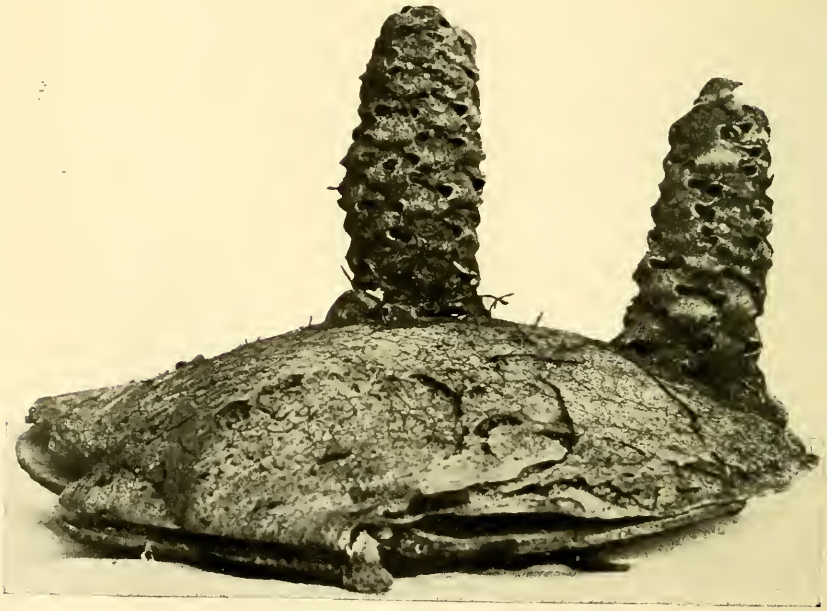
Mr. Frank C. Baker, curator of the Museum of Natural History, University of Illinois, will spend the summer in Wisconsin, continuing his study of the molluscan fauna under the auspices of the Wisconsin Geological and Natural History Survey.

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.



1



2

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

THE NAUTILUS.

Vol. XXXV OCTOBER, 1921. No. 2

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 fisher-

men "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 calcarea 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.

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 re-

mains 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	5⅔	5½	5¼

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 5¾ 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	5½	5¾	5¾

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 southeast 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.	Santa Monica, 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 nar-

rower 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 Malacological 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 mandi-

bles, 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 anteriodorsolaterally 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 defini-

tely: "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.*

References:

1864, Alder, J. and Hancock, A. Notice of a collection of Nudibranchiate Mollusca made in India, by Walter Elliot Esp., with descriptions of several genera and species. *Tethidae*, Ald. & Hanc. Trans. Zool. Soc. London, 5.

1863, Bergh, R. *Campaspe pusilla,* en ny clægtform af Dendrofotidernes gruppe, samt bemærkinger om Dotidernes familie. Prof. J. C. Schiödte, Naturhistirisk Tidsskrift, 3 Række, 1 bind, 3 hefte. Kjöbenhavn.

1871. *Doto,* Oken; *Scyllaea pelagica.* Beiträge zur Kenntniss der Mollusken des Sargassomeeres. Verh, zool,-bot. Gesell. in Wien, Bd. 21, Seit. 1275-1276, 1288, 1292.

1875, C. Semper, Reisen im Archipel der Philippinen, II, 2, Heft. 9.

1880, Beiträge zur Kenntniss der Japanischen Nudibranchien I, (*Melibe vexillifera*), Verh. zool.-bot. Gesell., 30.

1884, Beiträge zur Kenntniss der Gattung *Melibe* Rang (*Melibe papillosa De Filippi*). Z. wiss. Zool., 41.
1888, Beiträge zur Kenntniss der Aeolidiaden IX, (*Melibe ocellata*). Verh. zool,-bot. Gesell. Wien, 38.
1890, Die Nudibranchien des " Sunda-Meeres ". C. Semper, Reisen im Archipel der Philippinen II, 2, Heft. 17.
1892, Ibidem, wissenschaftliche Resultäte III, malacologische Untersuchungen, Heft. 15-18.
1902, Den Danske Expedition til Siam I, (1899-1900), Opisthobranchiata, (*Melibe bucephala*). D. kgl. Danske Vidensk. Selsk. Skrif., 6 Række, 12.
1904. *Nudibranchiata kladohepatica,* (*Melibe pellucida*), on the Columbia River, Washington. C. Semper, Reisen im Archipel Philippinen, wiss. Resultäte, 9, VI. Lief I.
1908, The *Opisthobranchiata* of South Africa; Tethymelibidæ. Trans. S. Africa Phil. Soc., 17.
1863, Cooper, J. G. On new or rare Mollusca inhabiting the Coast of California, II. Proc. Calif. Acad. Nat. Sci., 3, (1863-1867) p. 60.
1902, Eliot, C. N. E. On some Nudibranchs from Zanzibar. Proc. Zool. Soc. London, 2.
1889, Fewkes, Walter J. New Invertebrata from the Coast of California. Printed for the Author: Boston.
1867, De Filippi, (On *Jacunia papillosa,* syn. *Melibe papillosa,* etc.). Atti della R. Accademia della Scienze di Torino pubblicati dagli Accademici Secretari delle due Classi. Volume 2, 1866-1867.
1852, Gould, Agustus A. Mollusca and Shells (*Chioraera leonina,* syn. *Melibe leonina* Gould). United States Expedition, during Years 1838, 1839, 1840, 1841, 1842. Under the Command of Charles Wilkes, U. S. N. Boston. p. 310.
1919, Kjerschow-Agersborg, H. P. Notes on *Melibe leonina* (Gould). Pub. Puget Sound Biol. Station, 2, No. 49.
1921, Contribution to the knowledge of the Nudibranchiate Mollusk *Melibe leonina* (Gould). Amer. Nat., 55.
1922, The morphology of the Nudibranchiate Mollusk *Melibe* (*s. Chioraera*) *leonina* (Gould). ~~Jour. Morph.~~ Q. J. M. S.
1921, O'Donoghue, Chas. H. Nudibranchiate Mollusca from the Vancouver Island Region. Trans. Royal Canad, Inst., Toronto, 13, No. 1.
1860, Pease, W. Harper, Description of a new species of Mollusca from the Sandwich Islands, (*Melibe pilosa*). Proc. Zool. Soc., London, Part 28, p. 34.
1829, Rang, Sander, *Mélibée melibe,* Rang. Manual des Mollusques, pp. 129-130. Paris.

1876, Tapparone-Canefri, C. Genere *Melibe* Rang; *Melibe papillosa* De Filippi. Memorie della Reale Accademia delle Scienze di Torino. Sér. 2, T. 28, pp. 219-220.
1883, Tryon, Jr., George W. Structural and systematic conchology. Mollusca, 2.

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 consequently 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.

Museum, California Academy of Sciences.

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."

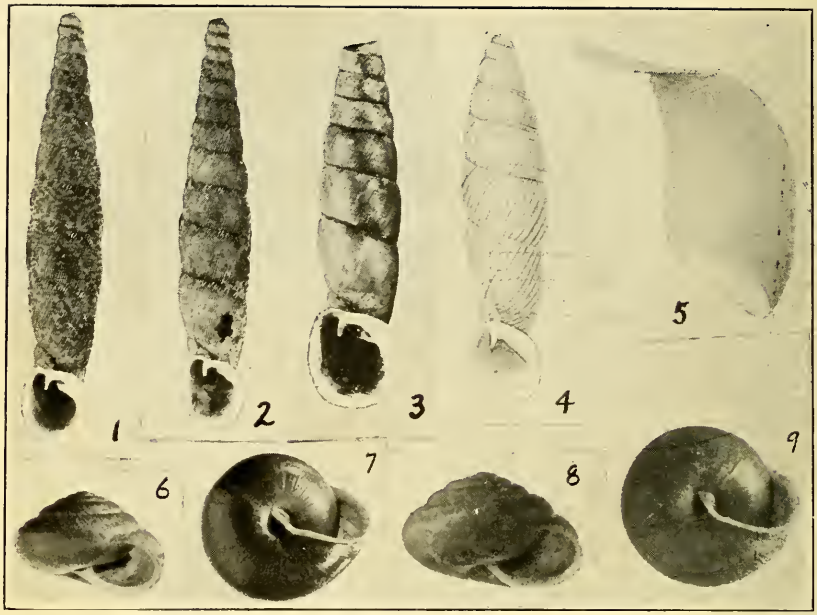
In the same work is the following note bearing on a fresh water mussel: "In 1824 the Linnean Society received the first recorded British specimens of the zebra mussel (*Dreissensia polymorpha*), these having been found in abundance attached to shells and timber in the Commercial Docks on the Thames. 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

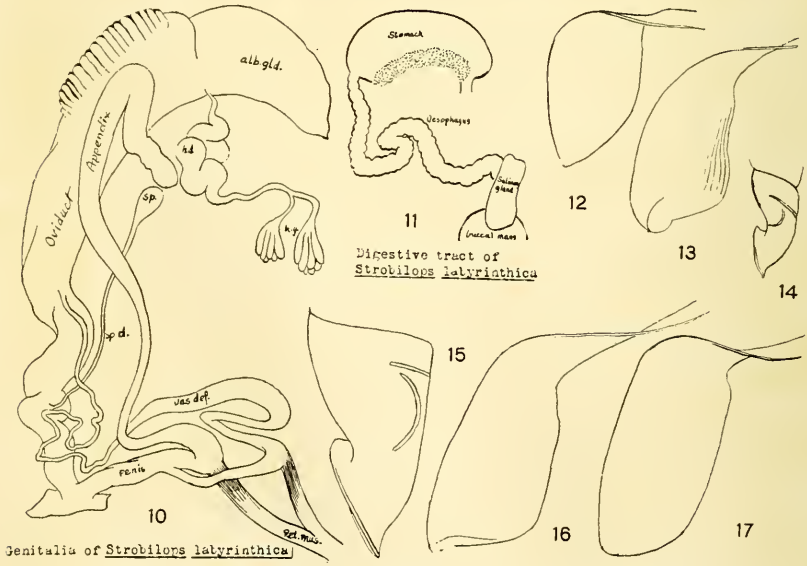
timber was removed from the ship's hold. The success of the zebra mussel as a colonist has been remarkable. It has spread from one locality to another until it has stations in some twenty English counties. In Scotland it is common in the Paisley canal and in the Forth and Clyde canal, where it used to 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.





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.

THE NAUTILUS.

Vol. XXXV JANUARY, 1922. No. 3

A SEARCH FOR 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 tideway, 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 direc-

tion, 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).

List of References.

1. Bergh, R. Beitr. zur. Kenntniss den Aeolidiaden, vi. Verh. d. K. Zool-bot. Ges. in Wien xxviii, 1878, p. 578.
2. Bergh, R. "On the nudibranchiate Gasteropod Mollusca of the North Pacific Ocean, with special reference to those of Alaska," Pt. I. Proc. Ac. Nat. Sci., Philadelphia, Pt. I, 1879.

3. Cockerell, T. D. A. "Notes on Two Californian Nudibranchs." Jour. Malacol., Vol. viii, No. 4, Dec., 1901.
4. Cockerell, T. D. A. and Eliot, C. "Notes on a Collection of Californian Nudibranchs." Jour. Malacol., xii, Pt. 3, 1905.
5. Cooper, J. C. "Some new genera and species of California Mollusca." Proc. Cal. Ac. Nat. Sci., Vol. ii, 1862.
6. Cooper, J. C. "New or Rare Mollusca Inhabiting the Cost of California," Pt. II. Proc. Cal. Ac. Nat. Sci., Vol. iii, Pt. I, 1863.
7. Eschscholtz, F. "Zoologischer Atlas." Viertes Heft. Berlin, 1831.
8. O'Donoghue, C. H. "Nudibranchiate Mollusca from the Vancouver Island Region." Trans. Roy. Canadian Inst., Vol. xiii, No. 1, 1951.
9. O'Donoghue, C. H. "Notes on the Nudibranchiate Mollusca from the Vancouver Island Region," I. Colour Variations. Trans. Roy. Canadian Inst. (in press).
10. O'Donoghue, C. H. *Ibid.*, III. Records of Species and Distribution. Trans. Roy. Canadian Inst. (in press).
11. O'Donoghue, C. H. and O'Donoghue, E. *Ibid.*, II. The Spawn of Certain Species. Trans. Roy. Canadian Inst. (in press).

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, plas. 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.

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 separation 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 dorso-lateral, 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.; $7\frac{1}{2}$ 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*.

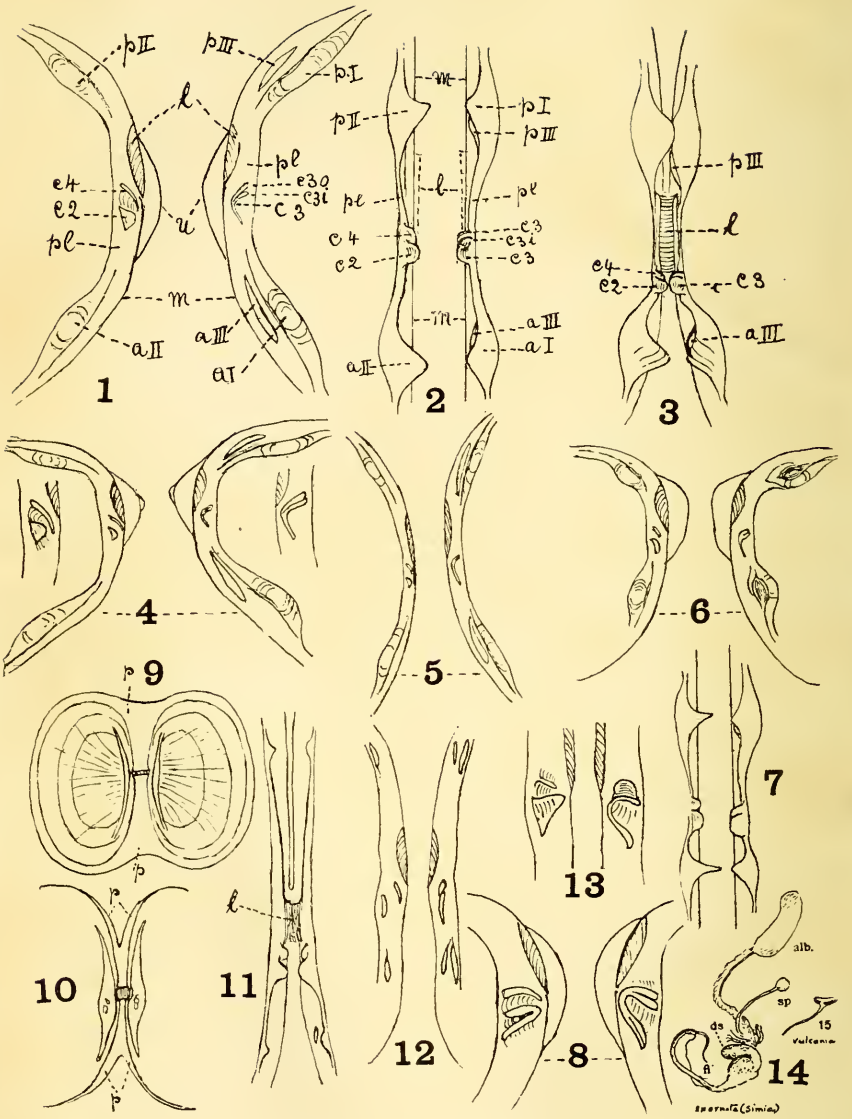
The second correction should also be made in the reference to Bergh, 1902, p. 56.

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.

Vol. XXXV APRIL, 1922. No. 4

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 appre-

ciably, *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 Λ-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 an-

terior 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 wing-like, 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 *Sphœrium* 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 Laminœ. 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 *Sphœrium, 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 worth-

less. 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."

Literature Cited.

Baudon, Auguste, Essai Monographique sur les Pisidies Françaises. Paris, 1857.

Bernard, Félix, Première (to Quatrième) Note sur le developpement et la morphologie de la coquille chez les Lamellibranches. Bull. Soc. Géol. France, sér. III, tome XXIII & seqq., 1895-1897.

Call, R. E., A Descriptive Illustrated Catalogue of the Mol-

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

lusca of Indiana, in Indiana Dept. of Geology, 24th Annual Report, 1900, pp. 437 & sqq. (Corbiculadæ).

Clessin, S., Die Familie der Cycladeen, Martini & Chemnitz, Vol. 9, pt. 3, 1879.

Pelseneer, Paul, A Treatise on Zoology edited by E. Ray Lankester, Part V Mollusca, London, 1906.

Prime, Temple, Monograph of American Corbiculadæ. Smithsonian Inst., 1865.

Sterki, V., The Nautilus, XXV, p. 1, 1911.

Walker, Bryant, On Certain Abnormal Sphæria, The Nautilus, IX, p. 135, 1896; Conf. l. c. XII, p. 117, 1899.

Westerlund, Carl Agardh, Fauna der . . . Palæarctischen . . . Binnenconchylien, VII, Malacozoa Acephala.

Woodward, B. B., Catalogue of the British Species of Pisidium. British Museum, 1913.

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 stamineum* 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 Pleas-

ant 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*.