

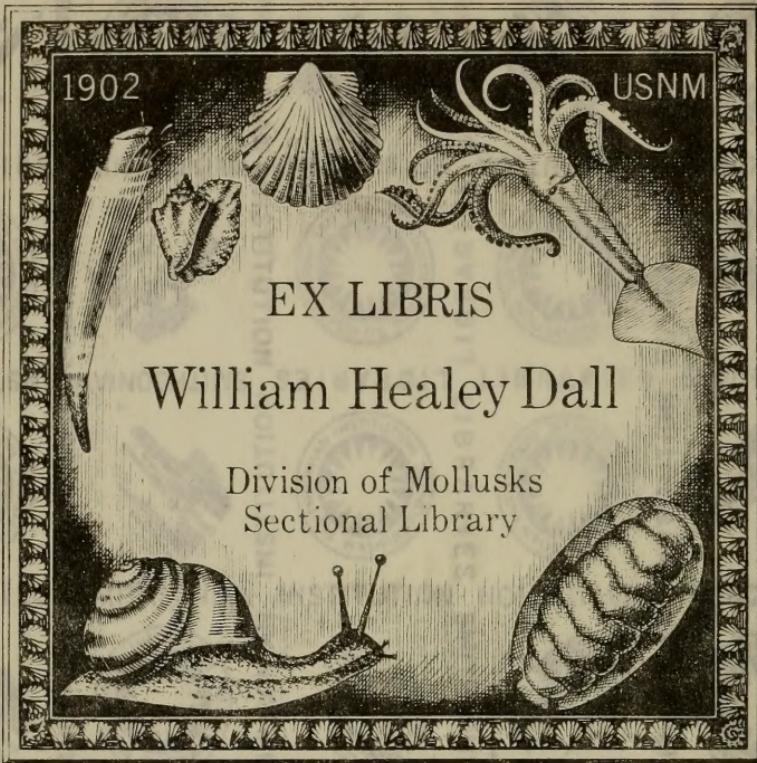
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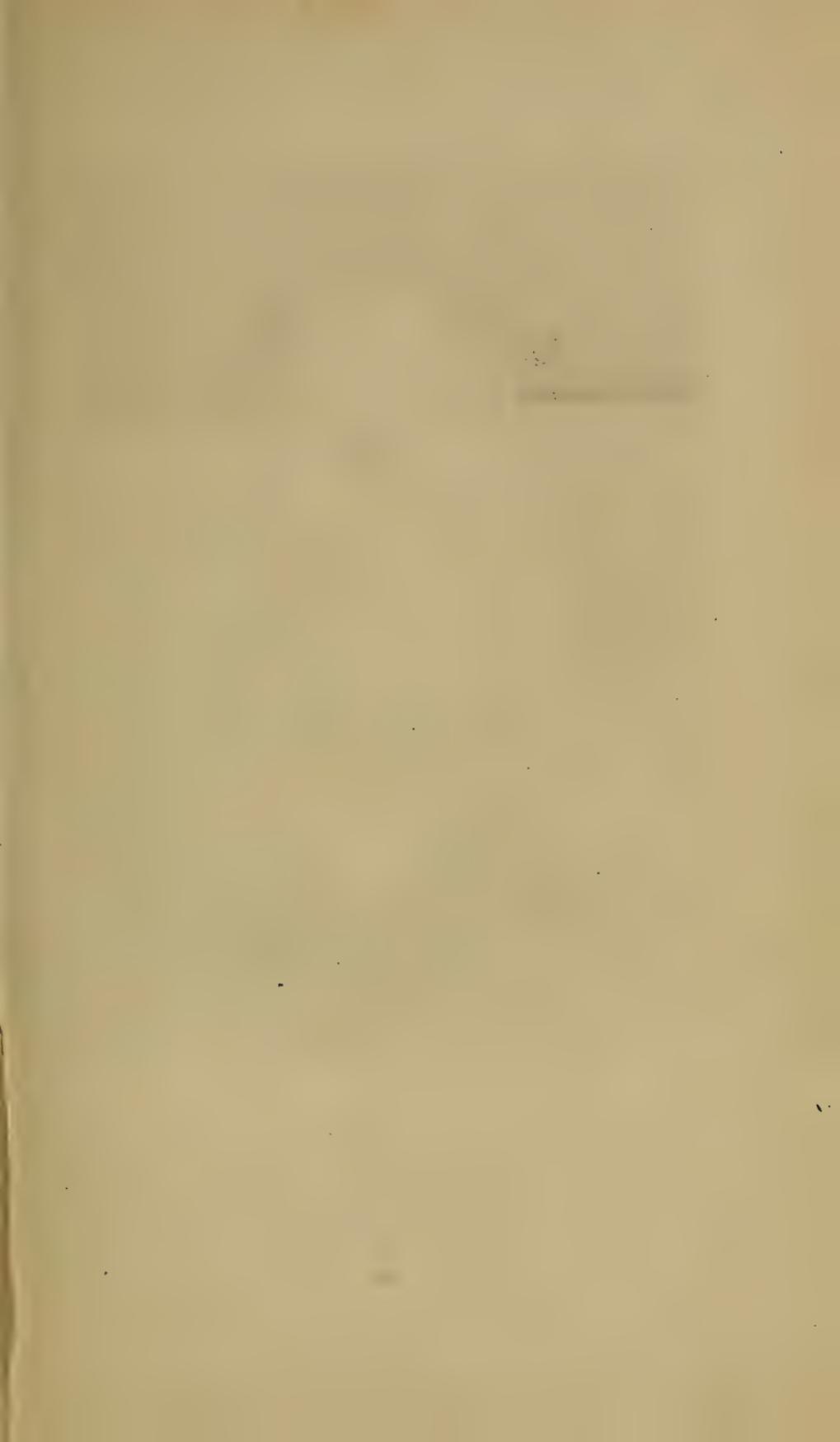
MALACOLOGICAL SOCIETY OF LONDON.

VOL. XIV.

1920 — 1921.

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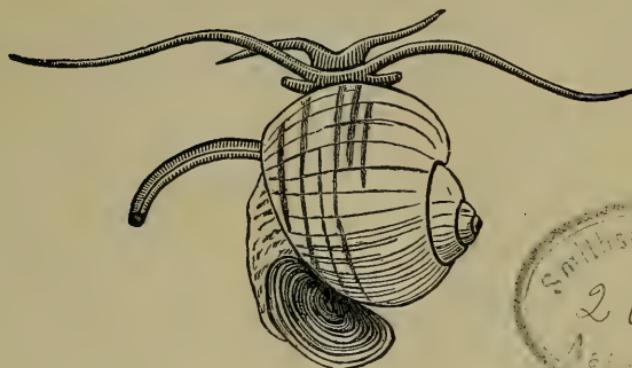
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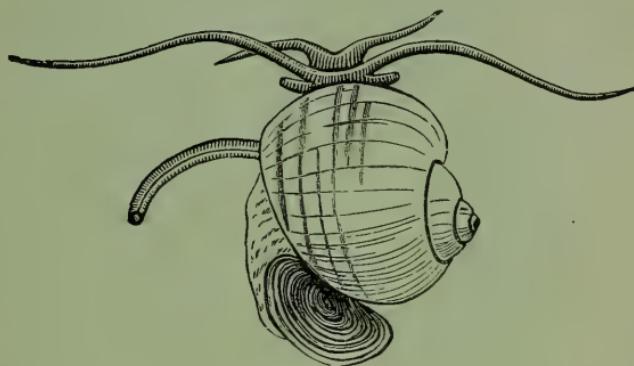
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Recd May 21/20

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ORDINARY MEETING.

FRIDAY, 14TH NOVEMBER, 1919.

G. K. GUDE, F.Z.S., President, in the Chair.

Mr. Ronald Winkworth, F.R.G.S., was elected to membership of the Society.

The following communications were read :—

1. "Studies in British Hydrobiidae, Part I." By G. C. Robson, B.A.

[Abstract.]

The author detailed certain experiments carried out with specimens of *Paludestrina jenkinsi*, with the object of analysing the reaction to light exhibited by this mollusc when kept in captivity.

The results obtained were not very positive, but it appeared that in a considerable number of cases the mollusc moved towards darkened areas and away from the light, although it was doubtful if this tendency constituted true phototaxis, and the question required further study.

2. "Description of a new sub-species of *Papuina tayloriana* Ad. & Rve." By H. C. Fulton.

3. "Additions to a List of recent Middlesex Mollusca." By J. E. Cooper.

Mr. T. Iredale exhibited an interesting collection of Marine Shells recently received from Twofold Bay, New South Wales.

Mr. J. Wintle, F.Z.S., exhibited Dr. Gwyn Jeffreys' annotated copy of his original list of British non-marine Mollusca, published in the Transactions of the Linnean Society, vol. xvi, pt. 2, 1830 (29th May, *fide* Dr. Dall), and pt. 3, 1833.

ORDINARY MEETING.

FRIDAY, 12TH DECEMBER, 1919.

G. K. GUDE, F.Z.S., President, in the Chair.

Dr. S. Stillman Berry and Mr. Herbert E. J. Biggs were elected to membership of the Society.

The following communications were read :—

1. "On the Abnormality of Structure in the Radula of certain Rhachiglossate Mollusca." By the Rev. A. H. Cooke, Sc.D.

2. "On the Affinities of *Pyramidula*, *Acanthinula*, and *Vallonia*." By Hugh Watson.

Dr. A. E. Boycott, F.R.S., exhibited a shell of *Limnaea stagnalis*, which had been repaired in captivity.

ORDINARY MEETING.

FRIDAY, 9TH JANUARY, 1920.

G. K. GUDE, F.Z.S., President, in the Chair.

Mr Charles William Alexander was elected to membership of the Society.

Messrs. Oldham and Fulton were appointed auditors.

The following communications were read :—

1. "On a new species of *Mitra* from California." By Dr. S. Stillman Berry.
 2. "On local variation in size of *Clausilia bidentata* and *Ena obscura*." By Dr. A. E. Boycott, F.R.S.
 3. "Molluscan Notes, No. IV." By H. C. Fulton.
-

A NEW SUB-SPECIES OF *PAPUINA TAYLORIANA* FROM DAMPIER ISLAND.

By HUGH C. FULTON.

Read 14th November, 1919.

PAPUINA TAYLORIANA, Ad. & Rve., n. sub-sp. *dampierensis*, Fulton.

From the typical *tayloriana* this new form is distinguished by its smaller size, less-compressed aperture, and rose-coloured peristome. The surface is finely corrugated and crossed by oblique lines above and spiral below, a characteristic of the *tayloriana* group. The keel of the last whorl is narrowly margined with white, the apex is dark purple-brown, and there is a narrow line of the same colour at the suture of the whorls, the remainder of the external surface being of a yellowish-brown, similar to typical *tayloriana*. Five specimens all similar.

Maj. diam. 24 ; alt. 14 mm.

Hab. :—Dampier I., New Guinea.

MOLLUSCAN NOTES IV¹.

By HUGH C. FULTON.

Read 9th January, 1920.

No. 17.—ON THE IDENTITY OF ENNEA (GULELLA) PALLARYI, Preston,
WITH ENNEA VRIESIANA, Ancey.

A COMPARISON of co-types of *Ennea pallaryi*, Preston (Ann. & Mag. Nat. Hist., 1909, vol. iv, p. 87) with specimens that I believe are authentic of *Ennea vriesiana*, Ancey (Bull. Soc. malac. France, 1885, p. 145) demonstrates their identity.

No. 18.—XESTINA GRANULOSA, Mölldff., A SYNONYM OF HELIX DANÆ, Pfr.

1862. *Helix danæ*, Pf., Proc. Zool. Soc. Lond., p. 268.

1902. *Xestina granulosa*, Mölldff., Nachr. Bl. Deutsch. Malak. Gesell., p. 156.

Comparison of original specimens of *Xestina granulosa*, Mölldff., with the type-specimen in British Museum of *Helix danæ*, Pf., proves that they are one species. The type of *danæ* is slightly flatter, but agrees in all other respects with *granulosa*.

No. 19.—ON THE IDENTITY OF BULIMULUS (DRYMAEUS)
PULCHERRIMUS, Ad., WITH SUBHYBRIDUS, Da Costa.

1866. *Otostomus pulcherrimus*, H. Ad., Proc. Zool. Soc. Lond., p. 442, pl. 38, fig. 3.

1906. *Gonostomus subhybridus*, Da Costa, Proc. Malac. Soc. Lond., vol. viii, p. 97, pl. xi, fig. 7.

A fine specimen of *Drymaeus pulcherrimus* from Huancabamba, Peru, having been compared with the type-specimen of *subhybridus*, has revealed their identity. The specimen of *pulcherrimus* was in the collection of the late J. J. MacAndrew, Esq., with another specimen, a variety with white peristome and purple aperture, but otherwise agreeing perfectly with typical *pulcherrimus*.

No. 20.—ON PSEUDACHATINA PERELONGATA, Rolle, AND P.
DAILLYANA, Pilsbry.

1902. *Pseudachatina perelongata*, Rolle, Nachr. Bl. Deutsch. Malak. Gesell., xxxiv, p. 211.

1903. ————— *daillyana*, Pilsbry, Tryon's Man. Conch., ser. II, vol. xvi, p. 214.

Having examined a specimen of *Pseudachatina perelongata*, Rolle, supplied by Rolle to the late J. J. MacAndrew, I have no hesitation in pronouncing its identity with *P. daillyana*, Pilsbry.

¹ For Nos. I to III see these Proceedings, vols. xi and xii.

Rolle did not describe the colour of his *perelongata*; our specimen agrees perfectly with the description given by Pilsbry of *P. daillyana*.

No. 21.—NEPTUNEA ANTIQUA, sub-sp. JAPONICA, Dautz. & Fisch.,
A SYNONYM OF CHRYSODOMUS INTERSCULPTUS, Sowb.

1899. *Chrysodomus intersculptus*, Sowb., Ann. & Mag. Nat. Hist., iv, p. 371.

1912. *Neptunea antiqua* (Linné), sub-sp. *japonica*, Dautz. & H. Fischer, Résult. Camp. Sci. Albert Ier, Fasc. xxxvii, p. 77, pl. ii, fig. 2.

Monsieur Ph. Dautzenberg agrees with me that the above are one and the same species.

No. 22.—AN ADDITIONAL NOTE ON MUREX SPINICOSTA, Kiener

In an interesting article on Florida in the *Nautilus* (vol. xxxii, July, 1919, p. 6) Mr. C. W. Johnson notes: "I also found my only living specimen of *Murex fulvescens*, Sowb. (*M. spinicostata*, Val.)."

I have already suggested in these Proceedings (vol. xii, 1917, "Molluscan Notes," No. 10) that the proper name is *spinicosta*, and that the species should be credited to Kiener and not to Valenciennes.

The first reference to *fulvescens* appears in the catalogue of Sowerby's "Conchological Illustrations", as follows: "sp. 94. *M. tubinatus*, Lam., vii, p. 170. Con. Illus. (*M. fulvescens*), fig. 30. Var. Con. Illus., fig. 90, 91."

If the fig. 30 is really the same species as *spinicosta*, Kiener, that name will fall and *fulvescens*, Sowb., take its place. To me, however, it is not certain that they are identical, and so I would suggest that *spinicosta*, Kiener, be adopted for the Florida shell, especially seeing the ambiguous manner in which *fulvescens* was published.

No. 23.—ON TYPE-SPECIMENS OF THE "MORELET COLLECTION".

In 1892 I purchased the collection of land and freshwater shells formed by the late Arthur Morelet. Unfortunately, during the transit from Dijon to London a good many of the more fragile specimens, owing to their having been mounted on very thick and heavy cardboard tablets, got broken, including some type-specimens. The British Museum acquired all the types, some 600 or so, and the late Mr. Edgar Smith, I believe, made a list of the missing types, but, as far as I know, never published it. The types were not marked as such, otherwise especial care might have been taken in the packing of them and their loss have been avoided. I have thought it useful to put these facts on record, and it would be well if a list of the missing types were published, in order that those having co-types of such might fill the gaps left by the loss of the actual types.

ADDITIONS TO THE LIST OF RECENT MIDDLESEX MOLLUSCA.

By J. E. COOPER.

Read 14th November, 1919.

THE following five species may now be added to the list published in these Proceedings, vol. viii, 1909, p. 219 :—

Helicella itala (L.). Harefield (C. Oldham).

H. gigaxii, Charp. Harefield (C. Oldham).

Pseudanodonta elongata, Hol. Thames at Penton Hook. (Dead shells only.)

Pisidium personatum, Malm. Several localities.

P. parvulum, Cless. Thames, Twickenham.

Numerous fresh localities have also been added to the list ; of these the following may be worth putting on record :—

Vitrea lucida (Drap.). Fortis Green. A few fine examples.

Punctum pygmaeum (Drap.). Hadley Wood.

Sphygradium edentulum (Drap.). Hadley Wood. An interesting find, as the only recorded Middlesex locality, near Uxbridge, was destroyed long ago.

Acanthinula aculeata (Müll.). Hadley Wood.

Helicigona arbustorum (L.). Edmonton (F. B. Jennings).

Jaminia secale (Drap.). Harefield (F. B. Jennings & C. Oldham).

Thus confirming this species as a Middlesex shell.

Vertigo pygmaea (Drap.). Harefield (F. B. Jennings).

Balea perversa (L.). Edmonton (F. B. Jennings ; one dead shell).

Limnaea stagnalis (L.), var. *albida*, Jeff. Dawley.

Planorbis crista (L.), var. *lævigata*, Adami. Dawley.

Physa rivialis (Maton & R.) [= *heterostropha*, Say]. Welsh Harp reservoir and River Brent. There is some difference of opinion as to the identity of these shells ; the writer at first considered them to be *P. acuta*, Drap., but now agrees they are not that species. This record adds another species to the Middlesex list.

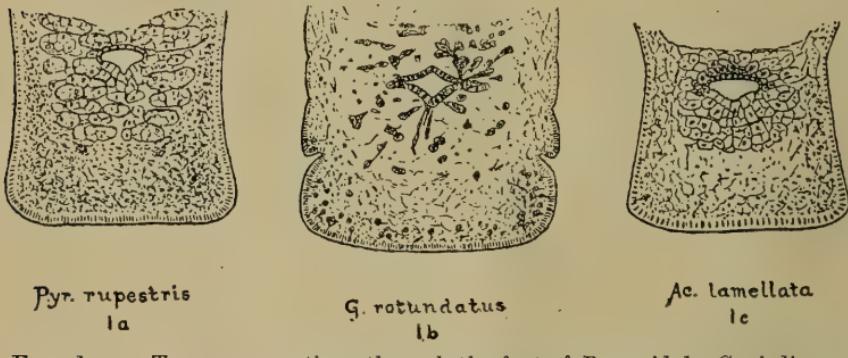
Aplecta hypnorum (L.). South Mimms.

THE AFFINITIES OF *PYRAMIDULA*, *PATULASTRA*,
ACANTHINULA, AND *VALLONIA*.

By HUGH WATSON, M.A.

Read 12th December, 1919.

INTRODUCTION.—Much uncertainty seems to prevail about the true affinities of some of the smaller snails found in the British Isles. Thus, *Pyramidula rupestris* (Drap.) and *Patulastra balmei* (P. & M.)¹—a species introduced into Ireland from the South of Europe—are commonly placed in the Endodontidæ; that is to say, in the same family as *Goniodiscus rotundatus* (Müll.), and even, as a rule, in the same genus. *Vallonia* and *Acanthinula*, on the other hand, are still often placed in the Helicidæ, between *Hygromia* and *Helicodonta*, although it is nearly twenty years since Dr. Pilsbry suggested that *Vallonia* should be removed from that family.² The chief purpose of the present article is to try to dispel this uncertainty, and to show that *Pyramidula*, *Patulastra*, *Acanthinula*, and *Vallonia* are fairly closely related to one another, but that these genera have very little affinity with either the Endodontidæ or the Helicidæ, their nearest British allies being among the forms assigned to the Pupillidæ, Cochlicopidæ, and Enidæ.

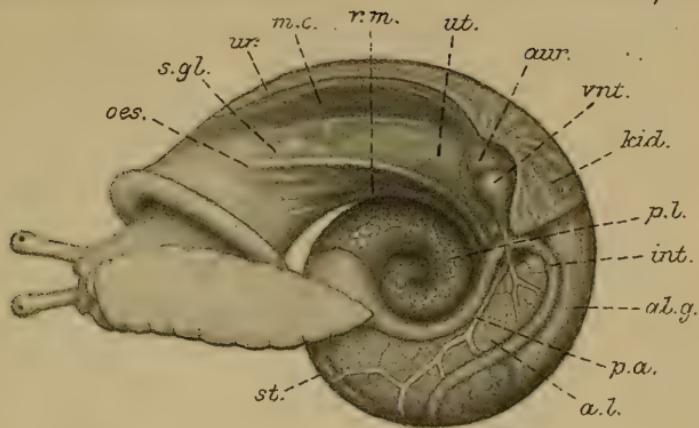


Figs. 1a-c.—Transverse sections through the foot of *Pyramidula*, *Goniodiscus*, and *Acanthinula*; showing the structure of the pedal gland, the presence or absence of peripodial grooves, etc.

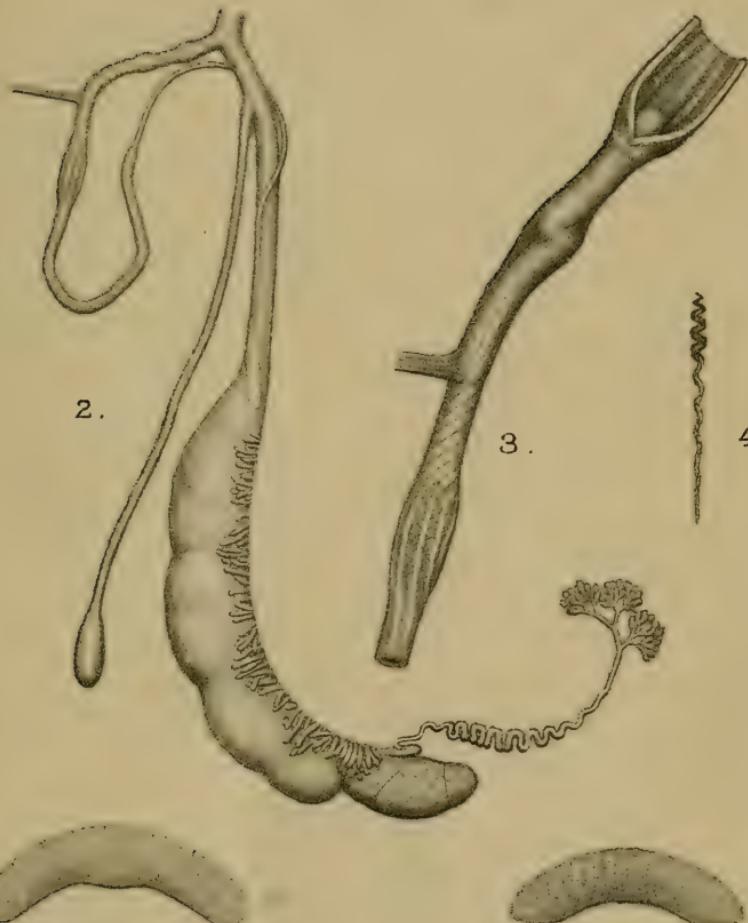
The compilation of this paper has been greatly facilitated by the kindness of Dr. A. E. Boycott, who has allowed me to study his beautiful serial sections of *Acanthinula* and of several other small British snails. I am much indebted to Mr. A. W. Stelfox for preserved specimens of *Patulastra balmei* (P. & M.) and *Helicodiscus lineatus* (Say) from Ireland, and to Mr. W. E. Alkins for some living examples of *Vallonia excentrica* from Staffordshire. My thanks are also due to Dr. Boycott and Mr. B. B. Woodward for the loan of

¹ = *P. flavidula* (Ziegler); see *Man. Conch.* (2nd ser.), vol. iii, 1887, p. 30.

² Proc. Acad. Nat. Sci. Phila., 1900, p. 564.



1.



Anatomy of *Vallonia excentrica* (Figs 1 & 6) &
Patulastra balmei (Figs 2-5).

reprints of three foreign papers which I was unable to consult in Cambridge.

EVIDENCE OF THE FOOT.—A mere examination of the outside of the foot of *Pyramidula rupestris* and of *Patulastra balmei* is enough to show that these species cannot be closely allied to *Goniodiscus rotundatus* or *Helicodiscus lineatus*, or, indeed, to any form rightly assigned to the family Endodontidæ as defined by Pilsbry;¹ for both these species resemble *Acanthinula* and *Vallonia* in having no peripodial grooves. The striking nature of this difference between *Goniodiscus* on the one hand, and *Pyramidula* and *Acanthinula* on the other, may be seen from text-fig. 1. This figure also shows that *Pyramidula rupestris* resembles *Acanthinula* much more closely than *Goniodiscus* in the structure of its pedal gland, and the same is true of *Vallonia*. Further, the type of pedal gland that is found in *Acanthinula*, *Vallonia*, and *Pyramidula* occurs also in the Pupillidæ and the Cochlicopidæ, and these families are also without peripodial grooves. We see, therefore, that the evidence of the foot strongly supports the view that these three genera are all more nearly related to the Pupillidæ and the Cochlicopidae than to the Endodontidæ.

EVIDENCE OF THE SIZE.—The Helicidæ, however, are also without peripodial grooves. But in this family the dorsal wall of the duct of the pedal gland is longitudinally folded,² which is not the case in *Acanthinula*, *Vallonia*, or *Pyramidula*. Moreover, the very small size of these snails at least suggests that they may not be rightly assigned to the Helicidæ. It is true that the Rev. E. W. Bowell has expressed the opinion that size "has counted for too much in our systems of classification".³ But he goes on to point out that an increase or diminution of size in an organism necessitates a redistribution of symmetry, because the constituent cells do not change their size proportionately, and that this rearrangement often involves a considerable morphological change. It would therefore seem improbable that a very great alteration in size could be easily and quickly effected in the course of evolution; and, if this be the case, the species of *Vallonia* and *Acanthinula* are not likely to be very closely related to *Helix pomatia* and its allies.

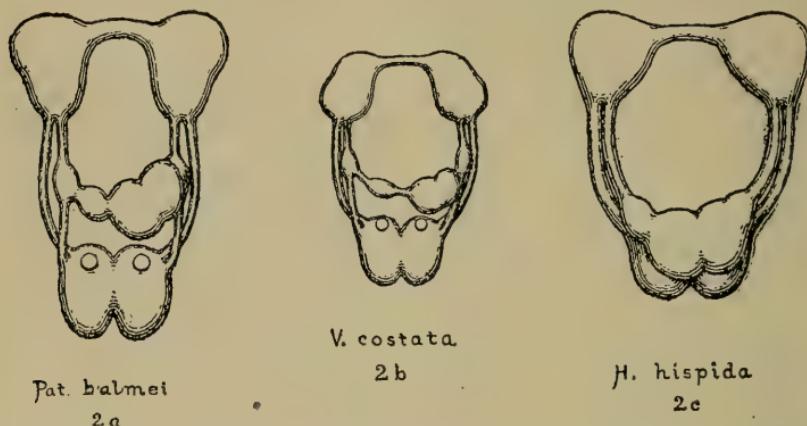
EVIDENCE OF THE CENTRAL NERVOUS SYSTEM.—Most students of comparative anatomy, however, would attach more weight to evidence afforded by the central nervous system than to mere considerations of size. Now the central nervous system in the Helicidæ is characterized not only by the close aggregation of the pedal, pleural, and visceral ganglia, but by the fact that the abdominal ganglion is completely united with the left parietal ganglion (see text-fig. 2c). Very different is the central nervous system of *Vallonia*, *Acanthinula*, *Patulastra*, and *Pyramidula*. In these

¹ *Man. Conch.* (2nd ser.), vol. ix, 1894, p. xxviii.

² André, *Rev. Suisse de Zool.*, vol. ii, 1894, p. 298, pl. xii, fig. 5.

³ *Proc. Malac. Soc. Lond.*, vol. viii, 1909, p. 379.

genera the ventral ganglia are much less closely aggregated, the pedal ganglia being some distance from the others, and the abdominal ganglion, instead of having become merged into the right parietal ganglion, is more or less united with the left. Text-fig. 2b shows the arrangement of these ganglia in the three British species of *Vallonia*, which do not differ appreciably from one another in their nervous system.¹ The central nervous system in *Pyramidula rupestris* and in both species of *Acanthinula* is almost identical with that in *Vallonia*. In *Patulastra balmei* (text-fig. 2a) the visceral loop is somewhat shorter, showing a tendency towards a greater concentration of the ganglia, but the nervous system remains of essentially the same type, that is to say, of a type quite different from that found in *Helix*,



FIGS. 2a-c.—Central nervous system of *Patulastra*, *Vallonia*, and *Hygromia*. The buccal ganglia, commissure, and connectives, which are of the usual type in all these genera, are omitted. (The figure of the nervous system of *Vallonia costata* might equally well represent that of *V. pulchella* or *V. excentrica*.)

but identical with that occurring in such forms as *Lauria cylindracea*, *Vertigo moulensisana* and *V. antivertigo*, *Cochlicopa lubrica*, and *Ena obscura*. It is true that a similar arrangement of the ventral group of ganglia also occurs in the Endodontidæ, and that the abdominal ganglion of *Goniodiscus rotundatus*, for example, tends to be united with the right parietal ganglion and not with the left. But we have already seen that the deep peripodial grooves which characterize the Endodontidæ do not occur in *Pyramidula*, *Patulastra*, *Acanthinula*, or *Vallonia*.

EVIDENCE OF THE EXCRETORY SYSTEM.—Perhaps the most striking evidence of the true affinities of these four genera is that afforded by the course of the ureter.

¹ Sterki states (Proc. Acad. Nat. Sci. Phila., 1893, p. 237) that "in *V. parvula* (and other species) the cervical masses are adjacent to each other in nearly their entire length"; but this is very far from being the case in, at least, the British members of the genus.

The researches of Simroth,¹ Pilsbry,² and others have shown that the Stylommatophora may be divided according to the characters of the excretory system into four main groups, the Sigmurethra, the Orthurethra, the Heterurethra, and the Clasturethra, the great majority of the families belonging to the first two of these groups. In the Sigmurethra, to which both the Endodontidæ and the Helicidæ belong, the ureter arises from the front end of the kidney, runs back along its upper edge, and then bends round at the hind end of the mantle-cavity and passes forward immediately beneath the rectum, until it reaches the region of the respiratory opening. The first part, running backwards beside the kidney, is generally known as the primary ureter; and the second part, that runs beside the rectum, as the secondary ureter. In a few of the most primitive members of the Sigmurethra the ureter throughout its length merely consists of a shallow open groove; and in many other genera, while the primary ureter takes the form of a closed duct, the secondary ureter remains open. But in most of the more highly organized snails both parts of the ureter are closed throughout, and this is the case in *Goniodiscus rotundatus*, as will be seen from text-fig. 3c. This species is clearly a typical member of the Sigmurethra.

In the Orthurethra, a group which includes the Pupillidæ, Cochlicopidæ, and Enidæ, the ureter follows a quite different course, for it passes straight forward from the front end of the kidney, parallel to the rectum but some distance below it. Just before reaching the mantle-edge the ureter terminates, its end being slightly bent upwards, and the opening being on the dorsal side of the extremity. From this point there runs backwards, along the upper side of the ureter, a shallow groove in the roof of the mantle-cavity, lined by an epithelium similar in character to that which lines the ureter itself. Now this description applies in every detail to the excretory system of *Pyramidula rupestris*, *Patulastra balmei*, *Acanthinula lamellata*, and the three species of *Vallonia*; that is to say, these forms all belong to the Orthurethra. In *Vallonia* the kidney and ureter are relatively shorter than in *Patulastra* or *Pyramidula*, as will be seen on comparing text-figs. 3a and 3b;³ but this is not an important difference, and is probably due to the whorls being fewer in number and the mantle-cavity shorter in consequence.

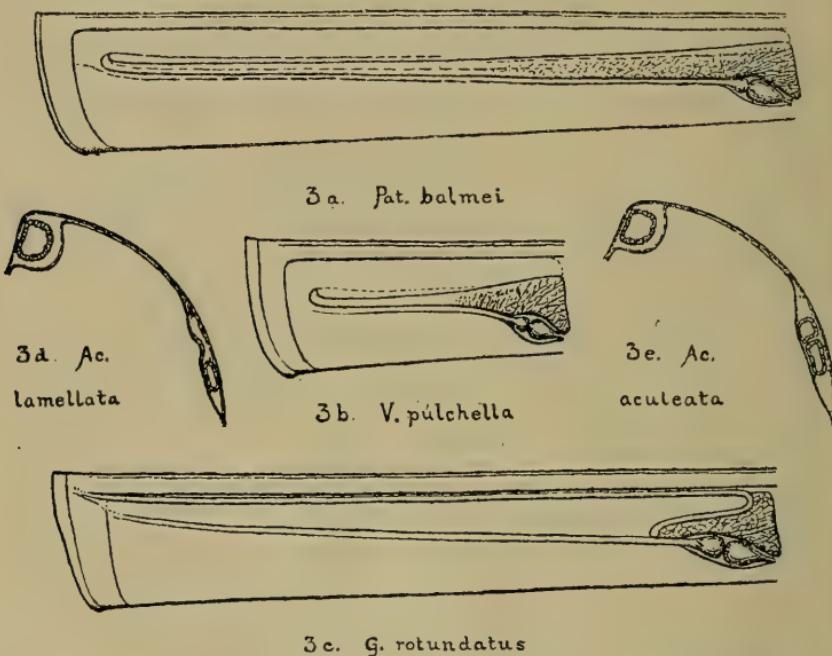
In *Acanthinula aculeata* we find a very interesting modification of the orthurethrous type. In this species the groove that runs backwards along the upper side of the ureter from its anterior opening has been converted into a closed duct; and the actual

¹ Semper's *Reis. in Arch. Philip.*, iii, 1894, p. 70; Bronn's *Tier-Reich*, vol. iii, 1911, pp. 374–437.

² Proc. Acad. Nat. Sci. Phila., 1900, p. 561; *Man. Conch.* (2nd ser.), vol. xx, 1910, p. vii.

³ See also pl. I, fig. 1, and pl. II, fig. 3.

opening of the ureter into the mantle-cavity is therefore just above the front end of the kidney, instead of near the mantle-edge. (Compare text-fig. 3d, which shows the condition in *Pyramidula*, *Patulastra*, *Vallonia*, and *Acanthinula lamellata*, with text-fig. 3e, which depicts a section through the roof of the mantle-cavity in *A. aculeata*.) Thus we might perhaps say that *A. aculeata* has a primary ureter running forwards leading into a secondary ureter running backwards, which is exactly the opposite arrangement to that found in sigmoidrethrous forms like *Goniodiscus rotundatus*, where the primary ureter runs backwards and the secondary ureter runs forwards.



FIGS. 3a-e.—Excretory organs of *Patulastra*, *Vallonia*, *Acanthinula*, and *Goniodiscus*. Figs. 3a, 3b, and 3c show the kidney, ureter, and other pallial organs, as seen from the outside, after the removal of the shell. Figs. 3d and 3e depict transverse sections of the roof of the mantle-cavity in front of the kidney, showing the ureter in section on the right and the rectum on the left.

The evidence of the excretory system, therefore, shows conclusively that none of the genera *Pyramidula*, *Patulastra*, *Vallonia*, and *Acanthinula* should be placed in or near the Endodontidae or the Helicidae, as they all belong to the Orthurethra. Indeed, it was apparently on these grounds alone that Pilsbry in 1900 suggested removing *Vallonia* from the Helicidae and placing it in the Orthurethra in a new family.¹ For while very little has hitherto

¹ *Loc. cit.*

been published about the excretory system of *Pyramidula*, *Patulastra*, and *Acanthinula*,¹ it has been known for thirty years that the ureter in *Vallonia* was of a different type from that of *Helix*,² although the systematic importance of this difference was at first not generally realized.

EVIDENCE OF THE DIGESTIVE SYSTEM.—The jaw in *Pyramidula*, *Patulastra*, *Acanthinula*, and *Vallonia* is rather commonplace (pl. I, figs. 5 and 6).³ It is thin—extremely so in *Pyramidula rupestris*—sometimes with a slight median projection, and crossed by a variable number of weak inconspicuous folds. It is usually furnished with a faint, ill-defined, backward extension, more or less divided into a number of small polygonal areas. Precisely the same type of jaw is found in the Pupillidæ, Enidæ, Cochlicopidæ, and some other Orthurethra, but as jaws of a similar kind are also commonly found in various sigmurethrous families, such as the Endodontidæ, Clausiliidæ, and Achatinidæ, not much importance can be attached to the evidence of this organ.

The radulæ of these genera are much more interesting. The Rev. E. W. Bowell has already published in these Proceedings figures of the radulæ of *Acanthinula aculeata* and *A. lamellata*, of *Vallonia costata* and *V. excentrica*, and of *Pyramidula rupestris*, as well as of *Goniodiscus rotundatus* and *Punctum pygmaeum*.⁴ I am therefore only portraying the radulæ of *Vallonia pulchella* and *Patulastra balmei*, the embryonic radulæ of the last species and *Pyramidula rupestris*, and the radula of *Helicodiscus lineatus* for comparison (text-figs. 4a–e).

The following are typical radular formulæ of the species with which this paper specially deals:—

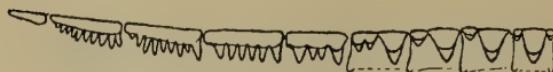
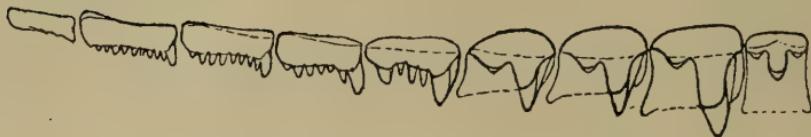
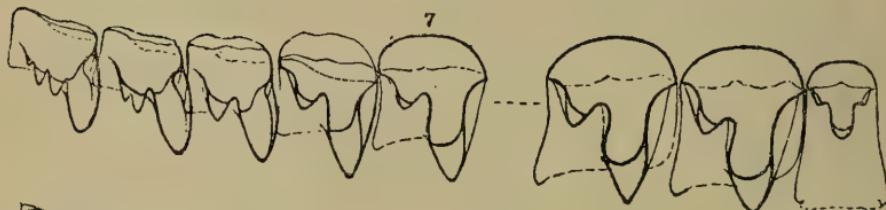
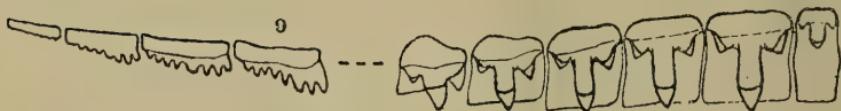
<i>Pyramidula rupestris</i>	.	(11 + 6 + 1 + 6 + 10) × 145
<i>Acanthinula lamellata</i>	.	(8 + 7 + 1 + 7 + 8) × 95
<i>Acanthinula aculeata</i>	.	(8 + 6 + 1 + 6 + 8) × 87
<i>Vallonia costata</i>	.	(9 + 5 + 1 + 5 + 9) × 70
<i>Vallonia pulchella</i>	.	(9 + 4 + 1 + 4 + 9) × 70
<i>Vallonia excentrica</i>	.	(9 + 4 + 1 + 4 + 9) × 76
<i>Patulastra balmei</i>	.	(17 + 9 + 1 + 9 + 17) × 125

¹ Hesse, however, quotes a brief but important note by Wiegmann, in which it is stated that *Pyramidula rupestris* has a remarkably elongated kidney, very different from that of *Goniodiscus rotundatus* or *G. ruderatus*, but resembling that of *Acanthinula aculeata*. (Nachr. Deutsch. Malak. Gesell., vol. xlvi, 1915, p. 57.)

² Behme, Archiv für Naturgeschichte, vol. i, 1889, pp. 5, 6.

³ Further figures of the jaw of *Vallonia* will be found in Sterki, Proc. Acad. Nat. Sci. Phila., 1893, pl. viii, figs. H, I, K, L, M, N, O, R; of *Acanthinula* in Lehmann, Die lebenden Schnecken u. Muscheln der Umgegend Stettins u. in Pommern, 1873, pl. x, fig. 25, pl. xi, fig. 32; and of *Pyramidula rupestris* in Taylor, Monogr. L. & F.W. Moll. Brit. Is., vol. iii, 1909, p. 171, fig. 226 (fig. 227 on the same page evidently represents the radula of a very different species).

⁴ Proc. Malac. Soc. Lond., vol. xi, 1914, pp. 158–61. Bowell has also figured the radula of *Pyramidula rupestris* in the Journal of Conchology, vol. xiv, 1915, p. 290.

4a. *Pyramidula rupestris* (embryo), $\times 1300$ 4b. *Patulastra balmei* (embryo), $\times 1000$ 4c. *Patulastra balmei*, $\times 750$ 4d. *Vallonia pulchella*, $\times 750$ 4e. *Helicodiscus lineatus*, $\times 750$

Figs. 4a-e.—Representative teeth from the radula of an embryo of *Pyramidula rupestris*, from Burnsall, Wharfedale; of a full-grown specimen of *Vallonia pulchella*, from Madingley, Cambridgeshire; and of embryonic and full-grown examples of *Patulastra balmei*, and a full-grown specimen of *Helicodiscus lineatus*, from the Glasnevin Botanic Gardens, Dublin.

Pyramidula rupestris usually has one more tooth on the left side of each row than on the right. *Patulastra balmei*, on the other hand, sometimes has one more tooth on the right side than on the left. In all three species of *Vallonia* there are often eight marginal teeth on each side, instead of nine. The number of transverse rows varies considerably.

The central tooth in *Pyramidula*, *Patulastra*, *Acanthinula*, and *Vallonia* is tricuspid, although the ectocones are usually very small. The whole tooth is also, as a rule, smaller than the laterals: in *Acanthinula aculeata*, *Patulastra balmei*, and all the species of *Vallonia*, it is very much smaller and narrower than the adjacent teeth; in *Acanthinula lamellata* it is also somewhat smaller; only in *Pyramidula* is it of about the same size as the laterals.

The lateral teeth in these genera are usually bicuspid, with quadrate bases, the outer posterior corners of the bases being more or less thickened, as is also the case in the central tooth. In *Pyramidula rupestris* the mesocones of both the central and lateral teeth are unusually broad, with very obtuse cusps, but this is probably an adaptation to the animal's special environment, for it would seem likely that broad rounded cusps would be best fitted for scraping the surface of the hard limestone walls and rocks on which this species generally lives. *Helicigona lapicida* is also very frequently found on limestone walls, and in this species the cusps of the central and lateral teeth have undergone a parallel modification, as Mr. Bowell has pointed out. In the embryonic radula of *Pyramidula rupestris* the broadening of these cusps is not quite so noticeable (text-fig. 4a), while in *P. humilis* (Hutton) it has not taken place at all (judging from a radula in the late Professor Gwatkin's collection). Excepting in *P. rupestris*, there is a decided gap between the mesocone and the ectocone of the lateral teeth, and in *Acanthinula lamellata* this gap is occupied by a small additional cusp, such as we also find in the genus *Vertigo*.¹ In *Vallonia*, and in the embryo of *Patulastra balmei*, the first lateral teeth are unusually large (text-figs. 4b and 4d).

The marginal teeth in *Pyramidula*, *Patulastra*, *Acanthinula*, and *Vallonia* are more numerous than the laterals, and are characteristically pectinate, having broad bases bearing a number of narrow cusps. The mesocone forms the first or innermost of these cusps. The remainder are smaller, excepting in *Pyramidula rupestris*, and are formed by the multiplication of the ectocone. No endocones are present in any of these genera.

Now, pectinate marginal teeth of this type do not occur in the Endodontidæ, nor in any other sigmurethrous family with which I am acquainted. It is true that in small snails of various types, and especially in those with narrow whorls, the outer marginal teeth tend

¹ See Bowell, Journ. of Conch., vol. xii, 1909, pl. v.

to become pectinate, the number of cusps being increased to compensate for the reduction in the number of separate teeth. But in the Sigmurethra the innermost cusp of these pectinate marginal teeth is formed by the endocone instead of the mesocone. This is the case, for example, in *Helicodiscus lineatus* (see text-fig. 4e), and in *Clausilia biplicata*, which has, perhaps, the most distinctly pectinate marginal teeth of our native Sigmurethra. In the Orthurethra, on the other hand, not only are pectinate teeth extremely common, but they are always of the type found in *Pyramidula*, *Patulastra*, *Acanthinula*, and *Vallonia*, that is to say, they are pectinate teeth without endocones. So far as I am aware, distinct endocones never occur in orthurethrous snails.

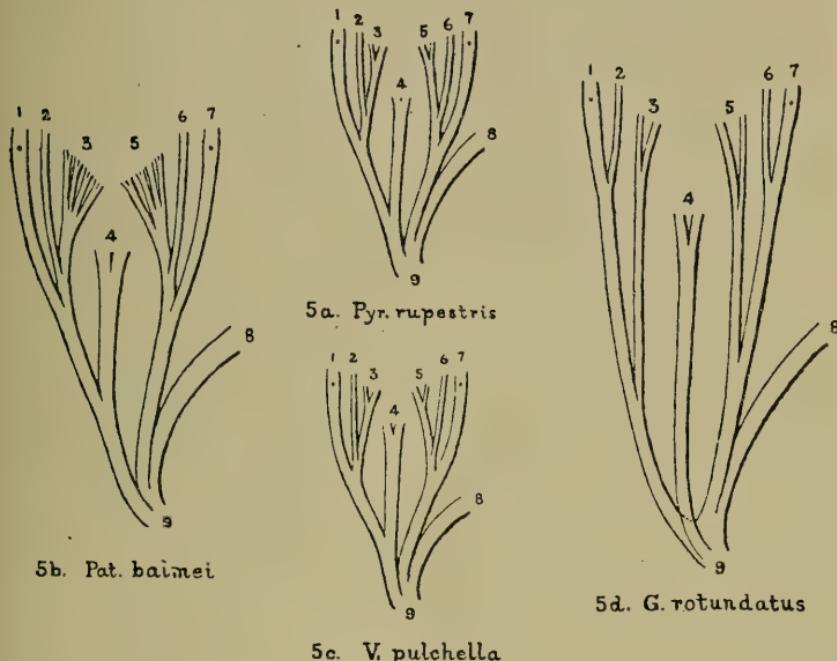
The marginal and lateral teeth of the four genera that we are considering are exceedingly like those occurring in many of the genera of the Pupillidæ, and they also greatly resemble those found in the Cochlicopidæ and Amastridæ; moreover, they only differ very slightly from those occurring in the less specialized members of the Enidæ. *Pyramidula* resembles the Pupillidæ in its central tooth being large; *Patulastra*, *Vallonia*, and *Acanthinula aculeata* agree with *Cochlicopa*, *Azeca*, and *Leptachatina*, in having small, narrow central teeth; while the intermediate size in the central of *Acanthinula lamellata* is what we also sometimes find in the Enidæ. In short, the type of radula found in *Pyramidula*, *Patulastra*, *Vallonia*, and *Acanthinula* differs from that found in any of the sigmurethrous families, but agrees very closely with that which characterizes the less specialized genera of the Orthurethra.

The remainder of the alimentary canal is of the ordinary type, and does not appear to present any features of much systematic importance. It may be worth mentioning, however, that the species of *Vallonia* and *Acanthinula* resemble *Cochlicopa lubrica* and *Ena obscura* in having the salivary glands united with each other below the oesophagus, and not above it—a rather unusual arrangement—and also that *Pyramidula rupestris* differs from *Patulastra balmei* and the three species of *Vallonia* in that the most posterior of the three lobes of the anterior division of the liver is without the dorsal extension which usually runs forward beside the suture, between the last part of the intestine and the albumen gland, in front of the stomach (compare pl. I, fig. 3, with Steenberg, Vidensk. Meddel. fra Dansk naturhist. Foren., vol. lxix, 1917, p. 12, fig. 7, f'').

EVIDENCE OF THE RETRACTOR MUSCLES.—It will be seen from text-figs. 5a-d that the branching of the columellar muscle is very similar in *Vallonia*, *Patulastra*, and *Pyramidula*; but that it is quite different in *Goniodiscus rotundatus*, particularly as regards the origin of the buccal retractor and the retractors of the lower tentacles. In such forms as *Lauria cylindracea*, *Ena obscura*, and *Cochlicopa lubrica*, however, the arrangement of these muscles is practically identical with that found in *Vallonia*, there being, apparently, very little

variation in the muscular system of the Orthurethra. In all these snails the retractor of the right upper tentacle passes between the penis and the vagina. We see, then, that the evidence of the cephalic retractors supports that of the radula, excretory system, etc.

The penial retractor of *Vallonia* and *Patulastra* arises from the front end of the diaphragm, as in *Ena obscura* and *Cochlicopa lubrica*. In *Pyramidula* and *Acanthinula*,¹ on the other hand, it arises from the hinder end of the diaphragm, as it does in *Lauria cylindracea*.



Figs. 5a-d.—Chief retractor muscles in *Pyramidula*, *Patulastra*, *Vallonia*, and *Goniodiscus*.

1. Retractor of left upper tentacle.
2. Retractor of left lower tentacle.
3. Retractor of lower part of left side of head and front end of foot.
4. Retractor of buccal mass.
5. Retractor of lower part of right side of head, genital atrium, and front end of foot.
6. Retractor of right lower tentacle.
7. Retractor of right upper tentacle.
8. Retractor of hinder part of foot.
9. Columellar muscle.

EVIDENCE OF THE REPRODUCTIVE SYSTEM.—Admirable descriptions and figures of the genital organs of the British species

¹ Steenberg states that in *Acanthinula aculeata* the penial retractor arises from the columellar muscle (*op. cit.*, p. 5); but Dr. Boycott's serial sections show that this is not the case in British specimens.

of *Acanthinula* have recently been published by Boycott¹ and Steenberg,² and the latter author has also dealt with the genital system of *Vallonia costata*;³ while the details of the reproductive organs of *Patulastra balmei*, *Pyramidula rupestris*, and *Vallonia pulchella* will be seen from Plate I, figs. 2–4 and Plate II, figs. 1, 2, 4, 6. For the purpose of the present paper it will be enough to draw attention here to some of the more striking features of these organs.

In the first place we notice that in *Acanthinula aculeata* and *Vallonia costata* the penis has a long lateral appendix, swollen distally and also near its origin, where it receives one of the branches of the forked penial retractor. Now, a similar penial appendix occurs in most of the Orthurethra, namely in the Enidæ,⁴ Amastridæ, and Achatinellidæ, in *Cochlicopa*, and in many of the Pupillidæ; and in the Enidæ,⁵ Pupillidæ, and Achatinellidæ (excluding the Tornatellinæ), the penial retractor is also forked, and sends a branch to the enlarged basal portion of the appendix. On the other hand, a lateral penial appendix of this character is rarely found among any of the sigmurethrous families, although it seems to occur in the Sagdinæ,⁶ a group of rather doubtful affinities.

A single specimen of *Vallonia costata* collected in November, 1919, at Little Shelford, Cambridgeshire, possessed a second appendix practically as long as the other, but without the basal enlargement, and arising from the anterior end of the penis (pl. II, fig. 5). Close to its terminal swelling this appendix was attached to the retractor of the right lower tentacle by a very slender muscle, and at about the same place it seemed to receive a small nerve from the right parietal ganglion. A second penial appendix, occupying a similar position, has also been found in a specimen of *Ena detrita*.⁷

In *Pyramidula rupestris* the penial appendix is much reduced, being represented by a mere knob (without muscular attachment), which occupies about the same position on the narrow penis as the appendix does in *Vallonia costata* (pl. II, fig. 4). It is easy to account for the reduction of the appendix in this species. *Pyramidula rupestris* is viviparous like so many of the Orthurethra, and the embryos before birth attain a relatively enormous size compared with the narrowness of the body-whorl of the parent: they do

¹ Journ. of Conch., vol. xv, 1917, p. 175; Proc. Malac. Soc. Lond., vol. xii, 1917, p. 221.

² Op. cit., pp. 2, 6.

³ Ibid., p. 9.

⁴ Excepting in *Chondrula tridens* (see Moquin-Tandon, Hist. Nat. Moll. France, vol. ii, 1856, p. 298, pl. xxi, fig. 27; and Lehmann, Die lebenden Schnecken u. Muscheln der Umgegend Stettins u. in Pommern, 1873, p. 137, pl. xiii, fig. 46).

⁵ Excepting in *Ena (Zebrina) detrita*. (See Beck, Jenaische Zeitschr. Naturw., vol. xlvi, 1912, pl. ix, fig. 25a.)

⁶ Pilsbry, Man. Conch. (2nd ser.), vol. ix, 1894, pp. 59, 65, pl. xxi, figs. 9, 10; pl. xxxv, figs. 2, 3, 12.

⁷ Beck, op. cit., vol. xlvi, 1912, p. 230, text-fig. 23.

not leave any room for accessory organs that are not absolutely necessary.

Patulastra balmei is also viviparous, and in this species there seems to be no trace of a penial appendix, as is the case in the British species of *Azeca* and in many of the Pupillidæ. But the absence of an appendix is fully counterbalanced by the remarkable complexity of the internal structure of the epiphallus and penis (pl. I, fig. 3). A well-marked epiphallus is also developed in the other three genera that we are considering, and in *Acanthinula aculeata* it bears a couple of extremely short, thick flagella. These are very different from the slender flagellum of *Helix*—very unlike “little whips”—but similar flagella occur in some of the Enidæ and Pupillidæ.

We see, therefore, that *Pyramidula*, *Patulastra*, *Acanthinula*, and *Vallonia* agree closely with the Pupillidæ, Enidæ, and their allies in their male genital ducts—when these are present. Boycott and Steenberg, however, have shown that in all the specimens of *Acanthinula lamellata* that they examined, the penis, epiphallus, etc., were entirely absent, and Dr. Boycott found that the same was true of about half of the full-grown examples of *A. aculeata* that he studied. In both species the first part of the slender vas deferens is present beside the oviduct, but in these individuals it stops abruptly at about the level of the anterior end of the receptacular duct, and not a trace of the rest of the male organs exists. The physiological significance of this remarkable phenomenon has been so ably discussed by Dr. Boycott that I need not deal with it again. From a purely systematic point of view it is of more interest to point out that the same phenomenon occurs in *Vallonia*. I have made a very careful examination of the genital ducts of no fewer than 98 full-grown specimens of *Vallonia*, 45 being examples of *V. costata*, 31 of *V. pulchella*, and 22 of *V. excentrica*. All the examples of *V. pulchella*, and most of those of the other two species were collected in Cambridgeshire; about half were examined in the spring, but 26 specimens of *V. costata*, 12 of *V. pulchella*, and 10 of *V. excentrica* not until November. Of all these specimens only three examples of *V. costata* had any male organs, two being found in November and the other one in the spring. In the remaining 95 individuals the female ducts were well developed, but there was no trace of the male ducts; even the first part of the vas deferens could not be found, but the reproductive organs of all three species closely resembled pl. II, fig. 6. The fact that this unusual phenomenon occurs in both *Vallonia* and *Acanthinula* supports the view that these two genera are closely related to each other and to the Pupillidæ, for the same phenomenon occurs in at least one member of that family, namely, *Vertigo mouliniana*.¹

¹ It has been suggested that *Vertigo* should be placed in a separate family, since it has no lower tentacles (Kennard & Woodward, *List of British Non-Marine Mollusca*, 1914, p. 2); but in most respects the anatomy of this genus

Steenberg has drawn attention to the peculiar form of the prostate gland in *Acanthinula* and *Vallonia*.¹ In these genera it consists of a small number of moderately long tubules, situated at the posterior end of the common duct, just in front of the albumen gland (pl. II, fig. 5). It is, however, characteristic of the Orthurethra that the so-called prostate gland, instead of forming a compact ribbon extending along the whole of the common duct, consists of more distinctly separate tubules, which sometimes attain a considerable length, but tend to be chiefly concentrated towards the posterior end of the common duct, and are, as a rule, entirely confined to that end in the smaller species. Thus, in *Cochlicopa lubrica* and *Lauria cylindracea* we find the same type of prostate gland as in *Acanthinula* and *Vallonia*.

In *Patulastra balmei*, a much larger species than the others, the prostate gland consists of a large number of separate narrow tubules, forming an irregular fringe, which extends along almost the entire length of the common duct (pl. I, fig. 2). It thus resembles more closely the type of prostate gland found in the Enidæ. In *Pyramidula rupestris*, on the other hand, the gland is greatly reduced, and consists of a few extremely small and narrow tubules at the posterior end of the common duct (pl. II, fig. 4).

It is interesting to notice that although a prostate gland occurs in *Acanthinula lamellata* it is absent in those examples of *A. aculeata* that have no male ducts;² while in the similar specimens of *Vallonia* it is quite vestigial, being so small as to be only visible in stained preparations under the microscope (compare pl. II, figs. 5 and 6). On the other hand, in the British species of *Azeca*, in which the vas deferens is unusually broad in comparison with the size of the snail, the prostate gland attains relatively enormous dimensions. While, therefore, the function of this gland remains doubtful, it seems not unlikely that it produces a secretion which normally passes down the male ducts.

The receptacular duct is long in the genera that we are considering, especially in *Patulastra balmei* and *Acanthinula aculeata*, and it is unbranched. In this it resembles all the Orthurethra, excepting *Cochlicopa* and the Palæarctic Enidæ. The oviduct and vagina are without other appendages.

More than fifty years ago Goldfuss said that *Vallonia pulchella* and *V. costata* both possessed darts,³ and in 1873 Lehmann stated that *Vallonia pulchella* had a dart-sac, and showed one in his figures of this species.⁴ He also showed dart-sacs in his figures of *Acanthinula*

closely resembles that of the Pupillidæ, and I agree with Dr. Pilsbry in thinking that it should be retained in this family (*Man. Conch.* (2nd ser.), vol. xxv, 1919, pp. 68, 69).

¹ *Op. cit.*, p. 14.

² Boycott, *Proc. Malac. Soc. Lond.*, vol. xii, 1917, p. 225.

³ *Verhandl. naturh. Verein. preuss. Rheinl. & Westphal.*, 1856, p. 52.

⁴ *Op. cit.*, p. 92, pl. xi, fig. 30.

lamellata and *A. aculeata*, and depicted a couple of curved darts as belonging to the latter species, although he does not mention them in the text.¹ In 1884 Ashford described and figured a dart and dart-sac in *Vallonia pulchella*, stating that the dart was straight, acutely conical, and 0·2 mm. in length.² Ashford, however, said that his information concerning these organs was offered subject to confirmation or correction, as further examination was desirable; and Steenberg has recently denied the existence of a dart-sac and dart in *Vallonia* and *Acanthinula*.³

In all the examples of these snails that I have examined, I have never found a dart; yet I would hesitate to say positively that one is never developed, and that all the older authors were quite wrong. It seems extremely improbable that the vagina of *Vallonia* or *Acanthinula* could ever develop a dart-sac, but there is much to be said in favour of the view that the enlarged basal portion of the penial appendix of the Orthurethra is homologous with the dart-sac of the Sigmurethra.⁴ The distance between the proximal end of the penial appendix and the genital atrium varies in the Orthurethra, and in some of the Enidæ the appendix seems to occupy exactly the position that the dart-sac holds in *Zonitoides* and many other members of the Zonitidæ.⁵ Moreover, the dart-sac in the Zonitidæ often has no dart, and sometimes it may bear a long continuation, very like the rest of the penial appendix in the Orthurethra.⁶ Now, if this homology be correct, it is quite conceivable that under certain circumstances *Vallonia*, and perhaps also *Acanthinula*, might possibly secrete a dart in the penial appendix; and as the older authors thought that these snails were Helices, if they did find a dart they might easily assume that the structure in which they found it must be a dart-sac of the type that usually occurs in the Helicidæ.

However this may be, it is clear that the evidence of the reproductive system, taken as a whole, supports that of the other organs which we have already considered. A classification that is based on the study of a single organ, or even of a single group of organs, is often unnatural, and should always be regarded with suspicion; but it is evident that those authors who have already transferred *Acanthinula* from the Helicidæ to the Orthurethra, on account of the form of the genital ducts, have undoubtedly acted rightly, and that not only *Vallonia*, but also *Pyramidula* and *Patulastra* must certainly be placed in the Orthurethra as well.

¹ *Ibid.*, pl. x, fig. 25, pl. xi, fig. 32.

² *Journ. of Conch.*, vol. iv, p. 198, pl. viii, figs. 8, 9.

³ *Op. cit.*, pp. 6, 8, 12, 13.

⁴ See Simroth, *Journ. Coll. Sci. Tokyo*, vol. xii, 1898, p. 82.

⁵ See, for example, Wiegmann's figure of *Pachnodus velutinus* (Pfr.) in *Mitth. Zool. Samml. Mus. Berlin*, vol. i, 1898, pl. iv, fig. 8.

⁶ As in *Staffordia daflaensis* Godwin-Austen, *L. and F.W. Moll. of India*, vol. ii, 1907, pl. cxiii, figs. 1*h*, 1*i*.

For we have seen that whether we regard the locomotory or the nervous system, the excretory or the digestive system, the muscular or the reproductive system, all the evidence points to the same conclusion.

FAMILY RELATIONSHIPS OF *ACANTHINULA*, *VALLONIA*, *PATULASTRA*, AND *PYRAMIDULA*. While it is easy to be certain that these four genera belong to the Orthurethra, and have very little affinity with the Endodontidæ or the Helicidæ, in the present imperfect state of our knowledge it is very difficult to decide exactly where they should be placed among the various orthurethrous families.

Steenberg considers that *Acanthinula* and *Vallonia* are nearly allied to each other, and he places them provisionally in a family by themselves, which he names the Acanthinulidæ, and which he believes to be closely related to both the Enidæ and the Pupillidæ.¹ Now it is evident that *Vallonia* and *Acanthinula* are closely allied genera. It is true that *Acanthinula* differs from *Vallonia* in the higher spire, narrower umbilicus, and darker colour of its shell; in the smaller size and slightly larger number of the lateral teeth of the radula;² and also, when the male organs are developed, in the shortness of the part of the penis in front of the penial appendix, the presence of a pair of small flagella on the epiphallus, and the posterior origin of the penial retractor. These differences, however, while quite enough to establish beyond doubt the generic distinctness of *Vallonia* and *Acanthinula*, are not very much greater than those that separate *Acanthinula aculeata* and *A. lamellata*,³ and would certainly not justify the placing of the two genera in separate families or even in separate sub-families.

That Steenberg is also right in regarding these genera as closely related to both the Enidæ and the Pupillidæ is abundantly clear from the evidence that has already been put forward in this article. But if the group which these genera form is to be regarded as a distinct family, it would seem better to call it the Valloniidæ rather than the Acanthinulidæ, inasmuch as the former name is not only shorter and derived from an older generic name, but has been in use for nearly twenty years,⁴ whereas the name Acanthinulidæ is little more than two years old.

Patulastra differs widely from *Vallonia* and *Acanthinula* in its reproductive organs; and while the fact that it is viviparous might partly explain the absence of a penial appendix (as in *Pyramidula*⁵), this would not account for the complicated structure of the epiphallus

¹ Vidensk. Meddel. Dansk Naturh. Foren., vol. lxix, 1917, p. 14.

² The other differences in the radula are extremely slight, the rounded inner edges of the marginal teeth of *Acanthinula*, and the length of the central tooth of *A. aculeata*, being somewhat exaggerated in Bowell's figures (Proc. Malac. Soc. Lond., vol. xi, 1914, p. 158).

³ See p. 29.

⁴ Pilsbry, Proc. Acad. Nat. Sci. Phila., 1900, p. 564.

⁵ See p. 16.

(pl. I, fig. 3), or the different character of the prostate gland (fig. 2). But the reproductive organs of *Patulastra* do not agree at all closely with those of any other genera with which I am acquainted, and in its radula (text-fig. 4d), as well as in most other features of its anatomy, it bears a strong resemblance to *Vallonia*. It would therefore seem best to assign *Patulastra* to the same family as *Vallonia* and *Acanthinula*, although it might perhaps be placed in a separate sub-family, unless any of the other foreign species of *Patulastra* should prove to have genital organs less unlike those of *Vallonia* and *Acanthinula* than are these organs in *P. balmei*.

Pyramidula differs from *Vallonia* and *Acanthinula* little, if any, more than does *Patulastra*, for while its radula is of a rather different type (text-fig. 4a), its reproductive organs are not quite so dissimilar (pl. II, fig. 4), and although it differs from *Vallonia* and *Patulastra* in the posterior origin of its penial retractor, it agrees in this respect with *Acanthinula*. The broad mesocones of the central and lateral teeth of *Pyramidula rupestris* may be due to its habitat (see p. 13), but this would not account for the larger central teeth, which are also possessed by *P. humilis* (Hutton). Now, similar central teeth are found in most of the Pupillidæ, and, apart from the broadened cusps of *P. rupestris*, the type of radula occurring in the genus *Pyramidula* agrees exactly with that usually found in that family. *Pyramidula* also closely resembles the Pupillidæ in its reproductive system, as well as in its central nervous system, pallial organs, retractor muscles, etc. Its black hermaphrodite duct resembles that of *Vertigo moulinsiana* and *V. antivertigo*, and the spirally coiled head of the spermatozoon (pl. II, fig. 1) agrees closely with that of *Lauria cylindracea*; while its exceedingly short lower tentacles also remind one of the Pupillidæ. Indeed, there seem to be no differences between *Pyramidula* and an ordinary member of the Pupillidæ, excepting in the form of the shell and the simplicity of its peristome.¹ But these differences in the shell disappear if we compare *Pyramidula*, not with a full-grown *Pupilla*, but with a young specimen, for many genera of the Pupillidæ have Heliciform umbilicate young, closely resembling the more conical varieties of *Pyramidula*. I would therefore suggest that *Pyramidula* is a member of the Pupillidæ in which the reproductive organs develop early, and the animal devotes its energies to providing its numerous offspring with well-developed shells before they are born, instead of completing its own shell.

A parallel case among British snails is found in *Balea perversa*. This species is also viviparous, and is very like a young *Clausilia*; it forms no clausium, and never completes its aperture in the elaborate manner which is characteristic of that genus. Yet, as

¹ Hesse, in a paper just received (*Nachr. Deutsch. Malak. Gesell.*, 1918, p. 110), upholds similar views to mine, but the species he terms *Pyr. rupestris* seems to differ from that examined by Moquin-Tandon and myself.

Steenberg has shown,¹ it is not a primitive member of the Clausiliidæ, but a highly specialized form, allied to *Clausilia biblicata*. The only reasonable explanation of the characters of the shell of *Balea perversa* seems to be that this species is a *Clausilia* which has sacrificed the completion of its own shell in its efforts to provide adequate shells for its young. And it seems likely that the same explanation applies to *Pyramidula*. For in the bleak, rocky situations in which *Pyramidula rupestris* is so often found, it is obviously specially advisable that the young should come into the world adequately protected.

If *Pyramidula* is simply a kind of *Pupilla* that never grows up, it clearly must be placed in the Pupillidæ. But we have already seen that the genus *Pyramidula* does not differ much from *Acanthinula* and *Vallonia*, excepting for the larger central teeth of the radula. In *Acanthinula lamellata*, however, the central teeth are not very much smaller than the laterals, and they are no smaller in *A. (Zoogenites) harpa*, according to Morse.² This feature, therefore, cannot be said to separate the Valloniidæ from the Pupillidæ, and there seem to be no other anatomical differences. The Heliciform shell of the Valloniidæ is not an important difference, for, according to Pilsbry, more than half of the sub-families into which he divides the Pupillidæ contain Helicoid forms.³ And although it is easy to attach too much weight to the "recapitulation theory", the fact that so many of the Pupillidæ are Heliciform when young, even though they are not when full-grown, suggests the possibility that the spire of the ancestral form of the family may have been no higher than that of *Acanthinula*, for example. There is some reason to suppose that the Pupiform members of the Streptaxidæ may have been evolved from the Helicoid forms, and possibly the course of evolution in the Pupillidæ may have followed parallel lines. Moreover, certain recent authors have already placed *Acanthinula* in the Pupillidæ,⁴ and if *Acanthinula* should be assigned to that family, so should *Vallonia*. In other words, the Valloniidæ should be reduced to the rank of a sub-family of the Pupillidæ, like the Vertigininæ, etc. *Patulastra* should probably be placed in the same sub-family as *Vallonia* and *Acanthinula*; though possibly it would be better placed in a separate sub-family of the Pupillidæ, on account of its very different reproductive system.

But *Vallonia*, *Acanthinula*, and *Patulastra* seem also to be very closely related to the Enidæ. This is due to the fact that the Palæarctic Enidæ do not differ in any essential features from the

¹ *Anatomie des Clausilie Danoises*: Mindeskrift for J. Steenstrup, No. 29, 1914, pp. 39, 40, 43.

² Binney, *Terrest. Air-breathing Mollusks of the U.S.*, vol. v, 1878, p. 341, fig. 225.

³ *Man. Conch.* (2nd ser.), vol. xxiv, 1918, p. x.

⁴ e.g. Pilsbry, *ibid.* (same page); C. R. Boettger: *Nachr. Deutsch. Malak. Gesell.*, vol. xli, 1909, p. 4; vol. xlvi, 1911, p. 24.

Pupillidæ, and should in my opinion be united with the family, although forming another distinct sub-family within the Pupillidæ.¹ *Ena* agrees closely with the Pupillidæ in its nervous system, excretory organs, retractor muscles, etc. There is no constant difference between the shells of the two groups, as is shown, for example, by the want of agreement among conchologists as to whether *Leucochiloïdes* (or *Pupoïdes*) should be placed in the Pupillidæ or in the Enidæ. The radulæ are of the same type, the only difference being that which is usually found between the larger and smaller species of the same group, namely, a tendency for the number of the cusps and the breadth of the teeth to be reduced in most of the Palæarctic Enidæ, as compared with the smaller Pupillidæ. The reproductive organs also are similar in most respects. The prostate gland, it is true, is longer in the Enidæ than in the majority of the Pupillidæ, but it is not longer than in *Patulastra balmei* (pl. I, fig. 2). The only constant difference seems to be that in the Palæarctic Enidæ the receptacular duct bears a diverticulum. But this feature can hardly be considered a sufficient reason for regarding the Enidæ as an entirely distinct family, since we may find in a single family some genera with, and some without, such a diverticulum as, for example, in the Helicidæ. And this difference is far less than that which sometimes exists between the reproductive organs of different individuals of *Vallonia costata*, living together on the same hedge-bank.

Moreover, the southern forms (such as *Pachnodus*) that are usually placed in the Enidæ are without this diverticulum of the receptacular duct. But these southern genera differ from the Palæarctic Enidæ in other respects also. Thus, most of the teeth of the radula, instead of having their major axes practically in a line with one another, are placed more or less obliquely, so that the outer side of one tooth is in front of the inner side of the tooth next beyond. This character, which gives a strikingly different aspect to the radula in many of the southern forms, is entirely absent in the Palæarctic species. There can be little doubt, in fact, that *Pachnodus* and its allies should be placed in a separate sub-family from the Palæarctic forms, or perhaps even in a distinct family.

Cochlicopa is in many ways intermediate between the Valloniinæ and the Eninæ in its anatomy. The radula, with its small central teeth, is, on the whole, very like that of *Vallonia* and *Patulastra*. The prostate gland is chiefly confined to the posterior end of the common duct, as in *Vallonia*, *Acanthinula*, and the more typical members of the Pupillidæ, although a few tubules are developed further forward. On the other hand, the receptacular duct bears a diverticulum, as in the Eninæ, and the penial retractor is not

¹ Hesse is also of the opinion that the Enidæ and the Pupillidæ should be united in one family (Nachr. Deutsch. Malak. Gesell., vol. xlvi, 1915, p. 57).

forked, but is of the same type as in *Ena (Zebrina) detrita*.¹ In its other organs *Cochlicopa* agrees closely with both the Eninæ and the Valloniinæ, as well as with the more typical Pupillidæ. It therefore seems evident that the Cochlicopidæ should also be reduced to the rank of a sub-family of the Pupillidæ.

Azeca is generally admitted to be closely allied to *Cochlicopa*, which it resembles in its radula as well as in its pallial organs, etc. Yet in its reproductive system the British species of *Azeca* differs widely from *Cochlicopa*.² The receptacular duct is unbranched, but the free oviduct bears an appendiculum instead. The prostate gland is greatly developed, especially towards its hinder end, which extends backwards beyond the albumen gland. The vas deferens is unusually thick, and there is no penial appendix in the British form, although Saint-Simon states that one is present in *Azeca menkeana alzenensis*.³ In view of these striking differences between the genital organs of *Cochlicopa* and *Azeca*, the latter genus might well be placed in a distinct sub-family by itself.

Leptachatina, *Amastra*, and the other genera that Pilsbry includes in the Amastridæ, have reproductive organs intermediate in character between those of *Cochlicopa* and *Azeca*.⁴ They have the large prostate gland and unbranched receptacular duct of *Azeca*, but in other respects they agree exactly with *Cochlicopa*. The radula has small central teeth, and is of the same type that we find in *Cochlicopa*, *Azeca*, and the Valloniinæ, and so are the pallial organs. Further, the shell in some species of *Leptachatina*, the most primitive of these genera, is remarkably like that of *Cochlicopa*. Indeed, Pilsbry himself says that "so far as the groups are known, no character of importance separates *Cochlicopa* from *Leptachatina*".⁵ He modified this statement later by saying that the Amastridæ could be distinguished from the European forms by one character, namely the prostate gland,⁶ but we have seen that this is not so, as *Azeca* has a large prostate like the Amastridæ. Therefore, in the present state of our knowledge there would appear to be no justification whatever for placing *Cochlicopa* and *Azeca* in one family and *Leptachatina* and *Amastra* in another. I therefore consider that the Amastridæ might also be reduced to the rank of a sub-family of the Pupillidæ and placed next to the Cochlicopinæ and the Azecinæ.

¹ Beck, Jenaische Zeitschr. Naturw., vol. xlviii, 1912, pl. ix, fig. 25a. In most of the Eninæ the penial retractor is bifurcated, as in *Vallonia*, *Acanthinula*, etc.; but the fork varies in size, being very small in *E. obscura*, though larger in *E. montana*.

² See Boycott, Journ. of Conch., vol. xvi, 1919, p. 53.

³ Annales de Malacologie, vol. i, 1870, p. 29.

⁴ Excepting in regard to the radula, my knowledge of the anatomy of these snails from the Hawaiian Islands is derived almost entirely from Pilsbry's excellent account in the *Manual of Conchology* (2nd ser.), vol. xxiii, 1915, pp. 57–68, pls. xii–xvii, xx, and xxii.

⁵ Op. cit., vol. xix, 1908, p. 212.

⁶ Ibid., vol. xxiii, 1915, p. 62.

In some respects these snails from the Hawaiian Islands show a specially strong resemblance to the Valloniinæ. Thus the lateral and marginal teeth of the radula of some of the species are remarkably similar to those of *Patulastra balmei*, more like them than those of any European form that I have seen. And although the central teeth in *Amastra* itself are even smaller than in the European genera, this does not seem to be the case in *Leptachatina*. Again, while the shells of some of the Amastrinæ scarcely differ from *Cochlicopa*, we find every gradation from this form to shells that are even flatter and more openly umbilicate than *Patulastra* or *Vallonia*; and the apical spiral striæ of *Armsia* and *Thaanumia* (a sub-genus of *Leptachatina*) resemble those of *Vallonia costata* and *Acanthinula aculeata*.

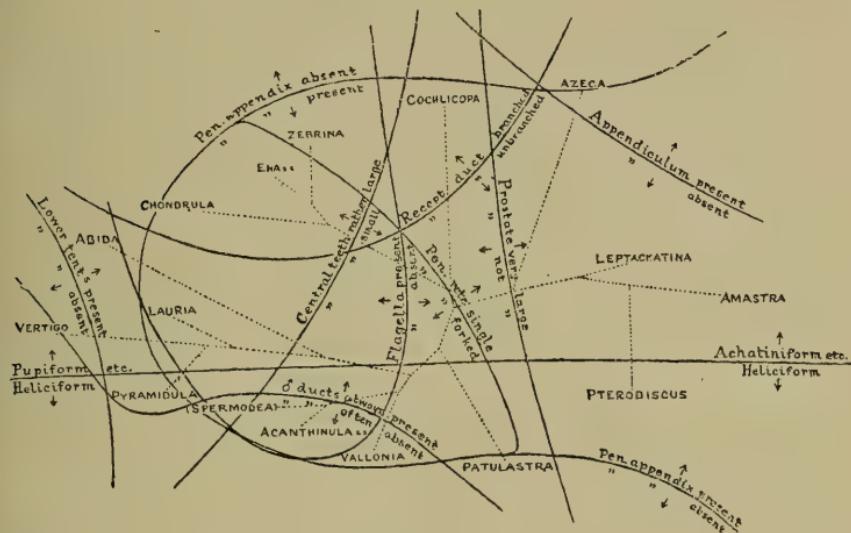


Diagram showing the diverse distribution of different characters among representative genera allied to the Pupillidæ, and illustrating the fact that a division of the group based on any single character would not accord with one based on any other. The dotted lines indicate one of the many possible views that might be held concerning the genetic connexions of the various genera.

We find, therefore, that although the sub-family Valloniinæ is undoubtedly closely related to the typical members of the Pupillidæ it is in many ways intermediate between the Pupillidæ, the Enidæ, the Cochlicopidæ, and the Amastridæ, agreeing closely with one group in one respect and with another in another respect, though resembling them all in most respects. It thus seems to help to link together these so-called families; to emphasize the fact that their supposed differences, when they exist at all, are scarcely to be compared with the differences that separate the families of the Sigmurethra, and to support the view that all these groups might well be united into a single family, divided into an unusually large

number of sub-families. It is remarkable that the most striking differences that do occur within this family are often found among members of the same sub-family; as, for example, the difference between the shells of *Carelia* and *Planamastra*, between the radulae of *Abida* and *Chondrina*, and between the genital organs of different individuals of *Acanthinula aculeata* or *Vallonia costata*.

It is not surprising that this family should have a wide distribution and a considerable variation in external form, seeing that it is the oldest known family of land snails. Shells generally assigned to the Pupillidæ—*Strophites grandæva*, Dawson, and *Dendropupa primæva* (Mathew)—have been found in the Upper Devonian strata of New Brunswick, and other species of the same genera occur in Carboniferous and Permian beds; and if the Upper Carboniferous shell from Nova Scotia, originally described as *Zonites (Conulus) priscus*, Carpenter, has been rightly regarded by modern authors as probably related to *Pyramidula*, it would seem that all the Palæozoic members of the Stylommatophora that have hitherto been discovered belong to this family.¹ This is a point of special interest, because the orthurethrous type of kidney is generally considered, on morphological grounds, to be more primitive and therefore, presumably, more ancient than the type found in the Sigmurethra, the group to which the majority of living snails belong.

The remaining families of the Orthurethra seem to be more distinct and less closely allied to *Pyramidula*, *Patulastra*, *Vallonia*, and *Acanthinula*. The family Achatinellidæ—in which I would include the Tornatellininæ as a very distinct sub-family—differs greatly from all the forms that we have been considering in its extraordinary radula, which resembles that of Athoracophoridæ. It is also characterized by its remarkably small albumen gland, while Pilsbry has pointed out that *Achatinella* differs from *Amastra* in other constant characters as well.² The Partulidæ is also a fairly distinct family, according to the same author's description.³

Glossula, which Pilsbry placed provisionally among the Orthurethra, is a sigmurethrous genus, very different from those with which we have been dealing, and it is not improbable that the same may prove to be true in the case of *Cæcilioides*, *Ferussacia*, and their allies. The radulae of these genera are of the type found in the Achatinidæ, and differ widely from the types occurring in the Pupillidæ, Achatinellidæ, and Partulidæ.

On the other hand, it is possible that one or two other genera of small Heliciform snails, usually assigned to the Endodontidæ or the Helicidæ, should be placed in or near the Valloniinæ, in addition to those with which this article specially deals. Thus, *Aspasita*, which has generally been regarded as a section of *Helicodonta*, is

¹ B. B. Woodward, Proc. Malac. Soc. Lond., vol. viii, 1908, pp. 73–7.

² Op. cit., vol. xxiii, 1915, p. 61.

³ Ibid., vol. xx, 1909, pp. 155–60.

probably an orthurethrous genus allied to *Vallonia* and *Acanthinula*, judging from Hesse's preliminary description of *A. triaria*, Fr.,¹ and it has recently been placed in the Pupillidæ by Pilsbry.² It must not be supposed, however, that this is likely to be the case with many of the numerous small snails, chiefly found in the Southern Hemisphere, which Pilsbry placed in the Endodontidæ. For although the shells in some of these forms are very like *Patulastra* or *Acanthinula*, it is certain that in the great majority of cases this resemblance is purely superficial.

MUTUAL AFFINITIES OF THE BRITISH SPECIES OF *VALLONIA*.—The three forms of *Vallonia* that live in the British Isles are closely related to one another, and many collectors doubt whether they are specifically distinct.³ Nevertheless, I think that Dr. Sterki was certainly right in regarding them as distinct species,⁴ for each is distributed over a very wide area in Europe and America, they are sometimes found together, and yet they do not appear to merge into one another, but differ constantly in several characters. Perhaps the failure of many collectors to appreciate the specific differences is due partly to the minute size of these snails, but chiefly to the fact that comparative descriptions and figures of the three species have hitherto not been very accessible to English students.

Vallonia costata is probably the most primitive of the three species, and should be placed first. It differs from the others not only in being furnished with conspicuous periostracal ribs, and in having more distinct microscopical spiral striæ on its protoconch, but also in the general form of the shell, and particularly in the deflection of the aperture (see text-fig. 6a). This last feature makes it easy to distinguish fossil specimens of this species, however worn they may be.

The radula of *Vallonia costata* differs from those of the other two British species in that the lateral teeth are five in number instead of four, the first being not quite so large as in *V. pulchella*, and their basal plates are more nearly square. Moreover, the marginal teeth usually have about five cusps, instead of six to eight, as in the other species.

This is perhaps the commonest species of *Vallonia* in England. It occurs with both the other species amongst grass, moss, etc., and also in drier situations, such as amongst ivy on the tops of walls, where it is frequently associated with *Lauria cylindracea*.

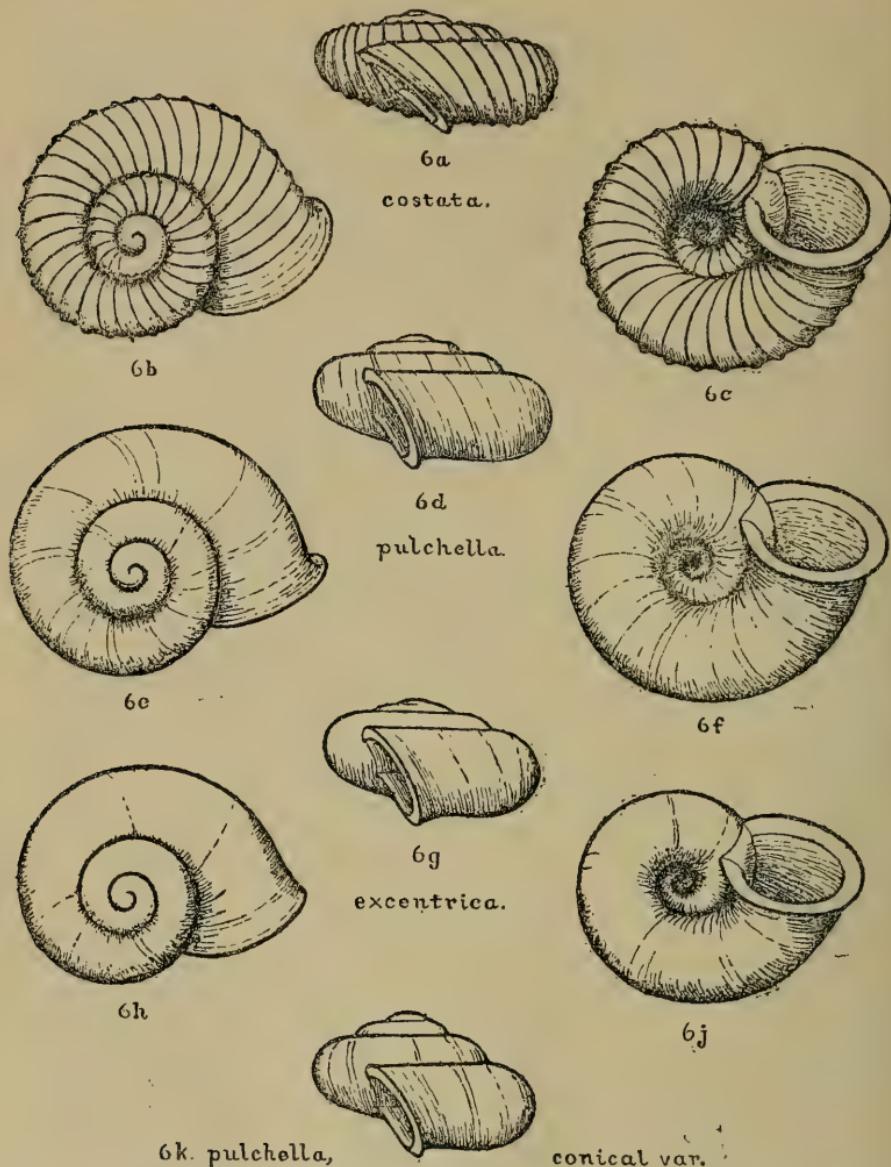
Vallonia pulchella is rather more local in its distribution, and seems to occur more often in damp situations. It appears to have

¹ Nachr. Deutsch. Malak. Gesell., vol. xlvi, 1915, p. 58.

² *Op. cit.*, vol. xxiv, 1918, p. x.

³ e.g., Cooper, Journ. of Conch., vol. xi, 1906, p. 340; Adams, *ibid.*, p. 364.

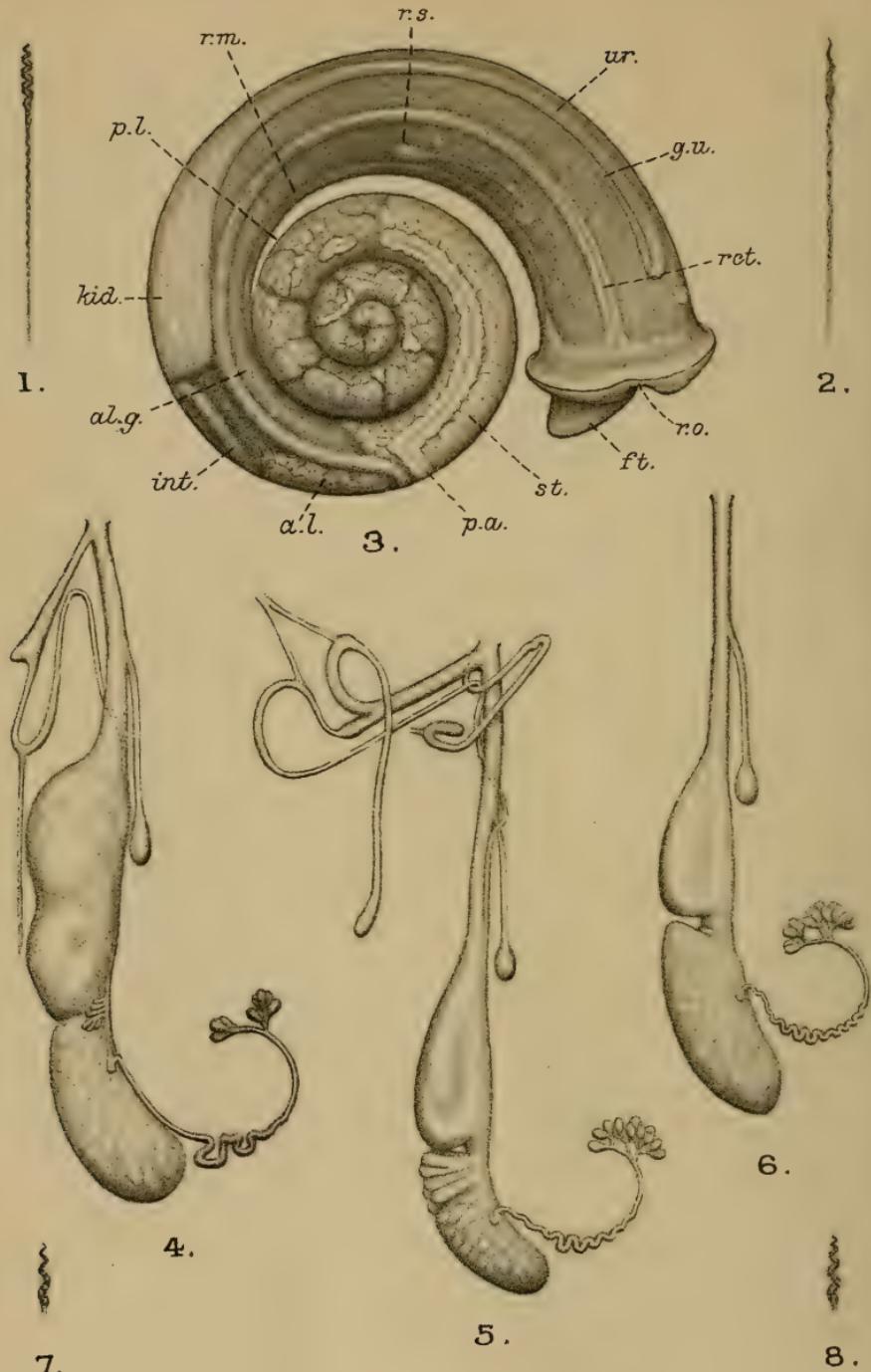
⁴ See his excellent "Observations on *Vallonia*": Proc. Acad. Nat. Sci. Phila., 1893, pp. 234–79, pl. viii; as well as his shorter account of the genus in *Man. Conch.* (2nd series), vol. xiii, 1893, pp. 247–61, pls. xxxii, xxxiii.



Figs. 6a-*k*.—Shells of the British species of *Vallonia*; all $\times 15$. Figs. 6a-6*j* represent normal specimens of the three species from Cambridge. Fig. 6*k* depicts an unusually conical example of *V. pulchella* from Madingley, Cambridgeshire.

closer affinities with *V. costata* than has *V. excentrica*, and should therefore take the second place among the British species.

Text-fig. 6*k* depicts an unusually conical specimen of this species, found near the village of Madingley, in Cambridgeshire, associated with normal individuals of *V. pulchella*, a single specimen of *V. excentrica*, and a few examples of *V. costata*.



Anatomy of *Pyramidula* (Figs 1, 3 & 4), *Vallonia* (Figs 2, 5 & 6) & *Acanthinula* (Figs 7 & 8).

Vallonia excentrica is common amongst grass, etc., in very many parts of England. It differs from *V. pulchella* in having a smoother and slightly smaller shell, somewhat oval in outline, with more rapidly increasing whorls. The suture is shallower, and the umbilicus is usually narrower in the centre, but shows more of the penultimate whorl near the aperture. The peristome is gradually expanded, instead of being abruptly reflected at the edge, as in *V. pulchella* (compare text-figs. 6e and 6h). This marked difference in the peristome seems to be quite constant, and forms one of the easiest means of separating the two species, as was first pointed out to me several years ago by Mr. G. H. Clapp.

The radular teeth of *V. excentrica* are, on the whole, very similar to those of *V. pulchella*, but the outer marginals are even more elongated transversely, and often have more cusps. The number of teeth in each transverse row is about the same as in *V. pulchella*, but the average number of rows is slightly greater than in either of the other species, notwithstanding the smaller size of the shell : 83 rows are the most that I have counted in *V. excentrica*, 77 in *V. costata*, and 76 in *V. pulchella*. The jaw of *Vallonia excentrica* also appears to differ slightly from those of the other two species, being usually a little broader, with a tendency to form a slight median projection, and showing some divergent striæ towards its lower edge (pl. I, fig. 6).

While this species is undoubtedly very closely allied to *V. pulchella*, it seems on the whole to be more highly specialized, and it should therefore be placed last among the British members of the genus.

MUTUAL AFFINITIES OF THE BRITISH SPECIES OF *ACANTHINULA*.—While the three British species of *Vallonia* are closely related to one another, the very reverse is true in the case of the two British species of *Acanthinula*. *A. lamellata* differs externally from *A. aculeata* in having a globosely pyramidal shell, with narrow whorls, and a simple, unreflected peristome, and in the protoconch being microscopically punctate instead of spirally striate, as in *A. aculeata*. Internally the differences are equally great. The recurrent ureter of *A. aculeata* is represented by an open groove, the lateral teeth of the radula have an additional small cusp between the mesocone and the ectocone, and the central tooth is only a little smaller than the laterals ; while the penis, epiphallus, etc., are not known to occur. In view of these important differences there can be no doubt that Westerlund was right in placing *A. lamellata* in a distinct sub-genus, which he named *Spermodea*.¹

SUMMARY OF CHIEF CONCLUSIONS.—*Acanthinula* and *Vallonia* are rather closely allied genera ; *Patulastra* and *Pyramidula* (s.s.) are each a little more isolated ; but all these genera are nearly related to the Pupillidæ, and should probably be placed in that family. They

¹ Rada Jugoslav. Akad., vol. cli, 1902, p. 90.

differ widely in their anatomy from the Endodontidæ, Helicidæ, and other sigmurethrous families, but they have much in common, not only with the Pupillidæ, but also with the Cochlicopidæ, the Amastridæ, and at least the Palæarctic division of the Enidæ. The latter groups, however, seem to differ so slightly from one another and from the Pupillidæ, that they also might well be included in that ancient family, which appears to be divisible into a large number of inter-related sub-families, comprising much diversity in the shape of the shell.

The three British forms of *Vallonia* are distinct, though nearly allied, species; they should be placed in the following order: 1, *V. costata*; 2, *V. pulchella*; 3, *V. excentrica*. The two British species of *Acanthinula* belong to separate sub-genera.

EXPLANATION OF PLATES.

FIG.

PLATE I.

1. *Vallonia excentrica* Sterki, from Oakamoor North Staffordshire, without its shell, seen from below. $\times 25$. *a.l.*, anterior division of liver; *al.g.*, albumen gland; *aur.*, auricle; *int.*, intestine; *kid.*, kidney; *m.c.*, mantle-cavity; *œs.*, œsophagus; *p.a.*, posterior aorta; *p.l.*, posterior division of liver; *r.m.*, retractor muscles; *s.gl.*, salivary glands; *st.*, stomach; *ur.*, ureter; *ut.*, uterus; *vnt.*, ventricle.
2. Reproductive organs of *Patulastra balmei* (P. & M.), from Glasnevin Botanic Gardens, Dublin. $\times 8$.
3. Penis (cut open) and anterior part of epiphallus of *P. balmei*. $\times 22.5$.
4. Head and anterior part of tail of spermatozoon of *P. balmei*. $\times 1200$. (The entire spermatozoon is about $\frac{1}{4}$ mm. long, only about one-fourteenth of the tail being shown in the figure.)
5. Jaw of *P. balmei*. $\times 30$.
6. Jaw of *Vallonia excentrica*. $\times 100$.

FIG.

PLATE II.

1. Head and anterior part of tail of spermatozoon of *Pyramidula rupestris* (Drap.). $\times 1200$.
2. Head and anterior part of tail of spermatozoon of *Vallonia costata* (Müll.). $\times 1200$. *V. excentrica* has very similar spermatozoa.
3. *Pyramidula rupestris* (Drap.), from Burnsall, Wharfedale, without its shell and with its head retracted, seen from above. $\times 22$. *a.l.*, anterior division of liver; *al.g.*, albumen gland; *ft.*, foot; *g.u.*, groove running backwards from opening of ureter; *int.*, intestine; *kid.*, kidney; *p.a.*, upper branch of posterior aorta, thickly coated with a calcareous deposit; *p.l.*, posterior division of liver; *rct.*, rectum; *r.m.*, retractor muscles; *r.o.*, respiratory orifice; *r.s.*, receptaculum seminis; *st.*, stomach; *ur.*, ureter.
4. Reproductive organs of *Pyramidula rupestris* (Drap.), from Burnsall, Wharfedale. \times about 22.
5. Reproductive organs of a specimen of *Vallonia costata* (Müll.), from Little Shelford, Cambridgeshire, with a penis and two penial appendices. \times about 25.
6. Reproductive organs of *Vallonia pulchella* (Müll.), from Madingley, Cambridgeshire. \times about 25.
7. Head of spermatozoon of *Acanthinula lamellata* (Jeff.). $\times 1200$.
8. Head of spermatozoon of *Acanthinula aculeata* (Müll.). $\times 1200$.

ON *MITRA MONTEREYI*, A NEW CALIFORNIAN SPECIES.

By Dr. S. STILLMAN BERRY, Redlands, California.

Read 9th January, 1920.

THE fine *Mitra* here described is one of several apparently unnamed marine molluscs, the publication of which has been delayed by the pressure of other work.

MITRA MONTEREYI, n.sp.

Diagnosis.—Shell of good size, robust, heavy, spindle-shaped, the maximum width contained in the length somewhat less than three times; whorls only slightly convex on the spire, the latter tapering quite rapidly; sutures distinct but only weakly indented. Aperture ample, its extreme measurement nearly or quite one-half the entire length of the shell; the heavy outer lip suffers moderate thinning at the edge; columellar plaits strong and primarily three, but there is apt to be an incipient fourth one where the columella begins to draw into the canal in front, and a small adventitious plait now and then appears between two of the major ones. Canal short, weakly upturned.

Practically the entire shell sculptured by numerous, rather fine, spiral threads, sometimes more or less obsolete on the peripheral region, and frequently so cut by the lines of growth as to result in an appearance of minute pitting, the spiral threads heaviest and coarsest in the region of the canal and the front of the shell generally. Lines of growth and incremental ridges numerous, varying from fine to coarse and irregular.

Entire shell covered by a strong black or very dark brown periostracum. Interior of shell white or brownish white, the columellar region (except the plaits) and inside of the outer lip frequently deep brown.

Measurements.

	Length	Maximum Width	Length of Body-whorl	Length of Aperture
Type	66·5	23·5	46·5	33·7 mm.
Paratype	60·0+	22·3	44·5	32·2 "
"	49·6+	19·1	37·0	27·0 "
"	30·5	12·0	23·2	17·0 "

Type.—Cat. No. 298 of the author's collection.

Type Locality.—12 fathoms off Del Monte, Monterey Bay, California; bottom of hard blue clay; S. S. Berry, June, 1906; four specimens.

Remarks.—*Mitra montereyi* is a characteristic member of the *orientalis-idae* group. The discrepancy between shells of this species and the more southern ones described as *Mitra idae* by Melvill (1893, p. 140) is very apparent, especially if specimens of the two

forms are brought side by side, when it is shown to lie chiefly in the larger size, far heavier and more robust outline, and relatively longer, more roomy aperture of *montereyi*. Otherwise they are very

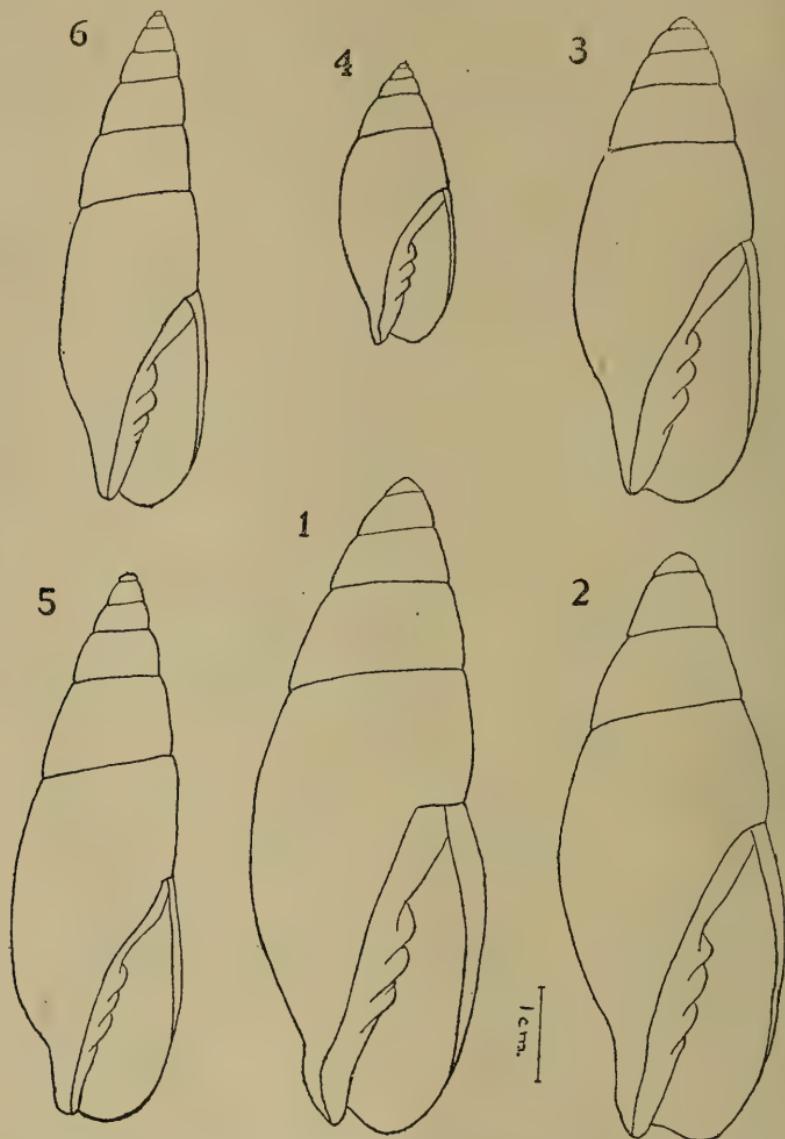


FIG. 1.—*Mitra montereyi*, n.sp., camera outline of type, from Monterey Bay, California; approximately natural size.

FIGS. 2-4.—*Mitra montereyi*, n.sp., camera outlines of three paratypes; same scale as fig. 1.

FIGS. 5-6.—*Mitra idæ*, Melvill, camera outlines of two shells from San Diego, California; same scale as figs. 1-4.

nearly related, so much so that specimens from intermediate localities may conceivably bridge the gap and bring the two forms

into the relationship of sub-species rather than distinct species. This is conjectural, however. Superficially the specimens of *montereyi* much more nearly resemble the published figures of *M. orientalis*, Gray (= *maura*, Swainson) than they do *idæ*, and it was under the name of *maura* that they were originally reported (Berry, 1907, p. 40). The type locality of *maura*, however, is far removed, being Iquique, Chile (Swainson, 1835, p. 193), and hence the range of both *idæ* and *fultoni*, Smith, as well as that of other less nearly allied forms, intervenes.

The type locality of *M. idæ* is given as Point Loma, California. Two San Diego specimens, entered as Cat. No. 202 of the writer's collection, which were probably taken not far from the type locality, are here figured in order better to bring out the differences as compared with *montereyi*. Caliper measurements of the larger of them are: length, 57·1; maximum width, 18·0; length of body-whorl, 37·6; length of aperture, 25·5 mm.

As shown by the figures, the contour of *montereyi* remains remarkably constant through the different stages of growth.

All the specimens seen are more or less eroded at the apex.

Literature cited.

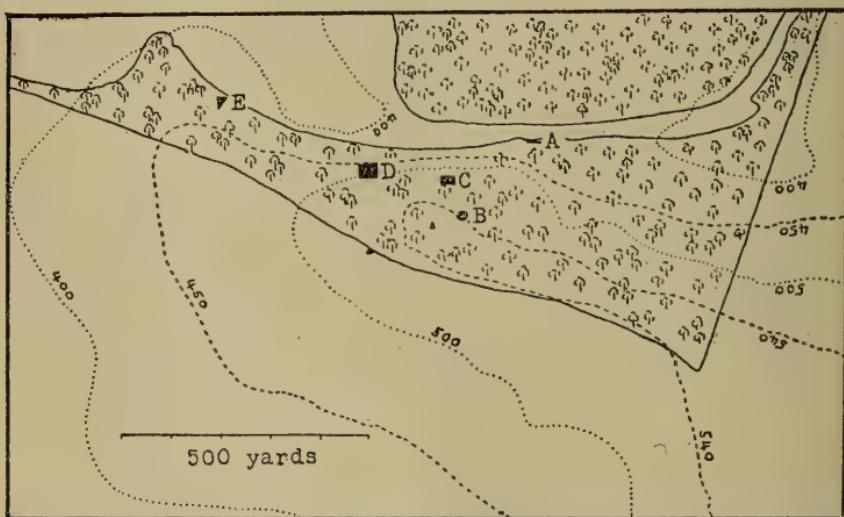
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ON THE SIZE VARIATION OF *CLAUSILIA BIDENTATA* AND
ENA OBSCURA WITHIN A "LOCALITY".

By Dr. A. E. BOYCOTT, F.R.S.

Read 9th January, 1920.

§ 1. It was shown in a previous communication¹ that specimens of *Clausilia bidentata* from similar habitats in the same neighbourhood could generally be readily distinguished from one another by differences in size. It was there shown that the snails living on one stone wall were usually larger or smaller than those living on a similar stone wall half a mile away, and therefore did not belong to precisely the same familial group. A question which was not then examined was how near together, in a habitat roughly homogeneous in character, such distinguishable loci might be—a locus for any species being an area throughout which that species is uniform in character. Facilities, imperfect but tolerable, for collecting over an extended period in a Wiltshire beech-wood, gave an opportunity for making some further inquiries into these questions.



Tower Hill Plantation.

§ 2. Tower Hill Plantation lies on a ridge of high chalk land, two miles west of Boscombe, in south-east Wilts. It forms part of a great ring plantation, and in its present form is presumably modern, though the northern slope is too steep to have ever allowed cultivation.² In the parts with which we are concerned it is a typical close-canopied beech-wood ; there is no ground flora except

¹ Journ. of Conch., vol. xvi, 1919, p. 10.

² I could find no signs of *Ena montana*, *Limax cinereo-niger*, or *L. tenellus* which would have indicated an ancient wood ; even *Helicigona lapicida* was absent, though it occurs a mile away in another wood.

for some moss in a few places and a scattered growth of *Cephalanthera* generally. The tree-trunks are also, with rare exceptions, free from moss or any but a scanty growth of lichens. The wood runs roughly east and west (see sketch-map); its southern edge nearly corresponds with the highest part of the ridge, while its northern part lies on a steep slope leading to a narrow valley, with a second wood beyond. The prevailing winds being from the south-west, the upper parts of the wood are exposed, while the northern slope and the valley beneath are much more sheltered. In a general way the whole wood would usually be considered a single homogeneous locus, and specimens collected in one part would not be separated from those from another part.

§ 3. The present inquiry was made to test this presumption by finding out whether *Clausilia bidentata* from one part of the wood was larger or smaller than from another part; incidentally, *Ena obscura* was also examined less fully.

To this end collections were made in five different areas (see map, p. 34), as follows:—

A: Six trees in a line 26 yards long in the valley, and very sheltered.

B: Thirteen trees in a rough circle of about 23 yards, 200 yards south-west of A, and some 120 feet higher, nearly on the top of the hill.

C: Twenty-one trees in 27 by 15 yards, 50 yards north and west of B, a little lower and more sheltered behind the hill-top; some moss on ground and trees.

D: Twenty-two trees in 41 by 30 yards, 120 yards west of C; lying on a steep slope, the difference in level between top and bottom being about 40 feet.

E: Twenty trees in a triangle of about 25 yards, 320 yards west of D; low and sheltered.

The shading varied to some extent; A was the lightest area, with thin trees to the south and none to the north. C and D are both open to some extent owing to the steep slope to the north. At B the trees are rather thin to the south, close on the other sides. E is the darkest locus. In three of these areas collections were made from individual trees as well as from the area as a whole, i.e. from six trees in area A, from three in area B, and from six in area D; their relative positions are shown in diagram 1. On an average there is one tree to about 35 or 40 square yards of ground.

The snails were collected as opportunity offered on various occasions between June 19 and December 2, 1918, as they crawled or sat upon the trunks, all the specimens found on the selected trees being taken without selection. The measurements and computations were made as already described.¹ A certain number of shells had to be excluded from measurement on account of decollation, in all

¹ Journal of Conch., vol. xvi, 1919, p. 11.

10 yards



AREA D

AREA A

AREA B

a
b
c
d
e
f

a
b
c

d

e
f

a
b
c

a
b
c

d
e
f

TABLE I.—SHOWING THE ALTITUDES AND DIAMETERS OF *CLAUSILIA BIDENTATA* FROM FIFTEEN TREES IN THREE AREAS.

ALTITUDE.	DIAMETER.	Number of specimens.																					
		Tree.			Maximum.			Minimum.			Variation.												
Mean.		Standard deviation.		Coefficient of variation.		Mean.		Standard deviation.		Coefficient of variation.		Mean.		Standard deviation.		Coefficient of variation.							
		2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9			Mean.	Standard deviation.	Coefficient of variation.	Mean.	Standard deviation.	Coefficient of variation.						
Tree.	8. 8·5. 9. 9·5. 10. 10·5. 11. 11·5. 12. 12·5.	1	8·9	12·5	10·139	0·646	6·4	4	15	16	4	2	2·563	0·096	3·7								
Aa	41	1	1	15	16	4	3	1	8·9	11·6	9·866	0·662	6·7	1	3	4	15	6	2·583	0·107	4·1		
b	30	1	8	9	7	3	1	9·2	11·3	10·310	0·561	5·5	2	2	12	29	10	6	2·610	0·095	3·6		
c	59	3	15	15	18	8	1	9·0	11·4	10·179	0·538	5·3	2	6	20	29	12	3	2·572	0·106	4·1		
d	72	4	24	21	18	4	1	9·1	11·4	10·150	0·551	5·4	1	2	17	33	20	7	2·617	0·100	3·8		
e	80	9	19	30	15	7	1	8·4	11·8	10·085	0·624	6·2	1	8	27	54	29	7	2	2·602	0·106	4·1	
f	128	1	3	16	34	35	31	7	8·4	11·8	10·085	0·624	6·2	1	8	27	54	29	7	2	2·554	0·094	3·7
Ba	204	1	12	52	69	49	20	1	8·4	11·2	9·732	0·550	5·6	4	20	73	80	24	3	2·548	0·096	3·8	
b	83	8	15	27	23	9	1	8·7	11·2	9·778	0·584	6·0	1	12	28	31	10	1	2·558	0·104	4·1		
c	113	1	6	21	37	33	12	3	8·4	11·4	9·833	0·583	5·9	1	14	40	43	12	3	2	2·562	0·097	3·8
Dd	234	2	16	55	97	45	16	3	8·3	11·2	9·685	0·540	5·5	1	3	23	74	92	39	2	2·534	0·089	3·5
b	164	2	17	44	58	30	11	1	8·4	11·7	9·624	0·585	6·1	3	22	71	54	13	1	2·551	0·100	3·9	
c	186	2	16	48	70	38	10	1	8·0	11·7	9·644	0·556	5·8	2	24	72	59	25	3	1	2·538	0·104	4·1
d	160	1	16	44	56	27	12	4	8·3	11·4	9·650	0·594	6·1	4	32	45	59	18	2	2·544	0·105	4·1	
e	115	1	16	21	34	25	15	2	8·4	12·1	9·743	0·692	7·1	1	4	15	43	33	19	1	2·526	0·110	4·3
f	121	4	18	29	35	22	11	1	8·1	11·8	9·593	0·678	7·1	9	19	38	43	10	9	2	2·526	0·110	4·3

39 out of 2,994, or 1·3 per cent. There is no evidence that large or small individuals are more likely to lose their apical whorls than those of moderate size, and the error introduced in this way may be neglected.

§ 4. With respect to the first question, whether shells from individual trees close to one another show differences in size, there are data for six trees in area A, three trees in area B, and six trees in area D. The figures for these fifteen lots are given in table I, and the result of the appropriate calculations in table II. From these it appears that the shells from closely adjacent trees are demonstrably different in size in two instances only, Ab being definitely shorter than Ac, and Da broader than Df. With six trees in area A there are fifteen comparisons and fifteen possible differences, in area B three, in area D fifteen, in all thirty-three, or, if we take altitudes and diameter separately, sixty-six. Of these two only are present. This negative result throws no light on the question as to how far a familial assembly of *Cl. bidentata* ranges ; it might mean that the range is greater than the area served by a single tree, or that families living near one another are not distinguishable in size with the available data.

TABLE II. — SHOWING THE SIGNIFICANT DIFFERENCE IN ALTITUDE (+) AND DIAMETER (o) FOR FIFTEEN SEPARATE TREES IN THREE AREAS.

	<i>Aa</i>	<i>Ab</i>	<i>Ac</i>	<i>Ad</i>	<i>Ae</i>	<i>Af</i>	<i>Ba</i>	<i>Bb</i>	<i>Bc</i>	<i>Da</i>	<i>Db</i>	<i>Dc</i>	<i>Dd</i>	<i>De</i>	<i>Df</i>
<i>Aa</i>										+	+	+	+	+	+
<i>Ab</i>						+									
<i>Ac</i>										+o	+o	+o	+o	+o	+o
<i>Ad</i>										+	+	+	+	+	+
<i>Ae</i>										+o	+o	+o	+o	+o	+o
<i>Af</i>										+o	+o	+o	+o	+o	+o
<i>Ba</i>	+						+o	+	+o						
<i>Bb</i>							+o	+	+o						
<i>Bc</i>		+					+o	+	+o						
<i>Da</i>			+				+o	+	+o						
<i>Db</i>				+			+o	+	+o						
<i>Dc</i>					+		+o	+	+o						
<i>Dd</i>						+	+o	+	+o						
<i>De</i>							+o	+	+o						
<i>Df</i>							+o	+	+o						o

§ 5. That the shells in the different areas are largely differentiated in size is shown pretty plainly if individual trees in one area are compared with individual trees in another. Taking table II as a whole, there are 105 possible comparisons; eighteen differ in altitude only, one in diameter only, and twenty-seven in both altitude and diameter, forty-six in all. The comparison is, however, best made in the simple form of taking each area as a whole, as in tables III and IV. The shells from each area differ in altitude from those in each of the other areas, with the exception that C and E are not differentiated. Nine of the ten possible differences

TABLE III.—SHOWING THE ALTITUDES AND DIAMETERS OF *CLAUSILIA BIDENTATA* FROM FIVE AREAS IN THE SAME WOOD.

ALTITUDE.
DIAMETER.

Area.	Number of specimens.	Altitude.	Mean.	Standard deviation.	Coefficient of variation.	Maximum.	Minimum.	Mean.	Standard deviation.	Coefficient of variation.	Maximum.	Minimum.	Mean.	Standard deviation.	Coefficient of variation.			
A	410	8, 8·5, 9, 9·5, 10, 10·5, 11, 11·5, 12, 12·5.	10·134	0·603	6·0	12·5	8·4	10·134	0·603	6·0	5	9·5	17·6	8·1	2·595	0·104	4·0	
B	400	26, 88, 133, 105, 41, 5	9·770	0·568	5·8	11·4	8·4	11·4	9·770	0·568	5·8	5	4·6	14·1	15·4	2·554	0·096	3·8
C	744	1, 27, 122, 256, 218, 94, 24, 2	9·906	0·566	5·7	11·8	8·2	11·8	9·906	0·566	5·7	12	9·0	25·6	27·3	2·552	0·088	3·4
D	980	12, 99, 241, 350, 187, 75, 12, 3	9·657	0·598	6·2	12·1	8·0	12·1	9·657	0·598	6·2	1	25	13·5	34·3	34·0	1·01	4·0
E	421	26, 58, 121, 133, 64, 14, 4, 1	9·954	0·624	6·3	12·2	8·5	12·2	9·954	0·624	6·3	4	37	14·9	15·6	5·9	1·00	3·9

TABLE V.—SHOWING THE ALTITUDES AND DIAMETERS OF *ENA OBSCURA* FROM THE SAME FIVE AREAS.

Area.	Number of specimens.	Altitude.	Mean.	Standard deviation.	Coefficient of variation.	Maximum.	Minimum.	Mean.	Standard deviation.	Coefficient of variation.	Maximum.	Minimum.	Mean.	Standard deviation.	Coefficient of variation.					
A	101	7·2, 7·4, 7·6, 7·8, 8·0, 8·2, 8·4, 8·6, 8·8, 9·0, 9·2, 9·4, 9·6, 9·8.	8·751	0·393	4·5	9·9	7·8	9·9	8·751	0·393	4·5	2	33	36	8	3·728	0·091	2·4		
B	131	1, 0, 2, 7, 10, 32, 28, 26, 14, 9, 2	8·453	0·348	4·1	9·3	7·2	9·3	8·453	0·348	4·1	3	56	31	9	3·714	0·098	2·6		
C	119	1, 1, 4, 4, 12, 17, 27, 21, 16, 8, 5, 2	8·505	0·426	5·0	9·6	7·3	9·6	8·505	0·426	5·0	3	50	24	5	3·693	0·088	2·4		
D	105	1, 0, 2, 10, 24, 20, 15, 20, 9, 1, 3	8·338	0·367	4·4	9·3	7·2	9·3	8·338	0·367	4·4	7	42	36	17	3·670	0·095	2·6		
E	110	1, 1, 2, 8, 17, 16, 22, 7, 2	8·643	0·403	4·7	16	16	22	7·5	9·4	8·643	0·403	4·7	2	60	30	2	3·713	0·074	2·0

exist, and five of the ten possible differences in diameter. Evidently, therefore, a beech-wood such as I am dealing with is not a homogeneous locus *quâ* the size of *Cl. bidentata*. The data for *Ena obscura*, unfortunately with less ample material, given in tables V and VI show that the same differentiation is shown by this species, though to a less degree; seven of the ten possible differences exist in altitude, diameter, or both.

TABLE IV. — SHOWING THE SIGNIFICANT DIFFERENCE IN ALTITUDE (+) AND DIAMETER (o) FOR THE FIVE AREAS COMPARED WITH ONE ANOTHER, *CL. BIDENTATA*.

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>		+o	+o	+o	+o
<i>B</i>	+o		+	+	+
<i>C</i>	+o	+		+	
<i>D</i>	+o	+	+		+o
<i>E</i>	+o	+		+o	

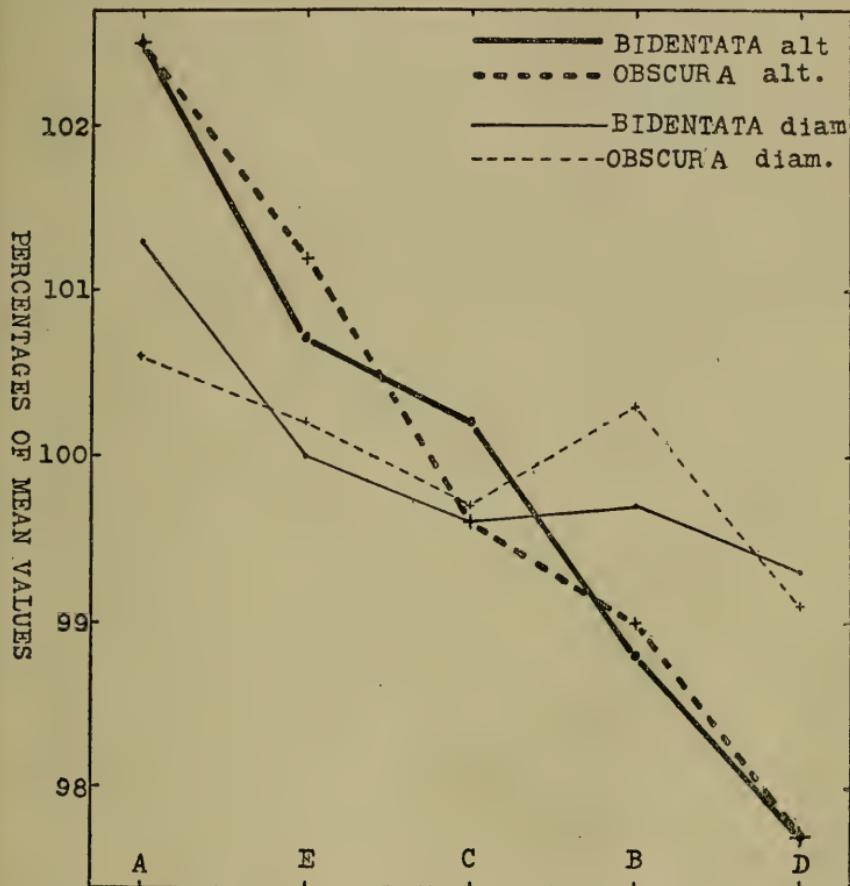
TABLE VI. — SHOWING THE SIGNIFICANT DIFFERENCE IN ALTITUDE (+) AND DIAMETER (o) FOR THE FIVE AREAS COMPARED WITH ONE ANOTHER, *E. OBSCURA*.

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>		+	+	+o	
<i>B</i>	+			o	+
<i>C</i>	+			+	
<i>D</i>	+o	o	+		+o
<i>E</i>		+		+o	

§ 6. Our beech-wood, then, does not form a locus in the sense that it is similar in all its parts as regards the size of the two snail-shells we have considered. The snails which live in different parts of it clearly differ in size, and on the basis of their differences the wood, which in a general way is homogeneous, may be dissected into many loci. It is an obvious question whether such varieties as these are correlated with variations in external circumstances, or whether they should be regarded as fortuitous results of relative isolation; clearly snails living several hundred yards apart cannot be suspected of much interbreeding. Bateson¹ says very truly that we have in the past been too ready to find the explanation of local differences in the localities rather than in the organisms. The present data may, I think, throw some light on the point. If the local differences arise from mutation within the organisms, the variations in *Clausilia bidentata* should have little or no relation with those in *Ena obscura*; if, on the other hand, they are caused by differences in environmental circumstances it is possible that the variations in the two species would run more or less parallel. Such proves to be the case in the present instance, for if we arrange the loci in descending order we get:—

¹ *Problems of Genetics*, 1913, p. 131.

Altitude.		Diameter.		Volume. ¹	
<i>bidentata</i> .	<i>obscura</i> .	<i>bidentata</i> .	<i>obscura</i> .	<i>bidentata</i> .	<i>obscura</i> .
A	A	A	A	A	A
E	E	E	B	E	E
C	C	B	E	C	B
B	B	C	C	B	C
D	D	D	D	D	D



It seems hardly credible that such a correspondence of relative sizes in the different loci as is shown in diagram 2 should be of fortuitous internal origin rather than an expression of environmental circumstances. The two species being of similar habits, it is not unlikely that they would be affected in the same way by similar conditions, and as far as their size is concerned such appears to be the case in the five cases under consideration.

Calculated on the (doubtless erroneous) assumption that the measured diameter = the diameter of the base of a cone and the measured altitude its height.

§7. The connexion between the sizes and environments is more obscure. It is suggestive that the largest specimens came from the two most sheltered areas (A and E), while B, the most exposed, yields the second smallest lot; the more so because in the Portmadoc series exposure was associated with small *Clausilia bidentata*. In North Wales, however, the densely shaded and sheltered loci also yielded small specimens—a difference possibly due to the difference in climate, close shelter on the chalk in Wilts giving agreeably damp conditions, which are exaggerated on the less porous strata of Portmadoc with a heavier rainfall to a degree of wetness which is detrimental. "Shelter" and "exposure" may be presumed to affect snails mostly by way of dampness; the duration of moist conditions after rainfall is greatly influenced by ventilation, and in exposed places the time during which snails can move about is considerably curtailed by rapid drying.

§8. It is interesting to note that the local conditions which influence decollation have no relation to those which influence size. Note was taken of the number of decollated shells from each area; they are most¹ frequent in A, least in E. The natural presumption is to look on decollation as an indication of vague unhealthiness, but it is as likely associated with exuberant growth as with stunted specimens.

Area.	Specimens.	Decollated.	per cent.
A	426	16	3·8
B	408	8	2·0
C	750	6	0·8
D	989	9	0·9
E	421	0	0·0
Total	2,994	39	1·3

§9. Summary.—(1) *Clausilia bidentata* from small loci of similar character within a few yards of one another do not usually differ in size.

(2) *Cl. bidentata* and *Ena obscura* from different areas in the same wood 50 to 300 yards apart may definitely differ in size.

(3) The size variation in the two species runs parallel.

¹ The differences A/C, A/D, and A/E alone are significant.

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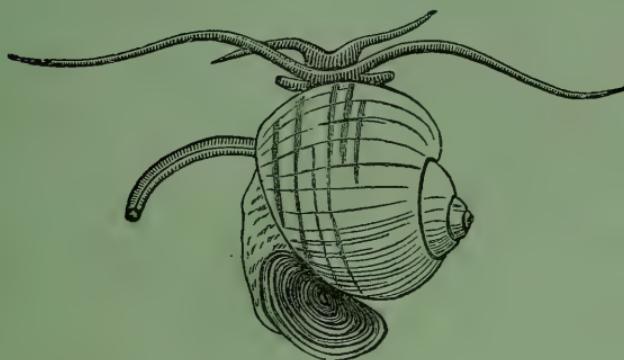
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LONDON :

DULAU & CO., LTD., 34-36 MARGARET STREET, CAVENDISH SQUARE, W. 1.

Conchological Society of Great Britain and Ireland.

HON. SEC.: J. W. JACKSON, F.G.S., etc., Manchester Museum,
Manchester.

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signed by at least two members.

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MUSEUM on the SECOND WEDNESDAY in each month from
SEPTEMBER TO JUNE.

The Journal of Conchology, the organ of the Society, is
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ANNUAL GENERAL MEETING.

FRIDAY, 13TH FEBRUARY, 1920.

G. K. GUDE, F.Z.S., President, in the Chair.

Mr. H. C. Fulton and Mr. B. O. Wymer were appointed scrutineers.
The following report was read :—

“ In presenting their twenty-seventh Annual Report the Council have pleasure in recording that the work of the Society is still well maintained. The monthly meetings have been held as usual, and the attendance has improved since the cessation of hostilities and the consequent release of members from National Service.

“ The communications read still maintain their high standard.

“ Among the losses that the Society has to deplore the Council wish to mention the names of Mr. Chas. Cooper, of Auckland, New Zealand, and Mr. M. M. Schepman, of Utrecht, Holland.

“ Communications from Corresponding Members are now again on the increase.

“ The membership roll has decreased somewhat, but it is hoped that new members will be added now that the ratification of the Peace Treaty is an accomplished fact.

“ The Council regret to announce the resignation of Mr. Jas. W. Wintle, who was appointed Honorary Secretary in place of Mr. G. K. Gude. Mr. Wintle has had to take up residence in South Wales, which prevents him from carrying out the Secretarial duties.

“ Acting under Rule XIX, the Council appointed Mr. A. E. Salisbury to be Honorary Secretary.

“ During the year two double parts of the ‘ Proceedings’, Vol. XIII, Parts 3 and 4, and 5 and 6, were issued in April and November respectively. They comprised 132 pages of text, including the Index, with the addition of the title-page. There were six plates and nine sets of figures; drawings or blocks for these were furnished by Major M. Connolly, the Rev. Dr. A. H. Cooke, D. Despott, Dr. J. C. Melvill, R. Bullen Newton, the late H. Suter, J. R. le B. Tomlin, and H. Watson, while Mr. J. H. Leonard, of the Natural History Museum, kindly gave his services in preparing the photographs for Plate IV, and the Frontispiece of your President for 1907-1909 was provided by private subscription.

“ The cordial thanks of the Society are again due to the Council of the Linnean Society for their continued kindness in allowing the meetings of the past years to be held in their apartments at Burlington House.”

The Treasurer presented the Statement of Income and Expenditure for the year ended December 31st, 1919.

On the motion of the President, seconded by Mr. Oldham, the foregoing Report, and the financial statement, were adopted.

The following were elected Officers and Council for the year 1920:—

MALACOLOGICAL SOCIETY OF LONDON.

INCOME AND EXPENDITURE FOR THE YEAR ENDED DECEMBER 31, 1919.

Dr.		Cr.	£ s. d.
To Balance at Bank January 1, 1919	88 15 1	By cost of "Proceedings", Vol. XIII, Parts 3, 4, 5, and 6—	
,, Annual Subscriptions—	£ s. d.	Printing and Postage	93 12 10
Ordinary Members	64 13 0	Illustrations and Blocks	12 15 0
Corresponding Members	41 5 4		<hr/>
	<hr/>		106 7 10
,, Entrance fees	3 13 6	Printing and Stationery	3 2 0
,, Life Membership fee	7 7 0	,, Linnean Society—	
,, Sale of "Proceedings" and Reprints	5 3 0	Expenses of Rooms	3 3 0
,, Donations	11 16 6	Gratuities to Attendant	1 10 0
,, Advertisement	15 0		<hr/>
,, Dividends on £50 Metropolitan 2½% Stock	1 5 0	,, Postages	4 13 0
	<hr/>	,, Cheque Book	2 15 9
	<hr/>	,, Balance at Bank December 31, 1919*	5 0
	<hr/>		107 9 10
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	<hr/>		£224 13 5

* This includes £15 19s. 11d. on account of Subscriptions paid in advance.

R. BULLEN NEWTON, Hon. Treasurer.

President.—G. K. Gude, F.Z.S.

Vice-Presidents.—H. O. N. Shaw, B.Sc., F.Z.S.; T. Iredale; J. R. le B. Tomlin, M.A., F.E.S.; A. S. Kennard, F.G.S.

Treasurer.—R. Bullen Newton, F.G.S.

Editor.—B. B. Woodward, F.L.S., etc.

Secretary.—A. E. Salisbury.

Six other Members of the Council.—A. Reynell; C. Oldham, F.L.S.; Major M. Connolly; H. Woods, M.A., F.G.S.; Rev. A. H. Cooke, Sc.D., M.A., F.Z.S.; H. H. Bloomer, F.L.S.

On the motion of Dr. Bowell, seconded by Dr. Boycott, a unanimous vote of thanks was passed to the retiring Officers and Members of the Council, the Auditors, and the Scrutineers.

ORDINARY MEETING.

FRIDAY, 13TH FEBRUARY, 1920.

G. K. GUDE, F.Z.S., President, in the Chair.

Mr. Henrich Christian Sell was elected to membership of the Society.

The President then delivered his address on "The Armature of Land Mollusca".

On the motion of Dr. Cooke, seconded by Mr. Crick, a vote of thanks to the President for his address was passed, with a request that he would allow the same to be printed, as far as possible, in extenso in the "Proceedings" of the Society.

ORDINARY MEETING.

FRIDAY, 12TH MARCH, 1920.

G. K. GUDE, F.Z.S., President, in the Chair.

The following communications were read:—

1. "A note on *Xylophaga præstans*, Smith." By J. R. le B. Tomlin, M.A., F.E.S.

2. "Notes on the Coloration of the shell of *Helix aspersa* and of *Cochlicella barbara*." By Hugh Watson.

The brown pigment in the shell of *Helix aspersa* is usually concentrated into spiral bands, homologous with those of *H. nemoralis*, etc.; although these bands are partly concealed, owing to the fact that the pale, opaque, substance of the shell crosses them in irregular streaks, instead of being confined to the zones between the dark bands, thus making the shell less conspicuous. But the stage of growth at which the pigment first becomes concentrated into distinct bands varies greatly. In some specimens the dark bands first appear before the middle of the second whorl, that is to say, close to the apex of the shell; in others, only the last whorl is distinctly banded. Moreover, breeding experiments show that this marked difference is hereditary; and that the mutation in which the bands develop late is apparently dominant to that in which

they develop early. Sometimes specimens are also found which are intermediate in appearance between these two mutations. This intermediate type, however, does not seem to be the result of a cross between individuals of the other two ; experiments rather suggest that it is due to another dominant hereditary factor which tends to reduce the effect of the factor that retards the development of the bands, although only producing a noticeable difference in about 70 per cent of the shells. Further experiments, however, are needed for the elucidation of these problems.

3. "A note upon certain Fossils of the Upper Tertiary beds of the Dardanelles." By Paul Pallary.

Dr. Bowell exhibited photographs from micro-slides of the radulæ of *Polita cellaria*, Müll., and *Linnaea palustris*, Müll., originally mounted in the year 1852 and remounted this year—1920.

Dr. Boycott exhibited a series of maps used by Mr. Roebuck in preparing the Census of Distribution of British Mollusca.

ORDINARY MEETING.

FRIDAY, 9TH APRIL, 1920.

J. R. LE B. TOMLIN, M.A., F.E.S., Vice-President, in the Chair.

Mr. G. C. Spence was elected to membership of the Society.

The following communications were read :—

1. "Further notes on Radulæ." By Dr. E. W. Bowell, M.A.

In the Testacellidæ all our three species can be easily and definitely discriminated by means of the radula. The central tooth is smallest in *T. haliotidea*, Drap.

In the genus *Limax* (sensu lato) we have adult forms (*maximus*, *cinerreo-niger*, and *flavus*), a peculiar form (*L. arborum*), and neopionic forms (*L. tenellus*, *Agriolimax agrestis*, and *A. laevis*). The points of distinction and relationship of these were described in more detail.

The two Milaces are very similar, but apparently separable. (Only thirteen specimens of *Milax gagates* had been examined, however, this total including no very large specimens.)

The reintroduction of the generic name *Zonites* was urged ; it is noted that *Z. algirus* is an adult form, while our larger species are neopionic ; *nitidulus*, however, is of the *algirus* type. The striking smallness of the central uncus in *lucidus*, *cellarius*, *rogersi*, and *alliarious* is explained by the folding of the radula and the increase in size of the pleural unci. It does not appear to be a character calling for the formation of a separate genus. *Z. scharffi* is considered as probably typical *cellarius*, *Z. hibernicus* as a local race of *cellarius*. The previously described distinctions are well maintained, but are considered to be of less than specific importance.

The unimportance of certain characters formerly relied upon for determination of species was pointed out. Such characters are : accessory cusps on any of the unci ; length of external cones ; length of base supporting uncus ; number of true externals ; elongation of radula.

In the above-mentioned species the radula is in each case characteristic ; though the determination is more difficult in the pairs of species *Limax maximus* and *L. cinereo-niger*, *Agriolimax agrestis* and *A. lœvis*, *Milax sowerbyi* and *M. gagates*. In these cases, however, it is believed that the distinguishing characters given, derived from careful and continued examination of a large number of specimens, will hold good. But the point of view is adopted that the use of radula study is to establish relationship rather than distinctions.

The paper was illustrated by a series of eighty-eight photographs.

2. "On the Hectocotylus of *Todaropsis*." By R. Winkworth, F.R.G.S.

While in Plymouth last January the author was fortunate in procuring a male and female of *Todaropsis eblanae*, Ball, the "Newfoundland sleeve" of Channel fishermen. Since no hectocotylus of the Oigopsida has previously been noted in English works, it is worth recording that the fourth right arm is modified throughout its whole length, the suckers being replaced by papillæ, which are large and alternate on the basal part and form a linear series along the distal two-thirds of the arm. The fourth left arm is also modified, but for the proximal third only. Drawings and specimen were exhibited.

3. "Concerning *Edentellina*." By Chas. Hedley, F.L.S.

On the motion of Mr. Kennard, seconded by Mr. Tomlin, a unanimous vote of congratulation to Mr. R. Bullen Newton (who is retiring from the staff of the British Museum) on his completion of fifty-two years' association with geological science was passed.

An obituary notice of the late R. Etheridge, jun., was read by Mr. R. Bullen Newton. The announcement of Mr. Etheridge's death was received with regret by the Society.

ORDINARY MEETING.

FRIDAY, 14TH MAY, 1920.

G. K. GÜDE, F.Z.S., President, in the Chair.

The following communications were read :—

1. "Nomenclatorial Notes relating to British Non-Marine Mollusca." By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S., etc.

2. "New Mollusca from Port Alfred." By G. B. Sowerby, F.L.S.

3. "On the Anatomy of two species of *Helicarion* from Tropical Africa." By Hugh Watson, M.A.

Mr. H. W. J. Biggs exhibited some very fine examples of *Limnaea pereger*, var. *ovata*, Drap., taken from the New River.

ORDINARY MEETING.

FRIDAY, 11TH JUNE, 1920.

G. K. GUDE, F.Z.S., President, in the Chair.

Mr. G. W. Young was elected to membership of the Society.

The following communications were read :—

1. "Note on the Dates of Publication of Brown's Illustrations of British Conchology, 2nd edition." By A. Reynell.

2. "A few varieties of Port Alfred Shells." By G. B. Sowerby, F.L.S.

3. "Description of a new species of *Mitra* from South Africa." By the Rev. Dr. A. H. Cooke, M.A., F.Z.S.

4. "Note on *Marginella guttula*, Sow." By John Shirley, D.Sc.

5. "Preliminary Notice of Roy Bell's Molluscan Collections." By T. Iredale.

Mr. Roy Bell has been collecting at Sunday Island, Kermadec Group, since I left, and the major portion of this collection was reported upon by Mr. W. R. Oliver. Subsequently he made large collections at Norfolk Island and Lord Howe Island, securing almost hundreds of novelties, which I hope fully to account for later. He served in the War, and having his demobilization venue fixed at Melbourne offered to collect Chitons for me if required near that locality. I indicated two desirable points, Port Fairy, in Western Victoria, and Mallacoota, the eastern limit of Victoria. If additional time were available Twofold Bay in New South Wales was suggested as the southernmost point in that colony. He visited Port Fairy first, and securing a representative collection of Chitons, also made valuable collections of marine molluscs generally. He thus added to the known Chiton fauna of Victoria three species, and enlarged the range of some Adelaidean shells into Victoria. At Mallacoota he determined the limits of the Peronian Region, adding a couple more Chiton records to Victoria and definitely establishing the range of others. The influenza epidemic practically prevented his leaving Australia for New Zealand, his home, so he settled at Twofold Bay and made a very extensive collection of marine mollusca in that locality, dredging in shallow water in every part of the Bay. I am now engaged in working out this collection, which is the most valuable yet examined by any extra-limital worker. Many valuable results have been achieved, and the greatest thanks are due to the energy of Mr. Roy Bell, whose field work is complete and unsurpassable in every way.

OBITUARY NOTICE.—ROBERT ETHERIDGE, JNR., 1847–1920.

THE death of Robert Etheridge, Director and Curator of the Australian Museum, Sydney, on January 4th of this year at the age of 73, removes a familiar name from the active list of the world's palaeontologists.

He was the son and only child of the late Robert Etheridge, F.R.S., the distinguished palaeontologist who belonged to the Geological Survey of Great Britain, and who was afterwards appointed on the staff of the British Museum. Our deceased member's early scientific training was obtained at the Royal School of Mines in Jermyn Street, soon after which, about 1867, he proceeded to Australia as an Assistant-Geologist on the Geological Survey of Victoria, then under the Directorship of Dr. A. R. C. Selwyn.

Returning home a year or two later through the disbandment of that Survey, Etheridge was next appointed Acting-Palaeontologist to the Geological Survey of Scotland, and subsequently received a palaeontologist's position in the Geological Department of the British Museum, where, during the transfer of the Natural History collections to South Kensington, he took a prominent part in the removal of the invertebrate fossils to the then new building in the Cromwell Road, now known as the Natural History Museum, and their arrangement in the various galleries of the Department, whilst he diligently laboured for nearly nine years both as a curator and research worker. His great ambition was, however, to return to Australia, and engage in solving the many interesting problems connected with the geological structure of that continent. Up to that time, a great part of his researches had been devoted to the study of Australian fossils, so that when the demand arose for his further services in Australia he was perfectly equipped for the acceptance of the dual position offered him in 1887 of Palaeontologist to the Australian Museum and to the Geological Survey of New South Wales. He therefore resigned his appointment at the British Museum, and settled down in Sydney for the remainder of his life. Further promotion came in 1895, when Etheridge succeeded Dr. Ramsay as Director and Curator of the Australian Museum, and he retained that post until his death, a period of twenty-five years, with considerable distinction to himself, carrying out a vigorous policy of administration and sparing no efforts to advance the interests of Australian Science.

Etheridge was elected to the Malacological Society of London at the December meeting of 1905, and although never contributing to its *Proceedings* he was a voluminous writer on a multitude of organisms found in the more important geological formations and belonging to both the animal and vegetable kingdoms, his memoirs finding a place in most of the Australasian Scientific Serials.

To show the versatility of his work it may be mentioned that he also studied Ethnological subjects, and published many interesting

observations on the history of the Australian Aborigines. But it was as a palaeoconchologist that Etheridge's research work is of chief interest to our Society. His first molluscan paper was published in 1873, and dealt with shells found in some Shell-marls near Edinburgh; then came a series of papers based on his studies of Carboniferous Mollusca, which mostly appeared in the *Geological Magazine* and in the *Annals and Magazine of Natural History*, including critical notes on the Carboniferous Gastropoda and Pelecypoda figured in Phillips' *Geology of Yorkshire*, besides recognizing the remains of certain colour-bands of a twinned character on a small Naticiform shell from the Carboniferous of Scotland. A little later he made known some Unioniform shells from the Tasmanian Tertiaries. Palæozoic Opercula associated with small Gastropods next claimed his attention, this being succeeded by an interesting account of the British Carboniferous Chitonidæ read before the Natural History Society of Glasgow, 1881, while in the same year he delivered his Presidential address to the Royal Physical Society of Edinburgh on "The Palæozoic Conchology of Scotland". His chief Australian memoirs included descriptions of the Cretaceous Shells of New South Wales, embracing those found in the opalized deposits of White Cliffs, besides which he wrote on the Palæozoic and Cretaceous Mollusca characterizing the deposits of the Bowen River region of Northern Queensland. Separate memoirs were devoted to the Pelecypod genus *Eurydesma* and "The Palæopectens", occurring in the later Palæozoic rocks of New South Wales. Much Molluscan information was incorporated in the *Geology and Palæontology of Queensland and New Guinea*, published in 1892, a most comprehensive work consisting of nearly 800 pages of text and numerous plates, which was written in conjunction with Dr. Robert Logan Jack, a former Government Geologist of Queensland. Etheridge also wrote a report on the Cretaceous Mollusca of Zululand. He founded some new genera of Pelecypoda, including *Unionella* and *Deltopecten* from the Palæozoic beds of New South Wales, while those from the Cretaceous rocks of the same colony, and Queensland, include *Tatella*, *Cyrenopsis*, *Fissilunula*, *Maccoyella*, and *Pseudavicula*. We must look to his Australian colleagues for a more complete analysis of his works, which can be only gathered from a survey of the scientific serial literature of Australasia.

The memoirs and papers here briefly referred to suffice, however, to indicate that the author was possessed of indomitable energy and unswerving perseverance, valuable attributes which enabled him very largely to build up a considerable fame as one of the leading palæontologists of his time. Australia recognized these important scientific services by awarding him the Clarke Memorial Medal of the Royal Society of New South Wales in 1895, while the Australian Association for the Advancement of Science bestowed upon him the Mueller Memorial Medal in 1911.

Professor Edgworth David, in the Sydney *Daily Telegraph* of January 9, rightly states of him that "the world has lost the man who, in his special branch of science, was the foremost worker in the Southern Hemisphere". The same writer also refers to Etheridge's notorious retiring disposition, ever avoiding social or even scientific functions, but for which "his name would have been a household word throughout Australia—he literally lived in his work, and he died in it, according to his wish".

R. BULLEN NEWTON.

NOTE ON *MARGINELLA GUTTULA*, SOWERBY.

By JOHN SHIRLEY, D.Sc.

Read 11th June, 1920.

In his list of the Marine Mollusca of Queensland, Mr. Charles Hedley, F.L.S., includes *Marginella guttula*, Reeve.¹ This is probably a mistake for *Marginella guttula*, Sowerby. As has been shown by Mr. J. R. Le B. Tomlin,² Reeve's name lapses, and his shell is now known as *Marginella pericalles*, Tomlin. It is a native of the West Indies and Mr. Tomlin has received specimens collected in a living state from Bermuda. It is therefore not likely to range from Bermuda to Eastern Queensland.

The following are my reasons for believing the shell of Mr. Hedley's list to be *Marginella guttula*, Sowerby :—

In January, 1911, I received from the late Mr. E. A. Smith, I.S.O., a letter in which he determined a shell collected on Murray Island, Torres Straits, as *Marginella triplicata*, Gaskoin.³ This name was subsequently proved by Mr. E. A. Smith to be a synonym of *Marginella guttula*, Sowerby.⁴ It is a curious little cowrie-shaped shell, and the folds on the columella are very characteristic.

In the paper to the Linnean Society of New South Wales in 1909, Mr. Hedley describes⁵ and illustrates a new shell, *Marginella anxia*. Of the illustrations, fig. 87 has all the characteristics of *Marginella guttula*, Sowerby—the cowrie-like outline squared off at the broad end, and the same peculiar triplicate folds. Comparisons of specimens of *Marginella guttula*, Sowerby, and of *Marginella anxia*, Hedley, will, I think, bear out these statements.

Specimens of *Marginella compressa*, Reeve, also from Murray Island, were named by Mr. E. A. Smith in the same letter.

¹ Proc. Austral. Assoc. Adv. Sci., vol. xii, 1909, p. 363, line 17.

² Proc. Malac. Soc., London, vol. xii, 1916, p. 64.

³ Proc. Zool. Soc., Lond., 1849, p. 19.

⁴ Proc. Malac. Soc. Lond., ix, 1910, p. 21.

⁵ Proc. Linn. Soc. New S. Wales, vol. xxxiv, pt. 3, p. 452, pl. xlivi, figs. 86–7.

PRESIDENTIAL ADDRESS.

By G. K. GODE, F.Z.S.

Delivered 13th February, 1920.

THE ARMATURE OF LAND MOLLUSCA.

THE subject on which I venture to address you to-night has been a favourite study with me for a considerable number of years. My interest in these structures was first aroused through the receipt of some specimens of *Corilla* from Ceylon, on which I based a new species. The Editor of *Science Gossip* having in 1896 requested me to contribute some articles on Mollusca, I chose the "Armature of Helicoid Land Shells" as my subject, which, however, was side-tracked into what amounts practically to a monograph of the genera *Corilla* and *Plectopylis*.

On that occasion I drew attention to the fact "that Mollusca have numerous enemies is well known to naturalists, for not only do they serve as food for many mammals, birds, and reptiles, but they are preyed upon by some insects, and even by other mollusca. Naked slugs are especially exposed to the attacks of birds, slow-worms, and snail-slugs (*Testacella*), and, in foreign countries, of carnivorous snails, such as *Glandina* and others. Shell-bearing Mollusca likewise are devoured by birds and mammals; they have besides many insect enemies, particularly in tropical climates, and we shall, therefore, not be surprised to find that in several instances these creatures have come to be provided with special means of protection. This has been attained in various ways, indirectly by protective resemblance between the forms or colours of the shells and their immediate surroundings; or directly by special structures, such as teeth, plates, or constrictions, serving as buttresses or barricades behind which the animal can withdraw. It is probable, however, that these structures may at the same time help to strengthen and support the outer wall of the shell".

That structures of this nature serve as a means of defence against the attacks of carnivorous insects and similar creatures was suggested as long ago as 1829 by Guilding,¹ who, in speaking of the teeth and laminae of the Pupidae, observed that "they may answer the purpose of an operculum to keep out enemies, while they afford no obstacle to the motion of the soft and yielding body of the animal".

Of much interest in this connection is a note by Lieut.-Col. Godwin-Austen, who, in a paper on the genus *Plectopylis*, states that "when breaking up a number of shells to expose the barriers and ascertain if their characters were constant, I was greatly interested to find in two instances the presence of small insects that had become fixed between the teeth".²

¹ Zool. Journ., vol. iv, 1829, p. 168.² Proc. Zool. Soc., 1874, p. 611.

During my investigation of these armatures in *Corilla* and *Plectopylis* I discovered that in most cases the barriers in immature shells differed considerably from those found in full-grown ones, more especially in those of *Corilla*, while in one case, i.e. *Corilla adamsi*, these protective structures occur only in the immature shells, the animal dispensing with them entirely on completing the shell. Without knowing the actual conditions in its surroundings it is, of course, impossible to account for this phenomenon, but it may be surmised that the absence of predatory insects may have produced this result, and that the formation of the barriers in immature shells is simply the survival of an ancestral character. Two other forms of protective structures, even more efficacious, are found (a) in the members of the genus *Clausilia*, which produce the elastic shutter, or clausilium, and (b) the numerous operculate genera, whose members are provided with a lid, or operculum, completely closing the shell.

The first group to be considered in detail is the family of TESTACELLIDÆ, subfamily STREPTAXINÆ.

Genus STREPTAXIS, Gray.

This genus ranges through South and South-Eastern Asia, the Mascarene Islands, tropical Africa, and South America. Several species are devoid of armature, such as the helicoid forms: *S. wagneri*, Pfr., and *S. apertus*, Mts., from Brazil, and elongate ones such as: *S. contusus*, Fér., from Brazil, *S. dacostæ*, Gude, from Colombia, and *S. nobilis*, Gray, from Liberia. In the simpler forms, such as *S. burmanicus*, Blanf., from India, *S. pfeifferi*, Zel., and *S. andamanensis*, Bens., from the Nicobar and Andaman Islands, only a raised, entering, parietal lamella is found, but the majority of species have complicated obstructions at the aperture. For instance, *S. theobaldi*, Blanf., from the Khasi Hills, has two raised lamellæ on the parietal callus, three on the basal lip and three on the outer lip of the peristome, while *S. paulus*, Gude, a Chinese form, has two of the parietal callus, two on the basal and two on the outer lip of the peristome. A curious helicoid form, *S. roebelini*, Mlldff., from the Samui Archipelago, has a raised lamella on the parietal wall and three palatal teeth; this species belongs to the section *Odontartemon*.

The genus *Systrophia*, Alb., confined to South America, is not provided with teeth, but the parietal callus is raised into a curved plate, in some species, such as *S. systrophia*, Alb., from Bolivia, closely approaching the upper and lower lip of the peristome, leaving only a narrow slit for the animal to protrude; there is besides a constriction behind the peristome. In *S. cheilostropha*, Orb., a Brazilian species, there are in addition two denticles, one on the upper and one on the lower lip of the peristome.

In *S. reyrei*, Souv., from Ecuador, the parietal callus is only slightly raised, but within, nearly one-quarter of a whorl behind the peristome,

occur four denticles, two on the parietal and two on the palatal wall. Again, *S. heligmoidea*, Orb., also from Ecuador, has the parietal callus raised and furnished with a compressed fold, which is continued for some distance on the parietal wall and coincident with a tubercle on the upper palatal margin of the peristome corresponding with a scrobiculation, the aperture being in consequence subtriangular.

Genus ENNEA, H. & A. Adams.

This has a wide distribution, being found throughout southern and south-eastern Asia from Arabia to Japan and the Philippine Islands; Madagascar, the Mascarene Islands, and throughout tropical and southern Africa.

E. mucronata, Mts., a Cameroon species, is provided with an entering, flexuous fold on the parietal wall near the upper part of the peristome, which bears a corresponding tubercle, while on the outer lip are found two flexuous, entering folds, and the columella bears a flexuous, entering fold, bidendate at the anterior end. *E. ringens*, H. Ad., from Sierra Leone, has a parietal lamina, three profound columellar teeth, and several lamellæ within the outer lip, four of which are longer and more prominent than the others. *E. infrendens*, Mts., a Natal species, has its aperture nearly closed, having a raised, compressed lamella at the parietal angle, a deep-seated, bipartite, columellar plica, two small teeth on the basal margin, and two on the palatal margin of the peristome, the upper one being the larger. *E. planti*, Pfr., another Natal form, possesses a slight, entering, flexuous fold on the columella, one short, compressed lamina on the parietal wall near the insertion of the upper margin of the peristome.

The next group for consideration is the family ZONITIDÆ.

Genus VITREA, Fitz.

Of this genus, which has a very wide distribution, only a few of the North American species are provided with armature. *V. interna*, Say, has two prominent sub-lamelliform white teeth, which do not reach the edge of the peristome. Several other species have radial series of internal teeth on the lower wall of the last whorl. In *V. multidentata*, Binn., some specimens have these teeth united at their base into barriers, these processes being distinctly visible through the thin shell-wall.

Genus GASTRODONTA, Albers.

This is confined to North America, and its members have more solid shells than those of the last genus dealt with. *G. gularis*, Say, has a long, revolving fold inside on the base of the last whorl, extending for about two-thirds of a whorl; some have a strong, raised denticle on the basal margin of the peristome. Immature shells show two folds. *G. lasmodon*, Phill., is provided on the base with two, nearly

parallel, prominent, deeply entering, revolving, white lamellæ ; on the other hand, *G. suppressa*, Say, is furnished only with one or two lamelliform, elongated, oblique teeth.

Genus SESARA, Alb.

Is restricted to India, Burma, and Siam ; some sixteen species are known, the majority of which are provided with teeth in the aperture. The simplest form in this respect is *S. helicifera*, Blanf., having only one long, curved, entering fold on the columella, while *S. harmeri*, Gude, is furnished with two raised, curved, short lamellæ on the base of the peristome. *S. tickelli*, Theob., and *S. hungerfordiana*, Theob., have a narrow aperture, with three teeth on the base of the peristome and one curved fold on the columella. *S. megalodon*, Blanf., also has a curved, entering fold on the columella, a small tooth on the outer lip, and a larger horizontal one on the basal margin, with a large, transverse plate between. *S. mouleyitensis*, Gude, is furnished with a large, curved, transverse plate near the basal margin, supported by two buttresses outwardly, and an entering, curved fold on the columella. In *S. pylaica*, Bens., no teeth are found, but the parietal callus has a raised lamella meeting a similar one on the basal margin, leaving only a narrow slit between.

We now come to an important group, i.e. the ENDODONTIDÆ, the first to be considered being the

Genus SCULPTARIA, Pfeiffer.

Only four species are known, with two or three varieties ; they are small shells, characterized by their beautiful sculpture, and confined to Damaraland, South-West Africa. *S. sculpturata*, Gray, is provided with a long, entering, raised, flexuous fold on the parietal wall and two horizontal, raised lamellæ on the palatal wall, while *S. damarensis*, H. Ad., has a similar fold on the parietal wall and three raised, horizontal lamellæ on the palatal wall. *S. retisculpta*, Mts., the most beautifully sculptured form of all, has likewise a parietal fold, while the palatal wall is furnished with a strong, transverse ridge on the outer wall close to the peristome, raised into a tubercle on the base.

Genus ENDODONTA, Albers.

This important genus, with numerous species, distributed over Australasia and Polynesia, has been split up into several subgenera and sections. The first subgenus, DIGLYPTUS, Pils., has but one species : *E. pagodiformis*, Smith. It is furnished with a strong, entering, parietal lamina and two close columellar plicæ, terminating in a large callous nodule on the columellar lip. The subgenus STENOPYLIS, Fult., consists of three or four species of minute shells from the Philippine Islands, Australia, and New Guinea. One of these, *E. coarctata*, Mldff., was originally placed in the genus

PLECTOPYLIS. It has the parietal callus raised into a flexuous, transverse lamella parallel with the outer and basal margins of the peristome, which are equally raised, nearly closing the aperture, while there are besides two internal parietal lamellæ.

The subgenus LIBERA, Garr., occurs only in the Society and Cook Islands. These shells are provided with revolving, entering folds on the parietal wall, and the lower part of the last whorl. *E. jacquinoti*, H. & J., from Tahiti, is a fairly large species, and possesses two revolving, entering lamellæ on the parietal wall, with one low curved fold on the columella and three raised, revolving lamellæ on the basal wall of the last whorl..

The subgenus ENDODONTA, s.s., ranges over the Sandwich, Society, and Pelew Islands. *E. lamellosa*, Fér., a Sandwich Islands species, is provided with no less than eight revolving, raised lamellæ : two on the parietal, one on the upper, four on the basal, and one on the columellar wall. *E. lacerata*, Semp., from the Pelew Archipelago, has only one entering lamella on the basal wall midway between the columellar angle and the periphery, one low revolving fold on the columella, while the parietal wall bears three raised ridges and several smaller ones between the latter and the columella, all these ridges being continued outside on the base of the shell as far as the peristome.

The subgenus THAUMATODON, Pilsbry, with numerous species, is distributed over Polynesia, New Zealand, New Caledonia, Tasmania, and the Philippines. *E. multilamellata*, Garr., a Cook Islands species, has three revolving lamellæ on the parietal wall, three on the basal wall, and one on the columella. *E. heptaptychia*, Q. & M., from Guajam, an island in the Ladrones Archipelago, possesses two revolving, entering, parietal folds ; three raised lamellæ on the outer wall, the middle one being largest ; three on the basal wall, the middle one smallest ; one on the columella ; all these lamellæ are some distance from the peristome. *E. tomlini*, Gude, another form from Guajam, has, like the former, two parietal folds ; three raised lamellæ on the outer wall, the topmost being smallest, and one the basal wall.

The subgenus NESOPHILA, Pilsbry, is of Polynesian distribution ; *E. tiara*, Migh., from the Sandwich Islands, is the largest of all the Endodonts, a full-grown specimen in my possession measuring as much as 14 mm. in diameter ; it has a wide aperture, and is provided with eight or nine low, revolving, entering folds on the parietal wall but without any palatal teeth or lamellæ. *E. hystrix*, Migh., and *E. jugosa*, Migh., also from the Sandwich Islands, are provided only with one low, revolving, entering fold on the parietal wall.

The subgenus PTYCHODON, Ancey, is a small group of minute species confined to New Zealand. *E. hectori*, Sut., has five parietal lamellæ, the principal one, stout and median in position, being grooved or bifid, the other four smaller and placed between it and

the columella, which bears two, well-developed lamellæ, the inner one with two or three sharp points; the second high, shaped like a sharp tooth; in addition, there are seven rather stout elevated lamellæ on the palatal wall, evenly distributed. *E. pseudoleioda*, Sut., is furnished with three folds on the parietal wall, one columellar and eight palatal plicæ, while *E. wairarapa*, Sut., with five parietal and one columellar lamellæ, has no less than ten palatal plicæ.

The subgenus HELENOCONCHA, Pilsbry, also a small group, is only found in St. Helena. *E. polyodon*, Sowerby, has three, revolving, entering liræ on the parietal wall, the upper and lower frequently double; there are about seven palatal plicæ, which are rather evenly distributed and extend some distance within. *E. minutissima*, Smith, has as many as six parietal liræ and from eight to ten palatal plicæ. The last Endodont subgenus to be considered is AFRODONTA, M. & P., with some six known species found in South Africa. *E. trilamellaris*, M. & P., possesses three, short, low folds, one parietal, one palatal, and one basal.

The Pyramiduloid subgenus HELICODISCUS, Morse, is restricted to North America, and contains four or five known species. *P. parallela*, Say, has radial series of two or three horizontal palatal teeth, these series being about one-third of a whorl distant from each other. It is probable that the earlier series are absorbed by the animal as the growth of the shell proceeds. In *P. fimbriata*, Weth., the series consist of a vertical, stout lamella on the outer wall and a smaller oblique one on the basal wall.

Genus RUTHVENIA, Gude,

was originally established as a section of *Plectopylis* until Lieut.-Col. Godwin-Austen investigated the anatomy and concluded that it was allied to *Thysanota*. Five species are known, four of these occurring in Ceylon and one in Southern India. They are small, fragile shells, bearing two series of small, horizontal, callous denticles on the palatal wall and a solid, transverse plate on the parietal wall. In some forms additional transverse denticles are found on the palatal wall.

The important and large group of HELICIDÆ next demands consideration, the first genus to be reviewed being

Genus ASHMUNELLA, Cock. & Pils.

This genus, of about thirty species, is restricted to the United States. *A. thomsoniana*, Anc., is provided with one oblique, parietal denticle, one transverse plate on the outer margin of the peristome, and two denticles on the lower margin. *A. levettei*, Bld., has a short oblique, parietal fold, one transverse fold on the outer margin of the peristome, and two short, horizontal plicæ on the lower margin.

Genus POLYGYRA, Say.

A large genus divided into three sections, all confined to North America. The first section, POLYGYRA, s.s., has about fifty species. *P. cereolus*, Muhlf., and *P. septemvolva*, Say, are characterized by a raised parietal callus, with an oblique, entering fold and a scrobiculation behind the peristome. *P. espiloca*, Bld., and *P. auriformis*, Bld., have in addition a transverse fold on the outer lip and a horizontal one on the lower lip of the peristome. *P. uvulifera*, Shutt., and *P. auriculata*, Say, have a similar armature, but more produced, the raised parietal plate is more tortuous and tongue-shaped and projects between the plates on the peristome almost closing the aperture. *P. hippocrepis*, Pfr., possesses an extraordinary form of armature, having the raised parietal callus provided with two parallel, horizontal entering laminae united at their inner termination by a high raised, curved, transverse fold, in the shape of a horse-shoe, which coincides with a hollow, raised, transverse tubercle on the base of the outer wall near the scrobiculation behind the peristome.

The section TRIODOPSIS, Raf., also contains about fifty species, with numerous varieties. Here the armature is less complicated, and in some forms altogether absent, but the peristome in all is strongly developed. *P. tridentata*, Say, and *P. fraudulenta*, Pils., have one oblique, entering fold on the parietal callus and two denticles on the peristome, one above and one below, while *P. profunda*, Say, is provided merely with a denticle on the basal margin of the peristome. *P. Sayi*, Binn., and *P. elevata*, Say, have an oblique entering denticle or fold on the parietal callus, whereas *P. albolabris*, Say, *P. multilineata*, Say, and *P. clausa*, Say, are devoid of any teeth, folds, or lamellæ whatever.

The section STENOTREMA, Raf., numbers some twenty-two species, the majority having the aperture nearly closed by the raised, transverse lamella on the parietal wall. In *P. spinosa*, Lea, this lamella has the distal end curved inwardly, fitting into the upper angle formed by the upper and outer margins of the peristome, which is considerably thickened; in addition an internal short buttress unites a part of the parietal and basal walls with the columellar wall, one-quarter of a whorl behind the peristome, this buttress being distinctly visible through the shell-wall, but can be more easily observed on breaking away a portion of the lower shell-wall, immediately behind the peristome. *P. labrosa*, Bld., and *P. stenotrema*, Fér., have the aperture still more obstructed. In these two species the basal margin of the peristome is inwardly produced with a small sinus near the distal end, and the outer margin carries a short tubercle, forming a sinus with the basal margin, into which the distal end of the parietal plate fits. *P. monodon*, Rack., and *P. fraterna*, Say, have a less complicated armature, being furnished simply with the raised, transverse lamella on the parietal plate, no processes occurring on the peristome.

Genus POLYGYRELLA, Binney.

Only three species are known, all American. *P. polygyrella*, Bld., has the mouth of the shell obstructed only by a raised, transverse lamella on the parietal callus, giving off a short horizontal fold. On the base, one-half of a whorl from the aperture, there may be seen through the shell-wall three short, horizontal, white lamellæ and one-quarter of a whorl further back the remains of a former set, partly absorbed.

Genus POLYGYRATIA, Gray.

This genus is split up into four sections; the first, POLYGYRATIA, s.s., with two species, one found in Brazil, the other in Bolivia. The first, *P. polygyratia*, Born, is a large, disc-shaped shell, a specimen in my collection measuring as much as 47 mm. in diameter. It is provided internally with short, horizontal and oblique folds, which can only be observed by breaking away parts of the shell-wall, which is very thick and solid. In the specimen examined three short, horizontal lamellæ occur on the outer wall, one-third of a whorl behind the mouth; one-third of a whorl further back is found a similar group, and in addition, facing the latter, an oblique, sinuous, raised fold on the parietal wall, with a short, low, horizontal lamella immediately below. The first to draw attention to these structures was Moricand,¹ who states that having examined several specimens he found these lamellæ to vary in number from one to three on either side, three series usually occurring in the last whorl.

Of the subgenus RIDLEYA, Ancey, only one species is known, *P. quinquelirata*, Smith, from the island of Fernando Noronha, a small shell, measuring only 5 mm. in diameter. It has a small aperture, which is provided with two entering, horizontal folds on the parietal wall, reaching near to the aperture, two on the basal, and one on the outer wall not reaching as far as the parietal, the lower of the latter intercalating between the outer and basal folds.

The section SYSTROPHIA, Pfr., contains some twenty-two species, all South American, and all many-whorled forms. *P. ortoni*, Crosse, from Ecuador, is simply deeply scrobiculate at the upper part of the peristome, the corresponding tubercle causing the aperture to assume a triangular shape. In *P. entodonta*, Pfr., however, are found three short, horizontal lamellæ on the outer and basal walls, some distance behind the peristome.

Genus MOELLENDORFFIA, Ancey.

This was at first classed as a subgenus under *Helicodonta* by Dr. Pilsbry, but subsequently he modified his views as to its affinities and considered it to be closely related to *Chloritis*. On conchological as well as geographical grounds this appears to me a more reasonable

¹ Mém. Soc. Phys. Hist. Nat. Genève, vol. xi, 1846, p. 151, pl. v, figs. 1-3.

attitude, and will probably be confirmed when the anatomy comes to be examined. The genus is distributed over China, Tonkin, Cambodia, and Formosa, with an outlying species in the Loo-Choo Islands. It is characterized by the absence of internal barriers on the parietal wall. In the subgenus *MOELLENDORFFIA*, s.s., comprising ten species, the outer edge of the parietal callus is solute, erect, and sinuous, bearing a short, raised tooth at the sinus; generally there are besides two furrows or sulci on the outer and basal wall, with corresponding lamellæ internally. In the subgenus *MOELLENDORFFIELLA*, Pilsbry, with only one species known—*M. erdmanni*, S. & B., from China, a flattened shell with sunken spire—the parietal callus is without the raised, sinuous edge, and the margins of the peristome are approximating. The subgenus *TRIHELIX*, Ancey, on the other hand, has the edge of the parietal callus slightly raised, but it is not sinuous and devoid of the raised tooth characterizing the first subgenus. *M. horrida*, Pfr., a Tonkin species, has two short sulci at the upper part of the last whorl—one behind the peristome, the other a short distance back, their upper ends convergent—and a similar one on the base, also behind the peristome, these three sulci having corresponding short lamellæ inside and forming a triangle. *M. hiraseana*, Pilsbry, from Formosa, has a long, curved scrobiculation at the upper part of the last whorl, a short distance behind the peristome, and a shorter, oblique one on the base, nearer the peristome, both with corresponding lamellæ inside. *M. eucharistus*, Pilsbry, a Loo-Choo species, is simply furnished with a very short sulcus on the base of the last whorl, close to the peristome, the corresponding short lamella inside being only slightly raised.

Genus STEGODERA, Martins,

and its subgenus *TRAUMATOPHORA*, Ancey, were for many years classed as subgenera under *Plectopylis*, until in 1905 Dr. Pilsbry suggested their relationship to *Moellendorffia*. Each contains only one species from China. The former is represented by a sinistral species—*S. angusticollis*, Mts.—which is devoid of internal barriers, but the last whorl is strongly constricted a short distance from the aperture, leaving only a narrow slit for the animal to emerge. The latter is represented by a dextral form—*S. triscalpta*, Mts.—which is also constricted a short distance from the aperture, but only slightly so. It is, on the other hand, furnished at the same place with three strongly developed sulci, the two uppermost long, curved, ascending at first, then slightly descending and terminating close to the peristome; the one at the base shorter, oblique; all three have corresponding elevated lamellæ inside the mouth, closely approaching the inner wall.

Genus CORILLA, Adams.

In the present genus and the next—*PLECTOPYLIS*—the internal armatures reach an extraordinary development. A careful

examination of immature specimens has revealed the fact that a new set of palatal lamellæ is formed on completion of each half of a whorl, after which the previous set is absorbed by the animal. I have observed several shells which contained two sets of barriers at a distance of half a whorl; in some cases the older set had almost vanished, only the foundations of the lamellæ being visible from the outside through the shell-wall. I have already in the introductory remarks to this address alluded to the fact that whereas in one species—*C. adamsi*, Gude—the mature shells are devoid of armature, the immature ones are provided with five oblique, palatal lamellæ, the same as obtains in the other members of the genus. Ten species are known, all with one exception—*C. anax*, Bens., which occurs in southern India—being natives of Ceylon.

In two species—*C. beddomeæ*, Hanl., and *C. anax*, Bens.—there are two or three horizontal, curved, parietal, entering folds, while in the other seven Ceylon species the number of parietal folds varies from one to three. One of these—*C. humberti*, Brot—possesses only one short, palatal lamella on the basal wall near the suture, corresponding to the fourth in the other species. The parietal folds are not formed until the shell approaches completion, while the palatal lamellæ in the immature shells are invariably much larger than in mature specimens, being almost triangular, overlapping, and reaching nearly to the parietal wall.

Genus PLECTOPYLIS, Benson.

This genus is divided into five sections and comprises some ninety species, ranging from North-East India through Burma, Tonkin, South and Central China, with one outlying species in the Loo-Choo Archipelago. They all have the interior of the last whorl obstructed by a transverse plate or plates on the parietal wall, and several transverse, oblique, or longitudinal denticles or plates on the palatal wall. In some forms—for instance, *P. woodthorpei*, Gude, a member of the section PLECTOPYLIS, s.s.—the palatal armature is in two series, the anterior set consisting of three thin, horizontal folds, while the posterior series is much more complicated, showing a thin, long, horizontal fold near the suture, a second one below it, still longer, and with an elevated compressed denticle posteriorly, next a very short, curved fold, below this a strong, vertical lamina, indented at the middle and giving off posteriorly at its lower extremity an obliquely descending ridge, where also occurs a small denticle, and on the upper extremity a similar ridge or support; another long, thin, horizontal fold is found near the lower suture. The parietal barriers consist of two, nearly parallel, vertical laminæ, the anterior one the shorter and giving off at each extremity anteriorly a horizontal fold, the lower one short, the upper one revolving parallel with the suture and joining the ridge at the aperture; below this occurs a free thin horizontal fold, parallel with the lower suture and joining the ridge on the parietal callus.

In *P. macromphalus*, Blanf., belonging to the section ENDOHYRA, the anterior set of the palatal barriers is much simpler, being composed of four short, broad, flattened, straight, horizontal folds, while the posterior set consists of six narrow, horizontal lamellæ, the fourth and fifth being a little obliquely deflected posteriorly. The parietal barriers again are much simpler than in *P. woodthorpei*, consisting of a strong, vertical plate provided posteriorly at its lower extremity with a minute denticle.

P. laomontana, Pfr., from Laos, a member of the section Chersæcia, is provided on the parietal wall with a single strong, lunate lamella, its convex side facing the aperture and deflexed posteriorly below (Fig. 1, b). On the palatal wall are found seven more or less horizontal lamellæ; the second (from above) bifurcated posteriorly, the sixth (which is very short) and the seventh (a little longer) have each an elongated denticle posteriorly (Fig. 1, c).

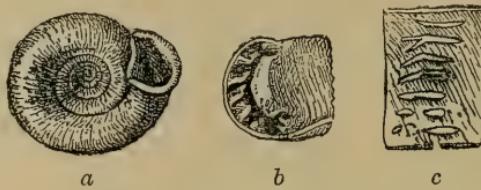


FIG. 1.—*Plectopylis laomontana*.

P. brachyplecta, Bens., a member of the section ENDOPLON, found in Burma, has the palatal barriers in one series, the upper fold being thin and horizontal; next come four short oblique folds, nearly parallel, concave towards the aperture, and below these a short, thin, horizontal fold near the lower suture; the second fold has a short, straight fold united to it posteriorly, while posteriorly between the fifth and sixth folds occurs another short oblique lamella. The parietal armature, on the other hand, consists of two strong, vertical laminæ, with short supports or ridges at the upper and lower extremities; a short, free, horizontal fold occurs below the vertical plates. In another species of the section ENDOPLON, *P. françoisii*, H. Fisch., occurring in Tonkin (see Fig. 2), the palatal folds are also six in number, the two upper and the basal one being horizontal, rather long, while the third, fourth, and fifth are short, semicircular, oblique, and a callous, transverse ridge connects the second, third, fourth, and fifth. The parietal armature is composed of two strong, obliquely divergent, transverse plates, with a short horizontal fold above and a longer one below.

In the section CHERSÆCIA—a typical example being *P. shanensis*, Stol.—the palatal barriers are again in two series, the anterior set comprising six thin, horizontal, subequal folds, while the posterior series is composed of nine short denticles arranged in a vertical row. The parietal armature consists of a strong, horizontal, median fold, revolving over nearly half of the last whorl, and united to the

parietal ridge at the aperture but free posteriorly ; a short distance beyond it occurs a strong, vertical lamina with, posteriorly, a short support below, and anteriorly a strong, horizontal fold, extending a little over half the length of the median fold, while a third horizontal, thin fold, close to the lower suture, commences just below the vertical plate and is united with the parietal ridge at the aperture. Another species in the same section, *P. brahma*, G.-A., has the palatal barriers also in two series, but here the anterior set is composed of but four rather short, horizontal folds, two above and two below, with a considerable space separating the upper and lower folds ; while

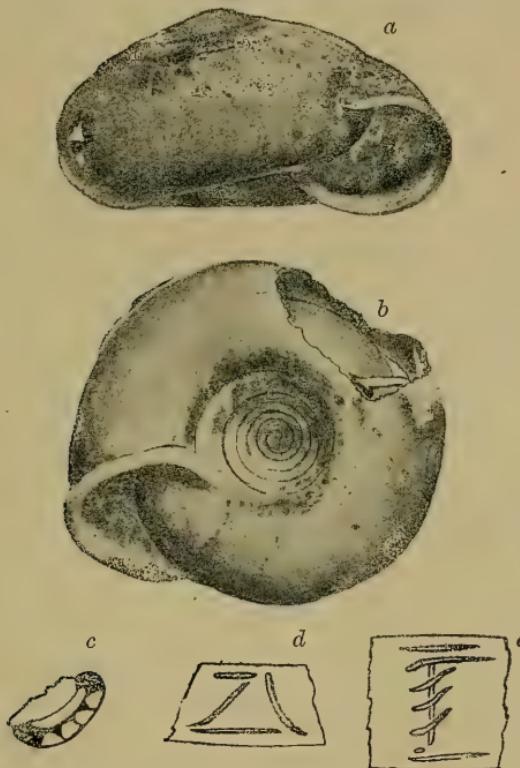


FIG. 2.—*Plectopylis françoisii*.

the posterior series exhibits no less than fourteen minute denticles arranged in a transverse row slightly deflected anteriorly below. *P. cyclaspis*, Bens., differs considerably in its armature from the other members of the genus, the parietal barrier being trifurcate with a free, short, horizontal fold below, while the palatal barriers are five in number : the two upper short and horizontal, the third crescent-shaped with the extremities curved downwards, the fourth strong, broad, and vertical, intercalating with the two lower arms of the parietal lamina, and below this another short horizontal fold.

The section SINICOLA contains nineteen species, one being found in

Tonkin—*P. emigrans*, Mlldff.; one in the Abor Hills, Assam—*P. babbagei*, Gude; one in the Loo-Choo Islands—*P. hirasei*, Pils.; all the others being natives of China. The armature is generally less complicated than in the other members of the group; in *P. schistoptychia*, Mlldff., for instance, the parietal barrier consists simply of strong vertical laminae, with a short support posteriorly at its lower extremity and two similar supports anteriorly, one above and one below; while the palatal armature consists of eight small denticles in two series of four each, a thin, horizontal fold above these near the suture, with a minute denticle near its posterior termination (see Fig. 3). In *P. diptychia*, Mlldff., on the other hand, the parietal

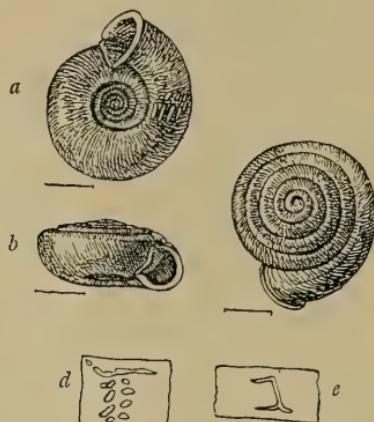


FIG. 3.—*Plectopylis schistoptychia*.

armature is composed of two strong vertical laminæ, almost parallel but slightly convergent above, the anterior one with a short support anteriorly above, the posterior one crescent-shaped; there are six short more or less horizontal palatal folds (see Fig. 4).

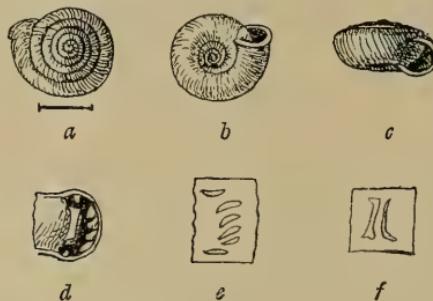


FIG. 4.—*Plectopylis diptychia*.

P. multispira, Mlldff., possesses one strong, lunate, transverse parietal plate, on the anterior side of which are found a short, horizontal fold above, next five minute denticles—the second and third being united, forming a double one (see Fig. 5). The palatal folds are

six in number, more or less horizontal, with a little elongated denticle posteriorly between the fifth and sixth.

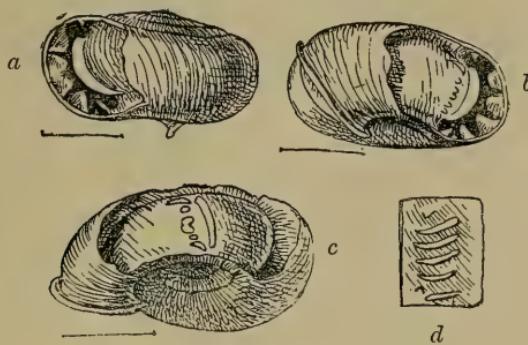


FIG. 5.—*Plectopylis multispira*.

Genus SAGDA, Beck.

This is restricted to Jamaica, except the subgenus ODONTOSAGDA, Mts., which occurs in Haiti and Cuba. The armature, generally visible through the shell-wall, is in the form of revolving, internal laminæ or interrupted laminæ forming series of denticles; in the section of HYALOSAGDA, Mts., they are, however, absent. *S. cookiana*, Gm., exhibits this interrupted lamina on the basal wall, and has, in addition, a short columellar fold.

In *S. alveare*, Pfr., the basal lamina is strongly developed and continues over the whole of the last whorl; the columellar fold is also well developed in some specimens. In *S. spiculosa*, Shutt., the basal lamina is very long, extending beyond the last whorl, but in *S. triptycha*, Shutt., it is only about one-third of a whorl long, although the foundation of the previous lamina can be observed through the shell-wall for a considerable length; the columellar fold is here in the form of a strong transverse nodule.

Genus PLEURODONTA, Fischer de Waldheim.

A large genus divided into several subgenera, or sections, distributed over the West Indies and northern South America. Many species are provided with teeth at the aperture. The Jamaican *P. bainbridgei*, Pfr., and *P. acuta*, Lam., with its numerous varieties, exhibit one or two teeth on the basal margin of the peristome, becoming more strongly developed and entering in *P. lucerna*, Müll. In *P. soror*, Fér., and *P. peracutissima*, C. B. Ad., also from Jamaica, the mouth is much contracted, and the basal margin bears four strong, elevated, entering teeth nearly closing the aperture; behind the basal margin of the peristome occur corresponding scrobiculations. Most of the other forms of the section PLEURODONTA, s.s., which is restricted to Jamaica, possess variants of his form of armature.

The section CAPRINUS, Montfort, distributed over the Lesser Antilles, possesses some remarkable forms. *P. nuxdenticulata*,

Chemn., from Martinique, has a strongly developed peristome, bearing two or more teeth or denticles on the basal and two on the outer margin, with a very strong, raised lamina on the parietal callus, the aperture being still further reduced by constriction behind the peristome. *P. nigrescens*, Wood, an inhabitant of the island of Dominique, bears a strong, obliquely entering lamella on the parietal wall, a short, strong fold on the columellar margin, and a longer, entering lamella on the basal margin of the peristome, with a corresponding scrobiculation.

P. auridens, Rang, the only species of the section GONOSTOMOPSIS, Pilsbry, from Martinique, and its variety *oligotricha*, Anc., is only provided with a short, raised lamella on the outer margin of the peristome. The section CARACOLUS, Montf., occurring in Cuba, Haiti, and Porto Rico, is composed of large species with ample aperture devoid of teeth or lamellæ.

The section ISOMERIA, Alb., confined to Ecuador, Colombia, and Peru, has most of its species furnished with one or more small denticles on the peristome, while a short parietal fold is also found in some species. *P. subcastanea*, Pfr., is an exception, having a strong, entering lamella on the outer part of the basal margin with a corresponding deep scrobiculation.

The section AMBAGES, Gude, consists of only two species from New Grenada, *P. vexans*, Dohrn, and *P. ænigma*, Dohrn, the latter twice the size of the former, but both having the armature on the same plan. The aperture is ear-shaped and considerably narrowed by its lamellæ; the basal margin is sinuous, strongly callous, and reflected, bent upward in the middle, forming an obtuse, squarish process; the upper and outer margins broadly expanded, arcuate, and bearing a short, entering fold in a line with the peripheral angulation, and below this a strong, raised, entering lamella, with a corresponding deep scrobiculation behind the peristome; the parietal callus has the margin sinuous, raised, continuous with the peristome, and gives off about the middle a very strong, raised, flexuous, obliquely entering lamella.

The section LABYRINTHUS, Beck, stands out from the other members of the group on account of the considerable constriction of the aperture in many of the species. It is characteristic of northern South America, extending northward in Central America as far as Costa Rica. They are all more or less flattened shells with narrow aperture. *P. labyrinthus*, Chemn., from Panama, has a strongly raised parietal callus continuous with the peristome and giving off a strong, median, sinuous, obliquely entering lamina, which almost meets a strong, high, triangular, entering lamina on the outer end of the basal lip, which bears a second, smaller lamina nearer the columella, with a deep sinus between them and corresponding deep pits or scrobiculations behind the peristome. *P. bogotensis*, Pfr., has the parietal callus and lamina similar to those found in *P. ænigma* and *vexans*,

but the upper lip here has a strong nodule, the basal lip bears on its outer portion two strong, entering lamellæ on a common base, and nearer the columella a strong, entering lamella and two denticles, all on a common base, a deep sinus occurring between these two sets, and all having corresponding scrobiculations. *P. clappi*, Pils., from Columbia, has the peristome developed to an unusual degree; its parietal callus and lamina resemble those in the last-mentioned species, but there is only one lamella on the outer part of the basal lip, and nearer the columellar there are two parallel, entering lamellæ, while the upper lip also has an entering lamella; all these folds or lamellæ are unusually well-developed and strong, especially those near the columella.

The next section, *THELIDOMUS*, Swainson, is not remarkable for its teeth or lamellæ, these being, generally speaking, conspicuous by their absence, but the section *POLYDONTES*, Montf.—consisting of but three species confined to Cuba—has one very remarkable member, *P. imperator*, Montf., which has an unusually strong and thick peristome, its inner edge being provided with a series of very strong teeth over its entire length and an obtuse fold near the columella.

Genus *AULACOSPIRA*, von Moellendorff.

Some seven species, all minute, are known, occurring in the Philippine Islands. Most of the species have four or five teeth in the aperture, one being provided with only one, *A. hololoma*, Mlldff., and one being edentulous, *A. mucronata*, Mlldff. *A. azpeitiæ*, Hid., has a long oblique pliciform tooth on the parietal wall, one transverse on the columella, and three smaller ones on the basal and outer margins.

Genus *METODONTA*, Mlldff.

A small genus comprising four known species from northern China, with lunate aperture nearly closed by two large teeth situate on a transverse callous ridge on the basal and outer walls a short distance from the edge of the peristome, and meeting two somewhat small teeth on the parietal callus, also on a common base, and with a small denticle on the columella. Examples: *M. houaiensis*, Cr., and *M. molnieri*, Gredl.

Genus *HELICODONTA*, Féruccac.

This group of European, north African, and south-east Asiatic distribution is characterized by a discoid form, or nearly so, of shell, the aperture being mostly triangular, lunar, rhomboid, with frequently teeth on the margins of the peristome. The section *LOOSIA*, Hesse, was established for the reception of one species, *H. diodonta*, Fér., from Hungary, a small flattened shell, with subtriangular aperture, the upper margin being furnished with a short, strong, obtuse tooth, while the lower margin carries a very stout, broad fold, which is continued within for about one-third of a whorl

by a slender low revolving lamella. The section ASPASITA, West., comprises three species, from Hungary. *H. triaria*, Friv., has two small denticles, one on the upper and one on the lower lip, while *H. trinodis*, Kim., has these two denticles stronger and more developed, and bears in addition a strong, entering, oblique fold on the parietal wall. The section TRISSEXODON, Pils., contains only two species, one from the Pyrenees and one from Southern Spain, *H. constricta*, Boub., and *H. quadrasi*, Hid. Here the parietal callus has the outer edge raised into a transverse lamella, narrowly constricting the aperture. The section MASTIGOPHALLUS, Hesse, again was established for the reception of one species, *H. rangeana*, Fér., also from the Pyrenees. This is a remarkable shell, having the upper margin fluted at its junction with the peripheral carina. The aperture is very narrow, the outer margin is constricted and bears a short, oblique fold, while the lower margin has a raised callus. In the section CARACOLLINA, Beck, we find *H. tlemcenensis*, Bgt., from Algeria, a species also with a narrow, lunar aperture, furnished with a short denticle on the basal wall and a broader one on the outer margin.

The next group to claim our consideration is that known as the PUPILLIDÆ, most of the members of which are furnished with teeth or lamellæ at the mouth. The first to be dealt with is the

Genus ANOSTOMA, Fischer.

The species are few in number and restricted to northern South America. They are peculiar from the fact that the last whorl is carried upwards, the mouth being consequently on a level with the periphery the effect being that the animal carries its shell with the spire downwards. *A. globulosum*, Lam., and *A. verreauxianum*, Hupé, are typical examples, the former having two strong, raised, flexuous, entering laminæ on the parietal wall and four raised, flexuous entering folds on the outer wall; the latter has only three short lamellæ on the outer wall, the upper one being very small, the two parietal laminæ are also less developed than in its congener.

Genus HYPSELOSTOMA, Benson,

ranges over Burma, Farther India, China, Malaysia, the Philippine and Loo-Choo Islands. They are all very small shells. In the type of the genus *H. tubiferum*, Bens., the last whorl, as in the genus *Anostoma*, is carried upwards, the mouth being horizontal and on a level with the apex. In the other species the last whorl is solute and not carried upwards, the mouth being either oblique or vertical. The aperture exhibits from four to seven lamellæ; in *H. tubiferum* one of the two parietal ones sometimes being bidentate, with one columellar and four palatal ones.

Genus TONKINIA, Mabille,

is allied to *Hypselostoma*, and is known by a single species—*T. mirabilis*, Mab., from Tonkin. The aperture is on a level with the spire, as in the genus *Anostoma*, the animal thus carrying the shell, which measures only 5 mm. in diameter and 2 mm. in height, with the spire downwards. The narrow, elongated mouth is furnished with a strong, entering, parietal lamella and a columellar fold, also entering, and bifid at the inner extremity, the latter forming a little channel at the angle of the columellar margin of the peristome.

Genus BOYSIDIA, Ancey,

occurs in India, Farther India, Malaysia, and China. In *B. plicidens*, Bens., there are three parietal lamellæ, the two upper ones being deeply entering, the second triangular and more elevated anteriorly, the third small and deep-seated. The palatal denticles are usually five in number, deep-seated, the three upper largest, the two lower minute; an elongated denticle occurs on the columella. *B. messageri*, Bav. & Dautz., and *B. gereti*, B. & D., from Tonkin, possess one parietal and one columellar, entering lamellæ, but whereas the former has three the latter has only one palatal fold; on the other hand, *B. robusta*, B. & D., and *B. paviei*, B. & D., also from Tonkin, are provided each with one columellar and two parietal laminæ, but the former possesses three palatal and the latter four palatal plicæ; finally *B. lamothei*, B. & D., is furnished with three parietal, one columellar, and five palatal folds, the upper parietal forming a sinus with the upper palatal fold.

Genus BIFIDARIA, Sterki.

Originally established as a subgenus of *Pupa* [i.e. *Pupilla*], it has since been raised to generic rank by Dr. Pilsbry, the species ranging over America, Asia, Polynesia, New Caledonia, and Mauritius. *B. tuba*, Pils., a native of Arizona, has the angular and parietal lamellæ combined into one long fold; there are: a deep-seated columellar lamella—slightly bifid—small, short, upper and lower palatal and basal folds, with a minute denticle between them, and another at the base. *B. huttoniana*, Bens., an Indian form, possesses a sinuate, parietal lamina, sometimes bifid, two palatal folds, and one or two columellar plicæ.

Genus ODONTOSTOMUS, Beck,

has several species in South America, fairly large, with elongated, much obstructed, aperture. *O. pantagruelinus*, Moric., from Brazil, has one oblique, entering, high, tongue-shaped lamella on the parietal callus with buttresses on the columellar side; the columellar lamina is erect, long, plate-like; there is a basal fold varying from simple and acute to compound and serrate; and finally it possesses

two palatal folds, the lower compressed, the upper large, elongate, and usually serrate; a few supra-palatal denticles generally occur above these. The subgenus SPIXIA, Pils. & Van., contains about thirty species, ranging from the Argentine to Brazil. The shells are less strong but more turreted, and usually have five folds in the aperture—one compressed parietal lamina, one oblique columellar, one basal, one compressed palatal, and one small supra-palatal fold; the basal and supra-palatal folds are sometimes obsolete or absent. The subgenus PLAGIODONTES, Doering, with about seven Argentine species, is somewhat peculiar in having a composite parietal barrier, formed by the fusion of three laminæ, i.e. the angular, parietal, and infra-parietal, it is outwardly trifid; there are besides two palatal folds—the upper twisted, two supra-palatal, a small compressed basal, and a columellar fold, the latter being largest of all. With the exception of *V. patagonicus*, all the species of this subgenus have in addition a high transverse lamella behind the lower palatal fold.

Genus TOMIGERUS, Spix.

Contains some seven known species occurring in South America, and is divided into two subgenera: TOMIGERUS, s.s., with one species, *T. gibberulus*, having two lamellæ on the outer lip, and PILSBRYELLA, Ihr., comprising the remainder, with only one lamella on the outer lip. A typical example is *T. clausus*, Spix, which exhibits two oblique, entering, parietal lamellæ, with a small denticle between; three entering, compressed lamellæ on the baso-columellar margin, the middle one the strongest, and a high, flexuous, oblique lamina on the outer lip, bidentate near the upper extremity; a corresponding scrobiculation is found behind the lip. A minute shell, 1·5 mm. × 1·5 mm., from St. Helena, *peregrinus*, Smith, has been doubtfully referred to this genus; in this the upper edge of the peristome is notched, having the appearance of being the termination of a tube.

Genus STROBILOPS, Pilsbry.

This genus has a peculiar distribution, being found in North America—one species also occurring in Jamaica—extending through Mexico and Central America to Venezuela. The mainland of China produces one, the island of Korea another, and a species has also been discovered in Japan, while the Philippine Islands contribute two. These two last were originally described as forms of *Plectopylis* by von Moellendorff, but Dr. Pilsbry has referred them to the present genus. *S. quadrasi*, Mldff., from Luzon, is, like all the members of the genus, a minute species, measuring only 3·5 mm. in diameter. It bears two parallel, horizontal folds on the parietal wall (see Fig. 6c and e), extending over nearly half the whorl, the upper one the stronger and united to the ridge at the aperture, the lower one thinner and not reaching quite so far; at their

posterior terminations they are united by a slight, vertical ridge, which projects a little beyond the upper fold. The palatal wall bears three short, parallel, horizontal folds at one-third of the whorl from the aperture.

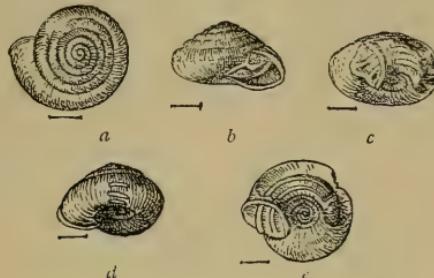


FIG. 6.—*Strobilops quadrasi*.

Strobilops trochospira, Mldff., which occurs in the island of Cebu, is a trifle larger than the last-named species, measuring 4 mm. in diameter; on the parietal wall are found two long, parallel, horizontal folds revolving over nearly half a whorl, the upper one being the stronger and united to the parietal ridge at the aperture, while the lower one is thinner and terminates at a short distance from the parietal ridge; a very thin, short, horizontal fold occurs



FIG. 7.—*Strobilops trochospira*.

posteriorly between these two (see Fig. 7e). There are five short, thin, horizontal, palatal lamellæ, descending a little anteriorly (see Fig. 7d).

Genus PUPILLA, Turton (*sensu lato*).

This is widely distributed, occurring in Europe, Asia, Africa, and America. It possesses numerous minute species, which are provided with teeth or folds in the aperture. *P. muscorum*, Lin., of circumpolar distribution and a well-known shell in these islands, only possesses a small denticle on the parietal callus. *P. brevicostis*, Bens., an Indian species, is provided with five or six plicæ: one short angular, one oblique, entering parietal, one columellar, and two or three palatal, rather deep-seated.

P. pentodon, Say, from North America, has from six to nine denticles or folds, those on the peristome being situate on a ridge of white callus; there may be one or two on the parietal wall, one

or two on the columella, and from three to five on the palatal margin, some of these being strongly developed.

Genus *VERTIGO*,[~] Muller (*sensu lato*),

also a genus of numerous minute forms, is of world-wide distribution. Many of the species have the mouth very much obstructed by folds and teeth, although in a certain number, such as *V. edentula*, Drap., and *V. minutissima*, Hartm., two British species, these barriers are absent. *V. ovata*, Say, a North American species, has generally six lamellæ: two parietal, two columellar, and two palatal.

It only remains for us to consider the

Genus *CLAUSILIA*, Draparnaud.

A large genus of wide distribution, being found in Europe, Asia, Northern Africa, South America, and Porto Rico. A great number of sections or subgenera have been established, some of doubtful value. The aperture is comparatively small, usually pear-shaped, provided with two spiral, entering lamellæ—usually on the parietal wall, the lower sometimes on the outer lip—continued internally as far as the seat of attachment of the pedicle of the clausilium; the upper follows the spiral convolution of the columella, and becomes the columellar fold, a second fold further back is known as the sub-columellar fold; these two folds form a long, flexuous groove, slightly dilated towards the aperture, but contracted further down. A curved, flexuous, tongue-shaped, elastic plate, known as the clausilium, characterizes and gives its name to the genus; higher up it becomes contracted into a narrow, twisted pedicle, its distal extremity attached to the inner shell-wall, between the distal extremities of the columellar and sub-columellar folds, the groove between these, lower down, receiving the clausilium as it is pushed to one side by the animal's extrusion. In addition there are a number of palatal plicæ behind the aperture and usually showing through the shell-wall. In some species two of these plicæ have the posterior extremities curved and approximating, ultimately uniting and forming the so-called lunella. While the animal is retracted within its shell the elastic pedicle causes the clausilium to rest against the sub-columellar fold on the inner side and against the shorter palatal plicæ or the lunella, when present, on the outer side, the anterior angle of its inner margin slightly projecting inwardly over the sub-columellar fold, an arrangement which effectively prevents the clausilium being forced to one side from without, thus securing the animal against intruding enemies. During extrusion of the animal the clausilium is pushed sideways into the groove between the columellar and sub-columellar folds, only its anterior portion being pressed slightly forward at the dilated part of the groove. The clausilium may, therefore, be regarded to act as a sliding door,

and while closed during retraction of the animal the spaces between the palatal plicæ are sufficient to admit air for breathing purposes. This peculiar sliding action of the clausilium I have not seen referred to by any previous author,¹ which may possibly be explained by the fact that the species which have served as a basis of investigation are rather small, and their examination is consequently somewhat difficult. This difficulty may be overcome by utilizing some of the larger Japanese forms—such as *C. martensi*, Herkl., and *C. valida*, Pfr. Five species belonging to the Palæarctic subgenus ALOPIA are without clausilium.

This completes our survey of the various groups of land mollusca furnished with armature.

NOTE ON *XYLOPHAGA PRÆSTANS*, SMITH.

By J. R. LE B. TOMLIN, M.A., F.E.S.

Read 12th March, 1920.

THIS species was described in these "Proceedings" (vol. v, p. 328). I am now able to give more definite details as to its habitat, and the following notes are written by Capt. J. H. Walker, the master of a trawler, who was the original discoverer, in a letter received 28th October, 1919 :—

"I have taken this shell off the Durham and Northumberland coast in various depths of water from 25 to 45 fathoms on five or six occasions, and always on pitchpine logs or masts that had been a long time in the water. I used to split the wood with wedges and take the shell out alive and keep it alive in water for several days.

"I noticed the animal was white with a fairly long siphon. I kept them in a 2 lb. glass jam-jar filled with water, and the animals could reach the surface of the water (about 4 inches), except the very smallest.

"I found they always bored across the grain of the wood in a perpendicular direction, and the larger the shell the deeper the cavity.

"On the top surface of the log or mast there was nothing to indicate the presence of shells except a number of very small holes like pin-holes.

"My largest specimens are fully $1\frac{1}{8}$ inches in diameter, whilst my largest *X. dorsalis* is only $\frac{3}{4}$ in. in diameter. I always found *X. dorsalis* in hard wood, oak, elm, or teak.

"Some of the largest specimens of *X. præstans* had bored $6\frac{1}{2}$ inches into the wood (by actual measurement). The animals are phosphorescent at night."

¹ I first drew attention to this fact in the *Fauna of British India, Mollusca*, vol. ii, 1914, p. 304, and my observations on that occasion have here been embodied.

CONCERNING *EDENTTELLINA*.

By CHARLES HEDLEY, F.L.S.

Read 9th April, 1920.

THE Australian fauna is remarkable for its wealth of oddities, and in the Pelecypoda this quality is expressed by several eccentric forms such as *Cleidothærus*, *Dimya*, *Ephippodonta*, *Foramelinea*, *Myochama*, *Pseudochama*, and *Neotrigonia*. To this assemblage is now added *Edentellina*.

A small strange bivalve was once found by Deshayes among the Eocene fossils of the Paris Basin. It took the form of a thin and depressed scale; on the umbo of the left valve was planted a spiral nucleus like the tip of the gasteropod *Strebloceras*, the hinge of the right valve carried a small cardinal tooth, and no muscular impressions were perceptible. He had intended to present it as a new genus, *Ludovicia*, and to place it next to *Pandora*.

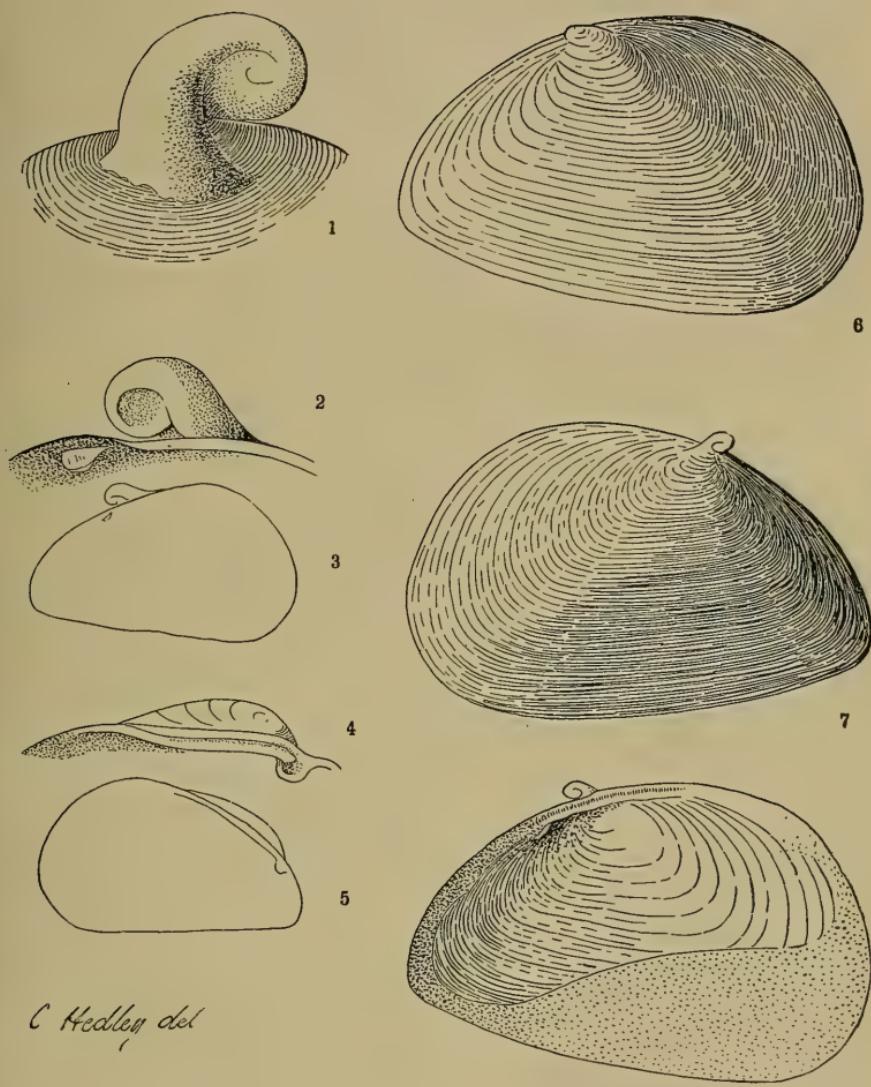
Deshayes, however, never finished his work and the little shell lay unpublished for a generation, until Maurice Cossmann in 1888 described and figured it as *Ludovicia squamula*.¹ He differed from Deshayes in his estimate of its relationship and proposed to bestow the genus in the family Galeommidae. Mr. W. J. Wintle kindly points out to me that *Ludovicia* is preoccupied by *Ludovicus*, proposed by C. Rondani (*Nuov. Ann. Sci. Nat.*, Bologna, vol. x, 1843, p. 43). According to Marschall the same name was afterwards (*Isis*, 1845, p. 719) rendered as *Ludovicia*.

Dredging within the Great Barrier Reef in August, 1906, I obtained numerous specimens as disassociated valves of a small shell which was provisionally labelled as *Ludovicia*, sp., and laid aside for further consideration. Meanwhile, a related form had been taken more than a thousand miles away, near Melbourne, and by Messrs. Gatliff and Gabriel was described and figured as *Edentellina typica*. Sir Joseph Verco, who had previously made the acquaintance of the species, then announced that it also occurred in South Australia.

The present writer commented on the absence from *Edentellina* of characteristic pelecypod features and suggested that possibly it might be the internal shell of a tectibranch; the likeness between the Parisian fossil *Ludovicia* and the recent Australian shell was also noticed.

Recent discoveries by Sir Joseph Verco have solved the problem as to which class the perplexing stranger belongs. At Guichen Bay, in South Australia, he procured better material than had been studied by the Melbourne naturalists. This showed the right and left valves to be united by a ligament and thus satisfactorily established

¹ Cossmann, *Mém. Soc. Roy. Malac. Belg.*, vol. xxii, 1887 (1888), p. 45, pl. ii, figs. 21–22.



C. Hedley del

FIGS. 1-5.—*Edentellina typica*, Gatliff & Gabriel.
,, 6-8.—*Edentellina corallensis*, n.sp.

the pelecypod nature of the shell. The hinge was also shown to contain "valid anterior teeth".

By the kindness of Mr. Ph. Dautzenberg I enjoyed an opportunity of examining cotypes of *L. squamula* in his collection. Not having specimens of *Edentellina* at hand for comparison I had to rely on memory, but my recollection is that *Ludovicia* and *Edentellina* are co-generic.

The situations in which dead shells have been found indicate that the species lives in shallow water a little below the level of low tide. The soft parts have not yet been seen by any zoologist. On a study of the animal will depend a final judgment of the taxonomic position of the genus.

So far as I am aware, it has not been noticed that *Julia exquisita* carries on the umbo of the right valve, but not on the left, a spiral horn, like, though far smaller, that of *Edentellina*. In hinge structure and general features there is also a general correspondence. On the strength of these resemblances I would refer *Edentellina* to the family Juliidae (= Prasinidae of Fischer's "Manuel").

The inequality of the valves, the spiral prodissoconch sometimes on the right, sometimes on the left, but unmatched in the opposite valve, and the massive cardinal suggests to me some relationship with the Chamacea.

The two recent Australian species of this genus are as follows:—

EDENTELLINA TYPICA, Gatliff & Gabriel. (Figs. 1–5.)

Edentellina typica, Gatliff & Gabriel, Proc. Roy. Soc. Vict., xxiv, 1911, p. 190, pl. xlvi, figs. 5–6; *id.* Verco, Trans. Roy. Soc. S. Australia, xxxvi, 1911, p. 328, and xl, 1916, p. 596; *id.* Hedley, Rec. Austr. Museum, viii, 1912, p. 134.

Hab.—Portsea (type), Point Nepean, and Shoreham, Victoria (Gatliff & Gabriel); Guichen Bay, South Australia (Verco); King George Sound, Western Australia (Prof. Dakin).

From South Australian specimens, 5 mm. in diameter, collected in 1916 at Robe, Guichen Bay, and kindly lent to me by Sir Joseph Verco, I now figure (1) the spiral umbo of the right valve seen from without, (2) the same from within and the anterior cardinal tooth, (3) outline of the right valve, (4) hinge, and (5) outline of the left valve.

EDENTELLINA CORALLENSIS, sp. nov. (Figs. 6–8.)

Compared with the preceding species, this has the valve more solid, more compressed, and more pointed anteriorly. The colour is pale sulphur yellow. Length 5, height 3, depth of single valve 1·3 mm.

Hab.—Coral mud, in 5 to 10 fathoms off the Hope Islands, North Queensland, where I dredged several separate valves in August, 1906.

NOMENCLATORIAL NOTES RELATING TO BRITISH NON-MARINE
MOLLUSCA.

By A. S. KENNARD, F.G.S., and B. B. WOODWARD, F.L.S.

Read 14th May, 1920.

TESTACELLA.

THE history of this genus was well summarized by Gassies and Fischer in 1856 in their "Monographie du genre *Testacella*" (Actes Soc. Linn. Bordeaux, xxi, pp. 195–248), whilst in December, 1861, Bourguignat published, by way of a supplement, his "Notice sur les espèces vivantes et fossiles du genre *Testacella*" (Rev. & Mag. Geol., sér. II, tom. xiii, pp. 513–24.—Reissued in his *Spiciléges Malacol.*, 1862, pp. 55–68). These two papers, however, were not, of course, conceived as regards nomenclature in the same light that obtains to-day, and hence modifications in their conclusions have become necessary, especially with regard to the three species present in Britain, with which alone we propose to deal.

A brief summary of the history of the genus, drawn mainly from Gassies & Fischer, is necessary to the understanding of the case we present.

1740. The first published notice of these molluscs seems to have appeared in 1740, when a M. Dugué wrote from Dieppe to Réaumur concerning the discovery in his garden of a slug carrying on its hinder end a claw-shaped plate. (Hist. Acad. Sci. Paris, 1740 [1742], pp. 1 and 2.)

1754. In this year it is said that a M. La Faille, of La Rochelle, made a similar communication to Guettard, but his observations were not published.

1774. La Faille seems to have sent Favanne a specimen in spirit, attributing the discovery to Dr. Guillemeau, of Niort.

1779. The Viscount De Querhoent, of Le Croisic in Brittany, wrote to Valmont de Bomare detailing the exhumation by his gardener, in October of that year, of a slug which was preying upon, and had partly swallowed, a worm. (Dict. rais. univ. Hist. Nat., ed. 4, tom. iv, 1791, p. 579.)

1780. Favanne de Montcervelle and his son when producing the third edition of Dezallier d'Argenville's "Conchyliologie", appended a series of plates under the title of "Traité de la Zoothomphose". Here on pl. lxxvi they depicted certain "Limaces à Coquilles", one of which may well have been taken from the specimen received as above recorded from La Faille, although no mention is made thereof.

1796–98. By order of the French Government an expedition to the islands of Teneriffe, La Trinité, Saint-Thomas, Sainte-Croix, and Porto Rico, under the command of Capt. Baudin, was sent out

in 1796, returning in 1798. R. Maugé was the zoologist and Le Dru botanist. The collections they brought back were deposited in the National Museum, but owing to Maugé's decease and other causes were not worked out (Gass. & Fisch., p. 199). Notes concerning them were published in Le Dru's account of the voyage in 1810, to be cited later.

1800. Cuvier instituted the name *Testacella*, which appears, without any definition or description whatever, on Table V of his "Leçons d'Anatomie Comparée", tom. i.

1801, January. Lamarck, who had evidently become acquainted with Maugé's specimen (or specimens) from Teneriffe, preserved in the Natural History Museum at Paris, accepted the name *Testacella*, and gave a description of the genus, citing after the custom of the time the nearest figures, which were those of Favanne, and giving as examples (Syst. Anim. s. Vert., p. 96): "*Testacella haliotoides*. n. ex *D. Mauger* [sic] ex ins. Teneriffæ."

Since "a genus proposed with a single original species takes that species as its type" (Internat. Rules Zool. Nomencl. Monaco, 1913, Art. 30, I, c), and in such cases the generic description obviously covers the species and is rightly held to do so (opinion 43), Lamarck's name, which is correctly formed, cannot be set aside as a *nomen nudum*, but must hold for the sole species of Teneriffe, afterwards renamed by Fé russac *Testacella maugei*.

About this time a M. Faure-Biguet rediscovered the genus in France, and supplied Draparnaud and Cuvier with specimens, as stated by the latter in his paper presently to be referred to.

1801, July. So that in his "Table des Mollusques terrestres et fluviatiles de la France", which appeared in July, 1801, Draparnaud was able to include the form under the generic name of *Testacella*, adding in a note (p. 99): "Il faut rapporter au genre Testacelle, les limaces à coquille de Favanne . . . qui sont toutes exotiques, et de l'île Ténériffe, selon Mauger [sic]." Apparently unacquainted with Lamarck's work, but similarly struck by the resemblance of the shell to that of *Haliotis*, he bestowed on the species the philologically incorrect name of *haliotidea*. His name, therefore, being a homonym of Lamarck's, cannot stand, although it has so long been in use.

1802. Early in the year Bosc, who was evidently unacquainted with Draparnaud's work, gave in his "Histoire Naturelle des Coquilles" (suites à Buffon classé par Castel), tom. iii, p. 240 (under *Testacella*, Lamarck) *T. haliotoides*, from Teneriffe, *T. costata*, from the Maldives, and *T. cornina*, locality unknown.

1802, March. Faure-Biguet published a note, "Sur une nouvelle espèce de Testacelle" (Bull. Sci. Soc. Philom. Paris, An x, p. 98, pl. v, f. [2] a-d), describing and figuring the form named *T. haliotidea* by Draparnaud, but himself giving no name of any sort, nor locality.

1805, February. Cuvier (Ann. Mus. Hist. Nat. Paris, v) described and figured the animals sent him by Faure-Biguet and their anatomy, under the name (p. 440, pl. xxix, f. 6–11) “*La testacelle de France (testacella haliotidea [sic], Drap.)*”. His figures leave no doubt as to the species with which he was dealing.

1805, June. Roissy (Hist. Nat. Moll.: Suites à Buffon rédig. Sonnini, v), in dealing with the genus *Testacella*, proposed (p. 252) the name of *T. europaea* for the French form, cited Faure-Biguet’s paper, and remarked that that writer gave it as occurring in the south of France, whilst Draparnaud recorded it from the north of France. He ignored Draparnaud’s name of *haliotidea*, and overlooked Draparnaud’s record of its occurrences both in northern and southern France. Roissy’s further species are *T. cornina*, without stated locality, *T. haliotoides*, from Teneriffe, and *T. costata* from the Maldives. For the reasons already given Roissy’s name *europaea* will stand in lieu of Draparnaud’s *haliotidea*.

1805. Late in 1805 Draparnaud (Hist. Moll. France, p. 121, pl. viii, f. 43–48; ix, f. 12–14) repeated his name of *Testacella haliotidea* unsupported by any references. We are sceptical concerning the suggestion that the shells figured on pl. viii, f. 46–48, as of the adult animal should be referred to *T. maugaei*.

1807. Féruccac (Essai méthod. Conchyl., p. 41) enumerated four species: (1) *Testacella haliotidea*, Faure-Biguet (an error as to the author of the species which was afterwards frequently copied); Cuvier and Draparnaud are also cited, and Roissy’s *T. europaea* correctly placed as a synonym. (2) *T. cornica* [sic], Roissy. (3) *T. haliotoides*, Roissy, Teneriffe. (4) *T. costata*, Roissy. In the “Concordance systématique” (p. 116) only *T. haliotidea* appears.

1810. Ledru’s account of the expedition of 1796–8 (Voy. aux îles de Teneriffe, La Trinité, etc., tom. i, p. 187) by a printer’s error gives another spelling for the name of the Teneriffe species, viz. “*Testacula haliotoides*”, Roissy’s version being evidently intended.

1819. Féruccac (Hist. Nat. Moll., ii, p. 94), following Montfort (1810), changed the form of the generic name to the masculine and cited *Testacellus haliotideus*, Faure-Biguet (pl. viii, f. 5–9, 11, 13–15), with other references as before, and *T. maugaei*, nobis (pl. viii, f. 10 and 12) with *T. haliotoides*, Lamk., as synonym. A repetition of these occurs in his later Tabl. Syst. des Limaces, 1821, p. 26, with the synonyms added to the former species of *Testacella europaea*, Roissy, *T. haliotidea*, Drap., and *T. galliae*, Oken.

1822, April. Lamarck (Hist. Anim. s. Vert., vi, pt. 2) so far underrated his original species as to say (p. 51) “Il n’y a encore quel’espèce suivante qui soit bien connue”, namely (p. 52) *Testacella haliotidea*, which he attributes to Faure-Biguet, whilst citing Draparnaud, Féruccac, and Cuvier.

1831. Michaud, late in 1831 (Complément Hist. Nat. Moll. France de Draparnaud, p. 9), furnished an example of careless

copying without reference to the original source when under *Testacellus haliotideus* he added "J'ai cru devoir conserver à ce genre le véritable nom qui lui avait été imposé par Faure-Biguet, Bull. Soc. phil. No. 61", which reference he obviously took from Féruccac.

1855. Grateloup (Distrib. géogr. fam. Limaciens, pp. 15 and 16), not satisfied with the existing names of the species, superfluously suggested others, and even for *maugei* two other names.

From the foregoing, therefore, it becomes apparent that the three British representatives of the genus should be known as :—

1. *Testacella haliotoides*, Lamarck.
T. maugei, Féruccac.
2. —— *europaea*, Roissy.
T. haliotidea, Draparnaud.
3. —— *scutulum*, Sowerby.

The more extended synonymy may be reserved for another occasion.

Several Continental forms of *Testacella* have been described at different times and attempts have been made to reconcile these with one or other of the above species. Until, however, much more complete knowledge of these is to hand it seems better to treat them as distinct after the manner of Gassies & Fischer, and of Bourguignat, than to guess at their possible affinities. More especially should species founded on imperfectly preserved fossils, some of which date back to the Miocene, be severely let alone.

MM. Gassies & Fischer concluded their monograph with a list of thirteen species which have been included in, but do not belong to, the genus *Testacella*. Strangely enough the twelfth is a myth of their own manufacture. "*Testacella teneriffæ*, D'Orb., père inéd. in Fér." resolves itself in the original (Féruccac, Hist. Nat. Moll., ii, p. 87) into "Description communiquée par Mr. d'Orbigny sous le nom de Testacelle de Ténériffe", Féruccac's own name for the animal being *Plectrophorus orbignii*. Liberties of this sort give an infinity of trouble to the student. Moreover, apparently by misreading d'Orbigny's statement (in Webb & Berthelot, Hist. Nat. Îles Canaries, tom. ii, pt. 2, 1839, p. 49) that *Testacella haliotidea*, Drap., occurred "dans l'île Canarie" [i.e. in Grand Canary] as "dans les îles Canaries", or the archipelago generally, they concluded that it occurred in Teneriffe also, which it seemingly does not, and proceed to make deductions therefrom that cannot be maintained. Orbigny's opinion was that *maugei*, Fér., was a climatal variety of *haliotidea*, Drap.

HELIX ACUTA, Müller.

We have recently maintained (Journ. Linn. Soc. (Zool.), xxxiv, 1920, pp. 206–207) that Linné's name of *Helix barbara* must be

allowed to lapse on account of ambiguity,¹ and favoured a return to Müller's name of *acuta* for the British species; and it is still our opinion, as it was that of Dillwyn (Cat. Shells, ii, 1817, p. 956), that this is correct.

Considerable controversy raged in the past as to the correct use of Müller's name, and to judge from a quite recent memoir divergent views still persist, so that it seems desirable to review the question yet once again in the light of modern zoological rules and requirements.

By way of prelude it is necessary to refer to certain cited figures on the interpretation of which a good deal depends. Lister, in his "Historiæ sive Synopsis methodicæ Conchyliorum", on pl. xix, fig. 14, gave an unmistakable representation of our British species, naming as localities: "Gall. nar. [= south-eastern France] Aldernensi Insula. A. [= Anglia]. Wallia. Flord." Then there are three sets of figures on pl. iv of Gualtieri's "Index Testarum Conchyliorum". Of these "I" manifestly represent the English shell, "L" a shell with a strongly marked lip that can have nothing in common with ours, and "N" a pair that might be held to represent young and rather tumid examples of "I", but do not resemble in shape or proportions the *Bulimus ventricosus* of Draparnaud.

Müller, in his "Vermium Historia", ii, 1774, p. 100, gave all too brief diagnosis of his *Helix acuta*, but he cited Gualtieri's fig. "N" and Lister's fig. 14. This last, with the dimensions "long. 4 lin. lat. $1\frac{1}{2}$ lin.", in our opinion, determines his species to be the form that has so long borne the name. Gmelin in 1791 (Linn. Syst. Nat., ed. 13, i, pt. 6, p. 3660) merely followed Müller.

Bruguière next, in 1789 (Ency. méthod., Vers. i, p. 323), transferred Müller's species to the genus *Bulimus*. He cited Lister's fig. 14 and all three, I, L, N, of Gualtieri; at the same time he gave as synonym the *Turbo fasciatus* of Pennant, and this with his dimensions, "Sa longueur est de quatre lignes et demie, et sa largeur au bas est du moitié moindre," showed that he, too, had the same shell in mind as Müller.

¹ Chemnitz (Syst. Conch. Cat., vol. ix, 1786, p. 190) suggested its identity with his *Helix cretacea*, etc. (pl. cxxxvi, f. 1263, Nos. 1-4), to which Gmelin afterwards (Linn. Syst. Nat., ed. 13, i, pt. vi, 1791, p. 3655) gave the name *Helix carinula*. Potiez & Michaud (Galerie Moll., i, 1838, p. 144) query its identity with their *Bulimus hieroglyphicus*, and this is quoted by Beck (Index Moll., 1837, p. 63). Pfeiffer (Mon. Helic. viv., ii, 1848, p. 124) placed *Bulimus barbarus*, Linn., next to *B. obscurus* and gave as synonyms *B. jeannoti*, Terv., and *B. tervierii*, Forb. Later, however (op. cit., vi, p. 63), he made *B. jeannoti* the species. Menke, who discussed the whole question in 1845 (Zeitschr. f. Malak., 1845, pp. 29-30), pointed out that *hieroglyphicus* had nothing in common with *jeannoti*, and concluded that while it might be assumed with confidence that *Helix barbara*, Linn., was a *Bulimus*, the species was yet doubtful; and that it was desirable that conchologists who in future might have more abundant Algerian material should not lose sight of the opportunity of solving the question.

Draparnaud, in 1801 (Tabl. Moll. France, p. 68), first described two kindred forms as *Bulimus acutus* and *B. ventricosus*. The name of the first was evidently taken from Bruguière. The dimensions and the figures cited, Gaultier's "I" and Lister's "14", show that this again was the form we have in England and identical with Müller's and Bruguière's. In the synonymy Draparnaud cited with a "?" *Helix barbara*, Linn. This last reference is omitted in his later "Histoire".

In illustration of his *B. ventricosus* Draparnaud cited Gaultier's figures L and N, whilst in synonymy the *Helix acuta*, Müller, and *Bulimus acutus* of Bruguière appear.¹

Now by this synonymy did Draparnaud mean to imply that without specifically mentioning it he adopted Bruguière's name for the one form and merely cited Müller and Bruguière under the other to show that they had, in his opinion, included the two forms under one name? The following sentence under *Bulimus ventricosus* in the "Tableau", but omitted from the "Histoire", seems to show that he did: "Coquille plus courte et plus ventrue que la précédente, avec laquelle il paraît que les conchyliologistes l'ont confondu."

Moreover, Draparnaud was hardly likely to have overlooked the fact that his predecessors had cited Lister's fig. 14 as he did, and that their dimensions tallied with his.

In our opinion there was nothing that would justify the inclusion in its entirety of the *Bulimus acutus* of Müller and Bruguière as a synonym of Draparnaud's *B. ventricosus*.

This seems to have been the mature view of Féruccac, for although in the "Concord Systématique" at the end of his "Essai", 1807 (pp. 120-121), he made *Bulimus ventricosa* [sic] the equivalent of *Helix acuta*, Müller, and *Bulimus acuta* [sic] the synonym of *Helix barbara*, Linn., when he wrote his "Tableau Systématique de la famille des Limaçons" in 1821 we find (Jan. ed. p. 56, June ed. p. 52), under *Helix (Cochlicella)* :—

No. 377 *ventrosus*, nobis [corrected p. 74 (or 70) to *ventrosa*].

Bulimus ventricosus, Draparnaud.

Helix acuta, Müller.

No. 378 *acuta*, Müller.

Helix bifasciata, Pulteney.

Turbo bifasciatus, Pennant.

Bulimus acutus, Bruguière.

No. 379 *barbara*, Linné, etc.

"... Rien ne prouve que cette espèce soit la précédente."

¹ Draparnaud further queried (p. 69) whether the *Helix ventricosa*, Müll., were only a variety of this species. Moquin-Tandon, however (Hist. Moll. France, ii, p. 279, note), stated that it was the young of *Bulimus obscurus*.

He thus inferred that Müller had included two forms under his *acuta*, whilst he overlooked the fact that Bruguière must, then, equally have done the same, and inclined to the opinion that *barbara* was distinct.

This disposition of the two forms now in question was followed by all the more noted French conchologists, such as Lamarck, Dupuy, and Moquin-Tandon.

Risso, however, in 1826 (*Hist. nat. Europ. mérid.*, iv, p. 77) raised Féruccac's *Cochlicella* to the rank of genus, adopted that author's *ventrosa*, but proposed the new name of *meridionalis* for Müller's *acuta*. Bourguignat, with his characteristic love of reviving dubious names, in 1864 (*Malac. Algérie*, i, p. 286), and again in 1868 (*Hist. Malac. Tunis*, p. 25), sought to identify Draparnaud's *ventricosa* with Linné's *barbara*.

On the other hand, in 1883, Fagot, in an entirely superficial paper (*Glanages Malac.*, iii, pp. 29–32), in which he completely ignored the figures cited by the original authors, reverted to Féruccac's abandoned synonymy of the "Essai" and adopted outright *Helix barbara*, Linn., for the *Bulimus acutus*, Drap., and took *Helix acuta*, Müll., for the *Bulimus ventricosus*, Drap.¹

This reading was subsequently followed by Westerlund in 1889 (*Fauna Paläarct. Region*, ii, p. 366), by Connolly in 1912 (*Ann. S. African Mus.*, xi, p. 157), by Caziot (*Feuille Jeunes Nat.*, xlvi, p. 160), and Germain in 1913 (*Moll. France*, pp. 118–119), whilst Pilsbry in 1895 (*Man. Conch.*, ser. II, vol. ix, p. 264) made *acuta*, Müll., a synonym of *barbara*, Linn., and accepted *H. ventricosa*, Drap., with "ventrosa, auct.", and *bulimoides*, Moq., as synonyms.

Draparnaud was, however, forestalled in the use of the name *Bulimus ventricosus* by Bruguière in 1792 (*Ency. Méthod.*, Vers, i, p. 363), so that Féruccac's *ventrosa* displaces it for the French shell, since Moquin-Tandon's objection to the name (*Hist. Moll. France*, ii, pp. 279–80) does not seem valid in the light of present rulings, and his substituted name of *bulimoides* consequently falls into synonymy.

HELIX SUBRUFESCENS, Miller, vice HELIX FUSCA, Montagu.

Unfortunately another well-known name in British non-marine Mollusca has to be changed. Montagu's appellation of *Helix fusca* (*Test. Brit.*, 1803, p. 424) was anticipated by Poiret (*Coq. Aisne*, 1801, p. 69), who applied it to what proves to be a colour variation of *Helix nemoralis*, Linn. Gray's *Helix (Zenobia) corrugata* (*Med. Repos.*, xv, 1821, p. 239) being a *nomen nudum*, the next name on the list, *Helix subrufescens* of Miller (*Ann. Phil.*, n.s., ii, p. 43), has to be

¹ Webb & Berthelot in 1833 (*Ann. Sci. Nat.*, xxviii, p. 317) had adopted *Helix acuta*, Müll., with *Bulimus ventricosus*, Drap., as synonym; but this was corrected by Orbigny in the molluscan portion of the "Hist. Nat. Iles Canaries", 1839, p. 67, to *Bulimus ventricosus*, Drap.

accepted. The correct generic name is at the moment of writing *sub judice*.

HELIX HAMMONIS and TURBO BIDENTATUS of Ström.

In his "Beskrivelse over Norske Insester. Förste Stykke" (Det Trondheim. Selskabs Skrifter. Dl. iii, 1765) Ström names and inadequately describes and figures certain molluscs. All trace of these seem to have been lost, but two of his names have of late been utilized in nomenclature, though, as we think, without justification.

His *Helix hammonis* (tom. cit., p. 435, pl. vi, f. 16) may well have been the fry of some larger species, as his *H. domestica* (tom. cit., p. 435, pl. vi, f. 15) obviously was. The older writers, who are more likely to have known what he meant, differ in opinion from the later ones, who could have had no other evidence to go upon save the original author's imperfect diagnosis and figure. Thus Müller in 1774 (Verm. Hist., ii, p. 32) gave it as a synonym for his own *Helix [Polita] nitida*. He was followed in this by Fabricius in 1780 (Fauna Groenlanica, p. 389), and, of course, by Gmelin in 1791 (Linn. Syst. Nat., ed. 13, i, pt. 6, p. 3633), who cited it under *H. nitens* [= *nitida*, Müll.]. Beck in 1837 (Index Moll., p. 6) followed suit, but with a "?" Forbes & Hanley likewise in 1852 (Hist. Brit. Moll., iv, p. 39) adopted this view. Gray in 1857 (Turton's Manual, new ed., p. 96) also recorded it under this species, which, however, he called *Zonites lucidus*.

Von Martens in 1856 (Malak. Blätter, 1856, p. 81) seems to have been the first to venture a new conjecture as to the identity of Ström's shell, and referred it to *H. pura*, Alder (cf. Pfeiffer, Mon. Helic. viv., iv, 1859, p. 83).

In 1864 Mörch (Synop. Moll. Danicæ, p. 13) treated Ström's name as valid, and placed the *Helix radiatula* of Alder as a synonym. His conclusion was adopted by Pfeiffer in 1868 (Mon. Helic. viv., v, p. 147) and by Westerlund in 1871 (Nova Acta Soc. Sci. Upsala, ser. III, vol. viii, No. 1, p. 25) under the name *Zonites (Hyalinia) hammonis* (Ström).

All these divergent views are obviously so purely speculative that it is clear Ström's name must be definitely rejected.

Ström's *Turbo bidentatus* appears to have had an equally chequered career. Müller in 1774 first made it a synonym of his *Helix bidens* (Verm. Hist., ii, p. 116), and then a little later on (p. 119) under his *Helix perversa* (which includes as the young forms what we now know as *Balea perversa*, and as adult the *Clausilia rugosa* of Draparnaud) wrote "Ström definitione Linneana seductus precedentis pullum *perversam*, adultum vero novam speciem sub nomine *bidentatae* finxit." Gmelin, of course, copied this dual entry (Linn. Syst. Nat., ed. 13, i, pt. 6, pp. 3609 and 3610). Then the matter seems to have rested till Mörch in 1864 (Synop. Moll. Daniæ, p. 30) revived the name

as a distinct species, followed by *Cl. dubia*, Drap., with *Cl. rugosa*, C. Pfr., as synonym thereof, but gave no reasons for his procedure: Mörch was followed as usual by Westerlund in 1871 (*Nova Acta Soc. Sci. Upsala*, ser. III, vol. viii, p. 78). No other authority, not even Boettger (*Clausiliensstudien*, 1877) appears to have given currency to Ström's name.

Since the original description and figure might equally well apply to such other form as *Cl. parvula*, Studer, it is best discarded.

The species to which it has been applied will therefore in future be known under Draparnaud's name of *Cl. rugosa* (1801), this having priority over *Cl. nigricans*, Maton & Rackett (*Trans. Linn. Soc.*, viii, 1807, p. 180). It has been generally overlooked that Maton and Rackett's citation in synonymy of "Pultney" refers not, as has been assumed, to the original editions of the "Catalogues" (1799), in which the name in question does not appear, but to the then forthcoming second edition in 1813, which Rackett was editing, and for which the plates had been prepared.

In re FITZINGER.

An eccentric genius, like Rafinesque, whom he resembled in that some of his work stands, Fitzinger was obviously very careless in the preparation of his manuscript and totally neglectful as regards its printing. How else can the following errors be accounted for in his classical "Systematisches Verzeichniss der in Erzherzogthume Oesterreich vorkommenden Weichthiere" (*Beitr. Landesk. Oesterreich.*, iii, 1833, pp. 88-122) ?

Thus at the bottom of p. 98 we find "*Gonyodiscus perspectivus*, Mihi" as a new name for *Helix perspectiva*, Mühlfeld; *H. rotundata*, Pfeiffer; and *Helicella rotundata*, Fér.; whilst at the top of the next page we have "*Discus rotundatus*, Mihi" for *Helix rotundata*, Argenville & Drap.; *Helicella rotundata*, Fér. Granted that he drew a distinction between the *Helix rotundata* of Pfeiffer and those of Argenville and Draparnaud, he can really not have intended to place the *Helicella rotundata*, Fér., at one and the same time in two different genera. Is it not rather likely that he wrote *Discus* at first, and subsequently changed it to *Gonyodiscus* (which, of course, should be *Goniodiscus*), making the correction on the first entry and expecting the printer to carry it through, which was not done.

The next oversight occurs a few lines down. The last entry under *Discus* being "*D. cristallinus*, Mihi" for "*Helix crystallina*, Müller & Draparnaud", this is immediately followed by "*Vitrea diaphana*, Mihi" for "*Helix crystallina*, Drap.; *H. diaphana*, Studer", etc. This second introduction of Draparnaud's species as an equivalent for *diaphana* is the more amazing since the latter does not occur in France. The two forms *crystallina* and *diaphana* are so absolutely inseparable generically and so unlike the other species put under *Discus*, that the error is obvious.

Again, on p. 100, under *Oxychilus* we see the species usually referred to the subgenus *Polita* (with the added blunder of referring *Helix nitida*, Müller, to both "*O. lucidus*" and "*O. nitidulus* var. *nitens*") having appended to them "*O. ericetorum*" and its "var. *cespitem*", both for the well-known Müllerian species. It is clear these were intended to form part of the following "*Helicopsis*" with its sole species "*striata*" and supposed synonyms *intersecta* and *fasciolata*, Poiret, *caperata*, Mont. Unfortunately, the name *Oxychilus* is rendered untenable by the earlier *Oxycheila* of Dejean, 1825, for Coleoptera.

The final slip is on p. 111, where under *Anisus*, for *Planorbis complanatus*, Drap., *carinatus*, Müll., and *marginatus*, Drap., *A. vortex*, Müll., is included, which could not have been intended to be separated from the immediately following "*Planorbis spirorbis*, Müller". Fitzinger probably borrowed his *Anisus* from Studer, 1820, who employed it for *Planorbis* with *Physa*, whilst his name as circumscribed is shut out by Dejean's use of it in 1821 for Coleoptera.

The type of *ANCYLYS*, Geoffroy.

It seems to have been generally overlooked that Geoffroy, when he founded the genus *Ancylus* (Traité Coq. Paris, 1767, p. 122), cited but one species, and that one (p. 124) the *Patella lacustris* of Linné. We think we have established (Journ. Linn. Soc. (Zool.), xxxiv, 1920, p. 210) that this was the form which came into Beck's group *Acroloxus* (= *Vellezia*, Gray), consequently *Acroloxus* becomes a synonym of *Ancylus* [s.s.].

The kindred British form *fluviatilis*, Müll., it is universally agreed, must be placed in a distinct genus, since among other differences is a sinistral animal, whereas *lacustris* is dentral, so that recourse must be had to the subgeneric name of *Ancylastrum*, proposed by Bourguignat in 1853 (Journ. de Conchyl., iv, p. 63), and that name must now be raised to generic rank.

Bourguignat's procedure in the same paper (p. 187) in replacing Müller's trivial name of *fluviatilis* by "*simplex*, Buc'hoz", cannot be sustained. Buc'hoz was not a binominal author, and there is nothing to show that his "*Lepas simplex*", etc., was in any way related to Müller's mollusc.

On *BULINUS* of Adanson.

The recent tendency to revive Adanson's old name of *Bulinus*, or, as amended by Oken, *Bullinus*, especially in medical literature dealing with Bilharzia, renders it desirable to once again point out that the name is not available, and further that its use especially in its present erroneous application to aquatic mollusca in widely separate regions is misleading and mischievous both to medical and geological science.

Adanson (Hist. Nat. Sénégal, 1757, Coquillages, p. 5) bestowed this generic name on a diminutive and probably immature physoid

shell, 3·5 mm. in length, in which the mantle did not, he says (p. 6), protrude beyond the margin of the shell, thus differentiating it from true *Physa*. Adanson's shell has remained indeterminate.

O. F. Müller, in 1781 (*Geschichte der Perlen-Blasen*, "Der Naturforscher," xv, pp. 1-20), took up this derelict, pre-Linnean name (p. 6), added the trivial name of *senechalensis* to Adanson's shell, and associated with it the three supposedly kindred molluscs from his "Vermium Historia", viz. *Planorbis bulla* (which he rechristens *B. perla*), *Pl. turritus*, and *Pl. gelatinus*. Of course, the adoption of Adanson's name involves the acceptance of his shell as the type of the genus. Since, however, that is indeterminate, this post-Linnean revival of the name is rendered nugatory. But for that *Bulinus*, Müller, 1781, would have precedence of *Physa*, Draparnaud, 1801.

Oken, in 1815 (*Lehrb. Naturgeschichte*, iii, abth. 1, p. 302), practically followed Müller, but emended Adanson's name to *Bullinus* (out of respect, apparently, to its Latin derivation), and added to the genus *Patella fluviatilis*, thus making confusion worse confounded. His name is equally invalid.

The name *Bullinus* next occurs in a quaint sale catalogue of the effects of Bishop O. Fabricius, entitled "Fortegnelse over en . . . Bogsamling . . . tillegemed en betydelig Deel Naturalier, hvori blandt en Conchyliesamling, afgang Biskop Fabricius's . . . som ved auction . . . forstkommende", etc., which was published in Copenhagen in 1823. On p. 71 of this book *Bullinus fontinalis*, *hypnorum*, and *terebellum* are cited.

Beck in 1838 (Index Moll., p. 116), apparently following Müller, employed Adanson's name, distinguishing two subgenera : 1 *Aplexa*, Fleming, for *A. hypnorum* (L.) B., *elongata*, Say, etc., and 2 *Bulinus*, B., for *B. fontinalis* (L.) B., *contortus*, *acutus* (Drap.) B., *senegalensis*, O. Müll., etc.

Meantime Ehrenberg, in 1831 (Symbol. Phys. Anim. Evert. [p. 87]), had established the genus *Isidora* for certain Egyptian and Syrian physoid molluscs.

In 1869 both Dohrn (Malak. Blätt., p. 18) and Von Martens (Malak. Blätt., p. 213) questioned whether *Isidora* might not be allied to Adanson's "Bulin". A suggestion that Jickeli in 1874 (Nova Acta K. Acad. Leop.-Carol., xxxvii, No. 1, p. 202) considered a very probable one.

H. Adams, in 1861, when describing certain shells in the Cuming Collection (Proc. Zool. Soc. Lond., 1861) created (p. 143) a new subgenus, *Ameria*, of *Physa*, for certain forms from Australia with flattened and angulated whorls, carinated at the posterior part.

Fischer, in 1883 (Manuel Conchyl., p. 509), accepting pre-Linnean writers, revived Adanson's name of *Bulinus* for a genus distinct from *Physa*, and placed in its synonymy *Isidora* of Ehrenberg, with Gray's *Diastrophia* (Turton's Manual, 1840, p. 16), which was established for the European *Physa contorta*, Michaud.

Cooke, in 1889 (Proc. Zool. Soc. Lond., 1889, pp. 136–43), discussing the sinistral shells from Australia that had been referred to *Physa*, concluded that they were, judging by the radula, generically identical with *Isidora*, and, evidently unaware of the history of the name detailed above, followed Fischer in accepting Adanson's *Bulinus* for them. In 1895, however (Cambridge Nat. Hist., iii), Cooke abandoned the name *Bulinus* in favour of *Isidora*. He seems to have overlooked the fact that Adams' name *Ameria*, were his conclusions correct, would have priority.

A comparison of Jickeli's figures of the radulæ of *Isidora*, on which Cooke relied, with those which the latter author gave of the Australian shells shows the existence of certain differences which lead us to think that he would nowadays be disposed to consider sufficient to differentiate the Australian physoids from *Isidora*, and as he pointed out that though Adams founded this *Ameria* on keeled examples "every gradation of keeling is observable . . . and occasionally the same species is indifferently keeled or perfectly smooth", would further be disposed to accept Adams' name for the Antipodean shells, whilst we are not sure but that he would separate off the New Zealand from the Australian forms. All this Dr. Cooke now assures us in a recent letter is in effect the case.

Tate in 1896 (Rept. Horn Exped. Centr. Austral., ii, p. 212) proposed the name *Isidorella* for certain other Australian physoid forms allied to the *Physa newcombi*, Ad. & Ang., in which there is no columellar fold.

Our conclusions, therefore, are : that the only group to which the name *Bulinus* could have been correctly applied would have been to that which bears, and should retain, the name of *Physa*; that the Egyptian shells which play the part of host to *Bilharzia* should be known as *Isidora*; that their Australian kindred should retain the names *Ameria* and *Isidorella*, the New Zealand offshoot receiving a fresh name; whilst the fossil *Physa prinsepia*, Sowb., which Annandale has lately referred to *Bullinus* (Journ. and Proc. Asiatic Soc. Bengal, n.s., xvi, 1920, p. xxiv) is most likely a distinct type.¹

VIVIPARUS.

The occurrence in the Linnean Collection of the numbered specimens of his *Helix vivipara* and the receipt from Dr. Johansen of plesiotypes of Müller's *Helix fasciata* has put the identity and nomenclature of the two British species beyond question.

How it came about that for a time there was considerable confusion, and its probable explanation, is, however, of interest, and we think

¹ Dr. Annandale writes : "From a purely technical point of view I agree that *Isidora* is preferable to both *Bullinus* and *Bulinus*, but *Bullinus* has obtained currency in medical literature, and I regard it as a *nomen conservandum*." Thus does error seek ever to justify itself !

can be explained as follows. The trouble seems to have arisen with Draparnaud, the first after Müller, we believe, to distinguish the two species, for his "Histoire", being the first well-illustrated book, was both largely used and followed.

In his "Tableau" (1801, p. 40) Draparnaud clearly reversed the two species as we now understand them. Not only is this shown by his measurements, but by the statement under *Cyclostoma achatinum*, "La coquille est . . . plus allongée que la précédente [*C. viviparum*] ; et la suture de la spire est moins profonde".

When he wrote the "Histoire" (1805), however, he would seem from his text to have changed them over just as he did his *Helix lucida* and *H. nitida*, for, though the dimensions are omitted and the descriptions of the two species annoyingly vague, he does remark of *Cyclostoma viviparum* (p. 35) "Spire composée de six tours convexes et très-distincts", and of *C. achatinum* (p. 36) "Spire de 6 tours convexes ; suture très-marquée", which clearly points the latter being the *Helix fasciata* of Müller. His synonymy, too, bears this out. The figures, on the other hand, which are not cited in the text, are numbered in accordance with the description of the "Tableau".

Now seeing that there were errors of lettering on other of the plates, as admitted and blamed to the engraver in the explanation to plate x, and cited in the "errata" for plate v, whilst as pointed out first by Brard (1815) for plate vi (where 12 should be *neglecta* and 16 and 17 should be *ericetorum*, it does not seem too much to postulate that a similar error was committed in the explanation of plate i, and that the "viviparum" to fig. 16 should be exchanged with the "achatinum" to fig. 18. This correction effected Draparnaud's text and figures become harmonious.

Except Brard, who failed to differentiate between the two species and did not therefore deal with the question, Draparnaud's successors seem to have overlooked his descriptive text and fastened their attention on his figures.

Millet (1813) accepted Draparnaud's synonymy, but did not cite his figures, whilst evidently following them as named in the explanation and giving his own amplified and perfectly clear descriptions. At the same time, objecting to the trivial name *viviparum* as not indicating a peculiarity of the species, he proposed instead "*conectum*". In the second edition (Actes Soc. Linn. Bordeaux, vi, 1833, p. 134) he adopted *Paludina* as the generic name for the two species, and abandoning his name of *conecta* made it a synonym for "*P. vivipara*, Lam.". In the third edition (Ann. Soc. Linn. Maine & Loire, i, 1854, pp. 304–305 [separate pp. 56–57]) he changed the generic name to *Vivipara* and the specific names to "*vulgaris*, Lam." and "*fasciata*". Since Lamarck did not, so far as ascertained, ever use the name here attributed to him, whilst Dupuy, who follows next in Millet's synonymy, did, we are inclined to believe that the

insertion of the "Lam." was a "printer's error", a supposition which the setting under *fasciata* tends to confirm.

C. Pfeiffer (1821), Lamarck (1822), Turton (1831 and 1840), Brown (1837-44 and 1845), all followed Draparnaud's figures in their nomenclature, and the correct allocation of the species was not restored till Forbes & Hanley (1850) did so more by accident, as their synonymy shows, than by design. Their *vivipara* corresponded to Linné's, but, unaware of Millet's work, they proposed the trivial name of *listeri* for the other species. Moquin-Tandon followed on the lines of Forbes & Hanley, but employed Millet's name of *conctectum* in lieu of *listeri*, and this arrangement was conformed to by Jeffreys and Reeve, and continued by later writers down to quite recent times. Only Bourguignat in 1862 (Rev. & Mag. Zool., 1862, pp. 110-112) confused the species and synonymy.

Locard, in his "Ipsa Draparnaudi Conchylia" (1897) detected the discrepancy between Draparnaud's text and figure in the case of "*Cyclostoma achatinum*", but misled as to the "*Nerita vivipara*" of Müller and its identity with Linné's *Helix vivipara*, failed to realize the true solution, as we think, of the confusion.

THE ANATOMY OF TWO SPECIES OF *HELICARION* FROM
TROPICAL AFRICA.

By HUGH WATSON, M.A.

Read 14th May, 1920.

THROUGH the kindness of Dr. Péringuey and Mr. K. H. Barnard, of the South African Museum, Cape Town, of Sir Sidney Harmer, K.B.E., and Mr. G. C. Robson, of the British Museum, and of Major M. Connolly, I have lately been given the opportunity of investigating the anatomy of two African species of *Helicarion*, an opportunity of which I am very glad to avail myself, seeing that so little is known about the Zonitidæ of Tropical Africa.

My description of *H. gomesianus* (Morelet) is based upon the examination of a single specimen belonging to the South African Museum, and kindly sent to me for dissection by Major Connolly, who informs me that its shell bears a very close resemblance to three shells of *H. gomesianus* from Pungo Andonga, Angola, which the late King of Portugal presented to the British Museum. The specimen was found at Pemba, a village or mission station in Northern Rhodesia, in what was formerly known as the Mashukulumbe country, about 120 miles north-east of Livingstone and some 30 miles north-west of the River Zambesi.

The second species is one of which several examples were presented to the British Museum in 1910 by Mr. F. J. Jackson, C.B., having been collected in British East Africa, "probably at Nairobi." Major Connolly considers that this species is probably one which has not yet been named. There can be no doubt that it differs from all those of which any part of the anatomy has been described, and it cannot be certainly identified with any of the species at present only imperfectly known from descriptions and figures of their shells. I am therefore regarding it as new to science.

HELICARION GOMESIANUS (Morelet).¹

Pemba, Northern Rhodesia.

PLATE III.

SHELL depressed, paucispiral, imperforate, yellowish-green, and extremely thin, the basal region being practically membranous. Spire slightly raised, suture rather deep, whorls three, rapidly expanding, rounded at the periphery, and crossed by fairly well-marked lines of growth. Protoconch with microscopical spiral sculpture.² Aperture large, oval, 12 mm. in breadth; peristome thin and simple. Altitude 6 mm.; breadth 15 mm.

¹ *Vitrina gomesiana*, Morelet, *Voy. Welwitsch, Moll. terr. et fluv.*, 1868, p. 52, pl. i, fig. 2.

² The shell was not in sufficiently good condition to enable me to describe its microscopical sculpture in greater detail.

Foot long and narrow, the hinder part laterally compressed but not keeled, the top being excavated beneath the shell but raised posteriorly in front of the large caudal mucous pore, which has the form of a vertically elongated slit. Sole truncate in front and rounded behind, tripartite by a pair of longitudinal grooves, the central area being equal in width to each of the lateral areas, excepting towards the hinder end, where it becomes narrower owing to the convergence of the longitudinal grooves, which meet at the extremity. Foot-fringe and lateral areas of sole crossed by numerous transverse grooves. Peripodial grooves well marked, bending upwards in front of the caudal mucous pore; ciliated epithelium of foot-fringe extending on to the lower sides of the peripodial grooves. Rather irregular radial grooves occur on each side of the hinder part of the foot, where there is also a longitudinal brown band.

HEAD AND NECK with well-marked lateral grooves; dorsal grooves ill defined; vertical facial grooves absent, the front of the head being covered with small rugæ. Genital opening in the right lateral groove on the side of the head, about 2 mm. from the right upper tentacle.

PALLIAL LOBES, comprising a pair of rather narrow, finger-shaped shell-lobes, one on each side of the shell, and about 3 mm. long in a specimen preserved in alcohol; together with right and left, slightly granular, body-lobes—the right forming a wide triangular flap beneath the respiratory opening and the right shell-lobe, the left being very broad and extending uninterruptedly from the respiratory opening over the neck and along the left side of the animal to a point a little behind the origin of the left shell-lobe.

DORSAL SKIN lining the shell opaque white, except for some translucent vein-like markings above the albumen gland, and for the area over the lung, which is also translucent, like the skin of the concealed undersides of the whorls.

LUNG short and somewhat wedge-shaped, being broad at the mantle-edge, but rapidly narrowing as it extends backwards. Roof of lung richly vascular, doubtless in order to compensate for the reduction of its area due to the encroachment of other organs normally occupying the spire. Main pulmonary vein coming towards the pericardium from the neighbourhood of the respiratory opening, but having numerous branches, including a large vessel from the left of the lung which unites with it close to the heart. Numerous short veins cross the narrow area to the right of the kidney, and these are mostly bordered with white.

AORTA dividing into two vessels soon after leaving the ventricle. The posterior passes backwards and then divides into two arteries which supply blood to the liver, etc.; the anterior bends round the loop of the intestine, gives off an artery to the salivary glands,

and then runs forwards towards the head, passing between the visceral and pedal ganglia.

KIDNEY sigmoidal, somewhat cylindrical, being thick and rather narrow; nearly 8 mm. long, and extending about 2 mm. in front of the heart. Primary ureter curved round at the anterior end, rather broad, and having its lining thrown into numerous thick, irregular, transverse folds of a light colour, contrasting strongly with the brown folds contained in the kidney itself. Secondary ureter containing much thinner transverse folds.

PEDAL GLAND embedded in the muscles of the upper part of the foot in the floor of the body-cavity, and extending back for a short distance in the solid hinder portion of the foot. Duct broad and rather flattened except at the posterior end, showing as a darker streak along the centre of the bottom of the body-cavity, from which it is only separated by a thin layer of transverse muscles. Roof of duct without folds; its floor with a pair of

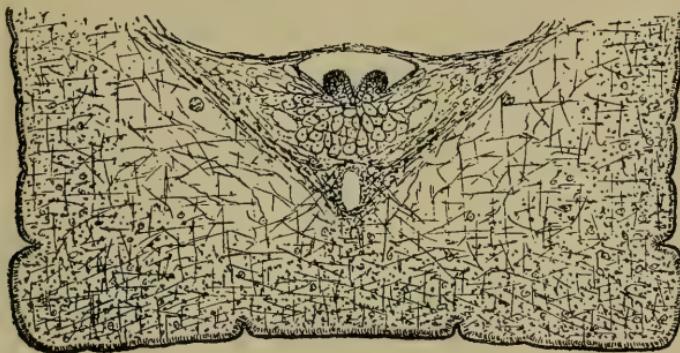


FIG. 1.—Transverse section through the foot of *Helicarion gomesianus* (Morelet); showing structure of pedal gland, etc., $\times 20$.

prominent rounded, longitudinal folds, separated by a median groove. These folds are covered with a ciliated epithelium of small, compact cells, but in the groove the cells become deeper and less compact, with unusually long cilia. Gland-cells situated below the duct and on each side of it.

NERVE-RING surrounding the oesophagus behind the buccal mass, and too small to allow the buccal mass to be retracted through it.

Cerebral ganglia situated as much at the sides of the oesophagus as above it, and having well-developed accessory lobes. The sensory nerves to the upper tentacles, and the two pairs of peritentacular nerves arise from the cerebral ganglia in front of the accessory lobes; from behind them there arise the nerves to the lower tentacles, the labial nerves, a pair of slender nerves to the two divisions of the buccal retractor, the penial nerve

from the right cerebral ganglion, and the three pairs of connectives. The cerebral commissure is broad, rather long, and arched, and a sub-cerebral commissure also appears to be present.

Buccal ganglia apparently double, each being divided by a transverse furrow into an outer and an inner lobe. Nerves to the oesophagus, salivary glands, etc., arising on each side from the anterior angle of the outer lobe near the end of the cerebro-buccal connective. Odontophoral nerves arising from the inner posterior side of the inner lobe of each ganglion. Buccal commissure rather short, uniting the inner lobes of the ganglia.

Cerebro-pedal and cerebral-pleural connectives shorter than usual. Pedal ganglia longer than broad, united by two short commissures, and closely contiguous excepting in front, where they diverge slightly. They are divided by slight transverse grooves into three or four apparent segments, of which the most anterior pair is the largest. Each ganglion gives off from its lower surface a longitudinal row of about six pedal nerves, the last pair being very large and passing straight backwards through the body-cavity to the hinder part of the foot. The nerves to the sides of the neck arise laterally near the short pleuro-pedal connectives. No otocysts were found.

Pleural and visceral centres very closely aggregated, but the five ganglia distinguishable from one another. Right parietal ganglion twice the size of the left; from each arises a pallial nerve. The two principal nerves arising from the abdominal ganglion were traced as far as the region of the anus, and the upper part of the common duct of the reproductive organs, respectively. Some of the cells of the visceral ganglia are very large, as is often the case, one at the posterior end of the abdominal ganglion being nearly 25 mm. long.

JAW broad, 2·3 mm. long (when flattened), thin, and smooth, excepting for the fine lines of growth and some traces of very delicate transverse striæ, but having a large, blunt, projecting angle in the centre.

RADULA measuring about $4\cdot1 \times 1\cdot9$ mm. when flattened out. Central and lateral teeth tricuspid, with rather long mesocones, and short, separate ectocones, the outer edges of which are sometimes slightly serrated. Endocones of lateral teeth rather narrow, and attached to the mesocones excepting just at the point. Marginal teeth five times as numerous as the laterals, aculeate, and mainly unicuspis. Mesocones of marginal teeth very long, except in the last eight or nine teeth, and only very slightly curved. In the first two or three marginals, and in several of the teeth towards the outer edge of the radula, the ectocone is represented by a small projection on the outer side of the mesocone near its base; but in most of the marginals the ectocone as well as the endocone is entirely absent. Bases of teeth

somewhat quadrate, with concave outer edges; narrower in the marginal than in the lateral teeth, but rather short in comparison with the length of the cusps. Rows of teeth nearly straight in the admedian area, there being only a very slight angle in the centre, but trending forwards on each side in the region of the marginal teeth. Radular formula : $(45 + 9 + 1 + 9 + 45) \times 98$.

ALIMENTARY CANAL.—Buccal mass large and muscular, the extremity of the radula-sac projecting slightly from its hind end. Oesophagus short, and having, in the specimen examined, a dorsal, backwardly directed pouch at the point where it bends down to pass under the cerebral commissure. Crop nearly twice as broad as the oesophagus, with a projection on the left side at its front end. It passes backwards, without any constriction, into the long and broad, thin-walled stomach. The hind end of the stomach bends down, and from it the intestine passes forwards almost to the heart and then runs back again, describing the usual S-shaped curve, finally passing forwards as the rectum to the anus.

SALIVARY GLANDS rather large, situated above and at the sides of the posterior half of the crop, separate from each other in front but joining above the crop further back. Salivary ducts rather long, issuing from the inner sides of the anterior ends of the glands.

LIVER consisting of a posterior division, which is smaller than usual and occupies the spire beyond the stomach, and an anterior division to the left of the stomach, which is partially divided into three lobes, one lying in each of the two loops of the intestine and one situated chiefly behind the posterior loop, but sending forward a narrow prolongation between the stomach and the rectum. Hepatic ducts opening into the hinder part of the stomach.

FREE RETRACTOR MUSCLES consisting of four main bands, separate practically from their origin on the columella : the buccal retractor, the right and left tentacular retractors, and a muscle that runs along the right side of the animal just within the body-wall, in which it is inserted near the head. Buccal retractor bifurcating some distance behind the buccal mass, the two divisions being inserted in the right and left sides of its hinder end, and being separately innervated from the corresponding cerebral ganglia. The right division is broader than the left, possibly because it lies in a more direct line between the buccal mass and the columella. Tentacular retractors each dividing further forward than the bifurcation of the buccal retractor into a large muscle inserted in the upper tentacle and a smaller one inserted in the lower tentacle on the same side. Retractor of the right upper tentacle passing between the penis and the vagina. Penial retractor very short, passing from the front of the diaphragm to the posterior end of the penis. No free pedal retractors occur in the body-cavity.

REPRODUCTIVE ORGANS.—Hermaphrodite gland consisting of a large number of very small follicles embedded in the posterior division of the liver. Hermaphrodite duct convoluted and somewhat swollen during the greater part of its course, bearing a sub-cylindrical vesicula seminalis at its anterior end. Albumen gland very large. Common duct contorted, and divided, as usual, into an opaque prostatic portion, and a more voluminous, translucent, female portion or uterus. Free oviduct long, the posterior part sacculated. Receptaculum seminis or spermatheca large, elongate, with very thin walls. Receptacular duct with thicker walls, unbranched, and short, being about half the length of the free oviduct. Vagina also short, and without any appendages.

Vas deferens somewhat broader than usual, with a sacculated or closely convoluted appearance as it passes forwards beside the free oviduct. As it bends round towards the penis it is narrower, but it then enlarges again rather abruptly to form a well-marked epiphallus, the walls of which are full of small, opaque white, calcareous glands. The upper end of the epiphallus winds half round the top of the penis before entering it. No flagella or other outgrowths of the male ducts are present.

The calcareous material within the epiphallus consists of innumerable microscopic granules, varying in length from .002 to .006 mm., and usually slightly less than half as broad as they are long. They are, as a rule, of a rather narrow oval form, but some are more irregular in shape, often having the appearance of being double; while here and there they are aggregated to form small concretions which may exceed .015 mm. in diameter.

Penis rather large, being about 5 mm. long and swollen towards the middle. The posterior end has the form of a knob separated from the remainder by a slight constriction, and into this knob the epiphallus enters and the short penial retractor is inserted. Longitudinal rows of minute papillæ line its walls internally, and it contains a small penis-papilla. The walls of the remainder of the penis have a quite different structure, possessing internal longitudinal folds, two of which are larger and more regular than the others.

Genital atrium very short, and bearing, in addition to the penis and vagina, an amatorial organ, about 3.5 mm. in length, and having an internal structure rather like that of a sponge.

No spermatophore was found.

Spermatozoa having both the head and the proximal part of the tail spirally twisted. Head rather narrow, sharply pointed in front, smooth, and larger than usual, being .009 mm. in length. Tail slender, more than .25 mm. long, its proximal part being furnished with a very narrow spiral flange.

HELICARION CRYPTOPHALLUS, n.sp.

Nairobi (?), British East Africa.

PLATE IV.

SHELL depressed-globose, paucispiral, narrowly rimate, yellowish-green, glossy, translucent, and extremely thin, the greater part of the shell being almost membranous and quite flexible when moist. Spire a little raised; apex rounded. Whorls $2\frac{3}{4}$, rapidly increasing, rounded at the periphery. Protoconch composed of $1\frac{1}{4}$ whorls, spirally punctate, that is to say, ornamented with spiral rows of minute circular depressions. Remaining whorls almost smooth, excepting for the ill-defined lines of growth, though showing traces of very minute spiral striæ when viewed through the microscope. Periostracum of last whorl not always reaching quite to the suture, but leaving next to it a very narrow lighter band. Suture shallow, not describing a regular spiral, owing to the fact that the top of the first half of the last whorl overlaps the spire to a slightly greater extent than does the top of the penultimate whorl, so that the protoconch has the appearance of being slightly tilted to the left. Aperture transversely oval, about 7.5 mm. broad. Peristome simple, very thin, slightly reflected over a narrow rima at its junction with the penultimate whorl. Columella describing a narrow hollow spiral. Altitude 6.3 mm., breadth 11.3 mm.

The shell of another specimen was slightly larger and its spire more raised, the measurements of this example being: altitude 8.5 mm., breadth 13.25 mm.

FOOT long and narrow, the hinder part somewhat compressed laterally, the top being flattened beneath the shell, but bluntly keeled for the last 3 mm., and ending in a short, obtusely pointed projection overhanging the large caudal mucous pore, the opening of which is diamond-shaped. Sole attaining a length of about 8 mm. and a maximum breadth of about 3 mm. in alcohol; tapering near the hind end, but rounded at the extremity; tripartite by a pair of longitudinal grooves, the central area being slightly narrower than the lateral areas, especially at the hind end, where the grooves converge. Foot-fringe and lateral areas of sole crossed by numerous transverse grooves. Peripodial grooves well marked, curving upwards at the hind end in front of the caudal mucous pore. A median longitudinal groove is present beneath the shell, but does not extend to the hind end; it gives rise to oblique radial grooves sloping down towards the foot-fringe.

Sides of foot sparsely mottled with dark patches and spots, especially towards its hind end. Most of these dark patches occur along the course of the peripodial grooves, and in a pair of ill-defined dark bands that are present towards the hind end of the foot, one on each side of the median dorsal zone, which is

unpigmented. Lateral areas of sole sometimes faintly mottled, but not the central area.

HEAD AND NECK having a darkly pigmented band on each side. A pair of dorsal grooves is present on the neck, but no vertical facial grooves occur on the front of the head, which is covered with very small rugæ. A well-marked oblique lateral groove occurs on each side, the genital opening being on the right lateral groove on the side of the head, about 1·75 mm. from the right upper tentacle. Labial palps rather large.

PALLIAL LOBES well developed, slightly granular, and spotted with small patches of dark pigment. Shell-lobes wide and rounded, but rather widely separated from each other, the right being about 4 mm. long and almost the same breadth (in alcohol, but probably larger in life), and the left being somewhat smaller. Body-lobes broad, the left extending uninterruptedly from the respiratory opening to a little behind the base of the left shell-lobe, and attaining a remarkable breadth over the animal's neck, which it covers more or less completely.

DORSAL SKIN lining the shell translucent and colourless over the lung, kidney, and pericardium, excepting for a trace of brown pigment over the front end of the kidney, but mainly opaque white over the upper part and left side of the liver and adjacent organs, though showing some irregular translucent patches, through which the dark liver is visible.

LUNG short, broad near the mantle-edge, but becoming narrower behind, the upper edge receding from the suture. Roof of lung richly vascular, a little more so even than in *H. gomesianus*. Main pulmonary vein receiving numerous branches just in front of the kidney, and a large branch from the left side of the lung as it enters the pericardium. The largest of the afferent veins is situated in front of this branch. A much smaller branched vein, from the lower surface of the kidney, also unites with the main pulmonary vein close to the heart. Numerous short veins cross the narrow area to the right of the kidney, and can be clearly seen from the outside through the roof of the lung.

HEART large, the auricle being larger than the ventricle.

AORTA dividing into two vessels just after leaving the pericardium. The posterior passes backwards and supplies blood to the liver, etc. ; the anterior, which is the larger, bends round the intestine and a small part of the anterior division of the liver, and passes forwards to the ventral ganglia, giving off on the way a branch on the left to the salivary glands, and one on the right to the body-wall immediately below the anus.

KIDNEY sigmoidal, thick and rather narrow, though broadening somewhat at the posterior end; about 6 mm. long, and extending about 2 mm. in front of the heart; containing very numerous folds of a brown colour. Primary ureter very broad

towards its anterior end, which is not so much curved as in *H. gomesianus*; lined by an irregular network of folds. Secondary ureter extending to the neighbourhood of the anus, and containing numerous transverse folds.

PEDAL GLAND embedded in the muscles of the upper part of the foot, and only separated from the body-cavity by a thin layer of transverse muscles, through which the gland shows as a pair of longitudinal light-coloured bands divided by a darker median line, the light bands being formed by the glandular tissue, and the dark line by the duct which runs along the centre of the top of the gland. Transverse sections show a similar structure to that found in *H. gomesianus*, excepting that the median groove in the floor of the duct seems to be deeper and the folds on each side of it somewhat higher.

NERVE-RING surrounding the oesophagus, too small to allow the buccal mass to be retracted through it, and closely resembling that of *H. gomesianus*.

Cerebral ganglia having well-developed accessory lobes, and giving rise to the paired olfactory, optic, and peritentacular nerves in front, to the single penial nerve, and the paired labial and lower tentacular nerves more laterally, and to a pair of slender nerves innervating the buccal retractor, which arise close to the origin of the cerebro-pleural connectives. Both pairs of labial nerves are slightly larger than usual, being quite as thick as the penial nerve, and not much thinner than the olfactory nerves and those to the lower tentacles. The cerebral ganglia are situated somewhat laterally as in *H. gomesianus*, and are united dorsally by an arched cerebral commissure, and ventrally by a more slender sub-cerebral commissure, which passes down each side near the cerebro-pedal connective, and crosses over the dorsal surface of the pedal ganglia.

Buccal ganglia bilobed, though not quite so conspicuously as in *H. gomesianus*. Five or six pairs of nerves to the oesophagus, salivary glands, etc., arise from each buccal ganglion near the end of the cerebro-buccal connective, one being united with the connective for a short distance. Odontophoral nerves consisting of one pair of rather thick nerves, and another thinner pair, which arise from the inner sides of the buccal ganglia at the origin of the buccal commissure, and a third pair of still more slender nerves arising from the commissure itself, which is of moderate length.

Cerebro-pedal and cerebro-pleural connectives shorter than usual. Pedal ganglia rather more rounded than in *H. gomesianus*, but showing the same slight traces of segmentation on the lower surface, and giving rise to the pedal and cervical nerves in a similar manner. Pleural, parietal, and abdominal ganglia closely aggregated, but not united, giving off the same nerves as in the

last species. Genital nerve having a branch to the posterior end of the diaphragm.

JAW broad, 1·9 mm. long (when flattened), thin, nearly smooth, but crossed by very fine transverse striae in addition to the equally fine lines of growth. Median projection broad and very low.

RADULA measuring about $4\cdot7 \times 2\cdot2$ mm. when flattened out. Central and lateral teeth tricuspid, with shorter mesocones than in the *H. gomesianus*. Their ectocones are short and quite separate from the mesocones; the endocones are narrow and poorly developed, being united with the mesocones along the whole length of their inner sides. Marginal teeth very numerous and very close to one another, gradually decreasing in size from the transitional teeth to the edges of the radula. Endocones absent on the marginal teeth; ectocones almost as long as the mesocones, with which they are united for the greater part of their length. The bifid cusps thus formed are strongly curved, and have their outer edges serrated, this serration becoming more and more pronounced towards the outer limits of the radula, so that, while the inner marginal teeth might be described as bicuspid, the outer marginals would be better described as multicuspid. Bases of marginal teeth narrow, about two-thirds of the length of the cusps; bases of the other teeth broader, with concave outer edges. Rows of teeth obtusely angled in the centre, whence they trend slightly forwards on each side. The total number of teeth is more than twice as great as in *H. gomesianus*, the radular formula being: $(86 + 14 + 1 + 14 + 86) \times 128$. In order to compensate for the small size of the outer marginals, a few short additional rows of these teeth are intercalated at the edge of the radula.

ALIMENTARY CANAL.—Buccal mass large, the extremity of the radula-sac projecting from its hind end. Oesophagus rather short, thin-walled, with internal longitudinal folds; sometimes swollen into a dorsal, backwardly directed pouch at the point where it bends down to pass under the cerebral commissure. Crop large, about 2 mm. in diameter, its front end projecting forwards on the left side. The anterior part of the crop has rather thick walls with internal transverse folds; the hinder part passes imperceptibly into the large, elongated, thin-walled stomach. This in turn gives rise to the thin-walled intestine, which describes the usual S-shaped curve, before passing forwards as the rectum, in the same manner as in the last species.

SALIVARY GLANDS broad, about 4 mm. long, and united with each other above the crop; a large portion of which they cover, although they do not usually reach quite to its front end. Salivary ducts of the usual form.

LIVER consisting of a posterior division behind the stomach, and a rather extensive anterior division, in which the loops of

the intestine are embedded, and which is partially divided by them into three main lobes, the most posterior of these lobes sending forward an unusually large prolongation between the stomach and the rectum. Hepatic ducts opening into the hinder part of the stomach, the anterior duct being rather large.

FREE RETRACTOR MUSCLES.—Buccal retractor united with the left tentacular retractor for a short distance posteriorly, bifurcating in front, the two branches being shorter than in *H. gomesianus* but similarly innervated. Tentacular retractors separate from their origin, dividing fairly far forward into the muscles of the upper and lower tentacles, but giving off no branches to the foot. Retractor of right upper tentacle passing between the penis and the vagina. The so-called tail-retractor is short and not separated from the body-wall, but it gives off a muscle which passes forwards along the right side of the body-cavity and is inserted in the skin near the head. Penial retractor short, passing from the diaphragm to the epiphallus.

REPRODUCTIVE ORGANS.—Hermaphrodite gland large, consisting of numerous very small follicles embedded in the posterior division of the liver, as in *H. gomesianus*. Hermaphrodite duct slightly swollen and very much convoluted throughout the central part of its course, bearing a rather small, subcylindrical vesicula seminalis at its anterior end. Albumen gland not very large in the specimens examined. Common duct somewhat contorted, especially towards its hinder end; prostate gland well developed, extending far forwards. Free oviduct short and rather narrow. Receptaculum seminis or spermatheca moderately large, spherical, and thin-walled; situated beside the middle of the common duct. Receptacular duct unbranched, long and broad, with unusually thick muscular walls, longitudinally folded within. Vagina very short, without appendages.

Vas deferens slender excepting towards its posterior end, where it is somewhat broadened, slightly convoluted near its junction with the epiphallus beside the anterior end of the penis. Both vas deferens and epiphallus longitudinally folded within, but not so strongly as the receptacular duct. Epiphallus long, divisible into two portions—a rather thin-walled portion, running backwards beside the penis-sheath to just beyond its posterior end, and a slightly broader, more muscular portion, which first runs forwards for a very short distance, and then doubles back, finally passing forward again into the penis-sheath, which conceals the rest of its course. Penial retractor muscle inserted in the more muscular division of the epiphallus just before it enters the penis-sheath. Two flagella are borne by the epiphallus, one where its two portions pass into each other not far from the posterior end of the penis-sheath; the other where the vas deferens passes into the epiphallus, near the anterior end of the penis-sheath. The latter

appendage, which might perhaps be regarded as the true flagellum, is rather long, but much convoluted, and slightly swollen towards its distal extremity; its walls are rather thick and have a gelatinous appearance; its lumen seems to be extremely narrow. The other flagellum, which might possibly be better termed the cæcum,¹ is also somewhat swollen at the end, but its walls are very thin, and have internal longitudinal folds, its lumen is relatively large, and it is not convoluted but curved round usually in a more or less spiral manner.

The thinner-walled portion of the epiphallus, lying between the two flagella, contains a certain amount of chalky material. This consists of minute calcareous granules, varying in length from .0025 to .006 mm., and about one-third as broad as they are long. They are of a narrow, oval form, being narrower and more regular in shape than are the calcareous granules in the epiphallus of *H. gomesianus*, and in the present species they do not show as great a tendency to become aggregated into concretions.

Penis-sheath forming a structure about 5 mm. long, simulating a large swollen penis. When cut open, however, it is seen to have a long muscular tube folded inside it, the tube when straightened out being more than twice the length of the sheath. At about the middle of its length this tube shows a very slight swelling, which marks the beginning of the true penis; posterior to this point the tube consists of a continuation of the epiphallus. When the penis itself is opened it is seen that the slight swelling is caused by the presence of a short penis-papilla, which projects into the anterior end of the cavity of the penis. The walls of the penis are furnished internally with characteristic diagonal folds, which in places show a slight tendency to be broken up into a little papillæ.

Genital atrium comparatively small. Amatorial organ absent.

Spermatophore consisting of a smooth-walled cylinder, about 6 mm. long and .4 mm. in diameter, curved in accordance with the loops of the more muscular division of the epiphallus in which it was found, and having each end drawn out into a narrow filament which was bent back upon the cylindrical portion. Of these two filaments the one arising from the anterior end seemed to be much the longer, exceeding the rest of the spermatophore in length, but consisting simply of a very slender tube, quite smooth excepting for a couple of slight longitudinal ridges running along it, one on each side.

¹ This appendage corresponds to that which Pilsbry terms the "lime gland"; but in the forms with which I am acquainted it seems to be neither glandular nor calcareous, the chalky granules in the epiphallus occurring chiefly towards the base of the other flagellum. I therefore prefer Godwin-Austen's terminology.

Spermatozoa having spirally twisted heads, about .006 mm. long by less than .002 mm. broad, apparently slightly flattened laterally, and tapering to a sharp point in front. Tail very long and slender, sometimes attaining a length of no less than .3 mm., or fifty times the length of the head. Proximal portion of tail (or "middle-piece") and head both having the appearance of being furnished with very fine spiral striæ. A more conspicuous spiral flange also surrounds the proximal portion of the tail; it is rather broad close to the head, but gradually becomes narrower posteriorly, until it disappears.

AFFINITIES.

Among the many members of the Zonitidæ that are found in Africa a large number have been named which bear a close general resemblance to the two species just described. But while these forms all have thin paucispiral shells, well-developed pallial lobes, and a long narrow foot ending in a very conspicuous mucous pore, they seem to show much diversity in their more essential characters.

The species found in Natal and the Cape of Good Hope¹ resemble *H. cryptophallus* in having an epiphallus bearing two flagella, and also in their type of radula; but they appear to differ from that species, as well as from *H. gomesianus*, in that the cerebral commissure is usually much shorter, the lung is far longer and less richly vascular, the left body-lobe is divided into two portions, and the caudal mucous pore is overhung by a pointed process often of considerable length; moreover, the detailed structure of the epiphallus, etc., seems to be very different. There can be little doubt, therefore, that these South African species are rightly placed in a separate genus from the tropical forms, although it is difficult to understand why they should have been placed by some authorities in as many as four or five different genera, in view of the general similarity of the internal organs of those that have been dissected.

The species occurring in tropical Africa seem to show a much greater diversity, although very little has hitherto been published about their anatomy. The two forms described in this paper resemble each other closely in their respiratory and nervous systems, but they differ widely in their radulæ and in almost every feature of their genital organs; while they also show less important differences in the jaw, the retractor muscles, the primary ureter, the spermatozoa, the form of the shell-lobes, the coloration of the animal, etc. It can therefore scarcely be doubted

¹ See Pilsbry, Proc. Acad. Nat. Sci. Philad., 1889, p. 279, pl. ix; and Godwin-Austen, Ann. & Mag. Nat. Hist., ser. viii, vol. i, 1908, pp. 131-133, pl. viii; vol. ix, 1912, pp. 122-139, 569-585, pls. i-vii, xii-xvii; vol. xiii, 1914, pp. 449-472, pls. xix, xx.

that they belong to separate sub-genera, and not improbably to distinct genera.

When, however, we try to decide which of the many other species from Tropical Africa should be most closely associated with either of these forms, great difficulties arise, chiefly owing to our lamentable ignorance of their anatomy. Pollonera¹ and Pilsbry² have figured the reproductive organs of *H. aloysii-sabaudiae*, and they closely resemble those of *H. gomesianus*; but an examination of a slightly immature specimen of that species in the British Museum shows that this resemblance does not extend to the other organs; for in *H. aloysii-sabaudiae* the cerebral and buccal commissures are extremely short—very different from those shown in Pl. III, fig. 4—the lung is longer, and the marginal teeth of the radula are of a quite different type, having short curved bifid cusps, rather like those of *H. cryptophallus* although

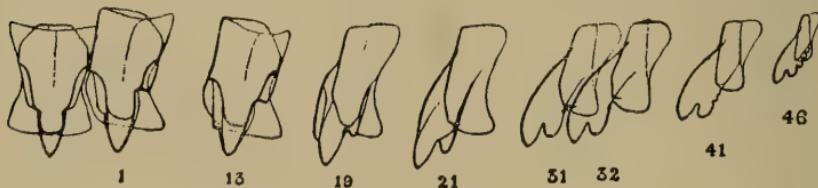


FIG. 2.—Representative teeth from the radula of *Helicarion aloysii-sabaudiae*, Poll., Bumaks Island, Victoria Nyanza. $\times 200$.

the teeth are not so narrow and crowded, the formula being $(31 + 19 + 1 + 19 + 31) \times 110$. *H. aloysii-sabaudiae* therefore appears to belong to a separate group of these snails. According to Thiele,³ *H. plicatulus*, Mts., *H. sowerbyanus* (Pfr.), and possibly *H. masukuensis*, Smith, also have genital organs like those of *H. gomesianus*, while the same seems to be true of *H. medjensis* (Pilsbry),⁴ but without further knowledge of their anatomy it is impossible to say whether these forms are more nearly related to *H. gomesianus* or to *H. aloysii-sabaudiae*. Externally, *H. plicatulus* seems to differ from both these species in having a dark band on each side of the animal's neck⁵ and a protoconch without any trace of spiral sculpture,⁶ while *H. medjensis* and *H. masukuensis* are also stated to have smooth embryonic whorls. In *H. welwitschii* (Morelet) the radula approaches that of *H. gomesianus* more nearly

¹ *Spedizione al Ruwenzori di Princ. Luigi Amadeo di Sovoia*, vol. i, 1909, pl. iii, fig. 15.

² *Bull. Amer. Mus. Nat. Hist.*, vol. xl, 1919, p. 277, fig. 140.

³ *Deutsch. Zentral-Afrika-Exped.* (1907–08), vol. iii, 1912, pp. 189–199, pl. vi.

⁴ *Bull. Amer. Mus. Nat. Hist.*, vol. xl, 1919, pp. 277–278, fig. 142.

⁵ Von Martens, *Monatsbr. Akad. Wissensch. Berlin*, vol. xxvii, 1876, pl. i, fig. 5.

⁶ D'Ailly, *Bihang K.Sv. Vet.-Akad. Handl.*, vol. xxii, pt. 4, 1896, p. 30.

than does that of *H. aloysii-sabaudiae* (judging from Thiele's figure), and this is also true of *H. nyasanus*, Smith; but in both these species the reproductive system lacks an amatorial organ as well as the flagella.

Several of the other species described by Thiele and Pilsbry, such as *H. bequaerti*, Pilsbry, *H. entagaricus*, Pilsbry, *H. insularis*, Thiele, *H. kivuensis*, Thiele, *H. niger*, Pilsbry, *H. ruwenzoriensis*, Pilsbry, *H. schubotzi*, Thiele, *H. subsucculentus*, Pilsbry, and *H. succulentus*, Mts., resemble *H. cryptophallus* in having an epiphallus bearing two flagella; but all these species, except *H. schubotzi* and *H. subsucculentus*, differ from *H. cryptophallus* in possessing a dart-sac; and in *H. schubotzi* neither the male organs nor the shell-lobes seem to resemble those of *H. cryptophallus* at all closely, while *H. subsucculentus* cannot be very nearly related to that species since it has a smooth protoconch. The descriptions of Thiele and Pilsbry, however, are insufficient to enable one to judge of the precise affinities of these species.

In the various forms mentioned above the shell has reached about the same stage of degeneration as in the two species described in this paper. But there are several other forms occurring in Tropical Africa in which the shell has become slightly more degenerate, and the shell-lobes are a little broader and united with each other over the front edge of the shell. Of these, *H. semimembranaceus*, Mts.—of which the reproductive organs and radula have been figured by Thiele¹—seems to have an epiphallus with two flagella, like *H. cryptophallus*; but it also possesses a large dart-sac, and its radula is of a highly specialized type, with an enormous number of narrow teeth, a specimen in the British Museum which probably belongs to this species having nearly 100,000 teeth, there being about 250 marginals on each side in a transverse row. It is not surprising, therefore, that Pfeffer placed this species in a distinct subgenus, *Zonitarion*.² The form from Abyssinia, for which Godwin-Austen established the subgenus *Africarion*, is evidently far removed from both *H. gomesianus* and *H. cryptophallus*, as well as from *H. semimembranaceus*, for it is portrayed as lacking not only a dart-sac and both flagella but also a distinct epiphallus.³ Nothing is known of the internal anatomy of *H. auriformis*, Thiele, *H. haliotides*, Putzeys, *H. maculifer* (Pilsbry), and *H. putzeysi* (Pilsbry), excepting some of the characters of their reproductive organs.⁴ These species bear

¹ *Deutsch. Zentral-Afrika-Exped.* (1907–08), vol. iii, 1912, p. 190, fig. xi; pl. vi, fig. 59. (Pilsbry is mistaken in saying that the genital organs of this form have not been figured.)

² *Jahrb. Deutsch. Malak. Gesell.*, vol. v, 1878, pp. 275–6; *Abhandl. Gebiete Naturwiss. Hamburg*, vol. viii, pt. 2, 1883, pp. 4, 8, 9, 11.

³ Godwin-Austen, *Mollusca of India*, vol. i, 1883, pp. 154–6, pl. xlvi.

⁴ Thiele, *Deutsch. Zentral-Afrika-Exped.* (1907–08), vol. iii, 1912, p. 198; Pilsbry, *Bull. Amer. Mus. Nat. Hist.*, vol. xl, 1919, pp. 259–64, figs. 122, 124, 127.

a certain resemblance to *H. cryptophallus* in possessing flagella on the epiphallus, and *H. maculifer* further resembles that species by having a sheath surrounding the penis and part of the epiphallus but excluding both flagella. Pilsbry states, however, that this species has no penis-papilla, a very important distinction.

The table on p. 107 shows as much as is known about the distribution of some of the more important differential characters among those species that have been dissected.

It is clear, then, that there is much diversity in the anatomy of the species found in Tropical Africa, but until a larger number have been adequately described it would be futile to suggest which of the numerous named forms are the most closely related either to *H. gomesianus* or to *H. cryptophallus*. Indeed, in our present state of ignorance it is almost impossible to say how the African *Helicarioninæ* should be classified, or into how many distinct genera or subgenera they will probably have to be placed. Nevertheless, Pilsbry has recently put forward a tentative classification of the forms with which he is acquainted, "as a basis for further work and criticism."¹ He suggests grouping the species as follows:—

Genus AFRICARION, Godwin-Austen.
pallens (Morelet).

Genus ZONITARION, Pfeffer.
semimembranaceus (v. Marts.) (type).

Genus MESAFRICARION, Pilsbry.
Subgenus MESAFRICARION (s.s.).

maculifer, Pilsbry (type), *haliotides* (Putzeys), *auriformis* (Thiele).

Subgenus BELONARION, Pilsbry.
putzeysi, Pilsbry (type).

Genus HELIXARION, Fér.

Subgenus GRANULARION, Germain.
duporti, Germain (type), *insularis* (Thiele), *subsucculentus*, Pilsbry.
stuhlmanni (v. Marts.), *issangoensis* (Thiele), *volkensi* (Thiele).

Subgenus ENTAGARICUS, Pilsbry.
entagaricus, Pilsbry (type).

Subgenus ANGUSTIVESTIS, Pilsbry.
niger, Pilsbry (type), *bequaerti*, Pilsbry, *ruwenzoriensis*, Pilsbry.
succulentus (v. Marts.), *kivuensis* (Thiele), *schubotzi* (Thiele).

Genus GYMNARION, Pilsbry.
alloysii-sabaudiæ (Poll.) (type), (?) *sowerbyanus* (Pfeiffer), *medjensis*
Pilsbry.

¹ Bull. Amer. Mus. Nat. Hist., vol. xl, 1919, pp. 258-278.

<p><i>Explanation.</i></p> <p>+= character well developed. ÷= character only slightly developed. —= character absent.</p>	“ <i>aliosii-sabaudiae</i> , Poll.	.....
	<i>aniformis</i> , Thiele	.....
	<i>bequaerti</i> , Pilsbry	.....
	<i>cryptophallus</i> , n.sp.	.....
	<i>entagarius</i> , Pilsbry	.....
	<i>gomesianus</i> (Morelet)	.....
	<i>haliotoides</i> , Putzeys	.....
	<i>insularis</i> , Thiele	.....
	<i>klunensis</i> , Thiele	.....
	<i>maculifer</i> (Pilsbry)	.....
+	<i>masuleensis</i> , Smith	.....
÷	<i>medjensis</i> (Pilsbry)	.....
—	<i>niger</i> , Pilsbry	.....
+	<i>nguanus</i> , Smith	.....
—	<i>pallens</i> , Morelet (?)	.....
+	<i>placatulus</i> , v. Marts.	.....
—	<i>putzeysi</i> (Pilsbry)	.....
+	<i>ravvenzoriensis</i> , Pilsbry	.....
—	<i>schubotzi</i> , Thiele	.....
+	<i>semimembranaceus</i> , v. Marts.	.....
—	<i>southernianus</i> (Pfeiffer)	.....
+	<i>subulmanni</i> , v. Marts.	.....
+	<i>subsucculentus</i> , Pilsbry	.....
—	<i>succulentus</i> , v. Marts.	.....
+	<i>welwitschii</i> (Morelet)	.....

This classification does not appear to be wholly satisfactory. It is based chiefly on the relative development of the pallial lobes, a comparatively trivial character, which Pilsbry himself admits "is probably of secondary importance", for nothing is more likely than that these lobes may have undergone parallel enlargement in different genera of the Zonitidæ. Moreover, the various characters which Pilsbry attributes to his genera and subgenera are often not possessed by all the species which he places in those groups. Thus, he describes his subgenus *Angustivestis* as possessing an oval dart-gland and a shell without a spiral series of punctures on the first whorl, and he also states (in his key) that it has a foot excavated and laterally keeled under the shell. Yet he includes in this subgenus *H. schubotzi*, which, according to Thiele,¹ has no dart-sac and a punctate protoconch, and *H. kivuensis*, in which the anterior half of the top of the foot is stated to be only somewhat flattened. Similarly, Pilsbry characterizes his genus *Mesafricarion* as having a penial sheath, "to which the penial retractor muscle is attached," and as lacking a dart-sac or amatorial organ; and yet his figures of the type species, *H. maculifer*, clearly show that in it the penial retractor is attached to the epiphallus above the penial sheath, as in *H. cryptophallus*, while in *H. putzeysi* the genital atrium bears a large excitatory organ, which may well be homologous with the dart-sac of *H. bequaerti*, *H. semimembranaceus*, etc., notwithstanding that it has become enclosed in a common sheath with the anterior part of the male duct. In the subgenus *Granularion* Pilsbry places certain forms, some of which have never been described anatomically, but which are said to agree in having the mantle-lobes "wholly separated, or only quite weakly united by a narrow rim in front". An examination, however, of Germain's figure of *H. duporti*,² the type of *Granularion*, and of d'Ailly's excellent drawings of *H. pertenuis* and the other species which Germain included in his subgenus,³ shows that in these forms the pallial lobes are united over the anterior edge of the shell, as in Pilsbry's photographs of *H. maculifer*.⁴ Therefore, although it is, of course, quite possible that *H. duporti* may differ greatly from *H. maculifer* internally, until this has been shown to be the case it would seem best to regard *Mesafricarion* as a synonym of *Granularion*, for *H. maculifer* also agrees with *H. duporti* in having a granulose mantle and a spirally sculptured protoconch. This, however, does not necessarily imply that a new name must be found for the

¹ Deutsch. Zentral-Afrika-Exped. (1907-08), vol. iii, 1912, p. 194.

² Bull. Mus. Paris, 1912, p. 257, fig. 58.

³ Bihang K. Svensk. Vet.-Akad. Handl., vol. xxii, pt. 4, 1896, pls. i, ii.

⁴ Bull. Amer. Mus. Nat. Hist., vol. xl, 1919, pl. xxii, figs. 1, 1a, 2.

H. issangoensis, another species included by Pilsbry in this subgenus, also has fairly broadly connected pallial lobes, according to Thiele.

group of species with separated shell-lobes, to which Pilsbry has applied the name *Granularion*, since it has yet to be proved that these forms differ from the others in any really important characters, notwithstanding that Pilsbry has placed them in a distinct genus. Unfortunately, *H. duporti* has never been dissected, and we also know nothing whatever at present about the radula, the nervous system, the cephalic retractors, the pedal gland, the respiratory system, or the excretory organs of any of the species which Pilsbry placed in either *Mesafricanion* or *Granularion*. The forms which he assigns to the genus *Gymnarion* are probably more nearly related to one another than to any of the preceding species; yet the only anatomical feature in which the members of this group seem to differ constantly from the other forms is in the character of the male ducts, and they show much diversity among themselves in other respects.

On theoretical grounds it is not improbable that the resemblance of these African snails to the typical species of *Helicarion* from the Australian region is largely due to convergence, brought about by the analogous degeneration of the shell and development of the pallial lobes in both regions. But at present there appears to be no justification for assuming that this is actually the case. *Helicarion cuvieri*, Fé., the type of the genus, seems to be very similar to some of the African forms, not only in its external features, but also in its radula and in its reproductive organs, which bear a single flagellum,¹ as in *H. auriformis*, Thiele. But whether *H. cuvieri* also agrees with the African species in its other organs awaits further investigation. It would be very interesting to know, for example, whether in the Australian forms the buccal ganglia are bilobed, in the same way as they are, to a greater or less extent, in all the African Zonitidæ that I have examined.² For the present, therefore, it would seem best to continue placing all the species from Tropical Africa with a paucispiral shell and a large mucous pore in the genus *Helicarion*.

If, however, it is thought advisable, even in our present state of ignorance, to classify in some way the species from Tropical Africa as a basis for further work and criticism, I venture to think that the following tentative classification of the better known species may possibly prove more acceptable than that proposed by Pilsbry. In each group an attempt is made to arrange the species as far as possible in order, beginning with those that are probably the most primitive.

¹ Semper, *Reis. im Arch. Philipp.*, Thl. II, vol. iii, 1870, p. 31, pl. iii, fig. 7; pl. vi, fig. 11; Thiele, *Deutsch. Zentral-Afrika-Exped.* (1907-08), vol. iii, 1912, p. 190, pl. vi, fig. 57.

² The buccal ganglia do not appear to be bilobed in *H. kuckenthali*, Kob., from the Island of Halmahera (Wiegmann, *Abhandl. Senckenb. naturf. Gesell.*, vol. xxiv, 1898, pl. xxii, fig. 21).

Genus *HELICARION*, Fér.¹
 Subgenus *ZONITARION*, Pfeffer.

Protoconch smooth, without spiral sculpture; remaining whorls usually with microscopical spiral striæ, excepting in some of the species with large shell-lobes. Left shell-lobe narrow or triangular, becoming flattened out into a low straight fold in those forms in which the shell-lobes are united. Right shell-lobe variable in size, often with a median ridge when large. Median projection of jaw low or obsolete. Central and lateral teeth rather narrow, with anteriorly prolonged bases; marginals extremely numerous (in *H. semimembranaceus*, at least). Epiphallus bearing two flagella, the distal one sometimes of a considerable size. Spermatheca usually somewhat elongated. Genital atrium bearing a muscular dart-sac.

Known distribution: Equatorial Africa, from the borders of Uganda to the west coast.

Section *ANGUSTIVESTIS*, Pilsbry.

Last whorl of shell spirally sulcate. Shell-lobes narrow and separate.

- ruwenzoriensis*, Pilsbry.
- kivuensis*, Thiele.
- niger*, Pilsbry (type of section).
- bequaerti*, Pilsbry.

Section *ENTAGARICUS*, Pilsbry.

Shell-lobes separate, the right broadly rounded, the left triangular. Dart-sac mushroom-shaped.

- entagaricus*, Pilsbry.

Section *BELONARION*, Pilsbry.

Shell-lobes con crescent, the right broad, the left triangular. An excitatory organ (= dart-sac ?) is included in the penial sheath, which reaches the retractor muscle.

- putzeysi* (Pilsbry).

Section *ZONITARION*, s.s.

Shell-lobes con crescent, the right broadly rounded with a median ridge, the left reduced to a low straight fold. A penial sheath apparently extends to the retractor muscle.

- haliotides*, Putzeys.
- semimembranaceus*, v. Marts. (type).

¹ On pp. 19 and 20 (or 23 and 24) of Féruccac's *Tabl. Syst. Anim. Moll., Fam. des Limaçons*, 1821, this word is misspelt *Helixarion*; but on p. 67 (or 71) of the same work Féruccac himself corrected this blunder, and it would seem to be a pity to ignore his correction, as Pilsbry has done.

Subgenus GRANULARION, Germain.

Protoconch spirally punctate (excepting in *H. subsucculentus*), often having the appearance of being slightly tilted to one side; remaining whorls glossy, with little or no microscopical spiral sculpture. Shell-lobes usually rather more granular than in the last subgenus, the left broad and nearly always rounded, the right more variable, but never ridged, often more or less concrecent with the left. Medium projection of jaw present, but usually rather low. Central and lateral teeth normal, marginals numerous. Epiphallus bearing two rather small flagella, rarely reduced to one. Penial sheath when present not extending to the retractor muscle. Spermatheca usually spherical. Genital atrium not bearing a dart-sac, which is either absent or takes the form of a hemispherical protuberance at the junction of the vagina and oviduct.

Known distribution : Equatorial Africa, from British East Africa to the west coast, and extending northwards into the Sudan.

- succulentus*, v. Marts.
- stuhlmanni*, v. Marts.¹
- insularis*, Thiele.
- schubotzi*, Thiele.
- subsucculentus*, Pilsbry.
- cryptophallus*, n.sp.
- columellaris*, d'Ailly.
- duporti*, Germain (type).
- pertenuis*, d'Ailly.
- issangoensis*, Thiele.
- maculifer* (Pilsbry).
- auriformis*, Thiele.

Subgenus AFRICARION, Godwin-Austen.

Shell-lobes rounded, concrecent, with a dark band on the left side. Median projection of jaw rather small, but prominent. Central and lateral teeth normal, marginals not very numerous. Spermatheca spherical. No flagella, epiphallus, or dart-sac.

Known distribution : Abyssinia.

- pallens*, Morelet (?).²

¹ The species referred to in this paper as *H. stuhlmanni*, v. Marts., is that described as such by Thiele (*Deutsch. Zentral-Afrika-Exped.* (1907-08), vol. iii, 1912, pp. 194-195, pl. vi, fig. 64). But Thiele states that his examples have neither the microscopical spiral striae seen in the type-specimen, nor the coarse furrows that von Martens describes as characteristic of his species. Moreover, von Martens states that the animal is dark grey (in alcohol), and that its right shell-lobe is triangular (*Deutsch-Ost-Afrika*, vol. iv, 1897, p. 37), while Thiele describes the animal as of a light colour, with rounded pallial lobes. It therefore seems possible that the form described by Thiele is not identical with von Martens' species.

² The Abyssinian form described by Godwin-Austen (*Moll. of India*, vol. i, 1883, pp. 154-6, pl. xlvi) is at present the only species known to belong to the

Subgenus GYMNARION, Pilsbry.

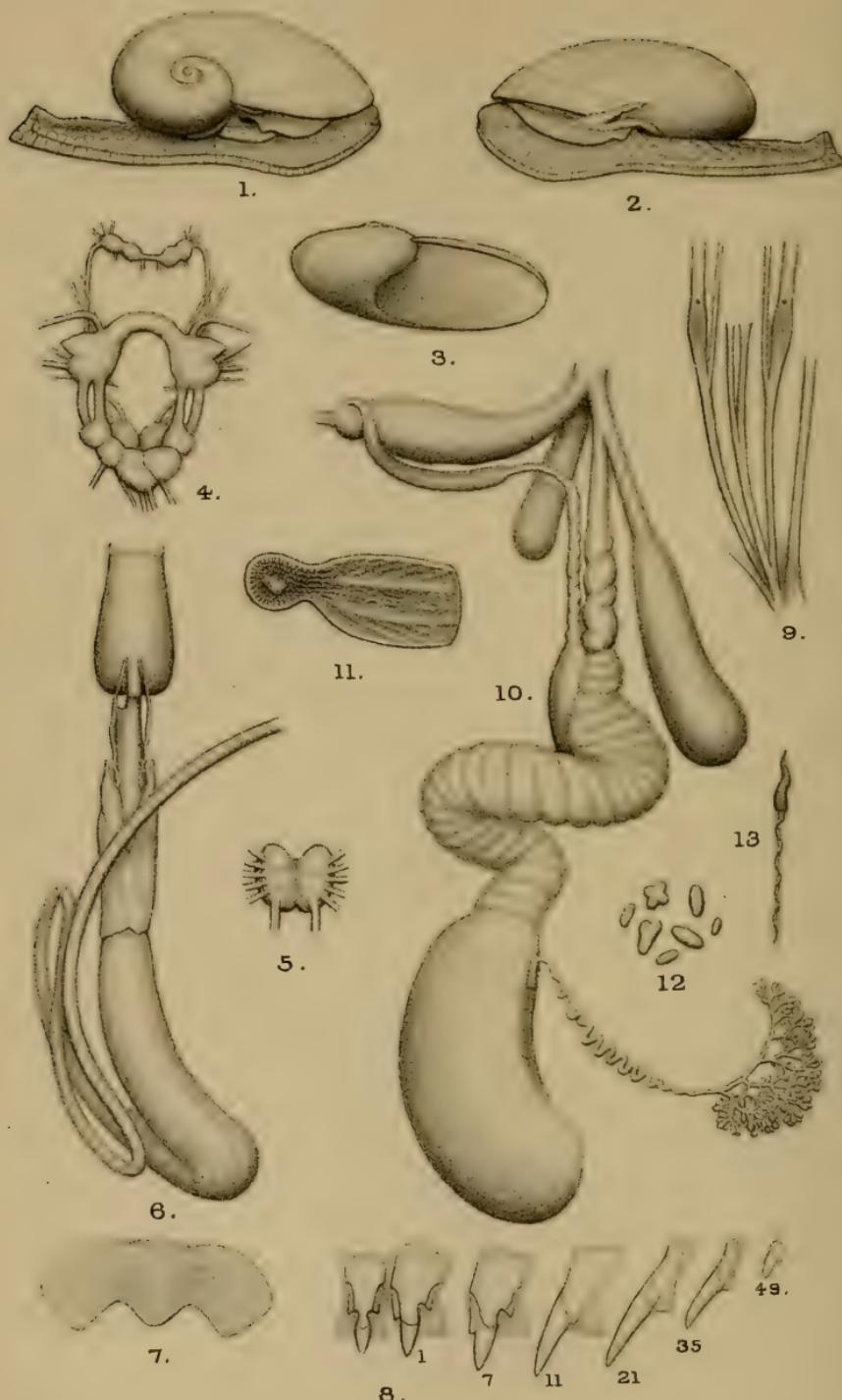
Protoconch smooth, or more usually spirally punctate (though apparently on a rather smaller scale than in *Granularion*) ; remaining whorls very finely microscopically granulate, except on the base. Shell-lobes narrow, separate, and usually quite small. Median projection of jaw prominent. Central and lateral teeth normal, marginals variable in form but never very numerous. Epiphallus present, but flagella absent. Penis ending in a slight knob, into which the epiphallus enters and the retractor muscle is inserted. Spermatheca usually oval, with a comparatively short duct. Genital atrium often bearing an elongated non-muscular amatorial organ.

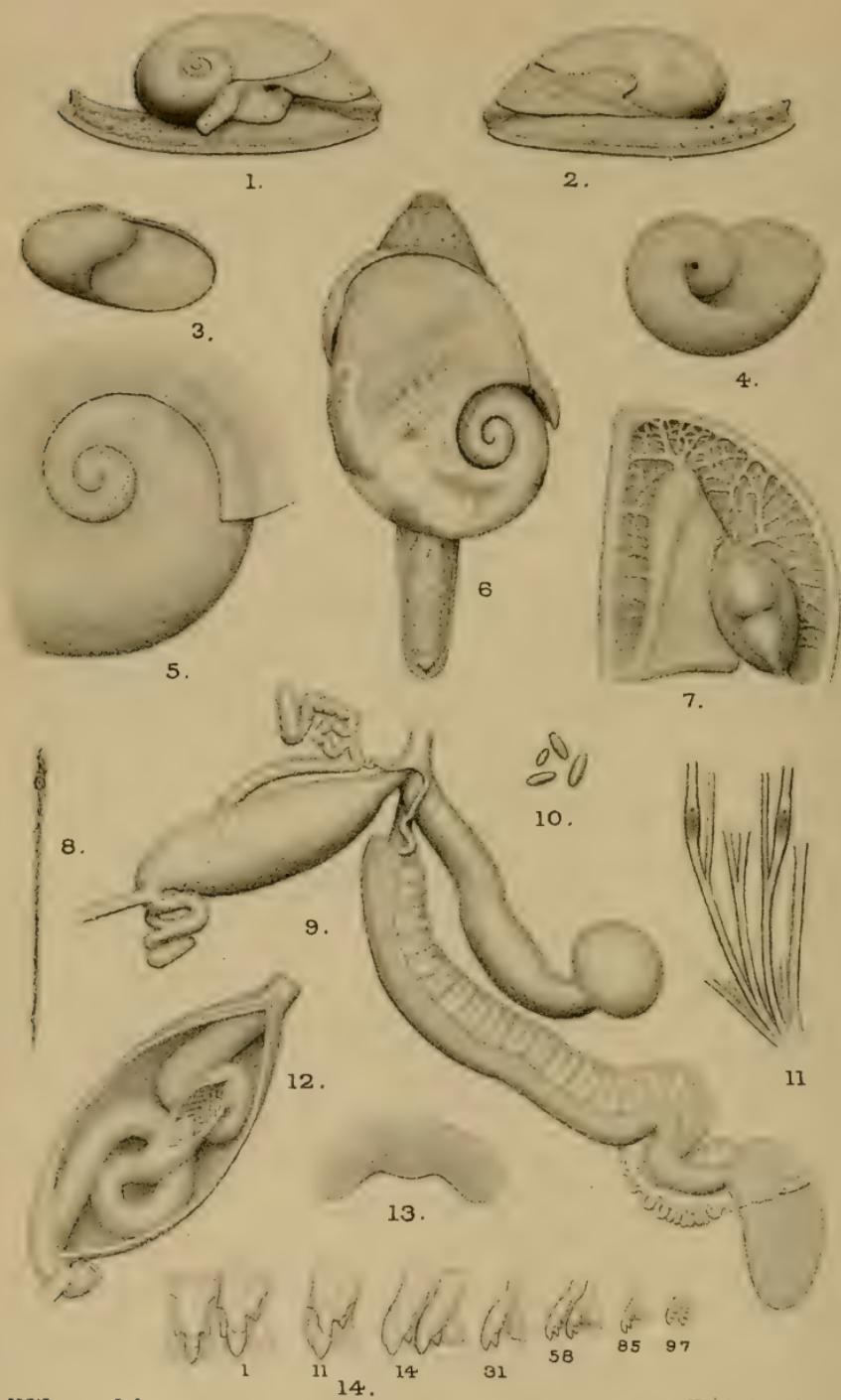
Known distribution : Equatorial Africa, from Uganda to the west coast, and extending in a southerly direction into Rhodesia and Portuguese East Africa south of the River Zambesi, which is much further south than the other subgenera are at present known to extend.

- plicatulus*, v. Marts.
- aloysii-sabaudiae*, Poll. (type).
- sowerbyanus* (Pfeiffer).
- gomesianus* (Morelet).
- welwitschii* (Morelet).
- nyasanus*, Smith.
- masukuensis*, Smith.
- medjensis*, Pilsbry.

Further investigation will probably show that this group should be separated generically from *Zonitarion* and *Granularion*, and just possibly from *Africarion* also ; and it will almost certainly have to be subdivided into two or three subgenera or sections. The species here placed in the subgenus *Granularion* also appear to belong to two or three different sections, but so little is known about their anatomy that it is not yet possible to say how they should be classified. Pilsbry has well said that at present most of the African species of *Helicarion* form a "nearly meaningless mass of materials which nobody can utilize until the descriptive work is all done over from a different standpoint".

subgenus *Africarion*, and its identification with *H. pallens*, Morelet, is still not quite certain. The two Indian species which Godwin-Austen at one time also placed in *Africarion* differ considerably from any of the African forms, and are now placed in the genus *Pseudaustenia*, Cockerell (see Blanford and Godwin-Austen, *Fauna of Brit. India, Moll. Testacellidae and Zonitidae*, 1905, pp. 206-9). It is possible, however, that *H. subangulatus*, v. Marts., from the Semliki Valley near Mount Ruwenzori, may prove to belong to this subgenus, but at present its anatomy is unknown.





H.Watson del.

Huth, London.

Helicarion cryptophallus n. sp.: British East Africa.

EXPLANATION OF PLATE III.

Helicarion gomesianus (Morelet); Pemba, Rhodesia.

FIG.

1. Animal and shell (preserved in spirit), seen from the right side. $\times 2$.
2. Animal and shell (preserved in spirit), seen from the left side. $\times 2$.
3. Shell, seen from the front. $\times 2$.
4. Central nervous system, seen from above. $\times 8$.
5. Pedal ganglia, seen from below. $\times 8$.
6. Alimentary canal, seen from above. $\times 4$.
7. Jaw, seen from the front. $\times 12$.
8. Representative teeth from the radula, seen from above. $\times 200$.
9. Free retractor muscles, seen from above. $\times 4$.
10. Reproductive system, seen from above. $\times 6$.
11. Posterior half of penis, split open and seen from within. $\times 8$.
12. Calcareous granules from the epiphallus. $\times 800$.
13. Anterior end of spermatozoon. $\times 800$.

EXPLANATION OF PLATE IV.

Helicarion cryptophallus, n.sp.; British East Africa.

FIG.

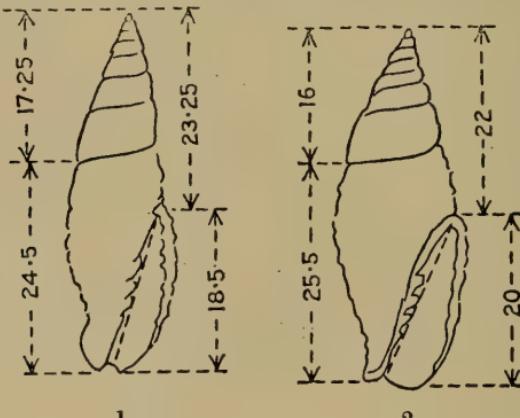
1. Animal and shell (preserved in spirit), seen from the right side. $\times 2$.
2. Animal and shell (preserved in spirit), seen from the left side. $\times 2$.
3. Shell, seen from the front. $\times 2$.
4. Shell, seen from the beneath. $\times 2$.
5. Spire of shell, seen from above. $\times 6.5$.
6. Animal without its shell, seen from above. $\times 3$.
7. Roof of mantle cavity, seen from within, showing respiratory and excretory organs. $\times 4$.
8. Anterior end of spermatozoon. $\times 800$.
9. Reproductive system, seen from above. $\times 6$.
10. Calcareous granules from the epiphallus. $\times 800$.
11. Free retractor muscles, seen from above. $\times 4$.
12. Contents of penis-sheath, with posterior end of penis split open (to show penis-papilla, etc.). $\times 8$.
13. Jaw, seen from the front. $\times 12$.
14. Representative teeth from the radula, seen from above. $\times 200$.

MITRA BURNUPIANA, N.SP., FROM SOUTH AFRICA.

By the Rev. Dr. A. H. COOKE, F.Z.S.

Read 11th June, 1920.

In a paper recently read¹ before the Zoological Society of London, mention was made of an undescribed species of *Mitra*, received from Durban through Mr. H. C. Burnup, and provisionally labelled as “*M. circula*, Kien., var.” The form of the radula, as was there explained, sufficiently differentiated the so-called variety from *M. circula* typical; it now remains to record the difference between the two species conchologically. Here we have the advantage of Mr. Burnup’s own notes on a number of specimens. The new species, to which we propose to attach the name *burnupiana*, belongs to that group of *Mitra* provisionally separated off as “group (7) of *sphaerulata*”, a group very far removed, by the radula, from the “group (10) of *scabriuscula*”, to which *M. circula* belongs.

FIG. 1.—*M. circula*, Kien. FIG. 2.—*M. burnupiana*, Cooke.*MITRA BURNUPIANA*, n.sp.

(Mr. Burnup’s notes take the form of a comparison between the so-called “var.” and the typical *circula*, Kien.)

“The ‘var.’ is not so narrow or elongate. A much greater proportion of the whole length of the shell is occupied by the body-whorl, so leaving the spire shorter. The body-whorl and spire are also considerably wider.

“The sculpture is somewhat similar, but the longitudinal grooves are both deeper and further apart in the ‘var.’, cutting the spiral costæ into much larger beads than in *circula*, and converting the intercostal threads into series of smaller oblong beads.

“The aperture is wider, especially below the middle, and also

¹ “The Radula of the Mitridæ”: Proc. Zool. Soc. Lond., 1919, pp. 405–422.

longer. The callus is much more strongly developed, quite forming an inner lip. The juncture of the callus above with the outer lip stands out from the body-whorl, almost forming a posterior canal, as it does not in *circula*.

"The outer lip is thicker, less crenulate, and more polished. The columellar plaits are more strongly developed, forming together a triangular mass, with the upper plaits so much longer than the lower that if a line be drawn from the tip of the fourth to that of the first and extended upward it would reach the suture; whereas in *circula* it would strike the paries considerably to the left of the suture.

"The columella is not so much 'produced in the style of the *Fusidæ*'.

"Although all the above distinctions may not be conspicuous in the comparison of any two individuals of the two forms, enough will always be found to enable the careful student to separate them without hesitation.

"Both forms, as found in Durban Bay, are a good deal short of Kiener's length dimensions, i.e. about 27 mm. against 38 mm. As both forms are found together, variation through environment is barred.

"The dimensions given with the above figure are those of the enlarged drawings, not of the shells themselves."

The actual dimensions of two specimens in my collection are :

		mm.
Total length of shell	<i>burnupiana</i>	27
" " "	<i>circula</i>	26.5
Breadth of shell at widest	<i>burnupiana</i>	10
" " "	<i>circula</i>	7
Length of spire	<i>burnupiana</i>	13
" " "	<i>circula</i>	15
" aperture	<i>burnupiana</i>	14
" " "	<i>circula</i>	11.5

The type-specimen is placed in the British Museum (Natural History).

NOTE ON THE DATES OF PUBLICATION OF THE EARLIER PARTS
OF CAPTAIN THOMAS BROWN'S *ILLUSTRATIONS OF THE
CONCHOLOGY OF GREAT BRITAIN AND IRELAND*, 2ND EDITION.

By ALEXANDER REYNELL.

Read 11th June, 1920.

SOME five or six years ago I came across a volume made up, evidently, of some few parts of the above-mentioned work. The front and back covers were formed of the original front wrappers of parts 2 and 4. These covers bear no date of issue, but fortunately, pasted inside, are two labels of the "Lincoln Library", bearing between them the following inscription, partly in manuscript: "Not to be circulated but on £1 0s. Od. deposit, March 14th, 1838."

On taking the second stitching to pieces and piecing letterpress and plates together according to the original stitching, I found I had the first four parts with their plates. The title on the cover reads as follows:—

"Illustrations | of the | Conchology | of | Great Britain and Ireland :—with the | Description and Localities of all the Species, | Marine, Land, and Fresh Water. | Drawn from Nature by | Captain Thomas Brown, F.L.S.M., W.S.M.K.S. | President of, the Royal Physical Society, etc. | Second Edition, greatly enlarged | Edinburgh | Published by MacLachlan & Stewart, 64, South Bridge; | Glasgow: John Smith & Son, 70, St. Vincent Street; | Dublin: William Curry Jun. & Co.; | Smith, Elder, & Co., 65, Cornhill, and W. S. Orr & Co, Paternoster Row, | London. | To be had of all other Booksellers."

At the top right- and left-hand corners are the price and part numbers respectively. The contents of the parts are:—

Part 1, pp. 1–8, plates i–iv.

„ 2, pp. 9–12, plates v–viii.

„ 3, pp. 13–16, plates ix–xii. Plate ix originally numbered iii, and altered; an x being struck over the second and third i's.

„ 4, pp. 17–20, plates xiv, xvi, xxii, xxvi.

Malacological Society of London.

(Founded 27th February, 1893.)

Officers and Council—elected 13th February, 1920.

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Vice-Presidents :—T. IREDALE ; A. S. KENNARD, F.G.S. ; H. O. N. SHAW, B.Sc., F.Z.S. ; J. R. LE B. TOMLIN, M.A., F.E.S.

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Editor :—B.B. WOODWARD, F.L.S., 4 Longfield Road, Ealing, London, W. 5.

Other Members of Council :—H. H. BLOOMER, F.L.S. ; Major M. CONNOLLY ; Rev. A. H. COOKE, Sc.D., M.A., F.Z.S. ; C. OLDHAM, F.L.S. ; A. REYNELL ; H. WOODS, M.A., F.G.S.

By kind permission of the Council of the LINNEAN SOCIETY, the MEETINGS are held in their apartments at BURLINGTON HOUSE, PICCADILLY, W. 1, on the SECOND FRIDAY in each month from November to June.

The OBJECT of the Society is to promote the study of the Mollusca, both recent and fossil.

MEMBERS, both Ordinary and Corresponding (the latter resident without the British Islands), are elected by ballot on a certificate of recommendation signed by two or more Members.

LADIES are eligible for election.

The SUBSCRIPTION is, for Ordinary Members £1 1s. per annum or £10 10s. for Life, for Corresponding Members 15s. per annum or £7 7s. for Life. All Members on election pay an Entrance Fee of £1 1s.

* * * All remittances should be drawn in favour of "The Malacological Society" and addressed to the Treasurer direct.

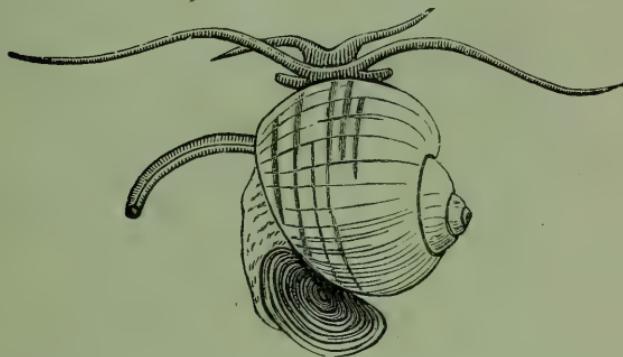
The PROCEEDINGS are issued three times a year, and each Member is entitled to receive a copy of those numbers issued during membership.

[Vols. I-VIII and Vol. IX, Parts I-III, price 5s. net per Part. Part IV of Vol. IX to Part VI of Vol. XIII, price 7s. 6d. each. Part I of Vol. XIV, and succeeding Parts, price 10s. each. A discount of 20 per cent upon the above prices is allowed to Members purchasing these Volumes or Parts through the Secretary.]

Further information, with forms of proposal for Membership, may be obtained from the Secretary, to whom all communications should be sent at his private address, as given above.

PROCEEDINGS

OF THE

MALACOLOGICAL SOCIETY
OF LONDON.

EDITED BY B. B. WOODWARD, F.L.S., ETC.,
Under the direction of the Publication Committee.

AUTHORS ALONE ARE RESPONSIBLE FOR THE STATEMENTS IN THEIR RESPECTIVE PAPERS.

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LONDON :

DULAU & CO., LTD., 34-36 MARGARET STREET, CAVENDISH SQUARE, W. 1.

Conchological Society of Great Britain and Ireland.

HON. SEC.: J. W. JACKSON, F.G.S., etc., Manchester Museum,
Manchester.

Subscription: 10s. per annum, or £6 6s. for life.

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Meetings are held by kind permission at the MANCHESTER MUSEUM on the SECOND WEDNESDAY in each month from SEPTEMBER TO JUNE.

The Journal of Conchology, the organ of the Society, is issued quarterly to all Members.

* * Back volumes to be had from Headquarters, and from Messrs. DULAU & Co., Ltd., 34-36 Margaret Street, London, W. 1.

Vols. II-IV and VII-XIV at 15s. each (to Members 11s. 3d.).

Vols. I, V, and VI out of print. (Vol. I will be reprinted and issued at 21s. net when a sufficient number of Subscribers has been obtained.)

For information concerning the
MALACOLOGICAL SOCIETY OF LONDON
See page iv of this wrapper.

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ORDINARY MEETING.

FRIDAY, 12TH NOVEMBER, 1920.

G. K. GUDE, F.Z.S., President, in the Chair.

The following communications were read :—

1. " Note on *Sphaerium nitidum*, Cl., a Siberian freshwater mussel in Sweden." By Dr. Nils Hj. Odhner (communicated by B. B. Woodward, F.L.S., etc.).

2. " New Shells from Port Alfred (collected by Lieut.-Col. W. H. Turton)." By G. B. Sowerby.

3. " Oecological Notes." By Dr. A. E. Boycott, F.R.S.

4. " Quelques rectifications de nomenclature concernant les Mollusques de la Faune Paléarctique." By Paul Pallary.

Mr. E. R. Sykes exhibited Rackett's copy of Pulteney's Catalogue of the Shells of Dorsetshire, containing a specimen of Rackett's handwriting, and read the following note concerning it :—

Some little while ago¹ Mr. Reynell in discussing the origin of the plates for the above work stated that the Rev. R. T. Rackett's writing was apparently unknown.²

I have Rackett's own copy of the book, which is of some interest on account of the following note in his writing, opposite the title-page :—

" The first impression of Dr. Pulteney's Catalogues, printed in 1801, was never published, having been destroyed by the fire at Mr. Nichols' printing office. To this second impression I have been enabled to make considerable additions, by communications from Dr. Maton, the late Revd. E. Binfield, the Revd. J. Jones, the Revd. T. Trahearn, etc., and by my own observations. See pp. 14, 23, 62, 101.

June 1st, 1813.

Thos. Rackett."

Not only does this copy fix Rackett's writing, but it raises a bibliographical point of some nicety with regard to the dates to be quoted for the new names.

Col. Peile exhibited a live specimen of *Rachis burnayi*, Dohrn, from Ibadan, S. Nigeria, collected by Mr. A. W. J. Pomeroy.

On behalf of W. J. Wintle, F.Z.S., there was exhibited a series of Mollusca from the Isle of Caldey, South Wales. It included (1) Very large examples of *Patella vulgata*, one of which measures 66 × 57 mm., and is only surpassed by an example in the possession of Hugh Watson, from Fair I., Shetlands, which is 70 × 63·5 mm.

¹ Proc. Malac. Soc., xii, p. 43.

² Since Mr. Reynell's paper was read a note in Rackett's own handwriting was found in the Linnean Society's copy of the work in question. This note is practically identical with that in Mr. Syke's copy as far as "Trahearn", but dated "May 24, 1813". The date of the fire was 1808; 1801 was that of Pulteney's death.—[Ed. Malac. Soc.]

- (2) Specimens of *Patella*, showing the intrusion in varying degree of sand grains between the mantle of the animal and its shell and their incorporation into the substance of the shell by subsequent deposition of nacre, as well as individuals both of *P. vulgata* and *athletica* that had been attacked by the boring Polychæte Worm, *Polydora ciliata*, with one showing a very large baroque pearl.
 (3) Suites of *Helix pisana*, *Helicella itala*, and *Hel. virgata*, including some of its varieties of banding, such as the rare var. *radiata* and var. *hypozona*, besides a large, high-spired form, which occurs on a wind-swept limestone cliff jutting out to sea, as well as *Hel. caperata* and its var. *ornata*, and *Cochlicella acuta*. All these Isle of Caldey helicoids are much darker than corresponding individuals of the same species on the mainland at Tenby, or in the British Isles generally. Possibly their dusky hue may indicate a tendency towards Melanism. (4) Examples of *Limnaea peregrina*, var. *maritima*, the only form of the species found on the island.

ORDINARY MEETING.

FRIDAY, 10TH DECEMBER, 1920.

G. K. GUDE, F.Z.S., President, in the Chair.

The Cornell University Library and the Manchester Public Libraries were elected to membership of the Society.

The following communications were read :—

1. "Unpublished Plates of Thomas Martyn, Conchologist." By T. Iredale.
2. "*Krapfia mirabilis*, Preston, and its affinities." By Hugh Watson.
3. "Note on some of F. E. Edward's specific names of Eocene Mollusca." By A. Wrigley (communicated by A. S. Kennard, F.G.S.).

Mr. B. B. Woodward exhibited sections of a "baroque" pearl in a *Patella* taken at Caldey Island by Mr. Wintle.

ORDINARY MEETING.

FRIDAY, 14TH JANUARY, 1921.

G. K. GUDE, F.Z.S., President, in the Chair.

Notice was given that a Special General Meeting would be convened on 11th February next to take into consideration and if thought advisable to pass alterations in Rules III and VIII.

Mr. Oldham and Col. Peile were appointed Auditors.

The following communications were read :—

1. "On a small collection of Land and Freshwater Mollusca from Manguli Island, Xulla Islands, with description of two new Helicoids." By Hugh C. Fulton.
2. "Notes on the distribution of British Land and Freshwater

Mollusca from the point of view of the environment." By Dr. A. E. Boycott, F.R.S.

3. "Nomenclature and Nonsense." By Dr. E. W. Bowell.

4. "The validity of the names *Testacella maugeri*, Fé., and *Testacella haliotidea*, Drap." By Hugh Watson, M.A.

At the conclusion of Dr. Boycott's paper, which was illustrated by lantern slides, Dr. Bowell exhibited an interesting series of lantern slides from micro-photographs of Radulae.

SPECIAL GENERAL MEETING.

FRIDAY, 11TH FEBRUARY, 1921.

The following resolutions were proposed and duly passed :—

(a) That the following addition be made to Rule VIII: "That Institutions be not eligible for Life Membership."

(b) That Rule III be altered to read as follows: "That the Society consist of Ordinary, Honorary, and Corresponding Members, the latter resident without the British Islands and that women be eligible for election. Honorary Members to be limited to five and to be nominated by the Council, such nomination to be confirmed at the ensuing Annual General Meeting.

ANNUAL GENERAL MEETING.

FRIDAY, 11TH FEBRUARY, 1921.

G. K. GODE, F.Z.S., President, in the Chair.

Mr. H. Fulton and Mr. G. Young were appointed scrutineers.

The following report was read :—

REPORT OF THE COUNCIL.

"In presenting their twenty-eighth annual report the Council have pleasure in recording that the work of the Society is still well maintained. The monthly meetings have been held as usual, and the attendance has continued to show an improvement. The communications read continue to be of a high standard. Among the losses that the Society has to deplore, the Council wish to mention the names of Mr. R. Etheridge, late Director of the Australian Museum, Sydney, and Mr. E. Collier, one of the original members of the Society.

"The Council are glad to report that Rule III has been altered so that Honorary Members may be elected, and have pleasure in stating that the following Honorary Members have been nominated and are hereby proposed for election :—

"Dr. Henry Woodward, first President and one of the founders of this Society, for valuable services to Malacology during a long period.

THE MALACOLOGICAL SOCIETY OF LONDON.

ACCOUNTS FOR YEAR ENDED DECEMBER 31, 1920.

INCOME AND EXPENDITURE ACCOUNT.

LIFE MEMBERSHIP FUND.

Dr.	Cr.	£	s.	d.	£	s.	d.
To £50 Metropolitan 2½ per cent Consolidated Stock valued at	By Brokerage , , , , ,	25	0	0	10	10	6
, , Transfer from Income and Expenditure Account	Amount of Fund, December 31, 1920	100	0	0	160	14	6
, , Three Composition Fees at £10 10s.		31	10	0			
, , Dividends on Investments		4	15	0			
					£161	5	0

BALANCE SHEET.

<i>Liabilities.</i>	<i>£ s. d.</i>	<i>Assets.</i>	<i>£ s. d.</i>
Annual subscriptions paid in advance	8 6 6	Annual subscriptions for 1920 in arrears	
Sundry Creditors	1 14 0	£7 7s., estimated to yield	4 4 0
Life Membership Fund	160 14 6	Income Tax recoverable	1 10 0
Balance of Income and Expenditure Account	41 9 6	<i>Investments—</i>	
Balance, being excess of Assets over Liabilities	4 0 0	£50 Metropolitan 2½% Consolidated Stock valued at £100 5% War Loan, at cost	88 1 3
	
		£100 5% War Loan, at cost	25 0 0
		Cash at Bankers and in hand	113 1 3
			97 9 3
			£216 4 6

Assets in addition to those shown in the Balance Sheet are (a) Stock of unsold publications,

(b) Annual Subscriptions in arrear prior to 1920.

Audited and found correct, 1st February, 1921.

CHAS. OLDFHAM }
A. J. PIELE } Auditors.

R. BULLEN NEWTON, Hon. Treasurer.

"Dr. Paul Pelseneer, for valuable services to Malacology, to which he has devoted a great part of his life.

"Mr. C. Davies Sherborne, for valuable and lasting services to Zoological Nomenclature.

"The membership roll has unfortunately decreased, in certain cases of Corresponding Members no doubt due to the adverse rate of exchange. The following will be the numbers of the various classes : Honorary Members, 3 ; Ordinary Members, 60 ; Corresponding Members, 81. Of the two latter classes 16 are Life Members, three of whom have compounded at the higher rate.

"During the year one single and one double number of the *Proceedings*, forming Vol. XIV, parts 1 to 3, were issued in April and September respectively.

"They comprised 116 pages of text, with four plates, a frontispiece (portrait of R. Bullen Newton, I.S.O., President 1910-12), and 21 sets of figures. Drawings or blocks for the illustrations were furnished by Dr. S. S. Berry, Dr. A. E. Boycott, the Rev. Dr. A. H. Cooke, G. K. Gude, C. Hedley, and H. Watson.

"The cordial thanks of the Society are once again due to the Council of the Linnean Society for their continued kindness in allowing the meetings of the past year to be held in their apartments at Burlington House."

The Treasurer presented the statement of income and expenditure for the year ended December 31, 1919.

On the motion of the President, seconded by Mr. Oldham, the Council's nominations of Honorary Members, namely Dr. Henry Woodward, Dr. Paul Pelseneer, and Mr. C. Davies Sherborne were confirmed, and the foregoing report and the financial statement were adopted.

The following were elected Officers and Council for the year 1921 :—

President.—G. K. Gude, F.Z.S.

Vice-Presidents.—T. Iredale ; J. R. le B. Tomlin, M.A., F.E.S. ; A. S. Kennard, F.G.S. ; Dr. A. E. Boycott, F.R.S.

Treasurer.—R. Bullen Newton, I.S.O., F.G.S.

Editor.—B. B. Woodward, F.L.S., etc.

Secretary.—A. E. Salisbury.

Six other Members of the Council.—C. Oldham, F.L.S. ; Major M. Connolly ; H. Woods, M.A., F.R.S. ; Rev. Dr. A. H. Cooke, F.Z.S. ; H. O. N. Shaw, B.Sc., F.Z.S. ; Lieut.-Col. A. J. Peile, R.A.

On the motion of Mr. T. Iredale, seconded by Dr. Bowell, a unanimous vote of thanks was passed to the retiring officers and members of the Council, the auditors, and the scrutineers.

ORDINARY MEETING.

FRIDAY, 11TH FEBRUARY, 1921.

G. K. GODE, F.Z.S., President, in the Chair.

The Society received with regret the news of the death, on January 31, of Mr. G. B. Sowerby (III), one of the original members of the Society. Mr. H. Fulton read an obituary notice.

The President then delivered his address on "Changes in the Classification of Helices during a quarter of a century".

On the motion of Mr. B. B. Woodward, seconded by Mr. Tomlin, a vote of thanks to the President for his address was passed, with the request that he would allow the same to be printed in extenso in the *Proceedings* of the Society.

SPHÆRIUM NITIDUM, CL., A SIBERIAN FRESHWATER MUSSEL,
IN SWEDEN.

By Dr. NILS HJ. ODHNER.

(Communicated by B. B. Woodward, F.L.S.)

Read 12th November, 1920.

ON a revision of the Swedish freshwater mussels of the family Sphæriidæ it appeared that the genus *Sphaerium* (excl. *Musculium*) is represented in the Swedish fauna by two species, *S. corneum*, L. (comprising also *S. draparnaldi*, *ovale*, and *mamillatum*) and the Siberian *S. nitidum*, Clessin (Martini and Chemnitz, *Conch. Cal.*, Küster's new ed., 1877; cf. also Westerlund, "Sibirien Land-och Sötvatten-Mollusker," K.Sv. Vet. Akad., Handl. 14, 1877). The latter species originally recorded from Jenissei, proves to be well separated from *S. corneum* not only in its shell (cardinals are straight, not curved as in *corneum*, and cardinal 4 covers only the rear half of 2, the hinge-plate is very narrow, the umbones usually inflated), but also in its anatomy. The best distinguishing character is offered by the nephridium, which lies as a paired mass between pericardium and posterior adductor, and is very easy to examine. Seen from above the dorsal parts of this organ have a different aspect in *S. corneum* and *S. nitidum*. In the former the dorsal surface of each nephridium has a U-shaped appearance, and both legs of the loop are separated by an interstice occupied by a small protruding part from the interior of the nephridium (the apical flexure of the inner or pericardial tube). In *S. nitidum* the two legs are entirely closed together, so that the inner parts of the nephridium are totally covered and do not protrude dorsally. Further, the dimensions of nephridium in relation to pericardium and posterior adductor are different from those of *S. corneum*, where each nephridium, seen from above, is short and broad, its length only slightly surpassing that of the adductor and that of the pericardium; its breadth is greater than half its length. These characters were constant in all forms of *S. corneum* examined. In *S. nitidum* the nephridium is twice as long as broad, and occupies twice the length of the adductor and twice that of the pericardium.

That the Swedish specimens are identical with the Siberian form was proved by a comparison with specimens from the original locality; the characters of the shells as well as of the soft parts are similar in both cases.

This interesting species has been found only in northern Sweden, north Lappland (whence it was mentioned by me in 1908 as *S. corneum* and *S. ovale*), south Lappland, and Jämtland (Coll. in Swed. State Mus.). It is entirely wanting in south Sweden, even in the deep and cool lakes where arctic relics are recorded (e.g. Vättern), and it therefore seems likely that *S. nitidum* is a rather late immigrant to the Swedish fauna, and that it has a direct eastern origin.

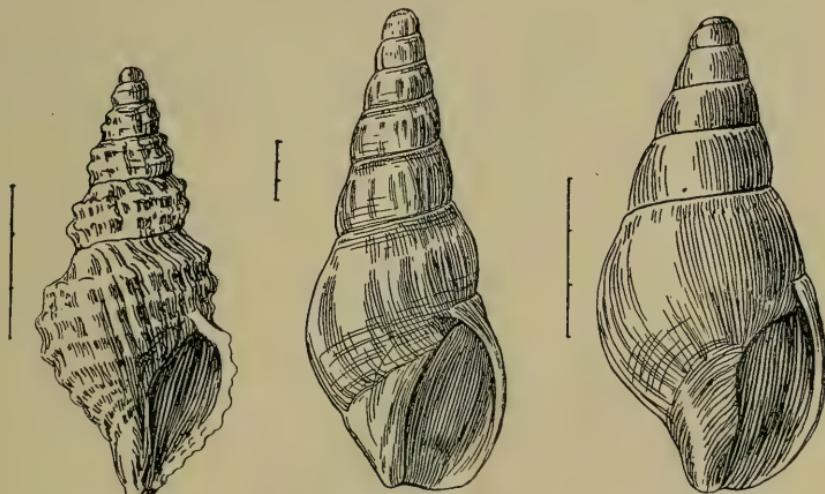
NEW SHELLS FROM PORT ALFRED, COLLECTED BY LIEUT.-
COLONEL W. H. TURTON.

By the late G. B. SOWERBY, F.L.S.

Read 12th November, 1920.

COMINELLA ACUTISPIRA, n.sp.

TESTA acuminata, pallide fusco-tincta ; spira elata, acuta, gradata ; anfractus 6, primi 2 leves, rotundati, sequentes rotunde convexi, spiraliter bi-lirati, longitudinaliter plicis nodulosis cancellati, ultimus $\frac{1}{2}$ longitudinis testæ æquans, spiraliter rugose sex-liratus, longitudinaliter irregulariter plicatus, supra concavo-planulatus, deinde convexus, infra attenuatus, breviter rostratus ; apertura oblongo-ovata, breviter canaliculata ; peristoma acutum ; columella fere recta. Long. 10, maj. diam. 4 mm.



*Cominella
acutispira, n.sp.*

*Bullia
dulcis, n.sp.*

*Columbella
approximata, n.sp.*

The scales at the sides represent millimetres.

Although of fairly simple character, I am unable to find any species analogous to this. It has a remarkably elate and acute spire, the rounded whorls being concavely depressed at the top. The whole surface of the shell is crisply nodulously cancellated. I have only seen two examples of this species, both in the collection of Lieut.-Col. Turton.

BULLIA DULCIS, n.sp.

Testa elongata, griseo-albida, languide fusco-flammulata, levis, nitens ; spira elata, mediocriter acuta ; anfractus 7, primus obtusus, rotundatus, sequentes convexi, superne spiraliter tenuissime striati, sutura angustissime sejuncti, anfractus ultimus longitudinis spiram

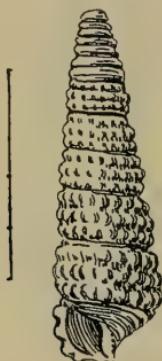
fere æquans, convexus, supra tenuissime spiraliter striatus, infra inepte sulcatus; apertura mediocriter lata, intus fusca, peristoma arcuatum, acutum, columella leviter arcuata, callo albo late expanso instructa. Long. 25, maj. diam. 10, apertura longa 9, lat. 4 mm.

A shell with a very glossy surface, differing from *B. semiflammea*, Reeve, in the convexity of its whorls. This species has been placed with *B. diluta* (Krauss), but it is pretty clearly distinguished by its somewhat different form, and especially by the extreme fineness of its spiral striæ. It also bears some resemblance to *B. similis*, Sowerby.

COLUMBELLÀ APPROXIMATA, n.sp.

Testa parva, elongata, levis, nitens, fulvo-fusca, spira elata, acuta; anfractus 6, primus minutus, rotundatus, sequentes leviter convexi, sutura anguste impressa sejuncti; ultimus convexus, spiram leviter superans, infra contractus, breviter rostratus, apertura oblongo-ovata, peristoma tenue, columella rectiuscula. Long. 10, maj. diam. 4 mm.

This shell is somewhat like *C. albuginosa*, Reeve, but of a more solid substance; its colour is plain brown without any indication of longitudinal streaks or other markings.



Triforis innocens, n.sp.

TRIFORIS INNOCENS, n.sp.

Testa sinistralis, mediocriter elongata, pura alba, anfractus 10 convexiusculi, tricingulati, cingulis exquisite et conspicue gemmatis, anfractus ultimus supra convexus, infra contractus, brevicaudatus; apertura oblique ovata; peristoma acutum, serratum; columella arcuata. Long. 5, maj. diam. 2 mm.

This exquisite, pure white, little shell, beset with bead-like granules, is something like *T. madria*, Bartsch, from which it differs in form, the whorls being more convex, and the shell altogether shorter in proportion to its length.

The following I name simply as colour varieties of known species:—

Drillia hottentota, Smith, var. *fuscescens*, n.var.—The type of *D. hottentota* is a white shell with a brown spire clearly defined from the top of the body whorl, while the var. *fuscescens* is tinted all over pale brown, with longitudinal streaks of darker brown.

Bullia pura, Melvill, var. *balteata*, n.var.—This differs from the typical *B. pura*, which is entirely white, in having a broad band of pale buff occupying most of the body whorl, and the lower part of the upper whorls.

Patella variabilis, Krauss, var. *constellata*, n. var.—The varieties of *P. variabilis* are rather numerous, but I venture to propose a name for one of rather remarkable character. It is of a dark brown colour, with numerous yellow spots sprinkled over its surface, having the appearance of a constellation.

Fissurella mutabilis, Sowerby, var. *aurantia*, n.var.—This striking variety is of a uniform orange colour. In form and sculpture it does not differ materially from the type, though somewhat more depressed.

ECOLOGICAL NOTES.

By Dr. A. E. BOYCOTT, F.R.S.

*Read 12th November, 1920.*1. *POMATIAS ELEGANS* ON SANDHILLS.

THERE is a general agreement of record and experience that this species is confined to calcareous soils, and its occurrence is often sharply limited to small areas by the presence of chalk, etc., at the surface. The probable explanation is that being largely subterranean in habit and spending a good portion of its time underground it requires a soil of a loose texture to burrow in. This is secured on calcareous soils by the flocculating action of calcium carbonate on the clay particles, which results in the dry granular loose surface characteristic of such loci. In the south-west of England it occurs on limestone near Ilfracombe (J. R. Tomlin, *Journ. Conch.*, v, 1887, p. 183), on chalk and greensand between Seaton and Sidmouth, where the chalk reaches its western limit, and, I suppose on calcareous greensand, at Torquay. Further west there are no calcareous soils, but it is of much interest to note that it has been found in sandhills on the coast at Perranporth (J. H. James in W. D. Roebuck's *Census*) and Rock near Padstow (A. Gardiner, *ib.*) in Cornwall, and at Woolacombe (M. J. Longstaff, *Journ. Conch.*, xiii, 1910, p. 23) in Devon. At this latter place I have seen it pretty freely on the old sandhills, now partly occupied by golf links, and in places dead shells are abundant in the sand scraped out by rabbits in the rough pastures to which the sand-blown coast has progressed at the southern end of Woolacombe beach. This sandhill habitat is, I believe, quite exceptional, perhaps because it is essentially mobile, unstable, and often comparatively modern. It is obviously well suited for burrowing. The facts suggest that the texture of the soil determines the common preference of the species for calcareous places, but they are by no means conclusive. For the sandhills are often, at any rate, highly calcareous, as is shown by the massive deposits of calcium carbonate which occur in their depths. The shore sand itself contains the remnants of molluscan shells, and where the dunes are covered with vegetation the plants will collect lime from considerable depths and bring it to the surface. This concentration of lime in the upper layers may be assisted by *Helicella virgata*, which eats the plants, and, living as it does for only one year (H. R. Bolton, *Naturalist*, ii, 1852, p. 105), rapidly accumulates dead shells. *Helix aspersa*, etc., have the same action. It remains, therefore, uncertain whether the ordinary distribution of the species is determined by chemical or physical considerations: one alternative does not necessarily exclude the other.

[In discussion Mr. C. Oldham pointed out that *Pomatias* does

not occur on the sandy breck country in Norfolk and Suffolk,¹ and that, while it occurs on the limestone at the northern end of Morecombe Bay and at the Great Ormes Head, it has not spread into the extensive adjacent maritime sand dunes in either neighbourhood: also that the calcareous nature of sea sand dunes is indicated by the occurrence of various calcicolous plants.

Mr. A. S. Kennard mentioned the abundance of the species in a prehistoric deposit among the sand dunes at Harlyn Bay, Cornwall West, 4 miles west of Rock: it no longer occurs alive there. He also pointed out that it did not occur on inland, and presumably non-calcareous, sands, in Essex, Kent, and Devon, though present in adjacent calcareous areas of chalk or greensand, and that the evidence as a whole indicated that the species wanted plenty of lime, and that a loose surface soil, unless calcareous, did not provide a suitable habitat.]

2. *SUCCINEA OBLONGA* AT BRAUNTON BURROWS.

In this well-known Devonshire locality *S. oblonga* (of the form *S. arenaria*: A. S. Kennard and B. B. Woodward, *Proc. Geol. Assoc.*, xxviii, 1917, p. 172) occurs abundantly in the flats behind the sandhills in slightly sunken areas, generally more or less circular, where the soil is definitely sandy and thinly covered with low-growing plants. It does not seem to live on the mobile or stabilized dunes, nor where the soil is earthy and thickly covered with grassy vegetation, nor on the slightly raised parts, where the soil is compact and *Salix repens* abounds, nor among the rushes (*Juncus effusus*) near the draining ditches with *Vertigo moulensisana*. By the kindness of Dr. E. J. Salisbury I put on record the following list of a complete collection of plants from a typical locus: *Potentilla reptans*, *P. anserina*, **Anagallis tenella*, **Sagina nodosa*, **Samolus valerandi*, †*Glaux maritima*, *Plantago coronopus*, *Linum catharticum*, *Mentha arvensis*, *Gentiana praecox*, *Carex glauca*, *Hypochaeris radicata*, *Prunella vulgaris*, †*Carex arenaria*, *Cardamine hirsuta*, **Eleocharis palustris*, **Hydrocotyle vulgaris*, †*Erythraea pulchella*, *Euphrasia stricta*, **Juncus articulatus*, **Carex æderi*, *Pellia fabroniana*, *Geoglossum hirsutum*; *Plantago coronopus* being by far the most abundant species. In various other *oblonga* areas we found in addition occasional plants of **Inula dysenterica*, *Equisetum arvense*, **Ranunculus flammula* var. *repens*, **Epipactis palustris*, *Bellis perennis*, **Teucrium scordium*, and *Lotus corniculatus*. Of these plants those marked † are maritime, while those marked * are marsh species, and the vegetation indicates a habitat which is damp and sometimes, but not always, under water. The marsh

¹ S. P. Woodward (in R. Tate, *Land and Freshwater Mollusks*, 1866, p. 222) notes it as "found in great profusion on the bosses of chalk that appear among the overlying Tertiary gravels and clays, and not found in the intervening areas".

beetle *Parnus*, sp., was abundant in several of the loci. The accompanying mollusca were in all cases:—*Helix aspersa*, *Helicella virgata*, *H. caperata*, segg., *Agriolimaæ agrestis*, *A. lœvis*, and *Limnæa truncatula*, and in two loci *Succinea elegans*; all these species occurred also in many places where there were no *oblonga*. *Cochlicopa lubrica* also occurred freely in one locus, but it is not of general occurrence. The other mollusca which were noted in various parts of the flats close to but not in the *oblonga* areas were *Arion ater*, *Helix nemoralis*, *H. hortensis*, *Limnæa pereger*, *Cochlicella barbara*, *Lauria umbilicata*, *Vallonia pulchella* agg., *Hygromia hispida*, *Yalinia alliaria*, *Carychium minimum*, *Succinea putris*, *Clausilia rugosa*, *Vertigo moulinsiana*, *V. antivertigo*, *Pupilla marginata*. A. Gardiner (*Journ. Conch.*, xvi, 1920, p. 95) found *oblonga* especially with *Scirpus holoschænus* at Braunton, an association which I did not recognize.

3. *MARGARITANA MARGARITIFERA* OUT OF WATER.

During the past two years four attempts have been made to send this species alive through the post: in each case they were dead on arrival. *Anodonta cygnea* and *Unio pictorum* travel quite successfully, will survive out of water for several days, and live in localities which are apt to dry up. The rivers in which *margaritifera* lives do not go dry, and the species is evidently not adapted to withstand drought.

UNPUBLISHED PLATES OF THOMAS MARTYN, CONCHOLOGIST.

By TOM IREDALE.

Read 10th December, 1920.

THE beautiful series of paintings of shells published by Thomas Martyn under the title of *The Universal Conchologist* have been well discussed during the last twenty years, and it would not seem necessary to add any more literature, save with the record of some additional novelty. In this note I believe such novelty will be found, since I have seen no account of the unpublished paintings prepared under the direction of Thomas Martyn. Ignoring the recent additional notes, I only cite Dall's two papers in the *Proc. U.S. Nat. Mus.*, vol. xxix, pp. 415-32, 1905, and vol. xxxiii, pp. 185-92, 1907, where most of the details of interest are published. In his second essay Dall gave the contents of the Explanatory Tables belonging to a copy in the Australian Museum, Sydney, N.S.W., from data forwarded to him by Mr. Chas. Hedley, and commented upon the untrustworthiness of the information given by Chenu previously cited by him. For my own usage I compiled the equivalent data from another copy, and I was surprised to find that my items did not exactly coincide with those published by Dall. All the differences proved to occur in connexion with volume iv, where Martyn appears to have become tired and careless. Dall concluded that perhaps the discrepancies between the Sydney copy and the Chenu collation were due to the fact that the former was an early issue and the latter taken from a corrected copy. The Sydney volumes may have been early, because in the copy I collated I find better results, though still not in agreement with Chenu's account. I conclude it will be as well to give Dall's data from the Sydney copy and those culled from the other copy in parallel columns:—

Dall.

Plate 121	<i>Limax spicatus</i>	<i>Limax spicatus.</i>
,, 121	<i>fusca spicatus</i>	<i>fuscus spicatus.</i>
	<i>nigra spicatus</i>	<i>niger spicatus.</i>
,, 125	(<i>Voluta</i>) <i>cosmographicus</i>	() <i>cosmographica.</i>
,, 128	(<i>Voluta</i>) —	() <i>Aplustre.</i>
		<i>Ducis Navalis.</i>
,, 135	(<i>Cochlea</i>) <i>coccinea</i>	() <i>coccinea.</i>
	— <i>dentrachates</i>	() <i>denrachates.</i>
,, 137	— <i>cretata</i>	() <i>caetata.</i>
,, 138	— <i>palatam</i>	() <i>palatum.</i>
,, 143	— —	() <i>albida.</i>
,, 154	<i>Ostria echinata</i>	<i>Ostrea echinata.</i>
,, 156	<i>Tellina cinnamar</i>	<i>Tellina cinnamea.</i>

I have checked the above with the copy in the British Museum (Natural History) Library and find that that also differs. The items given above ex Dall are in agreement save in connexion with plate 135, first name, and plate 156, and 137 where the readings are as in the second column.

These insignificant alterations deserve more consideration than they apparently merit, because they suggest different impressions of the explanatory tables, which would otherwise be unsuspected. It is possible that different paintings may be also published, as the facts hereafter cited may necessitate a reconsideration of the known copies.

Some time ago Mr. Alex Reynell showed me a volume of Martyn's plates, amongst which I noticed a stranger, though to me a very familiar shell. He very generously allowed me to study the volume, and publish my results, which are embodied in this note. While working at it Mr. B. B. Woodward also lent me a volume in his possession for comparison and criticism. Later Mr. Reynell showed me another copy, from which I collected some interesting items, and then again he secured yet another copy of plates, which confirmed all the previous data. Before dealing with these I would comment upon a well-known peculiarity of Martyn's published work, viz., the inaccuracy of some of the localities cited. In the Portland Catalogue, about which I wrote in this Journal, I found many of these localities corrected, that is Martyn for his (*Bucc(inum)*) *calcar* gave New Zealand; in the Portland Catalogue, pp. 10-139, Terra del Fuego is cited, which is the proper locality for this shell. Again, Martyn recorded from the Friendly Isles his *Limax fibratus*; in the Portland Catalogue I find that p. 36, lot 707, *Limax fibratus* Martyn came from New Caledonia, which is right. Also Martyn's *Trochus Canaliculatus* and *Annulatus* were reported from New Zealand, whereas they are West American shells, and in the Portland Catalogue, on pp. 101 and 89, they are credited to the N.W. Coast, America.

Now, it is also well-known that there was a second edition of Martyn's plates, and this is not so rare as the first edition, but still not common, and mostly only 80 plates are secured (the first 80), whereas the whole edition consisted of 160 plates. Reynell's first copy includes 77 plates, with the title-page of the first edition, and the Introduction and Preface of 39 pages, apparently also of the first edition. The plates, however, while of the same subjects, differ in every case from the accepted published figures. They are on Martyn's paper and bear the plate numbers on the top right-hand corner in agreement with the published specimens. Curiously enough, however, the paintings are very often better ones, but not so bold, more beautiful in miniature and smaller in size. Some of the most charming have against them the initials "R. A.", which I conclude are those of the boy artist who painted them. However, even more interest attaches to the pencilled identifications to each

of these plates ; these gives the names and references to the Museum Calonnianum, and may be even in the handwriting of George Humphrey himself. On the plate lettered "Fig. 47" are two paintings of a shell which were not published by Martyn, and there is a note "Genus not determined by G. H."

I at first intended to give a résumé of the paintings with the pencilled notes, but upon consideration concluded that more confusion to future synonymy collators would ensue than benefit to present enthusiasts. Hence I will only cite a few of the interesting items without introducing nomenclatural puzzles. Such are : On the plate numbered Fig. 57 there appears two views, back and front, of the common Black Nerite of East Australia and the North Island of New Zealand, labelled, "Inky Nerit, Port Jackson, New S. Wales." These figures were not published by Martyn, and the name given on this plate was not correctly introduced into literature, so that the scientific name given by E. A. Smith in 1884, exactly one hundred years later, must still be maintained. On the plate lettered Fig. 58 two views of the common *Calyptrea (Sigapatella)* of New Zealand are given, above and below, and it is called the "Thick-coated Vault Limpet, New Zealand". This was not published by Martyn, and its present scientific name was not proposed until fifty years later, while Humphrey's generic names are not acceptable. Another item of interest is seen in connexion with the plate lettered Fig. 43, where the paintings of *Buccinum succinctum*, Martyn, are very different from those published, and while Martyn cites New Zealand as the locality, it is here given as the "Waggon Road Scoop, Port Jackson, New S. Wales". This shell lives in both localities, but is far more common in the latter. Much has been recently written regarding the name "*Patella tramoserica* Martyn", from the "North-West Coast of America", which has been used for a common Australian limpet. Its occurrence on the North-West Coast of America is denied, and it has now been rejected from the Australian fauna. In this place the pencilling reads: "Sattin Limpet S. Sea r.r.", which seems to confirm the justice of recent conclusions.

Some of the paintings are of species, as will be noted already, never published by Martyn, and students of the literature surrounding Martyn's work will remember Gray's note of five volumes, the fifth volume having so far escaped recovery. It is possible, therefore, that such a copy may exist, including all the rejected unpublished drawings made by Martyn's pupils. The second volume shown me by Mr. Reynell included 172 plates, the full 160 as published by Martyn and eight additional ones agreeing with eight in the copy above which were never published, and four paintings by other artists.

The last-mentioned copy secured by Mr. Reynell simply has the word "Shells" on the back, has no letterpress whatever, and includes

80 plates which agree in many cases with the ones just criticized, but are generally poorer paintings. They, however, are on Martyn's paper with the plate numbers in agreement. That it should cover 80 plates is suggestive, as they are not in order and are not all lettered. The suggestion is that the rejects were collected and sold in lots of 80 (maybe two forties), as in the regular published series. There are, however, no comments whatever written on this series, and the volume is only noteworthy in that it contains several of the unpublished plates, and the paintings are often very different from the published ones. All the paintings, however, are exquisite, and worthy of preservation as artistic objects, though no scientific or systematic value can be accredited to them.

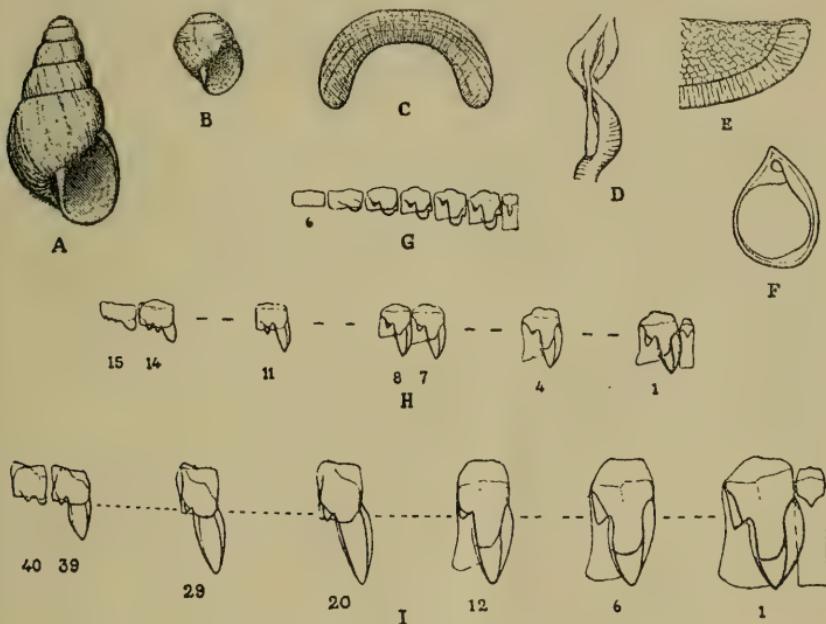
The first copy, however, with the pencilled notes, probably by George Humphrey, is of great sentimental value, and may yet prove useful in elucidating some unexpected problem.

KRAPFIELLA MIRABILIS, PRESTON, AND ITS AFFINITIES.

By HUGH WATSON, M.A.

Read 10th December, 1920.

IN 1911 Mr. Preston described a new shell from Mount Kenya, which seemed to him to be so singular that he named it *Krapfiella mirabilis*, establishing a new genus for its reception.¹ Through the kindness of Major M. Connolly and Mr. W. Falcon, I have lately received a specimen of this remarkable species, collected by Colin Harries in the Ndarugu River Valley, Kenya Colony, probably about 50 miles from Nairobi. The aperture of the shell was closed by a moderately thick epiphragm, and behind this I found some shrivelled remains of the animal, together with four embryos, indicating that the snail is viviparous.



KRAPFIELLA MIRABILIS, Preston.

FIG.

- A. Full-grown shell. $\times 1$.
- B. Embryonic shell. $\times 2$.
- C. Jaw. $\times 10$.
- D. Part of reproductive system. $\times 1.5$.
- E. Hinder end of foot. $\times 3$.
- F. Mantle-edge. $\times 1.5$.
- G. Teeth from near front end of embryonic radula. $\times 200$.
- H. Teeth from near hind end of embryonic radula. $\times 200$.
- I. Teeth from full-grown radula. $\times 200$.

¹ Ann. Mag. Nat. Hist., ser. VIII, vol. vii, p. 472, pl. xii, figs. 25A, 25B. Two additional and much larger species of *Krapfiella* were subsequently described by Preston in these *Proceedings* (vol. x, 1913, pp. 283-4).

The embryonic shell (Fig. *B*) consists of $2\frac{1}{2}$ whorls, and measures alt. 4·7 mm., breadth 4 mm. It is ovate in form, and very narrowly perforate, the columellar lip being reflected over the perforation, and showing an oblique but almost obsolete fold. The periphery is distinctly angled, and above this angle the shell is furnished with about a dozen very strong and regular spiral striæ. These striæ are well shown in Preston's photograph of the apex of the shell (Fig. 25*B*). Near the aperture the spiral striæ are crossed by other less regular striæ parallel to the outer lip.

The parent shell (Fig. *A*) agrees closely with Preston's description, only differing from the original specimens of the species in being very slightly more slender. The umbilicus is not quite so narrow as in the embryo, and there is no trace of a columellar fold. The peripheral angle disappears completely during the course of the last whorl. The yellowish periostracum is very faintly marked with numerous spiral lines, but the spiral striæ of the protoconch are entirely absent from the post-embryonic whorls, and the oblique riblets which take their place become less pronounced on the lower whorls. Under the microscope exceedingly fine striæ can be seen parallel to the lines of growth.

The foot (Fig. *E*) is broadly rounded at the hinder end, and has an undivided sole. Deep peripodial grooves cut off a broad foot-fringe, crossed by numerous transverse grooves. There is a rather poorly developed caudal mucous gland, opening by a vertical slit. A median longitudinal groove is present on the top of the hinder portion of the foot.

The mantle-edge (Fig. *F*) bears well-developed right and left body-lobes, the left being divided into two portions connected by a low ridge. The jaw (Fig. *C*) is about 2 mm. broad, strongly arched, of moderate thickness, and vertically striated. The radula of the full-grown specimen (Fig. *I*) measures about $5 \times 2\cdot2$ mm. when flattened out. The central tooth is very narrow, with a single, very small degenerate cusp. The lateral and marginal teeth are bicuspid, having large mesocones and small ectocones, the mesocones of the marginal teeth being particularly long in comparison with the size of the quadrate bases. The mesocones are furnished with lateral flanges, the inner flange being the broadest, especially on the first lateral tooth, where it overlaps the base of the central. The transverse rows of teeth are not quite straight, but trend slightly forwards on each side of the middle line. The radular formula is $(30 + 13 + 1 + 13 + 30) \times 83$:

The embryonic radula is specially interesting. The specimen examined has fifty-nine rows of teeth, and measures (when flattened out) about 1·4 mm. in length. In breadth it increases from 25 mm. at the front end to 6 mm. at the hinder end. Besides being smaller, the teeth near the hinder end of the radula (Fig. *H*) differ from those of the adult in being somewhat broader in

proportion to their length. The cusp of the central tooth is not quite so small; the mesocones of the other teeth are shorter, and two ectocones are present on some of the marginal teeth. The number of teeth in one of the posterior rows is $9 + 7 + 1 + 7 + 9$. Further forwards the number of teeth diminishes, until near the front of the radula a transverse row only contains $3 + 3 + 1 + 3 + 3$. The form of the teeth also gradually changes (Fig. G). They become still broader and shorter; the central tooth becomes relatively larger, with a prominent narrow median cusp and traces of a minute lateral cusp on each side of it; the mesocones of the other teeth become rounded, and their inner flanges become partly separated from them, so as to form distinct endocones. Thus, with the exception of the extreme outer marginals, which have no cusps, all the teeth at the front end of the embryonic radula are more or less tricuspid.

The other internal organs were unfortunately so shrivelled and decayed that it is not possible to describe them. All that could be made out of the reproductive organs is shown in Fig. D.

Affinities.—Although evidently belonging to the Achatinidæ, *Krapfiella mirabilis* differs considerably from most members of that family both in its radula and in its foot. There is, however, one genus of the Achatinidæ, namely *Pseudoglessula*, in which the radula and the foot bear a remarkably close resemblance to those of the present form. Moreover, the shell of *Krapfiella mirabilis* is not very unlike the type found in the species of *Pseudoglessula* belonging to the subgenus *Kempioconcha*, in which the columella is not truncate or folded, and a narrow umbilicus is usually present. The chief differences between *Krapfiella* and *Pseudoglessula* are to be found in the broad, rounded apex of the former genus, and especially in the apical structure; for in both *Kempioconcha* and *Pseudoglessula*, s.s., the protoconch bears strong vertical ribs, very unlike the regular spiral striæ of the present species. Nevertheless, there can be little doubt that *Krapfiella* is fairly closely related to *Pseudoglessula*.

These two genera together form a very aberrant group of the Stenogyrinæ, differing from the other known forms in their deep peripodial grooves and caudal mucous pore—in which they resemble the Ferussaciinæ and the families of the Aulacopoda—and also in their peculiar type of radula. Pilsbry has pointed out, however, that the radula in *Pseudoglessula* somewhat resembles that of a rapacious snail,¹ and the marginal teeth of these genera certainly bear a suggestive similarity not only to those of *Arion*, but also to the teeth of the Oleacinid genus *Varicella*. Probably, therefore, the peculiarity of the radula in *Krapfiella* and *Pseudoglessula* may

¹ Bull. Amer. Mus. Nat. Hist., vol. xl, 1919, p. 148.

be partly due to their common Stenogyroid ancestor having developed more or less carnivorous habits. This hypothesis is supported by a study of the embryonic radula of *Krapfiella mirabilis*; for, as we have seen, the lengthening of the teeth, and especially of the mesocones, has not taken place in the early rows of the embryonic radula, and only to a limited extent in the later rows. Further, we find that the endocones that occur so frequently in the Stenogyrinæ are present towards the front end of the radula, though later they become converted into the broad inner flanges of the mesocones. Thus, in its development the radula seems to recapitulate to some extent the characters of its probable progenitors, and to suggest that *Krapfiella* and *Pseudoglessula* have sprung from a more typical Stenogyroid ancestor.

NOTE ON SOME OF F. E. EDWARDS' SPECIFIC NAMES OF
EOCENE MOLLUSCA.

By A. WRIGLEY.

(Communicated by A. S. KENNARD, F.G.S.)

Read 10th December, 1920.

MANY students of such things are familiar with "Figures of the Characteristic British Tertiary Fossils (chiefly mollusca) stratigraphically arranged", compiled by J. W. Lowry, with the assistance of Mr. R. Etheridge and Mr. F. Edwards, and published by J. Tennant in 1866. The excellent figures given on the four folding sheets of this publication have often proved of great assistance to collectors who have been unable to obtain larger and more expensive works, but it is not generally known that several of Edwards' species, not elsewhere described, are here adequately figured.

This publication is not included in the bibliography appended to R. B. Newton's "Systematic list of the F. E. Edwards' collection", nor is it noted in the text of that work. Some of the specific names given in the list of Eocene and Oligocene Mollusca in the Geological Survey Memoir on the Isle of Wight (2nd ed., 1899) seem to have been derived from the source under consideration, for they are ascribed to Lowry.

At the end of Lowry's publication is a note: "It is believed that descriptions of the Eocene fossils, the specific names of which are within parentheses, have not been published. These names proposed by Mr. F. Edwards are therefore used provisionally only, and the shells under which generic names are also written within parentheses, it is believed would more properly be referred to such genera, but have not hitherto been published under those names."

An examination of the names appended to the figures shows that besides those in parentheses, there are several others of Edwards' naming which have not been elsewhere figured or described. The following is a list of these specific names, no attempt being made to revise the genera. The numbers are those of the plates, and the parentheses are given as originally printed:—

- Lucina inflata* [ii].
- ,, *spinulosa* [ii].
- Cytherea incurvata* [ii].
- Mactra fastigiata* [ii].
- Murex (hantoniensis)* [iii].
- Fusus (cymatodis)* [iv].
- ,, *Morrisii* [iv].
- Pyrula (angulata)* [iv].
- Cominella flexuosa* [iii].
- Cancellaria (pyrgota)* [iii].

- Niso (micromphalus)* [iii].
Cerithium (tritropis) [iv].
Scalaria Wetherellii [iv].
,, (*punctulata*) [iii].
Hydrobia anceps [iii].
Actæon Charlesworthii [iii].
Bulla (orbicula) [iii].
,, (*heterostoma*) [iii].

Neritina (planatula) (Edw. manuscript.) appears in R. B. Newton's " Systematic List " (p. 252) as first figured by Sandberger in 1873. This record is antedated by Lowry's figure of 1866.

Three manuscript species of other authors are also figured by Lowry :—

- Rissoinia Bartonensis* (Charlesworth MS.) [iii].
Odostomia pupa (Charlesworth MS.) [iii].
Triton (fasciatus) (Morris, 1854, MS.) [iv].

It will be seen that these figures of mollusca prepared under Edwards' direction and with names supplied by him constitute publication ; and that such names are entitled to priority up to the date of issue by Lowry in 1866.

QUELQUE RECTIFICATIONS DE NOMENCLATURE CONCERNANT
DES MOLLUSQUES DE LA FAUNE PALÉARCTIQUE.

Par M. P. PALLARY.

Read 12th November, 1920.

JE groupe ici un certain nombre de rectifications concernant des Mollusques terrestres de la région paléarctique. Je mentionne même deux corrections déjà faites parcequ'elles sont éparses dans d'autres recueils et ignorées, pour ainsi dire. La plupart de ces rectifications concernent des espèces du nord de l'Afrique : c'est encore une raison qui m'a fait les réunir dans le même article.

PATULA ANNAI, Paladilhe.

Dans une notice intitulée : "Kritische Fragmente," M. P. Hesse a fait observer, en 1915 (Nachr. der Deutsch Malak. Ges., p. 53) que d'après l'opinion du regretté J. Ponsonby qui a examiné le type de l'*Helix simplicula*, Morelet, cette espèce serait identique à *Helix annai*, Paladilhe.

P. Hesse ajoute que l'espèce de Morelet est un *Helicodonta* tandis que Westerlund en a fait un *Hyalinia* à cause de son péristome tranchant.

L'*H. simplicula* a été décrit en 1845 par Morelet dans : "Descrip. des Mollusques du Portugal," pp. 56, 57, et figuré pl. vi, fig. 2.

Le nom de Paladilhe date de 1875 in "Coq. terr. et fluv. rapp. du Maroc", par le Dr. Bleicher, Revue et Mag. de Zoologie, pp. 82-3.

Ce vocable d'*annai* déjà, d'ailleurs, été préemployé par Lewis et Semper (*vide* Pfeiffer, "Monogr. Helic," t. vii, pp. 324 et 527).

XEROPHILA AMANDA.

L'ingénieur G. Rolland a figuré dans son "Hydrologie du Sahara algérien," 1894, vol. iii, pl. xxviii, fig. 3, une Xérophile sous le nom d'*Helix amanda*, Rssmlr., qui est celui d'une espèce littorale des environs d'Alger.

Cette identification étant erronée, l'espèce désertique pourra s'appeler : *X. choisyi* du nom du chef d'une mission saharienne.

Le texte de l'ouvrage en question ne donne absolument aucune indication relative à cette intéressante forme.

XEROPHILA FINITIMA.

Dans sa notice sur les "Hélices recueillies dans le midi de l'Espagne et au Maroc" (Rev. et Mag. de Zool.), p. 621, Morelet, en 1854, au lieu de conserver à cette espèce le nom de *finitima* déjà donné par Féruccac (bien que sans description) a cru devoir substituer à ce nom déjà connu celui de *calpeana*!¹

Morelet est d'autant moins excusable d'avoir repris ce nom de

¹ *H. calpeana* = *H. finitima*, Fé., in Museum. Synonymie reproduite par Pfeiffer dans le 4e vol. de la *Monog. Helic.*, 1859, p. 188.

finitima qu'il le mentionne dès 1845 dans son ouvrage sur les "Mollusques du Portugal"; l'espèce, dit il, se trouve dans la collection de Féruccac comme provenant de Gibraltar (p. 24).¹

Mais ce qui est absolument déconcertant c'est que ce même auteur ait cru devoir reprendre en 1880 ce nom de *finitima* (in "Faune Maroc", p. 39) pour une espèce absolument différente du cap Cantin!

En résumé il faut restituer le nom de *H. finitima* à l'espèce décrite en 1854 par Morelet comme *H. calpeana*.

XEROPHILA PETRICOLA.

Ainsi que nous venons de l'indiquer le nom de *finitima* avait été déjà employé en 1837 par Féruccac et indiqué comme synonyme de *H. calpeana* par Morelet en 1854. C'est donc par suite d'un oubli de la part de ce malacologiste que ce même nom a été de nouveau employé par lui en 1880 pour une espèce d'un autre groupe.

Bourguignat, qui, le premier, a signalé cette confusion dans son "Prodrome de la Malac. de la Tunisie", 1883, p. 90, a proposé le nom de *cantinica* (de la localité originale : cap Cantin) qui a l'inconvénient d'avoir le même radical que celui de *cantiana*, Montagu.

Westerlund, 1889, in "Fauna paläaret", ii, p. 318, a publié une correction manuscrite faite par Morelet sous le nom de *petricola*. On a donc, en définitive, la synonymie suivante :—

- 1880. *H. finitima*, Morelet (non Féruccac) : "Faune Maroc," p. 39.
- 1883. *H. cantinica*, Bgt. : "Prod. malac. Tunisie," p. 90.
- 1889. *H. petricola*, Morelet in sched (Kobelt) in West., "Fauna paläaret.", ii, p. 318.

HELIX TÆNIATA.

Westerlund a décrit, en 1888 (Bull. de la Soc. malac. France, pp. 58-9) sous le nom de *tæniata* une Hélice du groupe Xérophile dont j'ai donné une figuration dans le "Journal de Conchyliologie", 1898, pl. vi, fig. 1.

Mais il existait déjà un *Helix (Heterostoma) tæniata*, Webb et Berthelot, 1833, "Synopsis," etc., p. 324, espèce des Canaries.

De plus d'autres espèces, appartenant à des groupes divers, portaient aussi ce nom de *tæniata* qui leur avait été donné par Reeve, Montrouzier et Megerle von Mühlfeld.

Nous rebaptiserons l'espèce de Westerlund : *Xerophila verminiana*.

HELIX MICROMPHALUS.

Lowe a publié, en 1852 (Ann. and Mag. Nat. Hist., ix, p. 118), un *Helix micromphalus*, de Madère, incorporé actuellement dans la section *Irus* dont il est également l'auteur.

¹ Ce nom de *finitima* se trouve dans le "Catal. de la Coll. de Féruccac", 1837, p. 5, avec l'indication. Europe Tan. (sans doute Tanger) et le nombre ; 10 exemplaires.

En 1870 Letourneux ("Excurs. malac. Kabylie": Annales de Malacologie, i, p. 304) a décrit un *Helix micromphalus* dans les. Cette Hélice est considérée comme un *Fruticicola*.

Nous dédions l'espèce de la Kabylie au savant et regretté Maupas avec qui nous étions lié par une solide amitié. En son souvenir cette Hélicidée s'appellera *Helix maupasi*.

HELIX TERVERI.

Il existe dans la nomenclature plusieurs *Helix terveri* ou *terveriana*. Mais trois seulement intéressent la faune paléarctique.

Le plus ancien et le plus connu est le *Xerophila terveri* de Michaud, 1831 ("Compl. Hist. Moll. France," p. 26, pl. xiv, figs. 20-1).

Le deuxième est le *Bulimus terveriana*, W.-B., 1833 ("Synopsis Moll. terr. Ins. Canarias": Ann. Sci. Nat., xxviii, p.), espèce du groupe *Cochlicella*.

Il faudra donc substituer à ce nom celui de *Cochlicella scalaroides*, Reeve ("Conch. Icon.", 1850, No. 590, pl. lxxx), qui est strictement synonyme.

Enfin Rossmässler a figuré dans l' "Iconographie", 1856, figs. 816-19, un *Helix terveri* qui n'est autre que le *X. adolfi*, Pfeiffer, 1854.

XEROPHILA MOGADORENSIS.

Dès 1860, Lowe (Journ. Linn. Soc. (Zool.), v, p. 197) a décrit une variété *mogadorensis* de l'*Helix caperata*.

La description que donne ce naturaliste au bas de la page 197 ne laisse aucun doute sur l'identité de cette variété *mogadorensis* avec l'*Helix jaylei* décrit en 1875 par Paladilhe. Si le doute pouvait encore subsister, la comparaison qu'il fait de cette variété avec la figure 830a de Rossamässler la léverait immédiatement. Il faut donc reprendre le nom de Lowe et modifier celui de *mogadorensis* attribué par Bourguignat à un *Xeroleuca*.

On aura donc :—

- 1860. *Xerophila mogadorensis*, Lowe.
- 1875. *X. jaylei*, Paladilhe.
- 1875. *X. rusticula*, Paladilhe.
- 1884. *X. alberti*, Kobelt.

Quand à l'espèce que Bourguignat a publiée en 1860 sous le nom d'*Helix mogadorensis* et qui appartient au groupe *Xeroleuca*, nous lui appliquons le nom de *Souïrensis* qui est la transcription indigène du nom de Mogador (Souïra).

XEROPHILA DISSIMILIS.

Tout récemment j'ai publié (Bull. Soc. Hist. nat. Afriq. nord., 1918, p. 141) un *X. dissimilis* du Maroc oriental.

Bien que je susse pertinemment que ce nom de *dissimilis* avait été appliqué antérieurement à des Hélicéens de groupes considérés anjourdhui comme génériques, j'avais crû pouvoir appliquer ce

qualificatif à une Xérophile puisque la confusion ne me semblait pas possible.

Mais M. Dautzenberg m'a fait amicalement observer qu'il y avait un inconvenient sérieux à se servir de noms déjà employés pour désigner d'autres Hélicéens car, si par suite de modifications de la Nomenclature une espèce venait à passer d'un genre dans un autre, le même nom serait porté par deux espèces.

Me rendant à cette suggestion j'ai nommé *X. lecointrei* (Journ. de Conchyl., 1919, p. 63), mon *X. dissimilis*.

XEROPHILA OMPHALODES.

Pour la même raison j'ai nommé *X. dzirana* (Journ. de Conchyl., 1919, p. 64) la Xérophile dont j'avais donné la diagnose (Bull. Soc. Hist. nat. Afriq. du nord., 1918, p. 138) sous le nom de *X. omphalodes*.

XEROPHILA AGENORA.

Dans mon "Catal. de la faune Malac. de l'Egypte", 1909, p. 35, j'ai nommé *X. gharibounensis* une Xérophile appelée *H. ptychodia* par Von Martens, mais très distincte de l'espèce publiée sous ce nom par Bourguignat.

Or ce *X. gharibounensis* est identique au *X. agenora*, West ("Fauna Paläarct.", ii, p. 353) comme j'ai pu m'en assurer en comparant le type de cette dernière qui me fût aimablement communiqué par son possesseur feu John Ponsonby.

Les figures des "Conchol. Mitth.", 1889, pl. xxxi, fig. 11 à 13, sont rigoureusement semblables au type du *X. agenora*.

COCHLICELLA.

La plupart des auteurs attribuent cette coupe à Risso alors qu'elle est mentionnée dès 1819 dans le "Prodrome" de Féruccac, p. 51. On la retrouve dans les : "Tableaux syst. des anim. moll.", 1821, p. 52 et, en 1837, dans le "Catalogue de la coll. Féruccac", p. 9.

Risso a adopté cette section et c'est pourquoi on la lui attribué si généralement.

MM. Fagot et Caziot ("Moll. de Corse", 1903, p. 211) donnent la préférence à *Elisma*, Leach, 1820, teste Turton 1831.

Mais c'est à tort que ces malacologistes affirment que le genre de Féruccac comprend des espèces disparates parmi lesquelles il est impossible de choisir un type.

Pour montrer combien l'assertion de MM. Fagot et Caziot est erronée voici la liste des espèces classées dans son onzième sous genre par Féruccac :—

Helix conoidea.

H. trochoïdes.

H. ventrosus = ventricosus, Drpd

H. acuta.

H. barbara.

H. oryza.

- H. clavulus.*
H. calcarea.
H. decollata.
H. septenaria.

Or la tradition exigeant que l'on prenne pour type d'une coupe la première espèce citée on peut se convaincre que le genre *Cochlicella* est bien valide puisque les cinq premières espèces au moins constituent un groupe très homogène.

Il faut donc restituer cette coupe à Féruccac et lui donner la priorité sur le genre *Elisma*.

ARCHELIX JOURDANIANA.

Ce nom de *jourdaniana* a été attribué par Bourguignat à une Hélice de la région de Tlemcen ("Moll. nouv. litig.", fasc. viii, 1867, pp. 75-7, pl. xxxviii, figs. 1 à 4).

Mais, comme je l'ai fait observer en 1914 (Nachr. Deutsch. Malak. Ges., p. 20) il existait déjà un *Helix jourdani*, Michaud (Journ. de Conchyl., 1862, pl. iii, figs. 12-13) espèce fossile du Miocène.

J'ai donc donné à l'espèce actuelle de l'Oranie le nom d'*A. agadirensis*, dérivé de l'ancien nom arabe de Tlemcen.

TACHEA COQUANDI.

Dans l' "Iconographie", 1920 (tom. xxiii, p. 241), M. P. Hesse a exhumé le nom de *litturata*, Pfeiffer, 1851, pour remplacer celui, plus connu, de *coquandi*, Morelet, 1854.

Cette rectification est d'autant plus admissible qu'il existe un *Helix coquandiana* fossile décrit en 1842 par Mathéron ("Catal. corps organ. fossiles Bouches du Rhône", pl. xxxiii, figs. 5-6). Terre à gypse près d'Aix. Eocène supérieur.

Par contre, c'est par erreur que M. Hesse identifie l'*H. dillwyniana* de Pfeiffer à l'*Eremina duroi* de Hidalgo (p. 256). L'espèce de Pfeiffer est plus probablement un *Chloritis*.

BULIMINUS CALLOMPHALUS.

En 1876 Bourguignat a publié ("Species novissimae", No. 23) un *Bulimus euryomphalus*, une des espèces les plus remarquables du nord de l'Afrique.

Mais, en 1891 ("Œuvres scientifiques", p. 67), cet auteur (sous le couvert du Dr. Servain) a indiqué, comme meilleur, le nom de *callomphalus*, parce qu'il existe un *Bul. euryomphalus*, Jonas, 1844, espèce du Vénézuela.

J'ajoute que le *Bul. callomphalus* est le type de la section *Omphaloconus*, West.

FERUSSACIA ATLASICA.

J'ai décrit sous ce nom une Féruccacie du grand Atlas (Bull. Muséum hist. nat., 1915, p. 27).

Or ce même nom se trouve dans le "Prodrome Malac. terr.

Tunisie ", 1885, de Letourneux et Bourguignat (p. 147). Toutefois ce n'est qu'un nom nû.

Mais il ne peut s'agir de la même espèce, un renvoi, au bas de la page, informant le lecteur que cette Féruccacie est une espèce du petit Atlas de Blida.

Je nomme donc à nouveau la forme marocaine : *Ferussacia derenica*.

Adrar n'Deren est le nom berbère du grand Atlas.

J'ai donné une figuration de mon espèce dans le Journ. de Conchyl., 1920, pl. ii, figs. 12 à 14.

SEMILIMAX.

Plusieurs auteurs, entre autres le Dr. P. Fischer, Westerlund, attribuent le genre *Semilimax* à Stabile 1859 (Rev. et Mag. de Zoologie).

Or ce genre a été institué en 1802 par Féruccac, père, et est mentionné dans les "Tableaux systém", du fils, 1821, p. 21, en synonymie de son genre *Helicolimax*.

Hermannsen en fait également mention en le considérant comme synonyme de *Vitrina*.

Il faudra donc restituer le genre *Semilimax* à Féruccac père.

PLANORBIS BOISSYI.

Ce nom a été donné à deux espèces : l'une, du bassin de Paris, par Deshayes ("Coq. foss. env. Paris", 1837, pl. xlvi, figs. 20-1).

L'autre, par Potiez et Michaud ("Galerie Moll. Douai, 1838-44, i, p. 208, pl. xxi, figs. 4-6) à une espèce actuelle de l'Egypte.

Mais feu Ancey (Journ. de Conchyl., 1903, No. 3, p. 321) a émis l'avis que le *Pl. subsalinorum*, Innés, est la même espèce que le *Pl. Boissyi*, Pot. et Mich. C'est donc ce dernier nom qu'il conviendra d'adopter pour l'espèce actuelle de l'Egypte. (Voir mon "Cat. de la faune malac. Egypte", 1909, p. 55).

PYTHIA.

Les *Proceedings* d'Octobre, 1919, pp. 136-9, contiennent une intéressante étude de MM. Kennard et Woodward sur les noms génériques des Ellobiidæ britanniques où ils concluent à l'adoption des genres *Phytia*, Gray, pour le groupe *Myosotis* et *Leuconia*, Gray, pour le groupe *bidentata*.

Or, dans mon "Catal. des Moll. du litt. méditer. de l'Egypte", 1912 (Addit. et correct., p. 187), j'ai écrit ceci :

" Le genre *Pythia*, Bolten, a pour type le *P. scarabeus* qui est une coquille exotique tout à fait différente.

" C'est le genre *Phytia*, Gray, 1821, qui a pour type : *Auricula myosotis*.

" Mais ce nom de *Phytia* n'est qu'une faute de copie pour *Pythia* (voir Hermannsen, ii, p. 383). Toutefois ce nom ayant été pré-employé par Bolten en 1798 et Schumacher en 1817 ne peut être adopté pour ce genre.

“ D'autre part, quoique le nom d'*Alexia* de Leach soit de 1818, ce nom est resté manuscrit et n'a été publié qu'en 1847 par Gray. Or, il existait déjà un genre *Alexia*, Steph., 1835, pour des Coléoptères.

“ Enfin le nom de *Kochia*, Pallary, 1900, dont le type est *Alexia denticulata*, Montagu, a été également préemployé en 1891 par Frech.

“ Il ne reste donc plus pour ce genre que le nom de *Myosotella* Monterosato, 1906, institué pour les *A. Payreudeaui*, *A. myosotis*, etc.”

J'ajoute que le genre *Auricella* (Brard), in Jurine 1817, qui pourrait être adopté pour le groupe *Pythia* est primé par *Auricella*, Hartmann, 1821 = *Carychium*, Müller.

Jaminia a été également plusieurs fois préemployé avant Brown.

Conovulus est de Lamarck et date de 1812 ; mais il ne s'applique pas aux espèces de ce groupe car il y comprend les *C. bulimoides* et *C. coniformis* qui en sont très distinctes.

Enfin dans son “ Hist. Anim. s. Vert.” (vi, pt. ii, 1822, pp. 136, 137). Lamarck écrit : “ J'avais d'abord pensé que, parmi les coquilles à columelle plissée et dont l'ouverture n'est point échancrée à sa base, celles qui ont le bord droit, simple et tranchant étaient réellement fluviatiles et j'en avais fait un genre particulier sous le nom de *Conovule* (*Conovulus*). Mais ayant appris, d'après des observations qui m'ont été communiquées par M. Valenciennes, que mes *conovules* étaient des coquilles terrestres ; je supprime maintenant ce genre, et en réunis les espèces à celles de mes anciennes *Auricules*.”

Il faut donc se résigner, en définitive, à adopter le nom récent de *Myosotella* pour ce groupe.

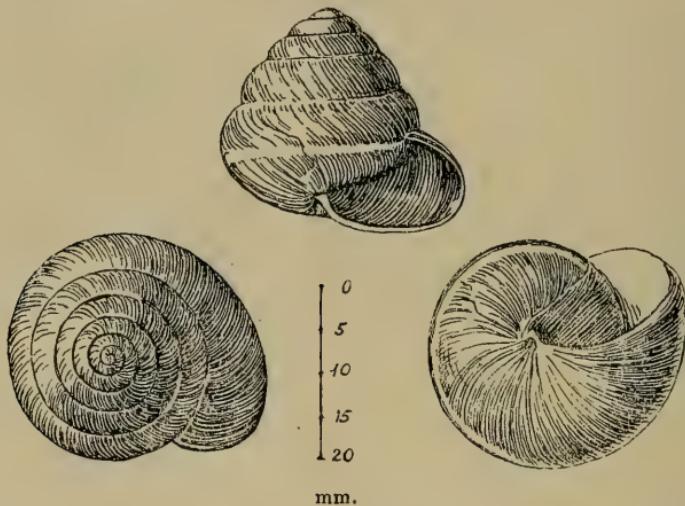
ON NEW SPECIES OF *HEMIPLECTA* AND *XESTA* FROM THE
XULLA (= *SULLA* OR *SULA*) ISLANDS, WITH NOTES ON
OTHER SPECIES FROM THE SAME LOCALITY.

By HUGH C. FULTON.

Read 14th January, 1921.

HEMIPLECTA AMBITIOSA, n.sp.

Shell conoid, solid, of a dark brown colour, with a narrow yellow spiral band situated just below the periphery of the last whorl; whorls $6\frac{1}{2}$, slowly increasing, the suture of the last two sharply defined by a thread-like line; first three almost smooth, lower whorls finely rugose and somewhat malleated; aperture ovate, interior whitish; peristome simple, broadening suddenly at columellar insertion and almost covering the very narrow umbilicus. Diam. maj. 29, alt. 28 mm.



Habitat.—Manguli, Xulla Ids. (W. F. C. Frost).

Type in British Museum.

This somewhat remarkable new species has a striking superficial resemblance in form and colouration to the Ceylon shell *Euplecta gardneri*, but lacks the characteristic sculpture of *Euplecta*. It is probably the shell referred to by Mr. M. M. Schepmann in his paper “On a collection of land and freshwater mollusks from Taliabu (Xulla Ids)” (Notes from the Leiden Museum, vol. xxviii, p. 120, July, 1906) with doubt as *Xesta trochus*, Müller.

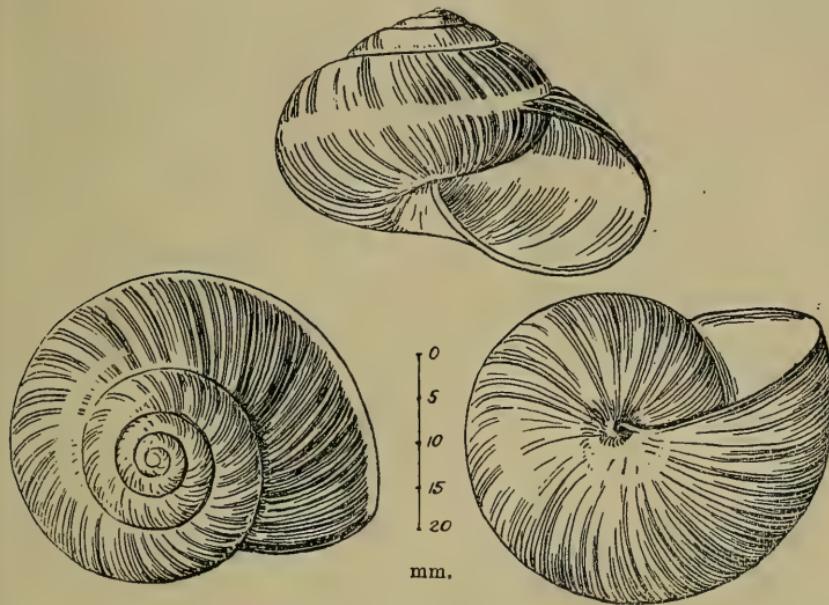
XESTA RUFOSTRIGATA, n.sp.

Shell depressed globose, very narrowly umbilicated, rather thin, surface somewhat dull, almost smooth, the lines of growth only visible by aid of the lens, nuclear whorls flesh coloured, the remainder of a cream ground covered with oblique, narrow reddish-brown

stripes, which are interrupted at the middle of last whorl by a yellowish-cream spiral band about 3 mm. wide, which is continued in a narrower band on upper whorls; whorls $5\frac{1}{2}$, convex, slightly depressed at the suture; aperture subovate, white, the outer markings showing faintly through; peristome slightly thickened, inner edge margined with brown colour. Diam. maj. 44, alt. 29 mm.

Habitat.—Manguli, Xulla Ids. (W. F. C. Frost.)

Type in British Museum.



Similar in form to the more globose forms of *Xesta citrina*, but sharply distinguished from that group by its oblique colour markings.

From the same locality Mr. Frost collected a large number of beautiful varieties of what I term *Xesta citrina*; they are probably identical with those Mr. Schepmann refers to *Xesta halmaherica*, Kobelt, which in the opinion of some conchologists is but a variety of *X. citrina*, a view shared by the writer; in any case our specimens do not quite correspond to Kobelt's description.

The following species were also collected by Mr. Frost at Manguli Id. Those marked with an * are in Mr. Schepmann's paper as having been found also on Taliabu Id.

* *Hemiplecta xullaiensis*, Schepmann (scarcely distinguishable from *H. fruhstorferi*, Marts., from Lombok Id.).

* *Trochomorpha nouhuysi*, Schepmann.

* *Obba marginata*, Müller.

Chloritis gruneri, Pf.

„ *unguiculina*, Marts., var.

- Planispira (Cristigibba) margaritis*, Pf.
Crystallopsis extensa, Müller.
* *Cyclotus guttatus*, Pf.
Scarabus ovatus, Pf.
Melania acutissima, Busch.
Neritina bicolor, Recluz.
N. dubia, Chem.
* *N. pulligera*, Linné.
* *N. subpunctata*, Recluz, var.
* *N. subsulcata*, Sow.
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PRESIDENTIAL ADDRESS.

By G. K. GUDE, F.Z.S.

*Delivered 11th February, 1921.*CHANGES IN THE CLASSIFICATION OF HELICES DURING
A QUARTER OF A CENTURY.

WHEN Dr. H. A. Pilsbry published his "Guide to the Study of Helices"¹ he broke new ground in several directions, and with his masterly grasp of anatomical and systematic details revolutionized the system of classification which until then had obtained. Numerous species, subgenera, and sections placed in *Helix* by various authors were transferred to other groups, and several new genera and subgenera created by him for the reception of many other forms. The genus *Helix* was reduced to some 300 species, while the other genera totalled over 3,700 species. The number of species of all Helicid genera now known exceeds six thousand. Several previous attempts had been made, notably by Albers, von Martens, Pfeiffer, and Clessin, and, for the Palæarctic forms, by Westerlund. The absence of anatomical data in many cases operated, however, against a rational grouping of the many genera and subgenera proposed by various authors.

That the whole of this new classification should be accepted without dissent by all students of Mollusca was not to be expected, since in several cases anatomical data were still wanting, and many genera and species were only tentatively allotted a place in the system. Dr. Pilsbry himself has since made a number of corrections in the light of subsequent anatomical investigations, while many other authors have made contributions of a similar nature. Several genera have been removed to other families, many others, again, have been incorporated, among these two large ones — *Strophocheilus* and *Amphidromus*—and a great number of new genera and subgenera have been created. I now propose to enumerate *seriatim* all these additions to our knowledge of this popular group of mollusca.

Lieut.-Col. Godwin-Austen in 1898² established *Philalanka* as a subgenus of *Entodonta*, but in 1907³ he placed it as a subgenus under *Thysanota*, Alb., at the same time proposing the subfamily *Thysanotinæ* of the family Entodontidæ. *Thysanota* had been classed as a section of *Eulota* by Pilsbry. The genus numbers twenty-one species.

In 1914⁴ I established the genus *Glyptaulax* for the reception of *Helix artificiosa*, Bens., placed in *Punctum* by Tyron, and under

¹ Man. Conch., ser. II, vol. ix, Nov., 1983–Feb., 1895.² Proc. Malac. Soc., iii, p. 11.³ Land and Freshw. Moll. India, ii, p. 190.⁴ Fauna Brit. India Moll., ii, p. 14.

Nanina by Nevill. It precedes *Thysanota*. Godwin-Austen also placed the genus *Sykesia*¹ (*Ruthvenia*²)—proposed by me in 1897³ under the preoccupied name of *Austenia*, as a section of *Plectopylis*—in the subfamily *Thysanotinæ*.

An addition to the family of Entodontidæ was made by Pilsbry by the creation of the genus *Radiodiscus*,⁴ containing five species of *Pyramidula*-like snails from Patagonia, previously ranged under *Stephanoda*, Alb.

The genus *Sphyradium*, Charp., originally proposed as a subgenus of *Pupa*, was referred to Entodontidæ near *Punctum* by Sterki,⁵ but Pilsbry transferred it back to Pupillidæ.⁶

Pterodiscus, Pils., a section of *Entodonta* comprising four small Pacific Island shells, was removed by Pilsbry to Achatinellidæ.⁷

In an exhaustive anatomical paper Mr. H. Watson proves⁸ that *Pyramidula rupestris*, Drap., belongs to the Pupillidæ. It does not, however, follow that all the numerous species that have been comprised under *Pyramidula* should share the same fate. In the same paper Mr. Watson refers *Pyramidula balmei*, P. & M., also to Pupillidæ. With this species for type, a new subgenus—*Pleurodiscus*—was proposed in 1919 by Herr W. Wenz.⁹

Pupisoma, Stol., doubtfully placed as a subgenus of *Pyramidula* in his "Guide", has also been transferred by Pilsbry to Pupillidæ.¹⁰

Wollaston proposed a section *Julus* for his *Helix garrachicænsis*, which was placed by Pilsbry as a section under *Pyramidula*. He drew attention to the fact that *Julus* was preoccupied, but did not give a new name. I substituted the name *Keræa*.¹¹

Ashmunella was created by Cockerell & Pilsbry¹² for some North American Helices previously ranged in *Polygyra*. It now numbers twenty species.

Helix reyrei, Souv., was placed in the genus *Polygyratia* by Pilsbry, but Kobelt in 1905,¹³ referred it to the family of Streptaxidæ, genus *Systrophia*, section *Entodina*, Anc. Von Ihering in 1912¹⁴ removed another member of the group, *P. janeirensis*, Pfr., to the same section, and suggested that *P. cheilostropha*, Orb., and others might have to

¹ Science Gossip, n.s., iii, p. 332.

² Proc. Malac. Soc., ix, 1911, p. 271.

³ Science Gossip, n.s., tom. cit., p. 300.

⁴ Proc. Acad. Nat. Sci. Philad., lviii, 1906, p. 154.

⁵ Nautilus, x, 1896, p. 75.

⁶ Ib., xxvi, 1912, p. 60.

⁷ Proc. Acad. Nat. Sci. Philad., lvii, 1905, p. 572; Man. Conch., ser. II, vol. xxi, 1911, pp. 118, 120; vol. xxiii, 1914, p. 16.

⁸ Proc. Malac. Soc., xiv, 1920, p. 6, et seqq.

⁹ Nähr. Bl. D. Malak. Ges., 1919, p. 78.

¹⁰ Man. Conch., ser. II, vol. xxvi, 1921, p. 19.

¹¹ Proc. Malac. Soc., ix, 1911, p. 271.

¹² Nautilus, xii, 1899, p. 107; Proc. Acad. Nat. Sci. Philad., 1899, p. 188.

¹³ Conch. Cab. Agnatha, ii, 1905, p. 86.

¹⁴ Journ. Acad. Nat. Sci. Philad., ser. II, vol. xv, 1912, p. 488.

follow suit. In the same article Von Ihering established the family Pleurodontidae for the reception of *Solaropsis*, Beck, *Chlorites*, Beck, and *Pleurodonta*, Fischer, the first included by Pilsbry in Protogona, the last two in Epiphallologona (Camæninæ).

Moellendorffia, Anc., included under *Helicodonta* as a subgenus by Pilsbry, was subsequently raised to generic rank by him,¹ with two subgenera added: *Moellendorffella*, Pils., and *Trihelix*, Anc. These with *Traumatophora*, Anc., and *Stegodera*, Mart.—formerly regarded by him as subgenera of *Plectopylis*—were now considered to have more affinity with *Chloritis*.

Corasia bourdillonii, Theob.—placed in *Nanina* by Nevill, in *Cochlostyla* by Pilsbry—has been made the type of a new genus, *Apateates*,² by me, coming before *Ganesella*.

The genus *Chloritis* has received many additions during this period, and it became necessary still further to subdivide it. In 1906 I proposed a new section, *Eustomopsis*,³ and included the genus *Albersia*, H. Ad., as another section at the end of the genus. My list of species at the time reached the total of 204, to which eleven more were added in 1907.⁴ Ehrmann in 1911⁵ proposed the genus *Parachloritis*, taking as type *Eulota telitecta*, Mlldff., with a new species added, *P. sericata*. Godwin-Austen created another genus, *Burmochloritis*, in 1920,⁶ for the reception of a new species, *B. kentungensis*, which he had dissected. This will probably class as a subgenus.

The genus *Strophocheilus*, Spix., previously included in *Bulimus*, was shown to belong to Acavidae by Pilsbry.⁷ It comprises the subgenera *Borus*, Alb., and *Dryptus*, Alb., totalling some forty-six species. The genus *Gonyostomus* [melior *Goniostomus*], Beck, with five species, follows likewise.

Plectopylis and *Corilla*, located with some doubt between Acavinæ and Sagdinæ by Pilsbry, I have placed in a subfamily, Corillinæ,⁸ next to Acavinæ.

Enteroplax, proposed by me as a section of *Plectopylis* in 1899⁹ for three small Philippine species, has been merged into the genus *Strobilos* by Pilsbry,¹⁰ who substituted the latter name¹¹ for *Strobila*, Morse, 1864 (preoccupied), when he stated it was of doubtful position, but subsequently¹² referred it to Pupidæ (= Pupillidæ),

¹ *Nautilus*, xix, 1905, p. 63.

² *Fauna Brit. India Moll.*, ii, 1914, p. 193.

³ *Proc. Malac. Soc.*, vii, p. 112.

⁴ *Tom. cit.*, p. 228.

⁵ *Sitz-Ber. Naturf. Ges. Leipzig.*, xxxviii, pp. 45, 53.

⁶ *Rec. Ind. Mus.*, xix, p. 9.

⁷ *Man. Conch.*, ser. II, vol. xiv, 1902, *Introd.*, p. iv.

⁸ *Fauna Brit. India Moll.*, ii, 1914, p. 53.

⁹ *Science Gossip*, n.s., vi, 1899, p. 149.

¹⁰ *Nautilus*, xxii, 1908, p. 79.

¹¹ *Proc. Acad. Nat. Sci. Philad.*, 1892, p. 403.

¹² *Nautilus*, xi, 1898, p. 117.

enumerating four species. Ten years later he found the species to occur in Korea and Japan, when he also included one of Heude's species and the three Philippine species forementioned. Wenz¹ retained *Enteroplax* as a section, and gave a list with full bibliography of eleven recent and sixteen fossil species.

Amphidromus, established by Albers² as a section of *Bulimus*, has been incorporated with *Helices* by Pilsbry,³ who from anatomical data supplied by Semper, Wiegmann, and Jacobi came to the conclusion that these South-Eastern Asiatic Bulimoid shells belonged to his group, *Epiphallogona* (*Camæninæ*), being intimately related to *Ganesella* and *Papuina*. He enumerated some 163 species *Pseudopartula*, Pfr., with three species, was added as a subgenus,⁴ but was subsequently⁵ transferred by him to *Zonitidae*.

Draparnaudia, Montr., consisting of five species, ranged under *Helicidae* by Clessin, but not included by Pilsbry in his "Guide", was subsequently placed next to *Amphidromus* by him.⁶

Dendrotrochus was established as a section of *Papuina* by Pilsbry. It contains twelve species of Pacific Island mollusca. Hedley in 1895⁷ considered it to be allied to *Trochomorpha*, while Leschke⁸ placed it at the end of the Naninidæ, before *Trochomorpha*.

Ganesella trochomorpha, Mlldff., was classed as a member of the operculate genus *Omphalotropis* by Möllendorff⁹ in 1895.

Buliminopsis, proposed by Heude as a genus for the reception of two of his species, was placed as subgenus under *Ganesella* by Pilsbry, who included six others. Some of the species had formerly been referred by Möllendorff to *Satsuma*, others to *Bulimus* by Ancey. Möllendorff subsequently described many other species, ultimately bringing up the total to 30, and raising the group to generic rank¹⁰ with five sections. F. Wiegmann examined some of the species anatomically¹¹ and found the genus essentially to be of the *Eulota* type. Gredler added another section, *Secusana*.¹²

Trochomorphoides, introduced by Nevill for *Helix acris*, Bens., was reduced to a synonym of *Ganesella*, and again made a subgenus of the latter by Bavay and Dautzenberg.¹³

Coniglobus was established by Pilsbry¹⁴ as a subgenus of *Eulota*

¹ Nachr.-Bl. D. Malak. Ges., 1916, p. 178.

² Die Heliceen, 1850, p. 138.

³ Man. Conch., ser. II, vol. xiii, 1900, p. 127.

⁴ Man. Conch., ser. II, vol. xiv, 1902, p. 1; Introd., p. iii.

⁵ Nautilus, xx, 1906, p. 47.

⁶ Man. Conch., ser. II, vol. xiv, 1902, p. 12; Introd., p. iii.

⁷ Rec. Austr. Mus., ii, p. 90.

⁸ Jahrb. Wiss. Anst. Hamb., xxix, 1912, p. 95.

⁹ Nachr.-Bl. D. Malak. Ges., 1895, p. 148.

¹⁰ Ann. Mus. Zool. St. Petersb., iv, 1899, p. 133.

¹¹ Ib., v, 1900, p. 145.

¹² Gymn. Progr. Bozen., 1900, p. 3.

¹³ Journ. de Conchyl., lvii, 1909, p. 199.

¹⁴ Proc. Acad. Nat. Sci. Philad., 1905, p. 735.

for three species from Formosa and Japan with *Ganesella sphæroconus*, Pfr., as type.

Two more Bulimoid forms—*B. siamensis*, Redf., and *B. rhombostomus*, Pfr.—were added as a subgenus to *Satsuma* by Ancey,¹ i.e. *Giardia*.

Psadara, Miller, given by Pilsbry as a synonym for *Solaropsis*, is stated by Von Ihering² to differ in its anatomy, and he quotes twenty-one species under it.

The genus *Dorcasia*, Gray, was split up into two genera by Pilsbry³: first, *Dorcasia*, with *H. alexandri*, Gray, as type, and four other species; second, *Trigonephrus*, with *H. globulus*, Mull., as type, and six other species. Melville and Ponsonby added to *Dorcasia* a subgenus, *Tulbaghina*,⁴ with two species, while Connolly⁵ raised the latter to specific rank.

Oxychona, Morch, with twelve species, was classified by Pilsbry in *Belogona Euadenia* (*Helicinæ*), next to *Polymita*; *Leptarionta*, Crosse & Fischer, was regarded by him as a synonym. Subsequently he split up the group,⁶ removing *Oxychona*, type *H. bifasciata*, Burr, and three other Brazilian species to *Bulimulidæ*, and restoring *Leptarionta* to independent status, with the remaining eight Mexican and Central American species, to remain in *Belogona Euadenia* (*Helicinæ*).

A new genus of slug-like, dart-bearing *Helicidæ* was announced by Pilsbry in 1900,⁷ under the name of *Metostracon*, with one species, *M. mima*, which he proposed to place near *Epiphramophora* and *Cepolis*, where at the same time he classed the genus *Xanthonyx*, created by Crosse & Fischer⁸ for the reception of *Simpulopsis cordovanus*, Pfr., and *S. sallaeanus*, Pfr.

Oreohelix was proposed in a short notice by Pilsbry⁹ for the group of *Helix strigosa*, Gld., previously classed in the subgenus *Patula* of *Pyramidula*. The following year¹⁰ he properly defined the genus and gave anatomical details, placing it near *Epiphramophora*, and creating a new subgenus—*Radiozentrum*. Eleven years after¹¹ he gave still further anatomical data with a list of twenty-four species and numerous subspecies and varieties.

Another new genus, *Sonorella*—with similar affinities, was proposed by him,¹² based on *Epiphramophora hachitana*, Dall,

¹ Bull. Sci. Fr. Belg., xl, 1906, p. 195.

² Rev. Mus. Paul., iv, 1900, p. 539.

³ Proc. Malac. Soc., vi, 1905, p. 286.

⁴ Ann. Mag. Nat. Hist., ser. VII, vol. i, 1898, p. 28.

⁵ Ann. So. Afr. Mus., xiii, 1915, p. 173.

⁶ Nautilus, xi, 1897, p. 87.

⁷ Proc. Malac. Soc., iv, 1900, p. 24.

⁸ Journ. de Conchyl., 1867, p. 223.

⁹ Nautilus, xvii, 1904, p. 131.

¹⁰ Proc. Acad. Nat. Sci. Philad., 1905, p. 268.

¹¹ Ib., 1916, p. 340.

¹² Ib., 1900, p. 556.

with four other species. This genus now numbers some forty-nine species.

Micrarionta, Anc., considered as a subgenus of *Epiphragmophora* in his "Guide", was raised to generic rank¹ and divided into three sections: typical *Micrarionta*, *Eremarionta*, and *Xerarionta*. The genus included some species previously referred to *Sonorella*, and now numbers twenty-six species.

In 1896 Mr. H. Fulton proposed a new subgenus, *Xenothauma*² for *Helix baroni*, Fulton. Kobelt³ placed this species in the genus *Bostryx*, while still considering it a *Helix*, at the same time referring to its apparent affinity to *Helix reentsi*, a species described by Philippi in 1855,⁴ which shared a similar fate when it was transferred by Pilsbry⁵ to *Bostryx*, who then reduced the latter to subgeneric rank under *Bulimulus*, creating a new section—*Platybostryx*—for the reception of *H. reentsi*, and substituted the specific designation *eremothauma*, on account of the previously described *Bulimus reentsi*.⁶

Cathaica, originally proposed as a group of Helices by Möllendorff, was adopted by Pilsbry as a section of *Eulota*, but Andreea in 1900 raised it to generic rank⁷ and split it into five subgenera, four of these new (*Eucathaica*, *Pliocathaica*, *Xerocathaica*, *Campylocathaica*), and *Pseudiberus*, Anc. In 1919 I introduced another subgenus, *Trichocathaica*,⁸ taking *C. lyonsæ*, a new species described at the same time, as type. *Semibuliminus*, proposed as a section of *Buliminopsis* by Möllendorff⁹ for *B. beresowskii*, and in which, subsequently, he included¹⁰ a shell described by Sturany as ? *Satsuma kutupäensis*,¹¹ I consider more probably as pertaining to *Cathaica*, and therefore suggest its transference, as a seventh subgenus of the latter. *Læocathaica* was introduced by Möllendorff¹² as a distinct genus of sinistral forms of *Cathaica* with *Helix christinæ*, H. Ad., as type. Fourteen species are now classed under it.

Acusta, introduced as a section of *Nanina* by Von Martens¹³ for three species, with *Helix ravida* as type, was treated as a synonym for *Eulota* by Pilsbry, but Möllendorff¹⁴ revived it as a section of

¹ Ib., 1913, p. 380.

² Ann. Mag. Nat. Hist., ser. vi, vol. xviii, p. 102.

³ Conch. Cab. Heliceen, iv, 1897, p. 843.

⁴ Ann. Univ. Chile, 1855, p. 213.

⁵ Män. Conch., ser. II, vol. x, 1896, p. 155.

⁶ Zeits. Malak., viii, 1851, p. 30.

⁷ Mitth. Roemer Mus., No. 12, p. 2.

⁸ Proc. Malac. Soc., xiii, p. 119.

⁹ Ann. Mus. Zool. St. Petersb., iv, 1899, p. 133.

¹⁰ Ib., 1902, p. 307.

¹¹ Denkschr. Math. Naturw. Cl. K. Akad. Wiss., 1900, p. 12.

¹² Ann. Mus. Zool. St. Petersb., iv, 1899, p. 86.

¹³ Die Heliceen, 1860, p. 56.

¹⁴ Ann. Mus. Zool. St. Petersb., 1899, p. 73.

Eulota; at the same time he proposed a new section *Eulotella*,¹ which now numbers some twenty-five species.

Some further subgenera of *Eulota* remain to be dealt with. *Neseulota*, proposed by Ehrmann² with three species, the type being *E. hemisphaerica*, Mildff.; *Landouria*³ with five species, having *H. huttoni*, Pfr., for type; and *Mikiria*⁴ by Godwin-Austen; *Cælorus*⁵ by Pilsbry for *E. cavigollis*, Pils., to which two other species were added subsequently; *Dolicheulota*⁶ created by Pilsbry for the reception of two Bulimoid forms: *B. (Amphidromus) formosensis*, Ad., and *B. swinhœi*, Pfr.

In 1913 M. Germain proposed the genus *Halolimnohelix*⁷ for tropical African mollusca, with a subgenus *Massaihelix*. Pilsbry in an important article on land mollusks of the Belgian Congo⁸ adds many new species with anatomical details, indicating its place in the system near *Eulotella* and *Trishoplita*. At the same time he suggests that all or several of the new genera introduced by Preston as Zonitoid⁹ may be synonymous with or of subordinate rank to Germain's genus. He also proposes two additional new genera—*Vicariihelix* and *Haplohelix*—of similar affinities, each with one species.

A new genus—*Stilpnodiscus*—was created by Möllendorff¹⁰ for the reception of three new Western China species with *S. vernicina* as type. Its place in the system appears to be between *Plectotropis* and *Ægista*. Sturany in the following year added a fourth species,¹¹ *S. euphyes*.

Trishoplita, a genus confined to Japan, was introduced by Jacobi¹² for *T. pallens*, Ehrm., and *Helix goodwini*, Smith, the latter classed in *Ganesella* by Pilsbry. Many others have since been transferred from *Ganesella* and new species described. It now totals twenty-two species.

Systemostoma was created in 1909 by Bavay and Dautzenberg¹³ for two small Indo-Chinese species, and placed next to *Plectotropis*. A third species was added in 1912¹⁴ by them, when they judged that the genus had affinity with *Hypselostoma* and *Boysidia*, a view

¹ Tom. cit., p. 76.

² Sitz.-Ber. Naturf. Ges. Leipzig, xxxviii, 1911, p. 61.

³ Rec. Ind. Mus., viii, 1918, p. 604.

⁴ Tom. cit., p. 611.

⁵ Proc. Acad. Nat. Sci. Philad., 1899 (Feb., 1900), p. 528.

⁶ Man. Conch., ser. II, vol. xiv, 1901, p. 18; Introd., p. iii.

⁷ Bull. Mus. Paris, xix, p. 351.

⁸ Bull. Amer. Mus. Nat. Hist., xl, 1919, p. 36.

⁹ Proc. Zool. Soc., 1914, pp. 795-803.

¹⁰ Ann. Mus. Zool. St. Petersb., 1899, p. 65.

¹¹ Denkschr. k. Akad. Wiss. Wien, lxx, 1900, p. 19.

¹² Journ. Coll. Sci. Imp. Univ. Tokyo, xii, pt. i, 1898, p. 65.

¹³ Journ. de Conchyl., lvii, p. 196.

¹⁴ Ib., lx, p. 23.

which was confirmed by Pilsbry,¹ who placed it near *Aulacospira* in Pupillidæ.

Aulacospira, introduced as a genus or subgenus of the family Hygromiidæ by Möllendorff,² was placed next to *Hygromia* by Pilsbry in his "Guide", but subsequently³ he transferred it to Pupillidæ.

Two subgenera to the genus *Theba* were proposed in 1914 by Hesse,⁴ i.e. *Paratheba* for *Helix fruticola*, Kryn., as type and *H. rothi*, Pfr., and *Metatheba* for *H. samsunensis*, Pfr., and *T. orientalis*, Hesse, the former taken as type.

Cylindrus proposed by Fitzinger in 1833 for *Pupa obtusa*, Drap., was transferred in 1895 by Pilsbry⁵ to the Helices, its place being indicated near *Helicella* and *Hygromia*.

Acanthinula of Beck, although with a very old species as type, *Helix aculeata*, Mull., was very imperfectly known from an anatomical point of view, until examination by Hesse,⁶ Steenberg,⁷ and Watson⁸ proved its affinity to lie with Pupillidæ.

The same fate was shared by *Vallonia*, the anatomy of which was investigated by Pilsbry⁹ and Watson.⁸

Soosia was proposed by Hesse¹⁰ as a genus with *Helix diodonta*, Mußlf., for type, placed in *Helicodonta* by Pilsbry. At the same time Hesse named a subfamily *Helicodontinæ* for (1) his new genus, (2) *Helicodonta* s.s., (3) *Drepanostoma*, and (4) *Caracollina* (sections of Pilsbry), (5) *Oestophora*, and (6) *Mastigophallus*, the latter another new genus for the reception of one species, *Helix rangiana*, Fér. *Oestophora* had been created by him previously¹¹ without naming a type, but now he fixes on *Helix lusitanica*, Pfr., and adds a list of fifteen species to be included.

Aspasita, established by Westerlund as a section of *Gonostoma*¹² for three small species from S.E. Europe, was retained as a section under *Helicodonta* by Pilsbry, but Hesse¹³ removes it with *Acanthinula* and *Vallonia* to Pupillidæ.

Klikia was proposed as a section of *Helicodonta* by Pilsbry in 1894 with *Helix osculum*, Thomae, a Miocene species, for type. C. R. Boettger proposed¹⁴ a section *Apula* under *Hygromia* for

¹ Man. Conch., ser. II, xxiv, 1917, p. 225.

² Ber. Senck. Naturf. Ges., 1890, p. 224.

³ Man. Conch., ser. II, xxiv, 1917, p. 225.

⁴ Mitt. Kauk. Mus. Tiflis, vi, p. 268.

⁵ Ann. Mag. Nat. Hist., ser. VI, xvi, p. 155.

⁶ Nachr.-Bl. D. Malak. Ges., 1915, p. 55.

⁷ Vidensk. Medd. Dansk. Naturh. Foren., lxix, 1917, p. 1.

⁸ Proc. Malac. Soc., xiv, 1920, p. 6.

⁹ Proc. Acad. Nat. Sci. Philad., 1900, p. 564.

¹⁰ Nachr.-Bl. D. Malak. Ges., 1918, pp. 103, 104, 109.

¹¹ Ib., 1907, p. 76.

¹² Fauna Pal. Binn. Conch., i, 1889, p. 18.

¹³ Nachr.-Bl. D. Malak. Ges., 1918, p. 119.

¹⁴ Ib., 1909, p. 15.

Helix devexa, Reuss, and *H. coarctata*, Klein, the former for type, but later,¹ while raising *Klikia* to generic rank, he subordinated *Apula* to the latter genus.

Brusina proposed *Vidovicia*² as a new genus for the group of *Helix lacticina*, Zieg.; Soos five years later³ suggested the name of *Hazaya* for *Helix cœrulans*, Muhlf. Now, *lacticina* being a synonym of *cœrulans*, Soos' designation becomes synonymous with Brusina's. This group of Helices was included by Pilsbry in the section *Chilostoma*, Fitz., of the genus *Helicigona*, Risso.

Further divisions of the groups of *Helix* included in *Chilostoma* by Pilsbry were made by Brusina² as follows: *Drobasia* for the group of *Helix banatica*, Partsch (C. R. Boettger proposed *Partschia*⁴ for the same group); *Sabljaria* for the *Helix stenomphala*, Mke. group, *Cattania* for *H. trizona*, Zglr., and its allies, *Botteria* for *H. setosa*, Zglr., with five other species, and lastly *Kosicia* for *Helix intermedia*, F., and two others.

Helix vermiculata and its allies were placed by Pilsbry under his section *Otala*, Schum. A considerable amount of exception has been taken to this course by many Continental authors. *Archelix*, considered a synonym by Pilsbry, has been revived for this group by Hesse,⁵ when he gave the result of his anatomical investigations and published a list of species.⁶ At the same time he separated a number of species to form two subgenera: *Archelix* s.s. and *Dupotetia*, the latter with two sections: *Dupotetia* s.s. and *Deserticola*. Pallary also dealt with the genus⁷ when he illustrated several species, and four years later established another section, *Tingitana*⁸ for a group of species of *Archelix*, which in the immature stage are strongly carinated and in the adult state have the earlier whorls edged. He selected his *Archelix minettei* as type, and described at the same time seven other species, together with several varieties.

Hesse proposed the subfamily *Murellinæ*⁹ for the following four genera: *Murella*, Pfr. (considered a subsection of section *Iberus* under *Helix* by Pilsbry), *Opica*, Kob.¹⁰ (many of the species placed in subsection *Macularia* by Pilsbry), *Marmorana* (Hartm.), Kob.,¹¹ and *Tyrrheniberus*, Kob. & Hesse.¹² Most of the species arranged

¹ Ib., 1912, p. 131.

² Ib., 1904, p. 162.

³ Ann. Mus. Nat. Hung., vii, 1909, p. 43.

⁴ Nachr.-Bl. D. Malak. Ges., 1911, p. 21.

⁵ Icon. N.F., xvi, 1909, p. 27.

⁶ Tom. cit., 1910, p. 97.

⁷ Nachr.-Bl. D. Malak. Ges., 1914, p. 8.

⁸ Bull. Soc. Hist. Nat. Afr. Nord., ix, 1918, p. 145; Journ. de Conchyl., lxiv (1918), 1919, p. 51.

⁹ Iconogr. N.F., xxiii, p. 230.

¹⁰ Ib., N.F., xi, 1904, pp. 156, 198.

¹¹ Tom. cit., pp. 157, 199.

¹² Tom. cit., pp. 157, 199.

by Pilsbry under section *Otala* have been redistributed by Hesse and others among the following genera : *Massylæa*, Mlldff.,¹ *Iberellus*, Hesse² (= *Balearica*, Kob.³), *Eobania*, Hesse,⁴ *Archelix*, Alb., and subgenus *Dupotetia*, Kob.,⁵ with a section *Deserticola*,⁶ *Codringtonia*, Kob.,⁷ and *Isaurica*, Kob.⁸ The other Palæarctic genera were placed under the subfamily *Helicinae*,⁹ i.e. *Euparypha*, Hartm., *Massylæa*, Mlldff., *Atlasica*, Pallary,¹⁰ *Iberellus*, Hesse, *Allognathus*, Pils., *Iberus*, Montf., *Rossmaessleria*, Hesse,¹¹ *Eobania*, Hesse, *Archelix*, Alb., *Pseudotachea*, C. R. Bttgr.,¹² *Cepaea*, Held., *Macularia*, Alb., *Maurohelix*, Hesse¹³ (= *Wiegmannia*, Hesse,¹⁴ = *Gaetulia*, Kob.),¹⁵ *Tacheocampylæa*, Pfr., *Codringtonia*, Kob., *Isaurica*, Kob., *Levantina*, Kob., with three subgenera : *Levantina* s.s., *Assyriella*, Hesse,¹⁶ and *Gyrostomella*, Hesse¹⁷ (= *Gyrostoma*, Hesse),¹⁸ *Tacheopsis*, C. R. Bttgr.,¹⁹ *Caucasotachea*, C. R. Bttgr.,²⁰ with two subgenera : *Caucasotachea* s.s. and *Lindholmia*, Hesse²¹; *Helix*, L., with the following subgenera : *Tyrrhenaria*, Hesse,²² *Hessea*, C. R. Bttgr.,²³ *Cryptomphalus*, M.T., *Maltzanella*, Hesse²⁴ (= *Maltzania*, Hesse non Bttgr.),²⁵ *Pseudofigulina*, Hesse²⁶ (= *Pelasga*, Hesse),²⁷ with two sections : *Pseudofigulina* s.s. and *Naegelia*, Hesse²⁸; *Helicogena*, F., with four sections : *Physospira*, C. R. Bttgr.,²⁹ *Rhododerma*, Hesse,³⁰ *Pachyphallus*, Hesse,³¹ and *Pomatia*, Leach. Lastly follow *Eremina*, Pfr. (= *Eremophila*, Kob.), and *Hemicyla*, Swains.

This completes my survey of the proposed changes and modifications in the classification of Helices since 1895.

¹ Nachr.-Bl. D. Malak. Ges., 1898, p. 120.

² Ib., 1908, p. 131.

³ Iconogr. N.F., xi, 1904, pp. 157, 200.

⁴ Nachr.-Bl. D. Malak. Ges., 1913, p. 13.

⁵ Iconogr. N.F., xvi, 1911, p. 95.

⁶ Tom. cit., p. 95.

⁷ Stud. Zoogeogr., ii, 1898, pp. 208, 306.

⁸ Iconogr. N.F., ix, 1901, p. 36.

⁹ Op. cit., xxiii, 1918, p. 233.

¹⁰ Journ. de Conchyl., xlili, 1917, p. 135.

¹¹ Iconogr. N. F., xiv, 1907, p. 8; xxiii, 1915, p. 32.

¹² Nachr.-Bl. D. Malak. Ges., 1909, p. 10; ib., 1911, p. 131.

¹³ Ib., 1917, p. 122.

¹⁴ Ib., 1916, p. 124.

¹⁵ Stud. Zoogeogr., ii, 1898, pp. 208, 357.

¹⁶ Zool. Jahrb. Syst., xxvii, 1908, p. 319.

¹⁷ Iconogr. N.F., xvi, 1911, p. 113.

¹⁸ Zool. Jahrb. Syst., xxvii, 1908, p. 320.

¹⁹ Nachr.-Bl. D. Malak. Ges., 1909, p. 10; ib., 1911, p. 130.

²⁰ Op. cit., 1909, p. 10; 1911, p. 130.

²¹ Nachr.-Bl. D. Malak. Ges., 1918, p. 38.

²² Tom. cit., p. 38.

²⁷ Ib., 1911, p. 128.

²³ Ib., 1917, p. 122.

²⁸ Ib., 1908, p. 140.

²⁴ Ib., 1917, p. 123.

²⁹ Ib., 1908, p. 139.

²⁵ Ib., 1918, p. 38.

³⁰ Ib., 1914, p. 103.

²⁶ Ib., 1918, p. 38.

³¹ Tom. cit., p. 38.

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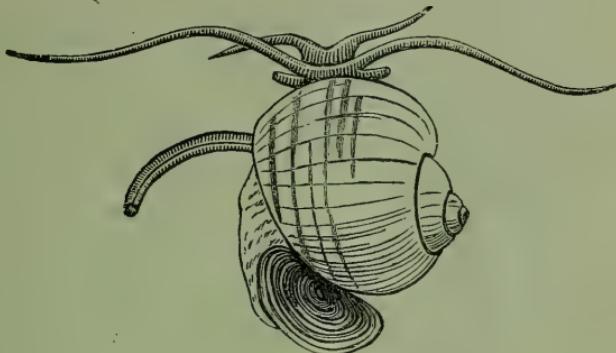
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OF THE

MALACOLOGICAL SOCIETY
OF LONDON.

EDITED BY B. B. WOODWARD, F.L.S., ETC.,
Under the direction of the Publication Committee.

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ORDINARY MEETING.

Friday, 11th March, 1921,

G. K. GUDE, F.Z.S., President, in the Chair.

The President read letters of acknowledgment from the first honorary members,—Dr. Henry Woodward, Dr. Paul Pelseneer,—and Mr. C. Davies Sherborn, in answer to the President's letters acquainting them of their election.

The following communications were read :—

1. "Description of a new *Phasianella* from W. Australia." By J. H. Gatliff and G. J. Gabriel.
 2. "Notes on the generic names *Ancylus* and *Bulinus* (*v. Isidora*)."
By Hugh Watson.
 3. "The application of the Law of Priority." By Hugh Watson.
-

ORDINARY MEETING.

Friday, 8th April, 1921.

G. K. GUDE, F.Z.S., President, in the Chair.

The following communications were read :—

1. "On *Helicella* Fér." By G. K. Gude, F.Z.S., and B. B. Woodward, F.L.S. Illustrated by specimens included under *Helicella* Fér. exhibited by the authors and by Mr. Tomlin.
 2. "On *Helix subuplicata* Sby." By Professor T. D. A. Cockerell. Communicated by B. B. Woodward, F.L.S.
 3. "Molluscan Nomenclatural Problems and Solutions, No. II."
By T. Iredale.
-

ORDINARY MEETING.

Friday, 13th May, 1921.

G. K. GUDE, F.Z.S., President, in the Chair.

The Rev. Edward Neale Dalton, B.A., was elected to membership of the Society.

The following communications were read :—

1. "Note on some species of *Pisidium*." By B. B. Woodward, F.L.S., etc.

2. "(Ecological Notes.)" By Dr. A. E. Boycott, F.R.S.

3. "Note on *Helix pisana* in Porto Santo." By Prof. Cockerell.

The following exhibitions were made :—

By Mr. B. B. Woodward: A collection of British Albinos, including *Helix aspersa*, collected by Mr. Wintle at Caldey Island.

On behalf of Mr. Wintle. A collection of *Nucella lapillus* from Caldey Island.

By Mr. Oldham: Albinos of *H. gigaxii* and *H. virgata*.

By Professor Cockerell : Albino specimen of *H. pisana* from Porto Santo.

By Col. Peile : Shells from Gallipoli.

By Mr. Cooper : A large series of British Albinos and Deformities.

By Mr. Salisbury : *Limnaea auricularia* var. *alba* from Uxbridge.

ORDINARY MEETING.

Friday, 10th June, 1921.

G. K. GUDE, F.Z.S., President, in the Chair.

The following communications were read :—

1. "Notes on Pearl Formation and Japanese Culture Pearls." By T. H. Haynes. Illustrated by a series of lantern slides.

2. "Note on some species of *Pisidium* : Addendum." By B. B. Woodward, F.L.S.

3. "The Mollusca as material for Genetic research." By G. C. Robson, B.A., F.Z.S.

Dr. Trechmann exhibited a fine shell of *Pleurotomaria adansoniana*.

Mr. B. B. Woodward exhibited a series of bivalves from Caldey, received from Mr. Wintle.

NOTES ON THE DISTRIBUTION OF BRITISH LAND AND FRESH-WATER MOLLUSCA FROM THE POINT OF VIEW OF HABITAT AND CLIMATE.

By Dr. A. E. BOYCOTT, F.R.S.

Read 14th January, 1921.

PLATES V AND VI.

THE facts dealt with here are those accumulated by the late W. Denison Roebuck for his "Census of distribution". The plan of the work and the details of the results obtained will be found in the "Journal of Conchology", vol. xvi, p. 165; it is enough here to note that the records are in all cases based upon the examination of actual specimens by the referees of the Conchological Society.

The distribution of our British snails has been dealt with pretty fully as a historico-geographical problem involving their past history, their routes of migration, and so forth. My present purpose is to consider it as a problem for the working field-naturalist of to-day and to make various surmises and suggestions about its relations to existing habitats and climatic conditions. The two points of view are in no way antagonistic, the one is the complement of the other. With further knowledge it will be possible some day to weave them together into a coherent whole, but just now I can do no more than to give some illustrations which indicate that the matter is worth more detailed and intensive examination.

(1) Some species (e.g. *Hyalinia alliaria*, *Arion ater*, *Pyramidula rotundata*, *Cochlicopa lubrica*, *Limnaea peregra*) are found commonly throughout, showing that they can tolerate the climate everywhere and that habitats suitable for them are to be found throughout the islands.

(2) Some species (*Limax cinereoniger*, *L. tenellus*) occur from the north of Scotland to the south of England, but are not common; they have no geographical distribution, except that *L. tenellus* is not found in Ireland, and their occurrence seems to be determined by the existence of suitable habitats in the shape of ancient woodlands. Similarly *Succinea oblonga* and *Vertigo minutissima* are rare species with a range from the south of England to the middle of Scotland, whose occurrence probably depends on some as yet undefined quality of their habitats.

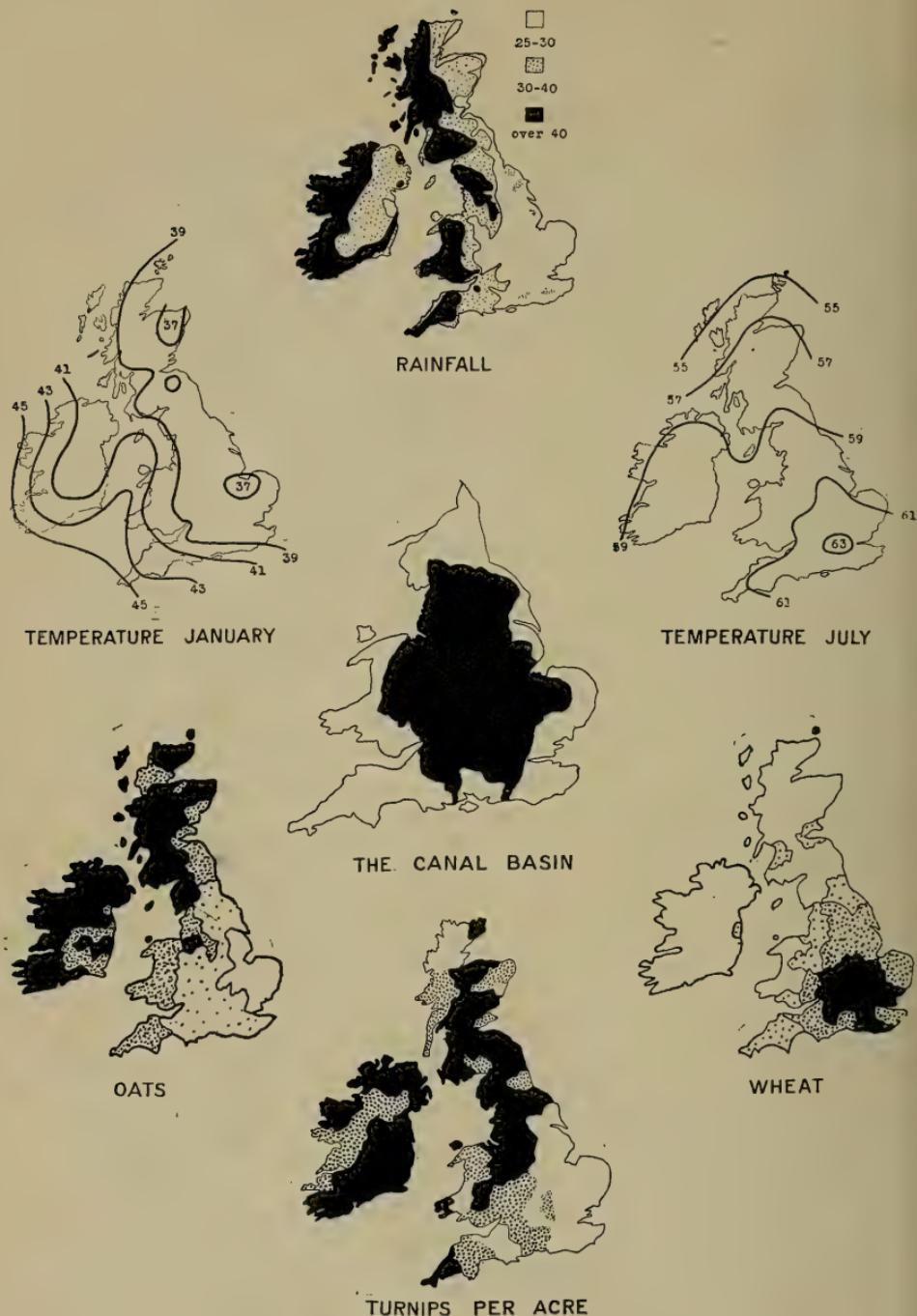
(3) *Hygromia fusca*, *Acanthinula lamellata*, *Pupa anglica*, and *Margaritana margaritifera* are definitely northern and western, being either absent or rare in the south-east. It seems fairly certain that *margaritifera* can live only in waters containing little lime and the rivers of the south-east are all calcareous.

(4) In contrast with these we have a larger number of species which are south-eastern in distribution, (a) such as *Theba cantiana*, *Helicigona lapicida*, *Azeca tridens*, *Pupa secale*, *Clausilia rolphii*,

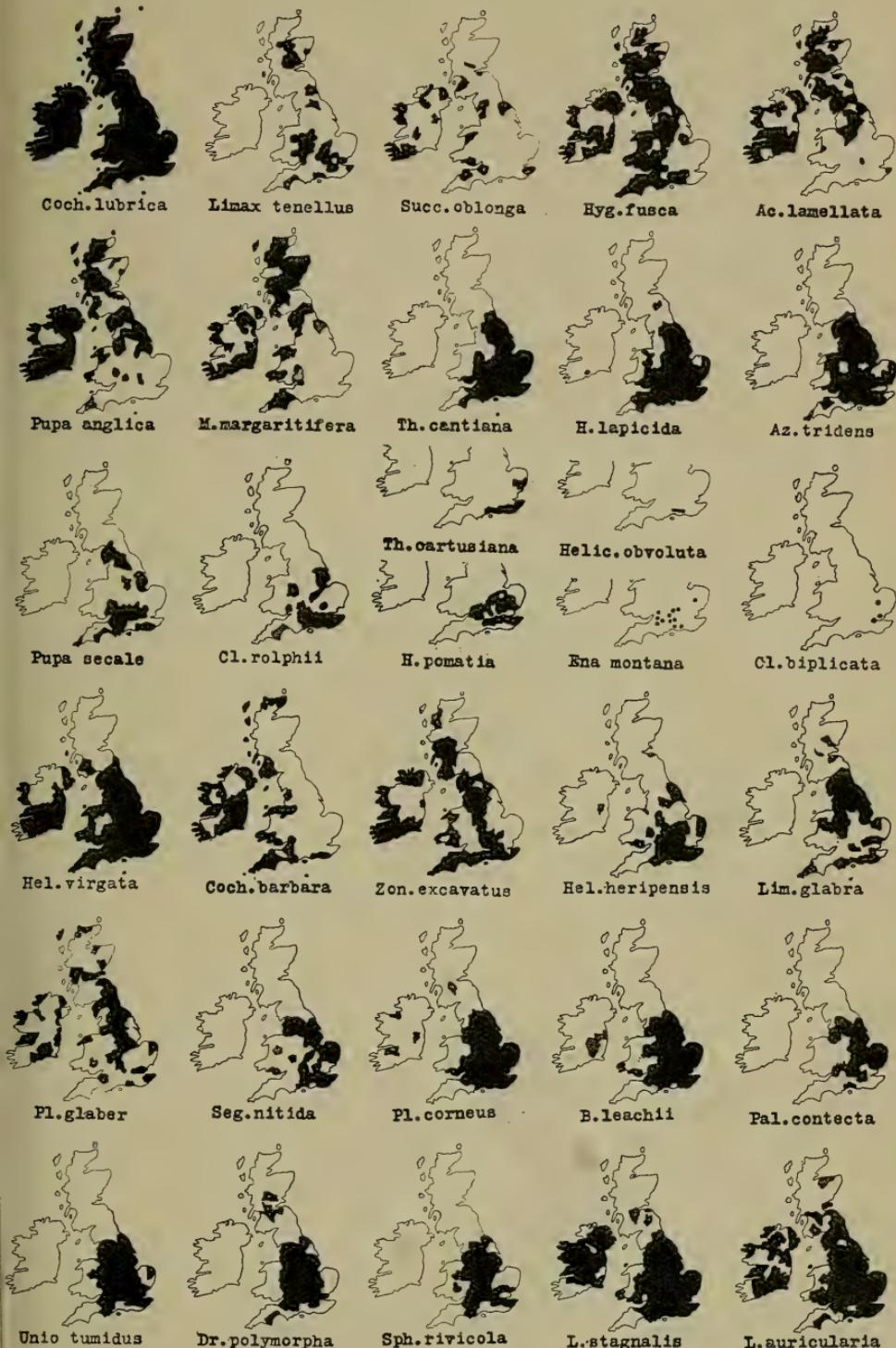
Bithinia leachii, etc., which extend through the greater part of England, or (b) like *Helix pomatia*, *Theba cartusiana*, *Helicodonta obvoluta*, *Ena montana*, *Clausilia bimaculata*, which have a much more restricted range.

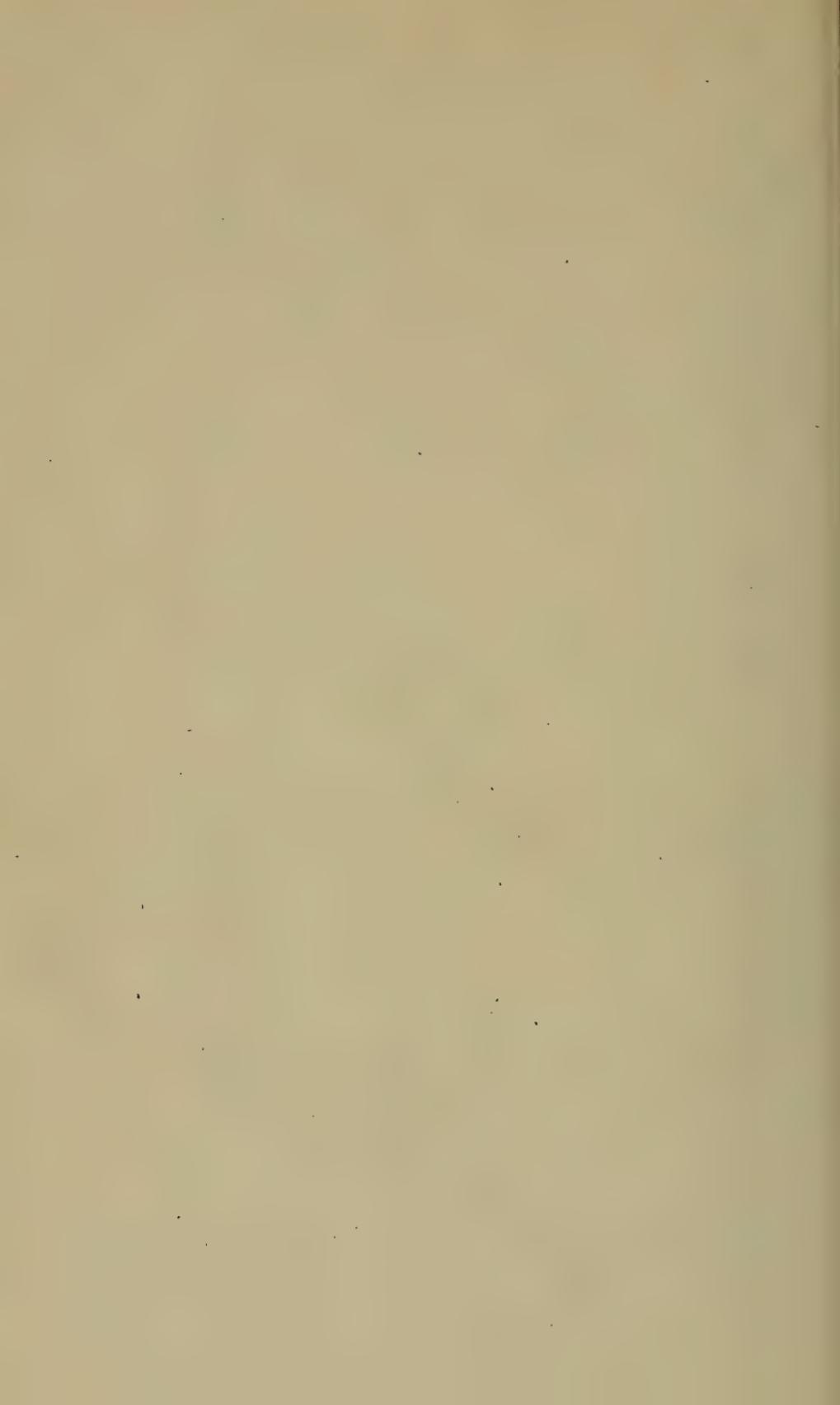
The contrast between the north-western and south-eastern groups appears quite definite. It has presumably in part arisen, like the similar distribution of human culture, from the geographical position of England in relation to the Continent, but it is at least possible that the prevailing meteorological conditions have something to do with it in both instances. Maps are shown (Pl. V) giving the data as regards temperature and rainfall in a summary fashion. It would be a long matter to discuss the best form in which these factors should be considered. Rainfall is no doubt more important *qua* snails at one time of year than another, whether it falls in a few large or many small doses is no doubt germane, the proportion of rainy days and their seasonal distribution require notice. The humidity of the air would be of the greatest interest if there were any data available worth consideration. Similarly the seasonal and diurnal temperatures and their ranges will ultimately require analysis, the night temperature being perhaps more interesting to nocturnal animals like slugs than to ourselves : the "accumulated temperatures" above some fixed point devised by Strachey for agricultural purposes suggest an interesting line of inquiry. Local differences within the same area may be considerable, the relation of rainfall to altitude being the most conspicuous. Viewed, however, in a broad way, no one can doubt that the crude maps of total rainfall and mean temperatures for January and July (Pl. V) show plainly that the south-east has a very different climate to the north-west : in brief summary, the south-east is as cold or colder in winter, hotter in summer, drier and more sunny.

It is instructive to compare with the snail distributions two maps showing the proportion of the acreage of what the Board of Agriculture calls "cereal crops" (wheat, barley, oats, rye, beans, peas) occupied in each county by wheat and oats respectively (Pl. V). In the former the country is shown in four areas, in which wheat occupies 15 per cent and under (plain) of the cereal land, 16 to 25 per cent (sparsely dotted), 26 to 35 per cent (thickly dotted), and more than 35 per cent (black) : in the latter the groups are under 25 per cent (plain), 25 to 49 per cent (sparsely dotted), 50 to 74 per cent (thickly dotted), and 75 per cent and over (black). Here again the exact form of comparison is open to considerable discussion and elaboration ; the main conclusions, however, come out much the same whatever method is adopted. In a general way the distribution of wheat and oats may be taken to be determined by climate ; a farmer will always grow wheat in preference to oats if he can, and the influence of soil has been largely obliterated by modern methods of cultivation and manuring : wheat is concentrated and valuable, so



MAPS SHOWING DISTRIBUTION OF TEMPERATURE, RAINFALL,
AND SOME CROPS IN THE BRITISH ISLANDS.





that costs of carriage do not compel attempts at its production in unsuitable localities. The maps show that wheat is south-eastern, oats north-western, and it is difficult not to believe that climate is the chief factor determining this distribution.

Turnips have to be dealt with in a different way because they are not particularly valuable, and are relatively bulky, so that they cannot be economically transported from a district where they flourish to one which is not very well suited for them. The map shows accordingly the produce of turnips and swedes per acre, the three areas being 13 tons or less (plain), 14 or 15 tons (dotted), and 16 tons and over (black). Turnips are evidently north-western, their relative failure in the remote parts of the north of Scotland and the west of Ireland indicating that they want good farming as well as plenty of rain.

Is it possible that *Helix pomatia* and other south-eastern species (see maps on Pl. VI) live where they do because the climate is congenial and not because they have recently arrived from Europe? The position of the north-western species may also be comparable to that of oats : J. W. Taylor would indeed find a parallel and say that they do not live in the south-east because the more highly specialized species, which are characteristic of that area, crowd them out in the same way that oats predominate where wheat cannot be profitably cultivated, and alders grow in swamps where they escape competition with other trees that cannot tolerate such places. The idea of direct competition on land between snail species which this view involves is, however, highly problematical, and it is significant that *Pupa anglica* and *Acanthinula lamellata* are found in holocene deposits in the south-east, where they are now extinct. Whether it is the complex of circumstances which we call civilization, or increasing dryness which has destroyed them there we cannot tell : the two are not mutually exclusive, for surface dryness is one of the attainments of English civilization both in our streets and in our cultivated land. I should say, therefore, that these north-western species require wetness without too much summer heat : note particularly that the summer temperature of south Ireland is that of Yorkshire.

(5) It is natural to suppose that different species will be differently affected by temperature in relation to their varying seasonal activities. In one case the summer climate may be most important, in another the winter weather. Species which breed in the late autumn and winter may be either mainly south-eastern (*Helicella virgata*, *H. caperata*), north-western (*Hygromia fusca*), general and local (*Limax tenellus*), or general and common (*Vitrina pellucida*), and at present I cannot trace any definite correlation. The range of another autumn breeder, *Cochlicella barbara*, from Sussex to the north of Scotland round the southern and western coasts, and more generally in Ireland, is suggestively coincident with the January isotherm of 39° . Another one, *Hygromia revelata*, is restricted to

the extreme south-west of England. Our ignorance of the breeding habits of many of our common species makes the inquiry difficult.

(6) The influence of *calcareous soil* cannot be summarily dealt with on a small scale map. Quite small areas, such as the bosses of chalk that come through the overlying strata in Norfolk or the patches of cornstone in the old red sandstone of Herefordshire, are imperceptible without local knowledge, but have their characteristic influence on the fauna. There seem to be only three species with absolute relations : *Zonitoides excavatus* is never found on calcareous soil, *Cyclostoma elegans* is never found away from it, *Margaritana margaritifera* occurs only in soft water. Other species, e.g. *Pupa secale* (which extends northwards to Cumberland) or *Clausilia rolphii* certainly show a very marked association with chalk and limestone. But in the case of several south-eastern species (*Helix pomatia*, *Ena montana*, *Helicodonta obvoluta*) it is difficult to say whether their distribution is determined by geographical position or by the lime in the soil : the geological map does not lend itself to the solution of the problem. The whole of the area in which they occur might from the map be reasonably supposed to be calcareous, and most of it actually is, but *H. obvoluta* certainly (and I think also the other two) is occasionally found in places where neither the surface soil nor the vegetation is chalky. These species, then, may belong to the same distributional group as *Helicigona laticida*, *Theba cantiana*, *Helicella heripensis* (= *gigaxii*), which are southern and eastern in their range, and therefore must live mostly on calcareous land : but they all extend sufficiently to the north and west to afford so many exceptions that one must regard their relation to limey strata as a coincidence. As regards water species, rivers represent the strata of their origin and the hardness or softness of their water may be deduced in most cases from the geological map. But ponds of soft water occur in calcareous districts, and springs and streams of very hard water may occur in non-calcareous areas : for these smaller waters local knowledge is necessary.

(7) Water snails show distributions which are analogous to those of land species. *Limnaea glabra* and *Planorbis glaber* are rare in the south of England, and *Segmentina nitida* seems to be mainly a south-eastern species. There is some evidence from aquarium observations that *L. glabra* dislikes water well warmed in a summer sun. In a broader way *Planorbis corneus*, *Bithinia leachii*, *Paludina vivipara*, *P. contecta*, *Dreissensia polymorpha*,¹ *Unio pictorum*, *Unio tumidus*, and *Sphaerium rivicola* are south-eastern, but their distribution has perhaps been so much influenced by canals that their present cannot be taken to represent indubitably their normal range. Practically all our canals were made between

¹ This species was re-introduced into this country in 1824 : it is, therefore, hardly in the same category as the others.

1760 and 1810, and they joined up the various river basins from Westmorland and Yorkshire to Wiltshire and Somerset, and from Norfolk to Montgomery and Hereford (Pl. V). The possibility of spread by their agency is particularly strong in *Dreissensia polymorpha* and *Spærium ovale*. Just as the provision of these very favourable habitats may well have helped a number of species to spread over central and southern England, so the rarity of suitable places (ponds, slow rivers, etc.) in western Wales and Devon and Cornwall may explain the absence of *Planorbis corneus*, *Pl. complanatus*, *Limnæa stagnalis*, and *L. auricularia* from these areas. The distribution of the Unionidæ may be related to the occurrence of appropriate fish on which to pass their parasitic phase, but I do not know of any definite indication in this direction for our British species.

The problem of the distribution of our British land and fresh-water mollusca seems therefore to be divisible into three groups of questions :—has the species ever had a chance of getting to the place ?—is the climate suitable ?—is there a suitable habitat ? In my own parish, for example, *Margaritana margaritifera* does not occur because the river, suitable in being not stagnant and in containing trout which are known to be a satisfactory host for its glochidia, has hard water ; *Limax tenellus* does not occur because there are no ancient woods, its abundance in other woods not far distant testifying to the suitability of the climate ; *Hygromia fusca* is absent because the climate of southern Hertfordshire is too dry for it. *Limax tenellus* may be presumed to be absent from Ireland because it has never been able to get there ; while *Hyalinia lucida*, often a garden species, has been transported and has become common in most parts of that country : but it may well be doubted whether the climate is suitable for *Helix pomatia* or *Helicodonta obvoluta*. Each species raises questions of great complexity, and I have been able only to indicate in the briefest outline some of the ways in which these may be approached.

ECOLOGICAL NOTES.

By Dr. A. E. BOYCOTT, F.R.S.

(Continued from p. 130.)

Read 13th May, 1921.

4. THE HABITATS OF *LIMAX MAXIMUS* AND *L. CINEREONIGER*.

L. maximus lives happily in gardens and cultivated ground : it also flourishes in wild places, especially woods. *L. cinereoniger*, on the other hand, is ordinarily found only in wild places, and it seems probable that its occurrence in a wood may be taken as evidence that the place is ancient forest : it is intolerant of civilization and cultivation. The point to which I particularly desire to draw attention is that the two species are seldom found together, from which it would follow that woods which are suitable for *cinereoniger*

are among the comparatively few places (apart from marshes, moors, etc.) where one is unlikely to find *maximus*. Mr. Oldham, whose experience with *cinereoniger* is exceptionally large, says "my general impression is that you do not usually find the two together, but this is not the invariable rule", and gives details of their concurrence in three beech woods in Bucks, Wilts, and Berks. There seems, therefore, to be something in ancient woodlands which *maximus* does not like; we should perhaps regard it as the civilized form of *cinereoniger*.

5. *HELICELLA VIRGATA* AND *H. CAPERATA* IN PLOUGHED FIELDS.

It is the experience of most collectors that land which is actually in arable cultivation or has been under the plough in the three or four preceding years is generally completely destitute of land mollusca. *Agriolimax agrestis* is sometimes found and may be abundant in seed grass, but the only conchifers which seem to be able to survive the operations of agriculture are *H. virgata* and *H. caperata*, including under the latter both *caperata* seg. and *H. keripensis* (= *gigaxii*). The fact that these species are fairly often found abundantly in the stubble of cornfields far from hedges or uncultivated grass on calcareous soils has been commented on by several observers,¹ some of whom have particularly noted that their abundance and size indicate that the conditions are favourable and that they are not merely surviving with difficulty. These observations correspond with my own experience, gained more especially in Wilts, Hants, and Herts, and I would suggest that the explanation of the exceptional habitats of these species is to be found in their breeding habits. Both species lay eggs late in the autumn (November–December), burrowing slightly into the surface of the ground to do so. I do not know when they hatch, but nothing more is seen of them till about the following May, when quite young individuals may be very abundant. After this they grow rapidly, reach maturity, and die about Christmas, their whole cycle lasting some twelve months. A certain number of *caperata* live through the winter, and adults are not very uncommon in the spring: *virgata*, however, I have never seen alive and grown up at that time, though a few probably survive sometimes. With normal cereal cultivation this means that the eggs are laid after ploughing and sowing are completed; after this they are not disturbed for about nine months, and when the upheaval of harvest and ploughing comes round again they are two-thirds or three-quarters grown. If we assume that the seriously vulnerable stages in the life history of snails are the eggs and young, we have here an explanation of why *virgata* can survive, while a species which lays eggs in the early summer (e.g. *Helix nemoralis*) is obliterated: arable cultivation is detrimental

¹ S. S. Pearce, Journ. Conch., vi, 123; C. Ashford, ib., v, 162; J. McMurtrie, ib., vi, 4; L. E. Adams, ib., ciii, 318; J. W. Horsley, ib., x, 48.

because it dries the surface of the ground and dryness is far more destructive to the early stages than to the adults. In general, too, it is probable that we should look to the causes of infant, rather than adult, mortality for the agencies which keep snail populations within bounds.

Agriolimax agrestis seems to breed at any and every time of year ; it lays eggs freely right through the winter in the milder spells. *Helicella itala*, *Cochlicella barbara*, *Vitrina pellucida*, *Hygromia fusca*, and *Limax tenellus* (of which the last three are certainly annuals) are also late autumn or winter breeders. I do not know that any of them occur on arable land, which is certainly about the last place one would expect to find *fusca* (damp woods, etc.) or *tenellus* (ancient woodlands.)

[In the discussion on this paper the President, Mr. Gude, said he had seen *C. barbara* on arable land in the Isle of Wight and pointed out that winter breeding would be a protection for snails living in the dry places (downs, sandhills, etc.), which are the normal habitats of *H. virgata*, *H. caperata*, *H. itala*, and *C. barbara*.

Mr. Oldham reported *H. itala* on ploughed fields in Gloucestershire.]

6. *BALEA PERVERSA* AND THE GEOPHOBIC HABIT.

It is well recognized that the normal habitat of *B. perversa* is "trees and walls". The best summary perhaps is that of L. Reeve,¹ who says "crevices of walls, rocks, or trees", for, as I believe, the essential thing is that there should be narrow cracks and holes in a dry place away from the ground. These are commonly afforded by trees and walls, but the thatch of a barn will do.² In Ireland it occurs "on trees (sometimes fallen trees or logs), dry and mortared walls and cliff faces" (A. W. Stelfox *in litt.*), and in the north of Scotland, where it is common, it was never observed away from walls.³

On trees it lives only on those which afford suitable shelter places either by having a naturally loose rough bark (elm, apple, willow, thorns on downs,⁴ gorse bushes⁵) or an adventitious coating of moss or something equivalent. It is, for example, quite rare on ash and oak⁶ or on normal beeches, but it may be found on the latter if they are mossy or have loose bark owing to disease or have widely open forks with a mass of dead leaves, etc. Round Aldenham it occurs sparingly on many of the elms (*Ulmus campestris*), but I have not found it on the oaks. On the elms it lives at the bottom of the deep narrow cracks in the bark in places which are in summer dry :

¹ Land and freshwater Molluscs, 1863, p. 106.

² In Oxfordshire ; W. Whitwell (Roebuck MS.).

³ F. Booth, Scottish Nat., 1913, p. 253.

⁴ J. E. Harting, Rambles in search of Shells, 1875, p. 89.

⁵ J. R. Tomlin, Journ. Conch., xiii, 79.

⁶ In Glamorgan ; F. W. Wotton (Roebuck MS.).

an occasional specimen of *Clausilia bidentata* may be found but, otherwise it seems to avoid any companions except woodlice (*Porcellio scaber*). It happens pretty often on these trees that, owing to some injury or disease, a piece of bark has become so far detached from the trunk that it has behind it a layer of brown granular, often dampish, debris (? faeces of larvæ), in which live worms, *Iulus*, and sometimes *Pyramidula rotundata* and *Hyalinia alliaria*; in these more populous places *perversa* is not found, though there may be plenty of them on other parts of the same tree.

In winter worms climb up along the crevices in the bark more freely, and may be found with *perversa*, which is exceptionally indifferent to cold weather.¹

Though its habitat on the trees is essentially a dry one, *perversa* is, I think, found more freely on the south-west sides, which receive most rain, and on the areas along which in a forking tree (e.g. apple) the rain runs down the trunk. The bark in these places is looser, or, at any rate, more readily detachable: whether this or the rather greater dampness is the reason for their preference I do not know.

The relation of *perversa* to the trees must be clearly distinguished from that of *Ena obscura*, *Clausilia laminata*, *Cl. bidentata*, *Limax arborum*, etc. These *anabatic* species, as they might be called, climb up trees freely in wet weather and may stop there several days, but their home is on the ground, whereas *perversa* lives up the tree all the time.

Rocks and walls afford adequate habitats irrespective of their nature so long as they furnish holes and crannies and are not wet. Very few live things except woodlice will be found there, and they reproduce by entirely different means the characteristics outlined for the suitable trees. There is, indeed, nothing common to the different places except dryness, absence of many other animals, and remoteness from the ground. As far as I know, the species has no relations with any plants: the authorities often mention moss, lichens, etc., but these seem to have no importance beyond providing shelter, for many of its homes are quite destitute of any vegetation more elaborate than *Protococcus*.

Balea is very seldom found on the ground. I have notes of only one definite and four probable records: "at the roots of decaying herbage on the rocks of the [Plymouth] Hoe,"² "among decaying leaves on Walton Downs, near Clevedon,"³ "among decaying wood and dead leaves, or lurking in moss,"⁴ "at the foot of trees, concealed by grass,"⁵ "among moss and dead leaves,"⁶ in Devon.

¹ A. W. Stelfox, Proc. Roy. Irish Acad., xxix (1911), 102; J. G. Jeffreys, Brit. Conch., i, 274; C. M. Steenberg, Landsnegle, p. 151.

² S. S. Bolton, Naturalist, iii, 1853, 128.

³ A. M. Norman in E. W. Swanton, Mollusca of Somerset, 1912, p. 42.

⁴ R. Tate, L.F.W. Molluscs of Great Britain, 1866, p. 165.

⁵ Cooper in J. E. Harting, Rambles in search of Shells, 1875, p. 64.

⁶ M. J. Longstaff, Journ. Conch., xiii, 107.

A. W. Stelfox tells me that he has never found *Balea* on the ground in Ireland, and diligent search round our local elm trees at all seasons of the year has failed to produce a single specimen on the ground. This is the more remarkable, because two at least of its most favoured haunts (walls, apple-trees, possibly also elms) are of human origin and the trees are in any case relatively temporary homes, with a duration of perhaps 100-150 years on the average; in many parts of England it cannot live in crannied rocks because there are none.

It appears clear, therefore, that it must sometimes live on, or at any rate move over, the ground. But it is equally clear that the ground is a place which it does not like. I take this interpretation of its habits and call it *geophobic*, because it seems much more likely that they are due to an effort to avoid evils on the ground rather than to attain delights in high places. Dryness and the absence of earth cannot *per se* be very attractive to a snail.

Pyramidula rupestris, which lives on rocks, quarry faces (of human origin), and such-like places, exposed to the weather in an extraordinary way, should also be classed as geophobic; probably too *Pupa umbilicata*.¹ In Herefordshire the most favoured haunts of this last species are ivy-covered stone walls, which harbour it in abundance with the greatest regularity, and the little ledges with thin grass and dead leaves which generally abound on the vertical faces of the limestone quarries. It is found also on trees, among stones and rubbish—in small numbers indeed almost anywhere—but it is evidently in these two artificial habitats that it finds the most favourable conditions. Dryness, absence of other animals, and remoteness from the ground seem again to be the essential features. On the chalk of Wilts and Hants, where the soil is drier and the rainfall less, it shows no preference for walls and lives, sometimes in beechwoods abundantly, on the ground. This suggests that a liking for lime has something to do with its habits in Herefordshire, and the fact that it is much less common and abundant in the dry east than in the damp west of England may also be incompatible with the view which I suggest. *Vallonia costata* and, with more probability, *Vertigo alpestris*² may also be geophobes.

It must be more than a coincidence that *B. perversa*,³ *P. umbilicata*, and *P. rupestris* are viviparous. The only other English land snail agreed to have this mode of reproduction, so obviously protective

¹ Trans. Herts Nat. Hist. Soc., xvii, 238.

² R. Standen, Journ. Conch., xi, 327; J. S. Dean and C. E. Y. Kendall, ib., xii, 210.

³ This seems certain (A. E. Craven, Journ. Conch., vi, 421; T. Rogers, ib., vii, 40; C. M. Steenberg, "Anatomie des Clausiliés danoises," 1914, p. 40; personal observations) despite the circumstantial account of eggs and their hatching given by Moquin-Tandon ("Histoire," ii, 351), and reproduced by Jeffreys ("Brit. Conch.," i, 274).

against drying of the eggs, is *Clausilia bisplicata*, which, freely anabatic as it is in wet weather, normally lives on the ground in places (at Mortlake, Cambridge, and Purfleet) which are neither particularly dry nor very wet. There is a difference of opinion about the other species of *Pupa*: Kennard and Woodward¹ say that *Pupilla* (which includes *marginata*, which lives in dry places on the ground) lays eggs, while *Lauria* (which includes *anglica*, living in wet habitats) is viviparous; Moquin-Tandon and Steenberg agree that *marginata* is viviparous, and Jeffreys says that *anglica* does not appear to be viviparous; no one says anything about the reproduction of *secale*. Of other geophobic species, *Vallonia costata* is oviparous, while of the habit of *Vertigo alpestris* nothing seems to be known; I may, therefore, hazard the prophesy that it will be found to be viviparous, especially as Moquin-Tandon (*Histoire*, i, 262) says that perhaps most *Vertigo*es are.

[Dr. Bowell and Professor Cockerell suggested in the discussion that dispersion of *Balea* from tree to tree was effected by birds carrying branches (cf. H. W. Kew, "Dispersal of Shells," 1893, p. 164). Mr. Oldham thought it more likely that birds like the tree-creeper picked them up accidentally on feet or feathers off the trunks in wet weather when the snails came out of the crevices; both *Balea* and *P. umbilicata* had exceptionally sticky mucus.]

¹ Proc. Geol. Assoc., xxviii, 170.

DESCRIPTION OF A NEW *PHASIANELLA* (*P. TOMLINI*) FROM
WESTERN AUSTRALIA.

By J. H. GATLIFF and C. J. GABRIEL.

Read 11th March, 1921.

PHASIANELLA TOMLINI, n.sp.

SHELL small, relatively solid, turbinate; of four whorls, including the smooth protoconch of about one and a half whorls, thence they are spirally ridged, ridges flatly rounded, between them linear grooves, which are finely obliquely striate, giving a punctate appearance. Colour varying from brown to pink radial maculations on a white or pink tinted background, the maculations are mostly divided into radial lines. Aperture round. An umbilical chink is caused by the thickening of the columella.

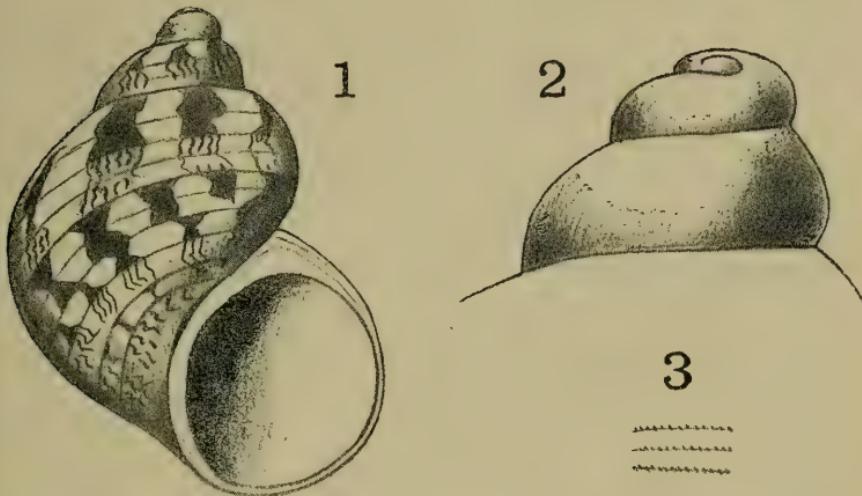


FIG. 1.—*Phasianella tomlinii*.

„ 2.—Apex of same.

„ 3.—Sculpture of grooves on body whorl.

Dimensions:— $5\cdot8 \times 4\cdot6$ mm.

Hab.—West Australia.

Observations.—As is usual in the genus the colour pattern varies greatly. The umbilical chink is not always present. In general habit it is comparable with *P. bicarinata*, Dunker.

Type in J. H. Gatliff's collection, and paratypes given to the British Museum.

ON *HELICELLA*, FÉRUSSAC.

By G. K. GUDE, F.Z.S., and B. B. WOODWARD, F.L.S.

Read 8th April, 1921.

IN January, 1821, Féruccac, in his "Tableau systématique de la famille des Limaçons",¹ instituted the subgenus *Helicella* as the sixth subgenus of his genus "*Helix*, Muller".

It was an agglomeration of 148 species, which, as the result of the researches of succeeding malacologists, are now referred to widely differing genera and even families. This dispersal was effected piecemeal, at different times, and under varying influences of opinion, hence there is neither method nor consistency in the conclusions arrived at by the several writers. Nor can this be wondered at, seeing that the necessary literature has, until lately, been but imperfectly known, and no agreed standard of nomenclature set up. Now, however, thanks to the untiring efforts of Mr. C. Davies Sherborn, in connexion with his "Index Animalium", and Mr. Tom Iredale (to both of whom we are greatly indebted for much valuable assistance and advice, which we here gladly acknowledge), as well as other workers, practically all the needful literature has been sought out and recorded, hence it has become highly desirable to scrutinize this composite group afresh, under the guidance of those International Rules of Zoological Nomenclature, which the majority of systematic zoologists now follow.²

The results are in some respects startling, and involve the discarding of some names that have become familiar, and the changing of others. The writers yield to no possible, or probable critics thereof in deplored this outcome of their researches; but if finality in nomenclature is ever to be obtained and justice done to the pioneers in malacology, the International Rules must be strictly adhered to.

Féruccac took the name for his subgenus from the nude vernacular "Hélicelle" of Lamarck,³ and must consequently have the credit

¹ Also cited, and by the author himself, as "Prodromus". Our citations are all given from the January edition; the numeration of the pages in the June edition is exactly four less, owing to the omission of the "Avertissement". Both editions are quoted indiscriminately in Féruccac's later "Histoire", and that sometimes on the same page!

² The latest edition of these Rules, extracted from the Proceedings of the Ninth International Zoological Congress, Monaco, 1913 (T. O. Smallwood, Washington, D.C., September, 1916), has here been followed.

³ Extrait du Cours de Zoologie, 1812, p. 115, last line.

of the Latinized form to the exclusion of Lamarck. Féruccac further added to Lamarck's group those of other authors, for his synonymy includes "*Sylvicola*, Humphrey; *Zonites*, Montfort; *Helicella*, Lamarck; and *Vortex*, Ocken [sic]."

The subgenus is further divided by him into four groups, with synonymy as follows:—

1. Les Lomastomes, *Lomastomæ*.
Sylvicola, Humphrey.
2. Les Apostomes, *Apostomæ* [misprinted *Aplostromæ*].
Helix, Humphrey.
Zonites, Montfort.
Helicella, Lamarck.
3. Les Hygromanes, *Hygromanes*.
4. Les Héliomanes, *Héliomanes*.

It will be noted that all these group names are intended to be in the plural, and that while the first two have been duly rendered into Latin plurals, the two Greek names have not been so treated, but are merely the vernacular repeated in italics.⁴

No one of them, therefore, can be employed as a generic, or sub-generic name on his authority. Gray, in 1840⁵ employed them in exactly the same sense as did Féruccac.⁶

In the next place it is quite obvious that *Helicella*, Fér., can only be applied to certain members of the second group, as Beck, Gray, S. P. Woodward, and H. & A. Adams recognized, and cannot be resorted to for any member of the fourth group as attempted by later writers, notably Pilsbry, who were misled by Risso. Risso, who was dealing, it must be remembered, not with Mollusca in general, but only those of a limited geographical area, manifestly intended to follow Féruccac in the use of the name *Helicella*, though he does not acknowledge the authorship. He included in it only three species, *algira*, Linn., *rupestris*, Drap., and *nitida*, Drap., of those in Féruccac's *Apostomæ*, drawing the remainder from the *Hygromanes* and *Héliomanes*. At the same time he separated out under *Theba* (Leach MS.) the *cartusiana* group, whilst confusing with them three species of the *Héliomanes* group—*pisana*, Müll., *pyramidata*, Drap., and *conspurcata*, Drap. So that even if Féruccac had not clearly indicated which group contained his typical *Helicellas*, Risso's assemblage could not well be taken as indication of a choice.

⁴ This was first pointed out by Mr. Iredale, Proc. Malac. Soc., xi, 1914, p. 176. Féruccac was notoriously careless in his formation of names from classical sources, e.g. *Cecilioides*, which he meant to derive from *Cecus*.

⁵ Turton's "Manual", new edition.

⁶ Beck, "Index Moll.", p. 18, in his synonymy of *Bradybæna* converted the two last of them into the equally unacceptable " *Hygromanæ*" and " *Heliomanae*".

The synonymy of Risso's *Theba*, when restricted as just mentioned, according to our reading, should be as follows :—

Genus THEBA, Risso, 1826.

- Type, *Helix cartusiana*, Müller (selected by Pilsbry, 1895).
- 1819. *Teba* [pars]: Leach, Synop. Moll. Brit., proof sheets, p. 91.
 - 1821. *Helicella* [pars]: Féruccac, Tabl. syst. Limaçons, Jan. ed., p. 41 (June ed., p. 37).
 - 1821. *Zenobia* [pars]: Gray, London Med. Repos., xv, p. 239. [Non Oken, 1815 (Lepidopt.).]
 - 1826. *Theba* (Leach MS.): Risso, Hist. Nat. Europ. mérid., iv, p. 73.
 - 1833. *Monacha* [pars]: Fitzinger, Beitr. Landesk. Oesterr., iii, p. 95. [Non *Monachus*, Kaup, 1829 (Aves).]
 - 1837. *Bradybæna* [pars]: Beck, Index Moll., p. 18. [Non *Bradybænus*, Dejean, 1829 (Coleopt.).]
 - 1837. *Fruticicola* [pars]: Held, Isis, xxx, hft. 12, col. 914.
 - 1838. *Cernuella* [pars]: Schlüter, Kurz. syst. Verzeichn., p. 6.
 - 1871. *Carthusiana*: Kobelt, Cat. Europ. Binnencnoch., p. 11.
 - 1889. *Latonia*: Westerlund, Fauna Palæart. Region, ii, pp. 30 and 68. [Non Meyer, 1843 (Rept.).]
 - 1889. *Euomphalia*: ib., pp. 31 and 92.
 - 1904. *Westerlundia*: Kobelt, in Rossmässler's Icon., N.F. xi, pp. 131 and 181 [n.nov. for *Latonia*].

Féruccac's first group, Lomastomæ, need not be dwelt on at length. It comprised thirty-seven species, two of which are indeterminate, while two are now referred to Zonitidæ, and one to Pupillidæ, the remaining thirty-two being distributed among various genera of the Helicidæ, as shown in the list with which this paper concludes.

The Apostomæ, on the other hand, since they include Féruccac's "*Helicella*, Lamarck", demand a close scrutiny. They were divided by Féruccac into: "Les Pesons, *Verticilli*," ten species; "Les Hyalines, *Hyalinæ*," twenty-three species; and "Les Rubannies, *Fasciatæ*," twenty species. In the first subgroup are seven species now referred to *Pyramidula*, *Punctum*, *Patula*, *Helicodiscus*, and *Goniodiscus* (*i.e.* the *Helix* of Humphrey et alii); and three, *algira*, Linn. (the type), with *verticillus*, Fér., and *gemonense*, Fér., belonging to Montfort's prior genus *Zonites*. With a few exceptions the *Fasciatæ* are now placed in genera belonging to one or other of the numerous subfamilies of Zonitidæ. Hence *Helicella*, Fér., s.s., comes into use for the bulk of the *Hyalinæ*, with *Helix cellaria*, Müller, as the type (fixed by Gray in 1847).⁷

Three distinct genera have since been formed for certain species of the group, namely, *Vitreæ*, Fitzinger, 1833, *Petasina*, Beck, 1847, and *Zonitoides*, Lehmann, 1862. The synonymy of the four genera will therefore run as follows :—

⁷ "List of Genera of Recent Mollusca" in Proc. Zool. Soc., 1847. This reference applies to all the citations from Gray for that year.

Genus VITREA, Fitzinger, 1833.

Type, *Helix diaphana* (Studer), Fitzinger.

1821. *Helicella* [pars]: Féruccac, Tabl. syst. Limaçons, Jan. ed., p. 41 (June ed., p. 37).
1833. *Discus* [pars]: Fitzinger, Beitr. Landesk. Oesterr., iii, p. 99.
1833. *Vitrea*: *ib.*
1837. *Hyalinia*, Ag. (Msc.) [pars]: Charpentier, Neue Denkschr. Allg. Schweiz. Gesell., i [No. 2], p. 13.
1837. *Polita* [pars]: Held, Isis, xxx, hft. 12, col. 916.
- 1855, } *Crystallus*: Lowe, Proc. Zool. Soc. Lond., 1854, xxii, p. 178.
Mar.
- 1855, } *Apostoma* [pars]: Moquin-Tandon, Hist. Moll. France, ii, p. 72.
Sept.

Genus HELICELLA, Féruccac, 1821.

- Type, *Helix cellaria*, Müller (selected by Gray in 1847).
1815. *Vortex* [pars]: Oken, Lehrb. Naturg., iii, abth. I, p. 314. [Non Humphrey, 1797.]
1821. *Helicella* [pars]: Féruccac, Tabl. syst. Limaçons, Jan. ed., p. 41 (June ed., p. 37).
1833. *Oxychilus* [pars]: Fitzinger, Beitr. Landesk. Oesterr., iii, p. 100. [Non *Oxycheila*, Dejean, 1825 (Coleopt.).]
1837. *Hyalinia*, Ag. (Msc.) [pars]: Charpentier, Neue Denkschr. Allg. Schweiz. Gesell., i [No. 2], p. 13.
1837. *Polita* [pars]: Held, Isis, xxx, hft. 12, col. 916.
1850. *Hyalina* [pars]: Albers, Heliceen, p. 66. [Non Schumacher, 1817 (Marginellidae), nec Studer, 1820 (*Vitrina*).]
- 1855, } *Lucilla*: Lowe, Proc. Zool. Soc. Lond., 1854, xxii, p. 177.
Mar.
- 1855, } *Apostoma* [pars]: Moquin-Tandon, Hist. Moll. France, ii, p. 72.
Sept.

Subgenus HELICELLA, s.s.

1857. *Euhyalina*: Albers, Malak. Blätt., iv, p. 91.
1907. *Euhyalinia*: Taylor, Monog. Moll. Brit. Is. [ii], p. 18.

Subgenus RETINELLA (Shuttleworth MS.), Fischer, 1877.

- Type, *Helix olivetorum*, Gmelin (indicated by Fischer).⁸
1877. *Retinella* (Shuttleworth MS.): Fischer, Notitiae, Malac. Shuttleworth, ii, p. 5.
1878. *Ægopina*⁹: Kobelt, in Rossmässler's Icon., vi, p. 15.

Genus PETASINA, Beck, 1847.¹⁰

- Type, *Helix fulva*, Müller (selected by Gray in 1847⁷).
1833. *Conulus* [pars]: Fitzinger, Beitr. Landesk. Oesterr., iii p. 94. [Non Leske, 1778 (Echinod.).]
1837. *Petasia* [pars]: Beck, Index Moll., p. 21. [Non Stephens, 1828 (Lepidopt.); nec Morren, 1829 (Infusor.); nec Audinet-Serville, 1831 (Orthopt.).]
1838. *Cernuella* [pars]: Schlüter, Kurz. syst. Verzeichn., p. 6.
1847. *Petasina*: Beck, Amtl. Ber. 24 Versamm. Deutsch. Naturf., p. 122.

⁸ The well-known British species, *nitidula*, Drap., *pura*, Alder, and *radiatula*, Alder, are now placed in this subgenus on anatomical grounds.

⁹ Previously the species of this subgenus had been referred to *Mesomphix*, Rafinesque (Journ. de Physique, lxxxviii, 1819, p. 425), but that name is now reserved for American species only.

1883. *Euconulus* : Reinhardt, Sitzb. Gesell. Naturf. Freunde, Berlin, 1883, p. 86.
 1886. *Trochulus* : Westerlund, Fauna Paläaret. Region, i, p. 26 and Beil. iii, p. 16. [Non Humphrey, 1797 (= *Monodonta*, Lam.); nec " *Trochulus*, Christ." Gray, 1847; nec *Trochula*, Schlüter, 1838 (= *Helicopsis*).]
 1889. *Ernstia* : Jousseaume, Mém. Soc. Zool. France, ii, p. 250.
 1890. *Arnouldia* : Bourguignat, Bull. Soc. Malac. France, vii, p. 330.

Genus ZONITOIDES, Lehmann, 1862.

Type, *Helix nitidus*, Müller.

1821. *Helicella* [pars] : Féruccac, Tabl. syst. Limaçons, Jan. ed., p. 41 (June ed., p. 37).
 1833. *Oxychilus* [pars] : Fitzinger, Beitr. Landesk. Oesterr., iii, p. 100. [Non *Oxycheila*, Dejean, 1825 (Coleopt.).]
 1837. *Hyalinia*, Ag. (Msc.) [pars] : Charpentier, Neue Denkschr. Allg. Schweiz. Gesell., i [No. 2], p. 13.
 1850. *Hyalina* [pars] : Albers, Heliceen, p. 66. [Non Schumacher, 1817 (Marginellidae); nec Studer, 1820 (= *Vitrina*).]
 1855. *Apostostoma* [pars] : Moquin-Tandon, Hist. Moll. France, ii, p. 72.
 1862. *Zonitoides* : Lehmann, Malak. Blätt., ix, p. 111.

Section 1 : *Zonitoides*, s.s., as above.

Section 2 : *Pseudohyalina*, Morse, 1864.

Type, *P. exigua* (Stimpson), hereby selected.

1864. *Pseudohyalina* : Morse, Journ. Portland Soc. Nat. Hist., i, pp. 5 and 15.
 1879. *Chanomphalus*, Streb., Beitr., Kennt. Fauna Mexik., L. & S. Conch. iv, 1880 [i.e. 1879], p. 19.

Hygromanes, Féruccac's third group, has had, like his first, to be redistributed. Beck, in 1837,¹⁰ practically incorporated it bodily, with some species from Héliomanes, in his *Bradybæna*, including *carthusiana* and *carthusianella*, which formed the core of Risso's *Theba* (Leach MS.). Seeing that Beck had already used *Theba*, Leach, for the bulk of Héliomanes plus some Hygromanes,¹¹ he cannot be held to have discriminated between the various forms classed together under Féruccac's Hygromanes.

The group as constituted by Féruccac, contained twenty-eight species. Of these, eight are referable to *Theba* (Leach MS.) of Risso ; three are now placed in *Eulota*, Hartmann ; one in *Acanthinula*, Beck ; one in *Thersites*, Pfeiffer ; while one, " *albula* ? Studer," remains indeterminate. The remaining fourteen form a concrete group that of late has been referred to *Hygromia*, Risso, 1826. Only two species were included by Risso under the name :— *cinctella*, Fér., and *folliculata*, Risso (= *ciliata* (Venetz), Studer, 1820), and Gray in 1847⁷ selected the former as the type. *Hygromia* as a generic name had, however, been already employed by Schrank in 1803 for Vermes,¹² and is consequently not available. Recourse must therefore be had to Held's name *Fruticicola*, founded in 1837.¹³

¹⁰ Index Moll., p. 18.

¹² Fauna Boica, iii, pt. ii, pp. 186 and 227-9.

¹¹ Ib., p. 10.

¹³ Isis, xxx, hft. 12, col. 914.

Gray in 1847 had made this a synonym for *Hygromia*, and consequently *cinctella*, which is the first species cited by Held, remains the type of the genus. The genus, which is a large one, has been divided into subgenera on anatomical grounds by more than one writer, the latest of whom, Mr. Hugh Watson,¹⁴ has so ably summed up the work of his predecessors for the greater part of the genus that it only remains for us to make some necessary alterations in his nomenclature, to supply some names for sections left innominate by him, and to add those sections with which he did not deal, in order to arrive at a correct synonymy of the whole genus.

Genus FRUTICICOLA, Held, 1837.

- Type, *Helix cinctella*, Draparnaud (selected by Gray, 1847⁷).
 1821. *Helicella* [pars]: Féruccac, Tabl. syst. Limaçons, Jan. ed., p. 41 (June ed., p. 37).
 1826. *Hygromia*: Rissio, Hist. Nat. Europ. mérid., iv, p. 66. [Non Schrank, 1803 (Vermes).]
 1837. *Bradybæna* [pars]: Beck, Index Moll., p. 18. [Non *Bradybænus*, Dejean, 1829 (Coleopt.).]
 1837. *Fruticicola*: Held, Isis, xxx, hft. 12, col. 914.

Subgenus FRUTICICOLA, s.s.

Section 1: *Zenobiella*, n.nov.

Type, *Helix subrufescens*, Miller.

1821. *Zenobia*: Gray, Lond. Med. Repos., xv, p. 239, for *Helix corrugata* [n.nud.=*Helix fusca*, Mont., fide Gray, non *H. fusca*, Poiret] = *subrufescens*, Miller. [Non *Zenobia*, Oken, 1815 (Lepidopt.).]

Section 2: *Fruticicola*, s.s.

1837. *Fruticicola*: Held, as above.

1902. *Sciaphila*: Westerlund, Rad Jugoslav. Akad., cli, p. 92. [Non Treitschke, 1829 (Lepidopt.).]

Subgenus MONACHELLA, n.nov.

Type, *Helix incarnata*, Müller.

1833. *Monacha* [pars]: Fitzinger, Beitr. Landesk. Oesterr., iii, p. 95.¹⁵ [Non *Monachus*, Kaup, 1829 (Aves).]¹⁶

Subgenus CAPILLIFERA, Honigmann, 1906.

Type, *Helix hispida*, Linné.

1840. *Trichia*: Hartmann, Erd. & Süssw.-Gaster., p. 41. [Non *Trichia*, Haller, 1768 (Mycetozoa)¹⁷; nec *Trichius*, Fabricius, 1775 (Coleopt.); nec *Trichia*, Haan, 1841 (Crust.).¹⁸]

1906. *Capillifera*: Honigmann, Abhandl. Mus. Magdeburg, i, p. 190.

¹⁴ Proc. Malac. Soc. Lond., xiii, 1919, p. 120–132.

¹⁵ Both Hartmann (Ind. gen. Malac., ii, July, 1847, p. 5) and Gray (Proc. Zool. Soc. Lond., 1847, Nov., p. 173) give *Helix carthusiana*, Müller, as the type, guided thereto evidently by Fitzinger's choice of the name *Monacha*; thus constituting *Monacha* a synonym of *Theba*, Risso, 1826.

¹⁶ Pilsbry (Man. Conch. ser. II, vol. ix, p. 271) makes Westerlund's *Latonia* a synonym, but puts all his species under *Theba*!

¹⁷ Honigmann advances this as a case of pre-occupation because some authorities classed the Mycetozoa with the Animal Kingdom.

¹⁸ Fauna Japonica, v, p. 109.

Section 1: *Capillifera*, s.s., as above.

Section 2: *Petasella*, n.nov.¹⁹

Type, *Helix unidentata*, Draparnaud (selected by Westerlund, 1902).

- 1826. *Trochiscus* [pars]: Held, Isis., xxx, hft. 12, col. 915. [Non Heyden, 1826, (Arach.).]
- 1837. *Petasia* [pars]: Beck, Index Moll., p. 21. [Non Stephens, 1828 (Lepidopt.).]
- 1838. *Cernuella* [pars]: Schläuter, Kurz. syst. Verzeichn., p. 6.
- 1847. *Petasina* [pars]: Beck, Amtl. Ber. 24, Versamml, Deutsch. Naturf., p. 122.
- 1889. *Perforatella*, Schläuter: Westerlund, Fauna Paläarct. Region, ii, p. 32. [Non Schläuter.]²⁰

Section 3: *Ponentina*, Hesse, Arch. f. Mollkunde, 1921, p. 62.

Type, *Helix subvirescens*, Bellamy.²¹

Section 4: *Perforatella*, Schläuter, 1838. [Non Westerlund, 1889, Pilsbry, 1895, et alii.]

Type, "P. bidentata, m." [= *bidentata*, Chemnitz].

- 1826. *Trochiscus* [pars]: Held, Isis., xxx, hft. 12, col. 915. [Non Heyden, 1826 (Arach.).]
- 1838. *Perforatella*: Schläuter, Kurz. syst. Verzeichn., p. 4.
- 1855. *Dibothrion*: Pfeiffer, Malakozool. Blätter., ii, p. 128.

Section 5: *Metafruticicola*, von Ihering, 1892.

Type, *Helix pellita*, Féruccac (selected by Tryon, 1888²²).

- 1884. *Pseudocampylaea*: Hesse, Jahrb. Deutsch. Malak. Gesell., xi, p. 237. [Non Pfeiffer, 1877.]
- 1889. *Cressa*: Westerlund, Fauna Paläaret. Region, ii, p. 4. [Non Böck, 1871.]
- 1892. *Metafruticicola*: von Ihering, Zeitschr. f. Wissensch. Zool., liv, p. 452 [buried in text].
- 1902. *Metafruticicola* [err. typ.]: Westerlund, Rad Jugoslav. Akad., cli, p. 92.

Subgenus CILIICOLA, Mousson, 1872.

Type, *Helix ciliata*, Venetz.

1838. *Cernuella* [pars]: Schläuter, Kurz. syst. Verzeichn., p. 6.

1872. *Ciliella*: Mousson, Neue Denkschr. Allg. Schweiz. Gesell., xxv, No. 1, 1872 (1873), p. 60.

¹⁹ *Petasia*, Beck, was proposed to take the place of *Conulus*, Fitzinger, 1833, nom. pre-occ., and like it contained species both of trochiform zonitoids and trochiform helicoids. Gray, 1847,⁷ selected as type of *Petasia* Beck's first species *Helix trochiformis*, Montagu = *fulva*, Müller. At the same time he named *Helix fulva*, Müller, as the type of *Conulus*. *Petasia* being preoccupied was changed to *Petasina*, which takes of course the same type. Hence *Petasina* displaces *Euconulus*, Reinhardt, 1883, and a new name is requisite for the group under consideration.

²⁰ Pilsbry (Man. Conch., ser. II, vol. ix, p. 277) followed Westerlund in this error.

²¹ Kennard & Woodward, Proc. Malac. Soc. Lond., xiii, 1919, p. 133.

²² Man. Conch., ser. II, vol. iv, p. 69.

1889. *Lepinota*: Westerlund, Fauna Paläart. Region, ii, pp. 2 and 16.
[*Non Lepinotus*, Heyden, 1850 (Neuropt.).²³]

What then becomes of Féruccac's fourth group, Héliomanes, to which the name *Helicella* has lately and wrongfully become attached?

Out of the thirty species, eight have been removed to genera in quite other families, viz. to *Euparypha*—*variegata*, Chemn., *pisana*, Müller, *subdentata*, Fér., *planata*, Chemn.; to *Cepolis*—*carnicolor*, Fér. [= *varians*, Menke]; to *Trochomorpha*—*exclusa*, Fér., *trochiformis*, Fér. While the identity of *elfordia*, Fér., has not been established.

The remaining twenty-one (referred by Beck²⁴ to the subgenus *Theba*, which, as already noted, had been established by Risso for the *cartusiana* group), will come under the generic name of *Helicopsis*, proposed by Fitzinger²⁵ in 1833 for the *Helix striata* of Müller. Pilsbry,²⁶ among the many slips inevitable in pioneer work such as his, converted the *Helicopsis* of Fabricius, 1807,²⁷ into *Helicopsis*, and hence set Fitzinger's name aside as pre-occupied, but the two names are quite distinct, and differ etymologically, so that Fitzinger's name must be accepted, although it unfortunately excludes the better-known and widely used *Xerophila* of Held, 1837, which would otherwise have replaced the misapplied *Helicella* of Pilsbry.

Of the several subgenera into which *Helicopsis* has been divided, only five are represented among the species enumerated by Féruccac, namely: *Cernuella*, Schläter (*olim Heliomanes*, auctt. *non Féruccac*); *Xerophila*, Held; *Helicopsis*, s.s.; *Jacosta*, Gray; and *Xeroclivia*, Monterosato (*olim Trochula*, Schläter, 1838, *non Trochulus*, Humphrey, 1797).

In view, however, of the numerous changes in the nomenclature of the subgenera of *Helicopsis* that have become necessary, it may be of service if the whole of them be restated here as it seems to us they should stand:—

Genus *HELICOPSIS*, Fitzinger, 1833.

Genotype, *Helix striata*, Müller.

1821. *Helicella* [pars]: Féruccac, Tabl. syst. Limaçons, Jan. ed., p. 41
(June ed., p. 37).
1833. *Helicopsis*: Fitzinger, Beitr. Landesk. Oesterr., iii, p. 101. [*Non Beck, 1837.*]
1837. *Xerophila* [pars]: Held, Isis, xxx, hft. 12, col. 913.

²³ Entom. Zeitschr. Stettin, xi, p. 84.

²⁴ Index Moll., 1837, pp. 11–14.

²⁵ Beitr. Landesk. Oesterr., iii, p. 101.

²⁶ Man. Conch., ser. II, vol. ix, p. 253.

²⁷ Illiger's Mag. f. Insektenk., vi, p. 285.

Subgenus XEROCRASSA, Monterosato, 1892.²⁸Type, *Helix seetzeni*, Koch.

1892. *Xerocrassa*: Monterosato, Atti R. Accad. Palermo, ser. III, vol. ii [Classe Sci., No. 2], p. 23.

Subgenus CERNUELLA, Schlüter, 1838.²⁹Type, *Helix variabilis*, Draparnaud (= *virgata*, Da Costa).

1838. *Cernuella*: Schlüter, Kurz. syst. Verzeichn., p. 6.

- 1840, } *Heliomanes*: Brown,³⁰ Illust. Conch. Gt. Brit., ed. 2, p. 49.
post } Sept. } [Non Newman, March, 1840 (Coleopt.).]

1856. *Heliomane* [err. typ. ?]: Moquin-Tandon, Hist. Moll. France, ii, p. 259.

1892. *Xeroampulla*: Monterosato, Atti R. Accad. Palermo, ser. III, vol. ii [Classe Sci., No. 2], p. 22 (with the further sectional names: *Xerofusca* (p. 22); *Xerolauta*, *Xerolincta*, *Xerolæta*, *Xerovaria* (p. 23); *Xerambigua*, *Xerolutea*, *Xeromagna*, *Xeropicta*, *Xerobulla* (p. 24); *Xeromunda*, *Xerocauta*, *Xerovera*, and *Xerolissa* (p. 25)).

Subgenus XEROPHILA, Held, 1837.

Type, *Helix itala*, Linné (selected under the synonym of *H. erectorum*, Müller, by Von Martens, in Albers "Heliceen", 1860).

1837. *Xerophila*: Held, Isis, xxx, hft. 12, col. 913.

1876. *Planatella*: Clessin, Deutsch. Excur. Moll. Fauna, p. 143.

1879. *Pseudoxerophila*: Westerlund, in Westerlund & Blanc, Aperçu Faune Malac. Grèce, p. 55.

1892. *Xerolenta*: Monterosato, Atti R. Accad. Palermo, ser. III, vol. ii [Classe sci., No. 2], p. 24 (with the further sectional names: *Xerolaxa*, *Xerofriga*, *Xerogyra*, and *Xerocincta*).

Subgenus XEROCAMPYLÆA, Kobelt, 1871.

Type, *Helix zelabori*, Pfeiffer.

1871. *Xero-Campylæa*: Kobelt, Cat. Europ. Binnenconch., p. 15, foot-note.

²⁸ The title-page of the volume bears date 1893, but on the back wrapper it is given as 1892. It was received at the Natural History Museum, 15th January, 1893.

²⁹ This genus of Schläuter has been overlooked by all but three authorities. Hermannsen (Ind. Supp., 1852, p. 27) followed by Paetel (Fam.- und Gatt.-Namen Moll., p. 39), who both put it under *Teba*, Leach, without indicating any type for either. H. and A. Adams (Genera Moll., ii, 1855, p. 215), who cite it as a synonym for their "Genus *Theba*, Risso" and give as examples *T. virgata*, Da C., and *T. pisana*, Müll. No type having, therefore, been fixed we select *Helix variabilis*, Drap. = *virgata*, Da C., as the type and use Schläuter's name for this subgenus.

³⁰ As already noted, neither Féussac, 1821, nor Gray, April, 1840, employed this name in either a generic or subgeneric sense.

Subgenus *HELICOPSIS*, s.s.Type, *Helix striata*, Müller.

1833. *Helicopsis*: Fitzinger, Beitr. Landesk. Oesterr., iii, p. 101.
 1871. *Candidula*: Kobelt, Cat. Europ. Binnconch., p. 22.
 1876. *Striatinella*: Clessin, Deutsch. Excur. Moll. Fauna, p. 149.
 1876. *Striatella*: Westerlund, Fauna Europ. Moll. Extramar., p. 105.
 [*Non* Brot, 1874, (*Melaniidæ*).]
 1892. *Xeroclausa*: Monterosato, Atti R. Accad. Palermo, ser. III,
 vol. ii [Classe Sci., No. 2], p. 22 (with the further sectional
 names: *Xerolena*, *Xerotringa*, *Xerovaga* (p. 22); *Xeroalbina*,
 Xeromicra, and *Xerotricha* (p. 23)).

Subgenus *MONILEARIA*, Mousson, 1872.

- Type, *Helix phalerata*, Webb & B. (selected by Pilsbry,
 1895).
 1872. *Monilearia*: Mousson, Neue Denkschr. Allg. Schweiz. Gesell.,
 xxv [No. 1], p. 39.

Subgenus *JACOSTA*, Gray, 1821.Type, *Helix albella*, Draparnaud = *explanata*, Müller.

1821. *Jacosta*: Gray, Lond. Med. Repos., xv, p. 239.
 1885. *Numidia*: Issel, Ann. Mus. Civ. Genova, ser. II, vol. ii, p. 8.
 1892. *Xerofalsa*: Monterosato, Atti R. Accad. Palermo, ser. III, vol. ii
 [Classe Sci., No. 2], p. 21 (with the further sectional names:
 Xerosecta, *Xeroplana* (p. 21); *Xeroamanda*, *Xeromæsta*
 (p. 22); *Xerocodia*, *Xeroplexa*, and *Xerotropis* (p. 23).)
 1893. *Tropidocochlis* [pars]: Locard, Échange, ix, p. 97.

Subgenus *XEROLEUCA*, Kobelt, 1877.Type, *Helix turcica*, Chemnitz.

1877. *Xeroleuca*: Kobelt, Jahrb. Deutsch. Malak. Gesell., iv, p. 25 [in
 text]. Reprint, as supplement to his "Catalog", p. 13.

Subgenus *OBELUS*, Hartmann, 1842.Type, *Helix Preauxii* [i.e. *despreauxii*, Orb.].

1842. *Obelus*: Hartmann, Erd.- & Süssw.-Gastrop., p. 158.
 1892. *Xeroptyca*: Monterosato, Atti R. Accad. Palermo, ser. III,
 vol. ii [Classe Sci., No. 2], p. 25.

Subgenus *XEROCLIVIA*, Monterosato, 1892.Type, *Helix elegans*, Gmelin.³¹

1837. *Turricula*: Beck, Index Moll., p. 10. [*Non* Hermann, 1783
 (Gastr.); *nec* Schumacher, 1817 (*Pleurotomidæ*).]
 1838. *Trochula*: Schlüter, Kurz. syst. Verzeichn., p. 7. [*Non*
 Trochulus, Humphrey,³² 1797 (= *Monodonta*); *nec*
 " *Trochulus*, Christ.", Gray, 1847 (*Helix hispida*, Linn.);
 nec *Trochulus*, Westerlund, 1886 (*Petasina fulva*, Müll.).]

³¹ *Trochoidea*, Brown (Illust. Conch. Gt. Brit., 1827, pl. xli, f. 80, 81), has been quoted for this subgenus under the belief that the *Trochus terrestris* of Pennant was the *Helix elegans* of Gmelin, whereas it was the *Helix fulva* of Müller without doubt.

³² Even if Humphrey's names in his "Museum Colonneanum" be set aside, the name *Trochulus* is so sure to have been quoted in some work that it is safer to suppress it.

1850. *Crenea* [pars] : Albers, Heliceen, p. 77. [Non Risso, 1826.]
 1892. *Xeroclivia* : Monterosato, Atti R. Accad. Palermo, ser. III, vol. ii
 [Classe Sci., No. 2], p. 25 (with the further sectional names :
 Xeronexa and *Xerocochlea*.)
 1893. *Tropidocochlis* [pars] : Locard, Echange, ix, p. 97.

The result of the foregoing investigations is to show that the species ranged by Féruccac under *Helicella* must be redistributed into the following families and genera :—

Family TESTACELLIDÆ.

Genus RHYTIDA, Albers.

(*Apostomæ* : *Hyalinæ*).
 capillacea, Fér.

Family CIRCINARIIDÆ.

Genus CIRCINARIA, Beck.

(*Apostomæ* : *Hyalinæ*).
 planorboides, Rafinesq. [= *concava*, Say].

Genus ZOPHOS, Gude.

(*Apostomæ* : *Hyalinæ*).
 concolor, Fér.

Family ZONITIDÆ.

Subfamily ZONITINÆ.

Genus MESOMPHIX, Rafinesque.

(*Apostomæ* : *Hyalinæ*).
 lævigata, Rafinesq.

Genus ZONITES, Montfort.

(*Apostomæ* : *Verticilli*).
 verticillus, Fér.
 algira, Linné.
 gemonense ? Fér.

Genus VITREA, Fitzinger.

(*Apostomæ* : *Hyalinæ*).
 crystallina, Müller.
 hyalina ? Fér. [= *diaphana*, Stud.].

Genus HÉLICELLA, Féruccac.

Subgenus *Helicella*, s.s.

(*Apostomæ* : *Hyalinæ*).
 glaphyra, Say [= *cellaria*, Müll.].
 cellaria, Müller.
 glabra, Studer.
 nitens, Maton & R. [= ? *alliaria*, Miller].

Subgenus *Retinella*, Shuttleworth.

(*Aplostomæ* : *Hyalinæ*.)

olivetorum, Gmelin.

protensa, Fér.

nitidula, Drap.

nitidosa, Fér. [= *radiatula*, Alder].

vitrina, Fér. [= *pura*, Alder].

Genus *PETASINA*, Beck.

(*Aplostomæ* : *Fasciatæ*.)

fulva, Müller.

Subfamily *ARIOPHANTINÆ*.

Genus *Zonitoides*, Lehmann.

(*Aplostomæ* : *Hyalinæ*.)

nitida, Müller.

arborea, Say.

Genus *Ariophanta*, Desmoulin.

(*Lomastomæ*.)

trifasciata, Chemnitz [= *lævipes*, var.].

(*Aplostomæ* : *Fasciatæ*.)

candida, Gmelin ? [= ? *lævipes*, Müll.].

lævipes, Müller.

Subgenus *Xestina*, Pfeiffer.

(*Aplostomæ* : *Fasciatæ*.)

Javacensis, Fér.

commendabilis, Fér. [= ? *bataviana*, V. de B.].

exilis, Müller.

Subgenus *Nilgiria*, Godwin-Austen.

(*Aplostomæ* : *Fasciatæ*.)

Korékouké, Fér. [= *maderaspatana*, Gr.].

Subfamily *DYAKINÆ*.

Genus *Dyakia*, Godwin-Austen.

(*Aplostomæ* : *Fasciatæ*.)

janus bifrons ? Chemn. [= *janus*].

Subfamily *XESTINÆ*.

Genus *XESTA*, Albers.

(*Aplostomæ* : *Fasciatæ*.)

nemorensis, Müller.

unizonalis, Lamk. [= *monozonalis*, Lamk.].

citrina, Linné.

Subfamily **HEMIPLECTINÆ.**Genus **HEMIPLECTA**, Albers.

(Lomastomæ.)

pernobilis, Féér.(Aplostomæ : *Fasciatæ*.)*rapa*, Müller.*clairvillia*, Féér. [i.e. *clairvillei*.].Genus **RHYSTA**, Albers.(Aplostomæ : *Fasciatæ*.)*bupthalmus*, Féér. [= *stolephora*, Val.].Family **TROCHOMORPHIDÆ.**Genus **TROCHOMORPHA**, Albers.

(Héliomanes.)

exclusa, Féér.*trochiformis*, Féér.Family **ENDODONTIDÆ.**Genus **PUNCTUM**, Morse.(Aplostomæ : *Verticilli*.)*pygmæa*, Drap.Genus **PATULA**, Held.(Aplostomæ : *Verticilli*.)*alternata*, Say.Genus **HELICODISCUS**, Morse.(Aplostomæ : *Verticilli*.)*lineata*, Say [= *parallelus*, Say].Genus **GONIOPHRAGMUS**, Fitzinger (em.).(Aplostomæ : *Verticilli*.)*rotundata*, Müller.*ruderata*, Studer.*perspectiva*, Say.*convexa*, Féér. [= *frivaldszkyana*, Rm.].Family **HELICIDÆ.**Subfamily **POLYGYRINÆ.**Genus **POLYGYRA**, Say.Subgenus *Triodopsis*, Rafinesque.

(Lomastomæ.)

richardi, Féér. [= *profunda*, Say].Genus **POLYGYRATIA**, Gray.

(Lomastomæ.)

polygyrata, Born.

Genus **SOLAROPSIS**, Beck.

(*Lomastomæ.*)

pellis serpentis, Chemnitz.

Genus **TRIGONEPHRUS**, Pilsbry.

(*Hygromanes.*)

ambiguosa, Fér.

Subfamily *ACAVINÆ.*

Genus **AMPELITA**, Beck.

(*Lomastomæ.*)

sepulcralis, Fér.

Genus **MACROCYCLIS**, Beck.

(*Lomastomæ.*)

laxata, Fér.

Subfamily *CAMÆNINÆ.*

Genus **CAMÆNA**, Albers.

(*Lomastomæ.*)

senegalensis, Chemnitz [= *cicatricosa*, Müller].

(*Aplostomæ*: *Fasciatæ.*)

cicatricosa, Müller.

Genus **OBBA**, Beck.

(*Lomastomæ.*)

collapsa, Perry [= *planulata*, Lam.].

Genus **PLANISPIRA**, Beck.

(*Lomastomæ.*)

zonalis, Fér.

exceptiuncula, Fér.

zonaria, Müller [i.e. Linn.].

zodiaca, Fér.

Subgenus *Trachia*, Albers.

(*Lomastomæ.*)

proxima, Fér.

fallaciosa, Fér.

ruginosa, Fér.

Genus **CHLORITIS**, Beck.

(*Lomastomæ.*)

unguicula, Fér.

ungulina, Linné.

circumdata, Fér.

Genus **ATHERSITES**, Pfeiffer.

Subgenus *Badistes*,

(*Hygromanes.*)

sutilosa, Fér. [= *jervisensis*, Q. & G.]

Subfamily *HELICINÆ*.Genus *CEPOLIS*, Montfort.Subgenus *Hemitrochus*, Swainson.

(Héliomanes.)

carnicolor, Fér. [= *varians*, Mke.].Genus *EULOTA*, Hartmann.Subgenus *Eulota*, s.s.

(Hygromanes.)

fruticum, Müller.Subgenus *Eulotella* (v. Mts.) Moellendorff.

(Hygromanes.)

similaris, Fér.Genus *CATHAICA*, Moellendorff.Subgenus *Eucathaica*, Andreae.

(Hygromanes.)

fasciola, Drap.Genus *HELICOPSIS*, Fitzinger.Subgenus *Cernuella*, Schlüter.

(Héliomanes.)

cespitosum, Drap.*variabilis*, Drap.*subrostrata*, Fér.*cretica*, Fér.*simulata*, Fér.*maritima*, Drap.Subgenus *Xerophila*, Held.

(Héliomanes.)

ericorum, Müller [= *itala*, Linn.].*neglecta*, Drap.Subgenus *Helicopsis*, s.s.

(Héliomanes.)

conspurcata, Drap.*striata*, Drap. [= *intersecta*, Mich.].*candidula*, Studer.*gratiosa*, Studer [= *candidula*, var.].Subgenus *Jacosta*, Gray.

(Héliomanes.)

groyana, Fér. [= *corrugata*, Gm.].*albella*, Drap. [= *explanata*, Müll.].Subgenus *Xeroclivia*, Monterosato.

(Héliomanes.)

pyramidata, Drap.*crenulata*, Olivier.*elegans*, Gmelin.*elata*, Faure-Biguet.*conica*, Drap. [= *trochoides*, var.].

Genus *THEBA*, Risso.(*Hygromanes*.)*olivieri*, Fér.*obstrusa*, Fér. [= *obstructa*].*Carthusianella*, Drap. [= *cartusiana*, Müll.].*Carthusiana*, Drap. [= *cantiana*, Mont.].*berytensis*, Fér.³³*cantiana*, Montagu.*strigella*, Drap.*glabella*, Drap. [= *cartusiana*, var.].Genus *FRUTICICOLA*, Held.Subgenus *Fruticicola*, s.s.(*Hygromanes*.)*cinctella*, Drap.*limbata*, Drap.Subgenus *Monachella*, Gude & Woodw.(*Hygromanes*.)*incarnata*, Müller.*sericea*, Müller [= *incarnata*, juv.].Subgenus *Capillifera*, Honigmann.Section *Capillifera*, s.s.(*Hygromanes*.)*villosa*, Drap. [i.e. Studer].*circin[n]ata*, Studer [= *montana*, Studer].*plebeium*, Drap.*rufescens*, Montagu [= *striolata*, C. Pfeiffer].*hispida*, Müller [i.e. Linné].*caelata*, Studer.Section *Ponentina*, Hesse.(*Lomastomæ*.)*martigena*, Fér. [= *revelata* (Fér) Mich.].(*Hygromanes*.)*revelata*, Fér.Subgenus *Metafruticicola*, v. Ihering.(*Lomastomæ*.)*naxientia*, Fér. [= *naxiana*].*lecta*, Fér.*pellita*, Fér.Subgenus *Ciliella*, Mousson.(*Hygromanes*.)*ciliata*, Venetz [i.e. Studer].³³ Hesse (Arch. f. Mollkunde, 1921, p. 67) places this in *Metafruticicola*, s.s.

Genus HELICIGONA, Féussac.

Subgenus *Chilostoma*, Fitzinger.

(Lomastomæ.)

carascalensis, Fér.³⁴*glacialis*, Thomas.*alpina*, Faure-Biguet.*cornea*, Drap.*cingulata*, Studer.*zonata*, Studer.*pyrenaica*, Drap.*lefeburiana*, Fér.Subgenus *Kosicia*, Brusina.

(Lomastomæ.)

intermedia, Fér.Subgenus *Elona*, H. & A. Adams.

(Lomastomæ.)

quimperiana, Fér.

Genus EUPARYPHA, Hartmann.

(Apostomæ) : *Fasciatæ.**leucas*, Linné.

(Heliomanes.)

variegata, Chemn. [= *pisana*, Müll.]*pisana*, Müller.*subdentata*, Fér.*planata*, Chemn.

Genus MURELLA, Pfeiffer.

(Lomastomæ.)

strigata, Müller.

Family PUPILLIDÆ.

Subfamily PUPILLINÆ.

Genus PYRAMIDULA, Fitzinger.

(Apostomæ : *Verticilli.*)*rupestris*, Drap.

Subfamily VALLONIINÆ.

Genus VALLONIA, Risso.

(Lomastomæ.)

pulchella, Müller.a) *costata*, Müller.

Genus ACANTHINULA, Beck.

(Hygromanes.)

aculeata, Müller.

³⁴ Hesse (Arch. f. Mollkunde, 1921, p. 59) makes this the type of a new genus *Pyrenæaria*, which he places in Fruticicolinæ.

THE ANATOMY AND RELATIONSHIPS OF *HELIX SUBPLICATA*,
SOWERBY.

By Professor T. D. A. COCKERELL.

(Communicated by B. B. WOODWARD, F.L.S.)

Read 8th April, 1921.

Helix subPLICATA is a fine species, of the general form of *H. aspersa*, confined to the island of Porto Santo, one of the Madeira group. It was described by G. B. Sowerby in 1824 (*Zool. Journ.*, i, p. 56, pl. 3, fig. 1) from specimens collected by Mr. T. E. Bowditch. For many years it was only known as an extinct species, fossil in the sandy Pleistocene deposits of Porto Santo. In the spring of 1848, however, it was found alive by Wollaston and Armitage on the Ilheo de Baixo, or Lime Island, the largest of the islets round Porto Santo. The living specimens showed that the shell was covered with a rich brown periostracum, and was wholly without bands or spots. When I was recently in Porto Santo I obtained a good series of fossil *H. subPLICATA*, varying much in size, in the vicinity of the Fonte d'Areia, on the main island. I visited the Lime Island and found one shell with the periostracum on the steep slope of the eastern side. On returning to Funchal I called on the Rev. Drummond Paterson, who very kindly placed at my disposal a couple of living *H. subPLICATA*, collected by Mr. José de Souza on the Lime Island. I was thus able to examine the anatomy and fix the position of the species in the classification.

H. subPLICATA crawls freely by day, and is not easily alarmed. When it crawls the foot projects behind the shell, but the head is only 2 or 3 mm. in front of the lip, instead of being far extended as in *H. aspersa*. The animal is of a very dark plumbeous colour, almost black, with oculiferous tentacles long (about 13 mm.); the inferior tentacles are also long; mantle grey; foot pointed behind; sole plumbeous, dilute grey in middle. There is a greater distance between the lower and the oculiferous tentacles than in *H. aspersa*. The rugæ are essentially as in *aspersa*. The shell is peculiar, not only for the strong transverse riblets, but especially for the character of the apical whorls, which show, except at the extreme apex, close-set, strong pustuliform granules, arranged more or less clearly in oblique decussating series. In this character the shell differs conspicuously from *H. aspersa*, as well as from *H. mazzullii*, *Leptaxis furva*, and *embescens*, *L. phlebophora*, etc. It resembles, in this peculiarity of sculpture alone, the extinct *Plebecula bowditchiana*, Fé., as well as certain other shells not closely related.

Pilsbry (*Man. Conch.*, 2nd ser., ix, p. 309), in another connection, comments on this type of sculpture thus: "A thorough study of the Miocene Helices is necessary to determine whether the peculiar sculpture which occurs in so many forms is a character assumed

simultaneously by many subgenera and genera, or an indication of actual genetic relationship. Not much evidence can be adduced in favour of the latter view from the recent fauna, for species of widely different genera exhibit the hairs or papillæ arranged in obliquely decussating series ; in *Hygromia*, *H. consona*, *lanuginosa*, etc. . . . in *Thysanophora*, *T. stigmatica* and its allies ; in *Eulota*, numerous oriental species. The list could be indefinitely increased. It will be perceived from this that those authors who insist upon the presence of *Chloritis* in the European Miocene fauna, stand upon narrow and insecure footing." It may well be, however, that the facts are somewhat intermediate between the two diverse views postulated ; namely, that the character is ancient and does indicate a remote common descent, but has been lost in the majority of living species. It seems significant that it is specially characteristic of a number of Tertiary forms.

An examination of the anatomy of *H. subplicata* shows that it is not, as I had expected on account of the sculpture of the shell, related to the other Helicidæ of the Madeira Archipelago. It falls near true *Helix*, of which it may be considered to represent a subgenus, for which I propose the name *Idiomela*. The principal characters of this monotypic subgenus (or genus ?) are as follows :—

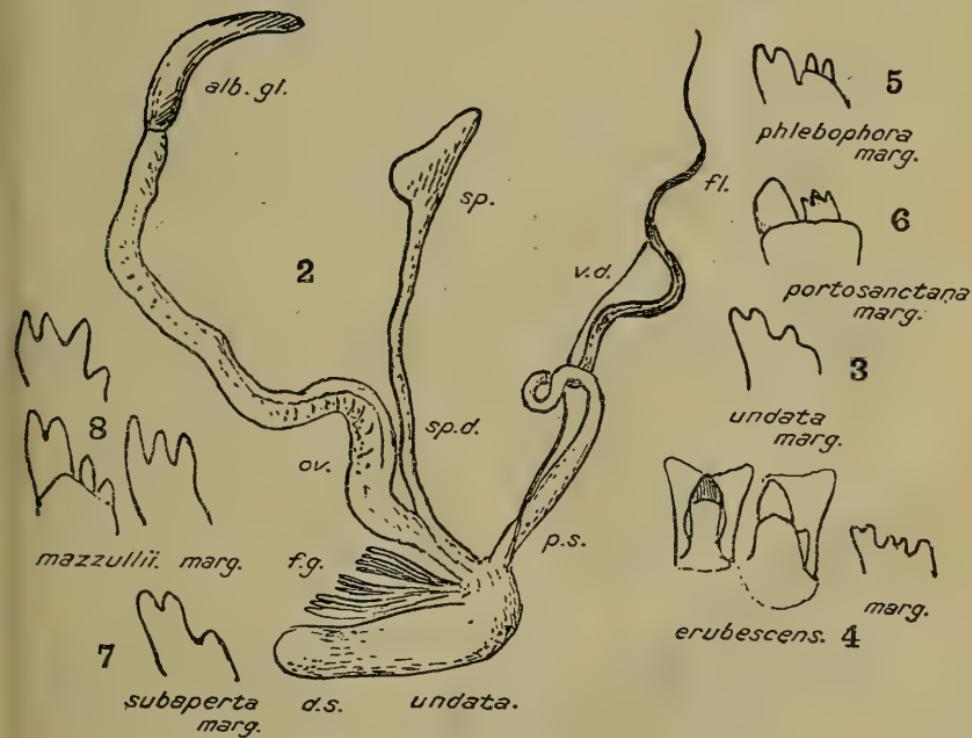
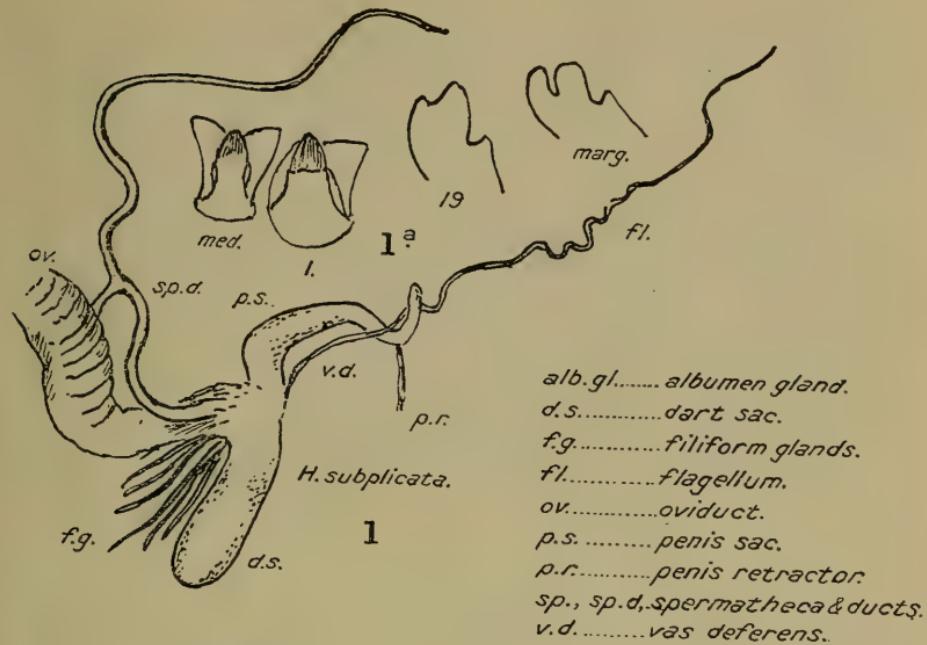
IDIOMELA subg.n.

Type *Helix subplicata* Sowerby. Shell large, shaped essentially as in *H. aspersa*, but apical whorls with closely set decussating rows of papillæ or granules ; last whorl with strong transverse plicæ or ribs ; periostracum brown, without bands or spots.

Jaw strongly curved, very dense and dark, with five ribs, the outer ones feeble, but the inner three strong, extending beyond the margin. This is of the same general type as the jaw of *H. hortensis*, but has fewer ribs than *H. aspersa*.

Radula of the usual *Helix* type (Fig. 1a) ; the median teeth with only rudimentary, non-angulate, side cusps ; laterals with similar rudimentary, merely band-like, ectocones, but about the fourteenth tooth a distinct cusp begins to appear, and from the eighteenth onwards the main or inner cusp is bifid ; marginals trifid. The radula thus differs from *H. pomatia* and *aspersa*, and resembles *H. nemoralis* and *hortensis*, in the absence of salient lateral cusps on the median and principal lateral teeth. The marginals are much as in *H. hortensis*, but with very blunt lobes on the inner part.

Genitalia of the *Helix* type (Fig. 1), with large dart-sac, filiform mucus glands, and very long flagellum. Dart about 9 mm. long, straight, hardly constricted above the base, with four sharp longitudinal keels at right angles to each other, the channels between them with a few irregular transverse films, but they are not regular or numerous, as in *aspersa*. Dart-sac about 11 mm. long and 4 broad, the end not at all differentiated. Filiform glands not so numerous



as in *aspersa*, little branched (much branched in *aspersa*), the longest about 12 mm. The filiform glands are thus more like those of *nemoralis* than *aspersa*. Flagellum very long (38 mm.), spirally twisted in middle; penis retractor to vas deferens about 5 mm. Spermatheca very long (prox. 48 mm.), slender, and cylindrical, with a basal cæcum imbedded in uterus. (All measurements from fresh material.)

On comparing the genitalia with those of *Leptaxis (Cryptaxis) undata* (Lowe),¹ from Funchal, Madeira, it at once appears that there is little affinity, in spite of a certain similarity in the sculpture of the shell. I give a figure of the genitalia of *L. undata* (Fig. 2), showing the filiform glands, short (11·5 mm.) flagellum, and boot-shaped end of spermatheca, all very different from *Idiomela*. The albumen-gland is about 10 mm. long. In the Gwatkin collection at the British Museum I found radulae and jaws of a number of Madeiran Helicoids—even a radula of *H. subplicata*, exactly like my specimen, but erroneously labelled “Madeira”. The following notes will serve to show some of the various differences between these snails and *H. subplicata*.

Leptaxis, sens. Pilsbry.

L. erubescens, Lowe (type of genus). Median teeth small, with rudimentary side cusps; first laterals with well-developed ectocones; marginals with inner cusps broad, feebly to strongly emarginate; outer cusp bifid or trifid, if bifid it is the outer lobe that is obsolete (Fig. 4).

L. undata, Lowe (*Cryptaxis*). Lateral cusps of median teeth more distinct but small; laterals with distinct but little produced ectocones, often slightly emarginate; marginals with inner cusp strongly emarginate, the lobes very obtuse, the outer cusp simple by the suppression of the outer lobule, or the latter may be slightly developed (Fig. 3).

L. phlebophora, Lowe (*Katostoma*). Jaw with about twenty-six flattened contiguous ribs, somewhat as in *H. terrestris*, Penn.; median and lateral teeth with small, hardly produced, outer cusps; marginals with inner cusp deeply bifid, obtuse, outer bilobed (Fig. 5).

L. portosanctana, Sowerby (*Pseudocampylaea*). Sowerby's original paper has the name *portosanctana*, possibly a misprint. Jaw with fourteen broad, closely set ribs; central teeth with well-developed side cusps; laterals with well-developed ectocones; marginals with very broad inner cusp, simple or feebly emarginate; outer with two or three sharp points. The lateral cusps of central teeth are little produced (Fig. 6).

¹ Unfortunately the name of this common Madeira snail must be changed, since there is an earlier name, *Helix undata* Gmelin, 1790, based on an entirely different shell, figured by Gualtieri. Gmelin gives no locality, but Wood (“Index Testaceologicus,” 1825) says it is from New Holland. *Helix undata* Lowe, Cambr. Phil. Soc. Trans., iv, p. 41 (1831) must be called *Leptaxis (Cryptaxis) groviana* (Férussac).

Plebecula.

P. punctulata, Sowerby (*Helicomela*). Median teeth with small side cusps, their upper margin horizontal, not rising above lateral notch; first laterals with strong triangular ectocones; marginals with outer cusp bifid and inner simple, thus wholly unlike *Idiomela*.

Geomitra.

G. bicarinata, Sowerby (*Hystricella*). Jaw with ten broad, flattened ribs, with narrow intervals between; median teeth with small lateral cusps; first laterals with large ectocones; marginals with inner cusp strongly bifid, outer also bifid, all the points sharp, wholly unlike *Idiomela*. *G. echinulata*, Lowe, has teeth like *bicarinata*.

G. polymorpha var. *discina*, Lowe (*Discula*). Jaw clear yellowish, with ten broad, flattened ribs, just as in *bicarinata*; median teeth with distinct lateral cusps; laterals with distinct ectocones; marginals with long sharp inner cusp, with small and sharp lobe on inner side, outer cusp bifid.

In Pilsbry's classification, *H. subplicata* falls in the section or group *Erctella*, Monts., the type of which is the Sicilian *H. mazzullii*, Jan. The radulla of *H. mazzullii* from Palermo has the centrals with very small angular side cusps; laterals with well-developed ectocones, strongly angulate; marginals, very variable, three or four lobed (Fig. 8).

H. subaperta, Ancey from Algeria has been referred to the same group, but it is very distinct. The median teeth have distinct cusps; laterals with large side cusps, equally strong on each side, so that they are nearly symmetrical; marginals with inner cusp strongly bifid, the lobes obtuse, outer simple and rudimentary (Fig. 7). These species show little resemblance to *Idiomela*.

There is reason to believe that while the present island of Porto Santo contains no rocks bearing fossils older than the Miocene, it rests upon an older basis, now submerged. The snail fauna seems to represent the remnants of the life of this older, doubtless Mesozoic, land. *Idiomela* may be regarded as an isolated type, related to the common stem of the continental *Helix*, but distinct from any of the living or fossil continental genera.

The species *H. subplicata* is at least as old as the Pleistocene, to which period the fossil specimens must be referred. West of the Villa Baleira is a region in which, some 30 feet below the surface, a bed of marine Pleistocene rests upon a basis of dark volcanic rock, and is covered by sands containing land shells. The land shells are, however, not necessarily younger than the marine beds, as the sand, shifting as it does to-day, may have been blown over them. At any rate, I found a specimen of *Geomitra coronata*, Desh., firmly embedded in the dense marine deposit, mixed with the marine shells

HELIX PISANA IN PORTO SANTO.

By Professor T. D. A. COCKERELL.

(Communicated by B. B. WOODWARD, F.L.S.)

Read 13th May, 1921.

No one knows when or how *Helix pisana* first reached the Madeira Islands, but it abounds in Porto Santo and the adjacent islets, and equally in the vicinity of Caniçal, on the Island of Madeira. Possibly it was brought by the Moors, who used to frequent these coasts, or it may have come through some "natural" agency, at present unexplained. It is not found in the Pleistocene deposits, although old shells get mixed with the fossils, and have been erroneously reported as such. The presence of a great number of species of endemic snails has in no wise hindered its multiplication, or spread. In the vicinity of Caniçal, *H. pisana* is represented by a small race. On Porto Santo and the islets nearby it presents many varieties, none of which seems to occur at any point to the exclusion of all others, though various localities are noteworthy for shells of a certain type. There are, however, two general types of *pisana*, which, though occurring intermixed, appear to retain their characters and possibly do not interbreed. One is the typical, thinnish form, usually conspicuously banded; the other is thick, opaque white, with a rosy aperture. The latter was actually described from Porto Santo as a new species, *Helix calcarea*, Pfeiffer. The type is in the British Museum. It does not depend on environmental conditions; thus it occurs with typical *pisana* on the small islet called Censuras, off Porto Santo. These Censuras "*calcarea*" shells are small—max. diam. 13–14 mm., alt. 9–10 mm.; the extreme apex is reddened. On the Ilheo de Baixo a very extraordinary shell (*mut. grandis*) of the *calcarea* type was found by Miss Nancy Paterson. It is thick, white, with rosy mouth; $6\frac{1}{3}$ whorls, spire elevated; diam., max. 24, min. 22, alt. 23 mm.; umbilicus to apex 15·5 mm. Gigantism in plants has been found to be correlated with a change in the number of chromosomes, but in animals it may be due to changes in the internal secretions. Among snails it seems to occur especially in certain places and at certain times. Thus the *H. nemoralis* I found in Portugal were unusually large; *Helix* or *Leptaxis groviana* from the Pleistocene at Caniçal is much larger than the form of the species now common in Madeira. Thus it seems possible that environmental conditions may, at least in part, control gigantism in snails; though the large *pisana* from I. de Baixo seems to have arisen, without any external cause, in a normal population of the *calcarea* type. The name *calcarea* is preoccupied, but similar shells have been described from the continent of Europe. In form and colour the large I. de Baixo *pisana* is very like *rhadanica* Locard, from Oporto. The *H. subpisana* Bourg., from Tunis, Spain, and the

Balearics, is a similar sort of shell, though typically depressed. In southern France *carpiensis*, Let. & Bgh., seems to represent the same kind of thing, but Taylor's figure of a specimen from Coimbra, heavily banded, is probably not true *carpiensis*.

True *pisana* in Porto Santo presents many colour-varieties, usually more or less local. Some have broad red bands on a white ground (var. *menkeana*, Moq.), others are nearly uniform reddish-yellow (var. *concolor*, Moq.), some are very delicate and beautiful pink, some nearly black all over, others heavily banded and looking rather like *Helix virgata*. It would be very interesting to study these forms in detail on the spot, and especially to breed them and determine the hereditary factors. One would expect such a variable snail to eventually split up into a number of species ; and, indeed, many such have been described from Europe and North Africa by Bourguignat and others, but they seem to be imperfectly segregated. Much more field work, with anatomical studies, is required for their elucidation.

Helix vargasiana, Pfeiffer, also described from Porto Santo, is given by Pilsbry as a synonym of *bowditchiana*. This cannot be, as it is "perforata conico-globosa, costulata, opaca, cretacea, facsiis nonnullis obsoletis griseis notata." Apparently it was based on a form of *H. pisana*.

MOLLUSCAN NOMENCLATURAL PROBLEMS AND SOLUTIONS.
NO. II.

By TOM IREDALE.

Read 8th April, 1921.

SUMMARY.

Museum Boltenianum.

C. S. Rafinesque.

"Les Fonds de la Mer" contains over 200 new species.

Megerle's MSS. Genera, cited by Scudder, only date from 1882.

Fabricius 1823 : Names are not binomial.

Neptunea, Bolten : Type *N. despecta* Bolten.

Siphonaria algesiræ Q. and G. should be called *S. grisea* (Gmelin).

Crassatellites.

Buccinulum, Swainson.

MUSEUM BOLTENIANUM.

The first edition of this work is now well known through the reprint of Sherborn and Sykes, but I have seen no notes regarding the second edition. This is reported to be a reprint of the first, and so far as my examination goes, though the pagination differs I have found nothing novel in the text. There are, however, attached four plates figuring certain species, and I note these species appear only as *nomina nuda* in the first edition. The figures, of course, validate the names, but only as from 1819, the date of the second edition. The preface is dated "Jan.", while the plates, all reversed, are lettered "J. J. Noodt" or "J. J. N." The figures have numbers inscribed against them, and I here transcribe the details for consideration :—

	2nd ed.		1st ed.
Plate 1, p.	98, 1763.9 67, 1202.47 62, 1117.19 72, 1288.15	<i>V(exillum) gloriosum</i> . <i>E(pitonium) pulchellum</i> . <i>T(urbo) pulcherrimus</i> . <i>L(unatica) taitensis</i> .	p. 139, 1749.9 95, 1226.48 88, 1139.19 102, 1313.15
Plate 2, p.	58, 1037.14 5, 73.66 59, 1071.6 79, 1425.17 6, 86.79	<i>T(rochus) Tectum chinense</i> . <i>P(atella) morio</i> . <i>C(idaris) otaitensis</i> . <i>B(uccinum) fenestratum</i> . <i>P(atella) oculus-cati</i> .	81, 1057.14 7, 73.66 84, 1093.6 113, 1451.17 8, 86.78
Plate 3, p.	31, 555.65 31, 1686.5** 130, 367.25 80, 1435.23	<i>C(ucullus) annulas</i> . <i>C(anthurus) tribuloides</i> . <i>T(ellina) solaris</i> . <i>B(uccinum) lamellosum</i> .	44, 555.65 133, 1671.5** 187, 369.25 113, 1462.23
Plate 4, p.	113, 90.21 114, 97.28 68, 1221.1a 14, 231.39	<i>C(hlamys) erminea</i> . <i>C(hlamys) tentorialis</i> . <i>S(trombus) palustris</i> . <i>N(erita) maculata</i> .	162, 90.21 163, 97.28 96, 1245.1a 19, 231.39

C. S. RAFINESQUE.

A few years ago in these Proceedings (ix, 1911, pp. 261-262) I gave some details of the names proposed concerning molluscs by C. S. Rafinesque in his "Analyse de la Nature", a small and rare book published in 1815. The only copy available at that time was the one in the library of the Zoological Society of London, though another copy was on record in North America. I recently secured a beautiful, clean, and complete specimen, and at the same time obtained a small pamphlet, of which I here give details, because it is the only one I have note of in this country, and its contents are of great interest to the student of that unfortunate genius. Its title page reads : "Circular Address | on | Botany and Zoology ; | followed by the | prospectus of two periodical works ; | Annals of Nature | and somiology of North America. | By C. S. Rafinesque, | of the Royal Institute of Natural Sciences of Naples, | and of several other Learned Societies | in Europe and America. | Chi fa quanto puo, fa quanto deve. | Philadelphia : | Printed for the Author, by S. Merritt, | 74, south Second Street. | 1816."

The second page reads : "This Circular is respectfully directed to all the Naturalists, Botanists, and Zoologists ; Professors and Students, Universities, Colleges, Institutes, and Learned Societies ; Collectors of Natural Objects and Mecenates of Natural Sciences ; Owners or Directors of Botanical Gardens, Museums or Public Libraries ; and to all enlightened Gentlemen, Ladies, Travellers, Supercargoes, Merchants, Ship Captains, Booksellers, Reviewers, Physicians, Farmers, Planters, Cultivators, Nurserymen, Seedsmen, etc., etc., etc., in America, Europe, and all the parts of the world, by the Author."

The address begins : "To . . . Philadelphia", the intention apparently being to write the addressee's name in the spaces between the words ; the wording starts : "I hope that the motives which lead me in the present instance, in taking the liberty to hand you this circular, will be considered as a sufficient apology for intruding so far upon you . . . After having published in Palermo in the early part of 1815, a comprehensive view of my new ideas on the study of nature, with the title of *Analyse de la Nature* . . . I meant to have paid a visit to the continent of Europe . . . but the new political convulsions which took place at that period, prevented me, . . . and induced me to leave Europe altogether and return to the United States of America with the intention of residing forever in that peaceful and happy country. . . . I left the island of Sicily on 21st July, 1815, and after stopping at Gibraltar and the island of St. Michael, I had reached the shores of America, when on the third of November, I had the misfortune to be shipwrecked, losing at once all my books, manuscripts, plates, drawings, maps, herbarium, collections, minerals, etc., the fruit of twenty years labours, exertions, and travels ; it was even with the utmost difficulty that I saved

my own life, and landed near New London, in Connecticut. . . This dreadful misfortune has not, however, impaired my zeal; I am determined to begin again my labours. . . Such a circumstance gives me a claim to your support; indeed, in the destitute state in which I have been left I must crave it. . . Allow me to state that I mean to reside in Philadelphia, but to employ part of this and next year in travelling to collect a new extensive American herbarium, etc., which will enable me to begin useful exchanges. I shall therefore delay my publications till next year. . . Gentlemen in all parts of the world! If we are already united by a mutual love of nature, and pure zeal for the investigation of the wide fields of natural sciences, let us strengthen the ties of our union by a friendly intercourse and beneficial exchange of labours, knowledge, and discoveries: I tender you the invitation, in full hope of meeting a suitable return on your side; I have not said all I might on the subject, but if our pursuits are similar, we shall understand each other, and you may easily supply all my omissions, by fancying yourself in my situation, and remembering that I unite to the most glowing ardour for the knowledge of nature, the most ardent desire to promote its study, by all the means in my power. Believe me, therefore, forever, your sincere well-wisher, constant friend, and fellow admirer of nature. C. S. Rafinesque."

This address covers six and a half pages, with very full instructions as to wants, etc., and is a delightful production. It is followed by a series of "Notes", which are important, and from which I extract the following items: "1. I will add a list of all my works and tracts, for the information of those who are not yet acquainted with any or the whole. . . 2. Analyse de la Nature. This work is the outline of a larger one on the plan of the *Systema Naturae* of Linnaeus, which will be gradually undertaken at a future period. . . 3. The following are the names of the principal manuscripts I had nearly ready for the press, and which were lost in my shipwreck. . ." Then follows the prospectus of the "Annals of Nature, or Repository of Natural Sciences, particularly Botany, Geology, Mineralogy, and Geognosy." "This periodical work will come out in numbers, once every season: in Spring, Summer, Autumn, and Winter. Four numbers shall complete one year and one volume. . . Each number shall contain from 60 to 100 pages, in 8vo, and sometimes one plate. The subscription shall be \$2 per annum." The most interesting item then follows, the prospectus of the "Somiology of North America, including the Flora and Fauna, or the Botany and Zoology of the United States of America and the Adjacent Countries. Zele et Perseverance. C. S. Rafinesque will attempt to carry into execution an undertaking . . . respecting the Plants and Animals of the United States, or North America in general . . . the adoption of the 8vo size, and the figures engraved on wood . . . The outlines of this plan are as follow: Every species of Plant and Animal will be drawn

by C. S. Rafinesque, or under his direction . . . To such a plate shall be annexed a full account of the specie or species, therein figured, contained in two, three, or more pages 8vo of letter press. . . This undertaking will begin in 1818 . . . when begun, from twenty to fifty plates, etc., will be issued monthly. . . The price to subscribers for the whole work, or any set or sets, of 100 numbers and upwards, will only be 5 cents for each number, containing one plate and several pages of description and elucidation. Should any subscriber want his plates neatly coloured, he must then pay double price or 10 cents for every number. . . Every 100 numbers will form a Centuria or Volume. . . Notwithstanding the magnitude of the undertaking, it is hoped it will be found an easy task: to complete the whole work about 5,000 numbers and 8 or 10 years are required. . ." Then a detailed synopsis of the work appears; "I. General Sets. 1. General Flora, or Botany of North America: about 4,000 species and 3,000 numbers. 2. General Fauna, or Zoology of North America: about 4,000 species and 2,000 numbers. II. Classical Sets." 26 of these are recited, No. 14 being "Apology of the United States, or Natural History of the Mollusks (including shells); over one hundred and fifty species." "III. Sets of Orders," six of these including "31. Real Natural Orders of Animals: sixty-four numbers. N.B. Some peculiar sets may be asked, of any striking Orders of Animals, such as . . . *Spironotia* the Spiral Shells, *Bivalvia* the Bivalve Shells, etc." "IV. Sets of Families. V. Sets of Genera. VI. Sets of Practical Floras and Faunas. VII. Sets of the State Floras and Faunas. VIII. Sets of Tract Floras and Faunas. IX. Sets of the Local Floras and Faunas," and "X. Sets of Adjacent Floras and Faunas." One hundred and fifteen variations of the above are cited, with a proviso that any other combination that suggests itself to the subscriber will be supplied.

From the plate in the Analyse, which gives his birth date as 1783, Rafinesque was only 33 when he projected this wonderful work, and as his Analyse was published previously, his genius is unmistakable. As I pointed out at the time of my previous paper, Rafinesque's names are troublesome in many ways, and I here call attention to a couple of instances. Thus, recently Dall recorded the fact that the genus name *Mitra* dated back to Martyn, where it had been validly introduced in connexion with a species quite unlike the typical species associated with the genus name by Lamarck. He therefore proposed *Papalaria* for the Lamarckian *Mitra*. In the "Analyse de la Nature", p. 145, 1815, Rafinesque had proposed "*Mitraria*, R. for *Mitra*, Lam.", so that Rafinesque's name would become usable in preference to Dall's novel proposal. In the Bulletin, U.S. National Museum, 112, 1921, Dall has published his long-awaited for "Summary of the Marine Shell-bearing Mollusks of the North-West Coast of America", and all conchologists must

unite in thanks for this excellent catalogue, wherein probably the only weak spots will be found in connexion with those groups where acknowledgment is accredited to his catalogue, such as the "family Synceratidæ". There is no such group in valid nomination, being simply another of Bartsch's blunders, the name *Syncera* Gray, 1821, being a *nomen nudum*, and therefore unavailable in the connexion cited. However, as to *Mitra*, Dall has continued, through inadvertence, the quotation (p. 87) of *Mitra* Lamarck, 1799, ranking *Thala* as a section only, a value quite unacceptable, the true *Thala* probably not even belonging to the family Mitridæ. On the same page he includes the genus *Mitromorpha* A. Adams with a ? in front of it. This cannot be understood in connexion with the facts without explanation. The genus is quite valid, so we can only surmise that the ? refers to the position in the family, which is not a customary mode of expression.

The other item is the status of such a name as "*Laphrostoma*, R. (1815)" for "*Neritina*, Lam." At the time that was written there was no Latin name *Neritina*, the name only existing in the vernacular "*Neritine*". The anomaly will then exist, if these prove acceptable, of the substitute name dating earlier than the one for which it was provided. In the present case it would mean the rejection of *Neritina*, Lamarck, even of 1816, in any connexion.

LES FONDS DE LA MER.

This rare, but important work is not known to all malacologists, and, moreover, is not commonly accessible. In 1913 a copy was secured by the British Museum (Natural History), and was examined by me in connexion with Pyramidellid nomenclature. A little later my friend, Mr. Alex Reynell, showed me some parts he had secured and I borrowed them for comparison and made some notes. I have just secured a perfect bound copy, which has enabled me to complete my examination leisurely, and I here give my results. The title page of Volume I states that it contains about 500 figures, representing 250 species and 300 pages of text, "commencée et dirigée par MM. L. de Folin and L. Périer," and published at "Paris, Savy, Libraire-éditeur, rue Hautefeuille 24, 1867-71". The exact pagination is 316, and 33 plates are included. Vol. II has the same wording, but "about 120 figures representing 60 species", and the date is 1875. The exact pagination is 365, and there are 11 plates with 11 explanatory pages. Vol. III has again the same wording, with "about 115 figures representing 75 forms", and the date 1875-9. The exact pagination is 337, and nine plates, each with explanatory text. No information as to method of publication can be gauged from these so that Reynell's parts are very valuable. The covers read "Les Fonds de la Mer . . . par MM. Berchon, De Folin, Périer . . . Edition avec planches, paraissant par livraisons de 16 pages". Reynell's lot consists of the fourth

to nineteenth livraisons, and the following items stand out. Livraisons 4 and 5 were published at Bordeaux at the Imprimerie G. Gounouilhou, 11 Rue Guiraude, and are dated 1868. Then the place of publication was changed to Paris, as given above, and livraisons 6 and 7 came out in one cover, also dated 1868. On the back of the cover is now printed: "Conditions de la Souscription. France : 1 fr. 50 la livraison ; Étranger : suivant les tarifs postaux. On souscrit pour *cinq livraisons* payables d'avance. Vingt livraisons forment un volume contenant environ trente planches." Livraisons 8, 9, 10, 11 came out separately, each dated 1869. Then 12 and 13 came out in one cover, and 14, 15, 16 separately, each dated 1870. Livraison 16 is curious, as the pages are headed 239-54, whereas they should be 241-56, and apparently a corrected livraison was issued, since in the bound work the lettering is corrected. Livraison 17 is dated 1871, and livraisons 18 and 19 appeared separately dated 1872. These prove the title page dates to be incorrect, and all the dates given in the text are simply MS. dates, and have nothing to do with publication. Apparently the first volume did appear in livraisons of 16 pages each, but it will be noted that twice two appeared together. The cover only of the third livraison is of the Bordeaux print, and is dated 1867.

Nearly 200 new species are described in the work.

MEGERLE'S MSS. GENERA.

In the *Nomenclator Zoologicus* by S. H. Scudder, published as Bulletin U.S. Nat. Mus., No. 19, 1882, there is a pitfall for the systematist I have not seen emphasized. In the preface to part i is written (p. vi) "It is a special pleasure to acknowledge my indebtedness to Mr. Alexander Agassiz, who freely placed at my disposal the manuscript additions and corrections which Professor Agassiz had made to his *Nomenclator*," and (p. xviii) "the name Agassiz is appended to all entries copied from his manuscript additions to the *Nomenclator* of 1846". Among such entries is a long series of generic names, copied from a MS. of Megerle, and to most of these an equivalent is cited. I have gone through the *Nomenclator* and extracted all these names, and here give a list, though on account of the difficulty it may not be complete. I give them in alphabetical order for ease of reference.

<i>Albula</i>	= <i>Natica</i> according to Agassiz MS.	<i>Callunea</i>	= <i>Helicogena</i> Risso.
<i>Anomalia</i>	= <i>Leucochroa</i> Beck.	<i>Canaria</i>	
<i>Artemon</i>	= <i>Strombus.</i>	<i>Cantharus</i>	
<i>Atracta</i>	= <i>Fusus.</i>	<i>Carinaria</i>	= <i>Littorina.</i>
<i>Brandaris</i>	= <i>Murex.</i>	<i>Cercon</i>	= <i>Pupa.</i>
<i>Cabestana</i>		<i>Chamaeleon</i>	
<i>Cadus</i>		<i>Cochlus</i>	
		<i>Cochlidium</i>	= <i>Buccinum.</i>

<i>Contorta</i>		<i>Noachina</i>	
<i>Corniculum</i>		<i>Obroluta</i>	= <i>Vortex</i> Beck.
<i>Costularia</i>		<i>Omalota</i>	= <i>Oxychilus</i> Fitzinger.
<i>Crassilabrum</i>		<i>Omphala</i>	= <i>Antigona</i> Schumacher.
<i>Cratera</i>	= <i>Eryyomphala</i> Beck.	<i>Onychina</i>	= <i>Neritina</i> .
<i>Cruentata</i>	= <i>Lucina</i> .	<i>Orbitis</i>	= <i>Teba</i> Leach.
<i>Cucurbita</i>	= <i>Mitra</i> .	<i>Orthocentrus</i>	= <i>Strombus</i> .
<i>Cyphona</i>	= <i>Bulla</i> Lam.	<i>Pedicularia</i>	= <i>Trivea</i> [sic] Megerle Gray.
<i>Cymatia</i>	= <i>Trochus</i>	<i>Pelecania</i>	= <i>Chenopus</i> Philippi.
<i>Dactylium</i>	= <i>Pterocera</i> .	<i>Phonurga</i>	= <i>Bulimus</i> .
<i>Dactylophora</i>	= <i>Pterocera</i> .	<i>Planuria</i>	= <i>Turbo</i> .
<i>Dentina</i>	= <i>Castalia</i> ?	<i>Platyostoma</i>	= <i>Buccinum</i> .
<i>Elea</i>	= <i>Neritina</i> .	<i>Pomularia</i>	= <i>Dolium</i> .
<i>Elatia</i>	= <i>Pleurotoma</i> .	<i>Praenuntius</i>	= <i>Turbo</i> .
<i>Epidromus</i>	= <i>Strombus</i> .	<i>Pronuba</i>	= <i>Lucina</i> .
<i>Epiploa</i>	= <i>Triton</i> .	<i>Pterygia</i>	= <i>Marginella</i> .
<i>Epitonium</i>	= <i>Cerithium</i> .	<i>Pumilio</i>	= <i>Helix</i> .
<i>Fimbriola</i>	= <i>Cassis</i> .	<i>Pyrena</i>	= <i>Pupa</i> .
<i>Femorale</i>	= <i>Triton</i> .	<i>Rapa</i>	= <i>Pyrula</i> .
<i>Fusula</i>	= <i>Fusus</i> .	<i>Rotala</i>	= <i>Helix</i> .
<i>Ferricolaria</i>		<i>Rubeta</i>	= <i>Triton</i> .
<i>Glabrella</i>		<i>Saga</i>	= <i>Oliva</i> .
<i>Glandula</i>	= <i>Bulla</i> .	<i>Sagitella</i>	= <i>Orthocera</i> ?
<i>Gallus</i>	= <i>Strombus</i> .	<i>Scaevela</i>	= <i>Bulinus</i> .
<i>Gaffraria</i>	= <i>Venus</i> ?	<i>Scaphula</i>	= <i>Arca</i> .
<i>Haustorium</i>	= <i>Purpura</i> .	<i>Scopus</i>	= <i>Trochus</i> ?
<i>Hystrionica</i>	= <i>Tachea</i> Leach.	<i>Serrostoma</i>	= <i>Turbo</i> .
<i>Lancinula</i>		<i>Sinula</i>	= <i>Pirena</i> ?
<i>Labialia</i>	= <i>Neritina</i> .	<i>Sinum</i>	= <i>Turbo</i> .
<i>Luhuana</i>	= <i>Strombus</i> .	<i>Sphaerostoma</i>	= <i>Turbo</i> .
<i>Lunatica</i>		<i>Spodium</i>	= <i>Turbo</i> .
<i>Magula</i>	= <i>Trochus</i> .	<i>Tetraena</i>	= <i>Sanguinolaria</i> ?
<i>Mirana</i>	= <i>Terebra</i>	<i>Theobroma</i>	= <i>Auricula</i> .
<i>Misile</i>	= <i>Ovula</i> .	<i>Tribulus</i>	
<i>Minaretus</i>	= <i>Pyramidea</i> Swainson.	<i>Umbella</i>	= <i>Patella</i> .
<i>Megastoma</i>	= <i>Pomatia</i> Beck.	<i>Urcea</i>	= <i>Strombus</i> .
<i>Nauticaria</i>	= <i>Cymbium</i> Schum.	<i>Valgum</i>	= <i>Pupa</i> .
<i>Nodularia</i>	= <i>Helicodonta</i> Férussac.		

None of these names appears to have been previously published, although twice a reference is given to "Berl. Mag.", once in connexion with *Elatia*, the other with *Noachina*, when the year 1811 is added. Megerle wrote a few papers in that journal, but I

have not found either of these names. Scudder does not appear to have recognized Megerle as his own "Mühlfeldt", as he also includes "*Cratere*, Mühlfeldt (cf. Porro, Mal. Prov. Com. p. 47), 1838. *Dentina*, Mühlfeldt MSS., Teste Villa, Disp. Syst., p. 45 (= *Lentidium* Cr. et Jan.), 1841. *Contorta* ib. ib., p. 19 (= *Drepanostoma*). *Thiara*, Mühlfeldt Cat. MSS. (= *Melania*) Agassiz."

It is now considered correct for a worker to verify all references, and in these instances none of the names call for recognition anterior to Scudder's publication of them. Nevertheless, we find that Cossmann has proposed *Antimurex* (Essais de Paléoconch comp. livr. 5, p. 12, Décembre, 1903) as a new name to replace *Crassilabrum* Jouss(eaume), *non* Megerle; but Megerle's name was not published until after Jousseame's and, furthermore, at that later date is absolutely a *nomen nudum*.

FABRICIUS' 1823 NAMES.

Another series of generic molluscan names that has been recorded by Scudder are those accredited to Fabricius, which appeared in a tract entitled "Fortegnelse over afg. Bishop Fabricius ses esterladte Naturalier", the date being given as 1823.

The list of names is not regularly binomial, and questionably of binary composition. They are all *nomina nuda*, and no authorities being cited, consequently indeterminable. I have noted the following:—

PAGE.

53.	<i>Unino.</i>	Apparently ? error for <i>Unio</i> .
57.	<i>Macra.</i>	do. do. <i>Mactra</i> .
70.	<i>Birostris.</i>	Cited by Scudder as "Fabricius Cat. Cab. Fabr. (= Birostra Swains), 1823 <i>Agassiz</i> ".
71.	<i>Catinus.</i>	id.
74.	<i>Plicaria.</i>	id. (= <i>Cancellaria</i>).
80.	<i>Tuba.</i>	id. (= <i>Achatina</i>).
81.	<i>Unicornu.</i>	Not in Scudder.
83.	<i>Tusus.</i>	Apparently ? error for <i>Fusus</i> .
	<i>Sipho.</i>	Scudder, "Fortegn, p. 83, 1822."
	<i>Simpulum</i>	Not in Scudder.
86.	<i>Pugil.</i>	Scudder, "Fortegn, p. 84, 1822."
	<i>Digitata.</i>	id.
87.	<i>Varicaria.</i>	Scudder as "Fabr. Cat. Cab. Fabr. ex Agassiz = <i>Purpura</i> ".
90.	<i>Canistrum.</i>	Not in Scudder.
93.	<i>Lunaria.</i>	Scudder, "Fortegn."
94.	<i>Auricularia.</i>	Scudder as "Fabr. Cat. Cab. Fabr. ex Agassiz" = <i>Lymnaea</i> .
98.	<i>Saccus.</i>	id. = <i>Ampullaria</i> .
101.	<i>Labiata.</i>	Scudder, "Fortegn."
104.	<i>Caminata.</i>	As "Fabr. Cat.", etc. = <i>Fissurella</i> .
	<i>Coronaria.</i>	id. = <i>Aspergillum</i> .

Apparently Scudder saw a copy and collated the names which he claims and cites "Fortegn, 1822"; the other names are included from the Agassiz MS., and in two instances duplications occur as *Pugilis* for *Pugil* and *Labrata* (= *Calyptrea*) for *Labiate*.

NEPTUNEA, BOLTEN.

I herewith designate as type of *Neptunea*, Bolten, Mus. Bolten, p. 115 (pref. Sept.) 1798, the first species *N. despecta*, Bolten based on Martini 4, t. 138, f. 1296.

In view of Dalls' recent transference of Bolten's name from the shells with which it had been associated for from fifty to seventy years without question, to another well-known series with which it had never been considered until 1902, I have searched through the literature in an effort to find a legitimate type designation which would enable a definite settlement. I found that all the leading conchologists, whether British, Continental, or American, had continually used *Neptunea*, when their attention was drawn to it, in the sense above designated, and had cited as examples the shell-form I have named. The above definite designation will, I hope, place their action beyond dispute, and is in agreement with the opinions of the International Commission on Zoological Nomenclature, that a rigid observance of the rules of type-selection is absolutely necessary in doubtful cases.

SIPHONARIA GRISEA vice S. ALGESIRÆ, Q. & G.

In 1833 Quoy and Gaimard described a *Siphonaria* from the Straits of Gibraltar in the "Voy. de l'Astrol", vol. ii, p. 338, as *S. algesiræ*, and it was figured on pl. xxv, figs. 23-5. It is fairly well known under that name, but appears to have been named many times previously, and also since.

Blainville, in the "Dict. Sci. Nat." (Levrault), vol. xxxii, p. 267, 13th November, 1824, admitted Sowerby's genus *Siphonaria*, and recognized the shell figured by Adanson under the name "Mouret" as a member of the genus. He proposed to name it *Siphonaria mouretus*.

In the following volume, published 22nd January, 1825, Blainville, p. 161, introduced the genus *Mouretus* for the Mouret of Adanson ("Sénég.", p. 34, pl. 2), naming the species *Mouretus adansonii*. He here stated that his genus was identical with the prior *Siphonaria* of Sowerby, and in vol. xlix, published on 13th October, 1827, he monographed the genus *Siphonaria*, explaining: "Adanson . . . designée sous le nom de *mouret*; aussi depuis longtemps, dans mon *Genera*, envoyé en Angleterre en 1816, pour le supplément à l'*Encyclopédie d'Ecosse*, je l'avois séparée pour en constituer un genre distinct, auquel je conservois cette dénomination." On p. 295 he named the species *Siphonaria adansonii*. About the same time, in the Tankerville Coll. Catalogue, published in January, 1825, Sowerby introduced (p. 32) *Siphonaria mouret* for "Mouret Adanson."

It is somewhat obvious that Adanson's shell is the same as Quoy and Gaimard's, and it is interesting to find confirmatory evidence as follows: In the "Journ. de Conch.", vol. xi, 1863. M. Petit de la Saussaye, commenting upon a Catalogue of the Marine Mollusca of Algeria by Weinkauff, wrote (p. 142):—"Siphonaria striatocostata. M. Philippi a décrit sous ce nom une Siphonarie de la côte du Sénégal, qui nous parait être le Mouret d'Adanson, dont le *S. Algesiræ* de M. Quoy pourrait bien n'être qu'une variété." On p. 233 Weinkauff pointed out that it was not Philippi but Dunker, "Index Molluscorum," etc., pl. 1, fig. 1-6, who had named the shell, but did not discuss the identification. Recently Dautzenberg ("Mém. Soc. Zool. France", vol. iii (ante 30th July), 1890, reporting upon Senegal molluses, included (p. 164) "Siphonaria algesiræ, Quoy & Gaimard = ? Mouret Adanson, Dakar! abundant."

The identification can scarcely be doubted, but Menke, in the "Zeitschr. für Malak.", x, 1853, dealing with West Indian shells, has recorded (p. 68) that *Siphonaria moureti*, Sowerby is *Patella grisea*, Gmelin n. 188, based on Adanson's Mouret, and this is correct, so that *Patella grisea*, Gmelin, "Syst. Nat." i, pt. 6, 1791, p. 3727, No. 188, is available, and consequently the shell here treated should be called *Siphonaria grisea* (Gmelin, 1791). Reeve described *Siphonaria venosa* (Conch. Icon., pl. iii, sp. 10, f. 10a, b, March, 1856), from the Cape Coast, and Reeve's type seems to be simply a monstrosity of this species.

It is possible that this species is subgenerically separable from typical *Siphonaria*, in which case *Mouretus* must be used. Nobre in the "Journ. de Conch.", 3rd series, vol. xxvi, 1886, p. 32 (received B.M. 8th June, 1886), indeed introduced *Patellopsis* as a new subgenus for this shell, but *Mouretus* must be used instead.

CRASSATELLITES.

This name has been used in recent conchological science as a valid substitute for *Crassatella*. The latter name was proposed for one group and used for a different one. The misusage has been corrected (!) by the acceptance of the above name, but further consideration seems necessary. Upon looking into the question, I found this name to be simply one of a very long series of names proposed *simply* as substitute names for fossil representatives of recent genera. Should they be regarded as such, or should they be restricted to fossil shells? Upon referring to Sherborn's "Index Animalium", such names will be found recorded as occurring as early as 1759, and these have been here ignored.

Schlottheim in the "Taschenb. Mineral" (Leonhard) 17th year, 1813 (pref. dated Easter, 1813), includes over thirty, of which I merely cite *Nautilites*, *Helicites*, *Turbinites*, *Patellites*, *Chamites*, *Donacites*, *Anomites*, *Buccinites*, *Ostracites*, *Trochilites*, *Venulites*, *Dentalites*, *Muricites*, *Bullites*, *Pectinites*, *Pinnites*, *Tellinites*,

Neritites, *Strombites*, *Solennites*, *Pholadites*, *Mytilites*, and *Volutites*. In 1820 Schlotheim (*sic*) added a few more, and then Kruger in the "Geschichte der Urwelt", vol. ii, 1823, continued the series by adding -ites to almost every known genus name, fifty-five being collated by me, including the present one, *Crassatellites*. The rejection of all these as applicable to recent conchology is advisable, but the means of doing so needs consideration. Thus, one instance of the complexity of the problem appears in connexion with *Bullites*, Schlottheim, 1813. If this be regarded as a substitute name only for *Bulla* L., it has priority over *Bullaria*, Rafinesque, 1815, but its usage would be paradoxical, and the fossil "Bullas" included under *Bullites* appear to have little relationship with the recent species we know under the name of "Bulla"—*Bullaria* of recent usage.

BUCCINULUM, SWAINSON.

Mr. J. R. le B. Tomlin showed me a little book and allowed me to make the following notes. The cover and title page reads: "Catalogue | of the | Foreign Shells | in the possession | of | the Manchester Natural History Society, | arranged according to the system of Lamarek. | 1837." No author's name appears, and the list extends to 99 pages, names sometimes accompanied by localities, generally without authorities, sometimes the latter, and in a few cases "MSS." added.

It may have been drawn up from Swainson's manuscripts, since most of the novelties are accredited to him. Moreover, mis-spellings, the hall-mark of Swainson's touch, commonly occur, such as p. 37, *Moretsia*, Sowerby, for *Mouretia*. Only three names appear to be of importance: thus on p. 67, under the genus *Turbinella*, against a series beginning with *T. capitellum*, there is noted in brackets *Plicatella*, Swainson, and on p. 75, in the same manner, *Lobatus*, Swainson, is recorded for *Strombus bituberculatus*; and on p. 81 *Buccinulum*, Swainson is referred to in connexion with *Buccinum lineatum*, *lineolatum*, *maculosum* and *coromandelianum*. Similarly introduced names have been accepted, so it appears that the above three names should be made use of. The only one needing consideration is that used as the heading of the note, and I herewith designate *Buccinum lineatum* as type. This may be regarded as indeterminable, or otherwise the name *Buccinulum* will come into use for the New Zealand shell, now known as *Euthria linea* (Martyn), which, however, would bear the name of *Evarne linea* (Martyn) if my conclusions as to its separation were accepted. Under the present circumstances the name would become *Buccinulum linea* (Martyn), and *Euthria* would be preserved for the European *cornea*, L. These species were discussed in a previous number of these Proceedings (*antea*, vol. xiii, pts. 1-2, p. 33, 1918).

NOTES ON SOME SPECIES OF *PISIDIUM*.

By B. B. WOODWARD, F.L.S.

Read 13th May, 1921.

PISIDIUM CINEREUM, Alder, vice *P. CASERTANUM*, Poli.

When the "Catalogue of the British Species of *Pisidium*" was issued in 1913, Poli's work¹ being binominal was accepted by most zoologists, and had been included in Sherborn's "Index Animalium". Since there was no doubt as to the identity of his *Cardium casertanum*, which, moreover, was the sole species in the type locality, and the name had been in use on the Continent, it was adopted in the "Catalogue." The fact, however, that Poli consistently gave in each case one name to the shell and another to the contained animal has since led to his book being ruled out as not a serious contribution to systematic zoology, and his names have to be discarded.

What, then, will be the best name to replace *casertanum*, because of those included in its synonymy some may, nevertheless, be open to question when absolute certainty of identification is demanded.

The next in order of date is the *Cyclas vitrea* of Risso,² of which the description is inadequate. Comm. E. Caziot most kindly sent me plesiotypes of the specimens that are now in Risso's old collection under the name, and these were certainly *casertanum*. There is, however, grave doubt whether, considering the vicissitudes the collection has been through,³ the present are the original specimens; certainly the name does not favour it. Risso could hardly have described these shells as glassy. Hence it does not seem advisable to accept his name.

The *Cyclas prisca* of Eichwald,⁴ which follows, was founded for a fossil from a freshwater deposit at Kuncza, Podolia. The description is worthless, and although Eichwald's figure⁵ suggests the present, or some closely allied species, until the type is known its exact nature is uncertain, and the name best passed by.

Of the *Pisidium australe* of Philippi,⁶ it can be stated that while the description is better, it is still too general for purposes of exact identification and the figure is poor and quite unidentifiable.

¹ Testacea utriusque Siciliæ, etc.

² Hist. Nat. Europ. mérid., iv, 1826, p. 338.

³ Proc. Acad. Nat. Sci. Philad., 1919, p. 157.

⁴ Naturh. Skizze Lithauen, 1830, p. 207; and Lethæa Rossica, iii, 1852, p. 87, pl. v, f. 8.

⁵ The figure given in illustration of this species by Hoernes, "Foss. Moll. Tertiär-Beck. Wien," Abhandl. k.k. Geol. Reichsanst., iv, 1870, pl. xx, f. 1, and repeated by Sandberger, "Land- and Süßw.-Conch. Vorwelt," 1875, pl. xxx, f. 6, is quite a different shell.

⁶ Enum. Moll. Sicil., i, 1836, p. 39, pl. xiv, f. 11.

Specimens received from the Continent under this name are mostly flattened forms of *casertanum*, which is hardly consonant with the "tumidiuscula" of Philippi's description. In the absence of the type, and considering the doubt attaching to its identification, it will be wiser, for the present at all events, not to adopt the name.

As regards the *Pisidium cinereum* of Alder,⁷ we are furnished with a description, which, though far ampler than those of the species just passed in review, still leaves much to be desired for the purposes of modern requirements. On the other hand, Alder's types are extant in the Newcastle Museum, and from these and the numerous co-types distributed by him to correspondents, the identity of his species is well established, so that we are on sure ground, and hence it would be safest in my judgment to employ his name in future for the species.

PISIDIUM PARVULUM (Clessin MS.) Westerlund.

This species was established by Westerlund on Clessin's manuscript in 1873,⁸ with a very imperfect description, and no figure. A variety, *martensi*, Cl., was also indicated. The habitat being given as Blekinge district, near Ronneby. The species was repeated by Clessin in his monograph on the "Cycladeen" and figured.⁹

Whilst preparing the "Catalogue of the British Species of *Pisidium*", I received from Dr. A. C. Johansen examples of a Danish form under the above name, and, although it had not then been found in Britain, included it, with illustrations, in the "Catalogue" as a species to be looked for, but did not so completely describe it as I should have done had it been British. The occurrence of the same form in Lake Baikal was also noted, whence it had been received under the name "*P. aliena*, Mts."—a name which cannot be traced, and which has certainly nothing to do with the *P. alienum* of Clessin,¹⁰ which is a synonym for *P. amnicum*, var. *nova*, Paul.

In 1914 Dr. Johansen in a "Note on the Danish species of *Pisidium*",¹¹ pointed out that this Danish form was apparently not the *parvulum*, Clessin, of Westerlund, but distinct. He further mentioned that some co-types from Ronneby, determined by Westerlund, belonged to *P. obtusale*.

For reasons which will presently become apparent, it seemed desirable to probe this question now, and accordingly endeavours were made to see or ascertain the identity of authenticated specimens. Dr. Scharff of the National Museum of Ireland very kindly allowed me to inspect specimens under his charge that comprised two sets from Ronneby, the one received directly, the other indirectly from

⁷ Trans. Nat. Hist. Soc. Northumberland, ii, 1838, p. 341.

⁸ Fauna Moll. Sveciae, ii, p. 553.

⁹ Syst. Conch.-Cab., ed. Küster, 1874, p. 17, pl. i, f. 17–21.

¹⁰ Ib., p. 269, 1879.

¹¹ Vidensk. Meddel. Dansk. Naturh. Foren., lxvi, pp. 81–3.

Dr. Westerlund. The former set, labelled by Westerlund himself, proved to consist of two opened and one closed pair of *P. pusillum*, and two opened pairs of *P. hibernicum*. The second set included two valves of *P. cinereum*, f. *lacustris*, and four valves of immature *P. pusillum*.

Dr. Nils Hj. Odhner most obligingly sent for my inspection from the Stockholm Museum a tube labelled in Clessin's handwriting "Pis. *parvulum* Cless | Bleckinge | 1gt Westerlund | com. Clessin". This gathering included two whole *P. milium*, one whole *P. nitidum*, and five valves of *P. hibernicum*. Dr. Odhner informed me that he had received from Berlin one of the original specimens of the variety which proved to be *P. obtusale*.

Dr. D. Geyer of Stuttgart has been so good as to examine Clessin's collection there. He reports finding three gatherings of *P. parvulum*, which on inspection resolved into: small *obtusale*, half-grown *nitidum*, young *cinereum*, and three specimens of *millum*!

It is therefore quite obvious that *Pisidium parvulum* of Clessin and Westerlund is a composite of species all otherwise named and that the name must disappear from literature. The form, therefore, which of late has passed with us under that name, will take Stelfox's happily suggested designation, and be known as:—

PISIDIUM TORQUATUM, Stelfox.

When this species was first added to the British fauna in 1916 by Mr. R. A. Phillips,¹² the only standard of comparison which we possessed were the squarrose examples Dr. Johansen had sent me from Fursoe, and I was unable to assent to the reference of the whole of the specimens claimed as "*parvulum*" to that species and maintained that some, and especially the very triangular forms from the Thames Valley deposits, were merely the fry of *P. supinum*.¹³

Lately fresh fossil material has come into my hands and I have had the privilege of studying Mr. C. Oldham's collection of this form, and have verified the fact that examples quite as triangular as those in the Thames Valley deposits occur living at Welshpool. Whilst as to the distinction between *torquatum* and juvenile *supinum*, both Dr. Johansen in 1914¹¹ and Mr. Stelfox in his useful paper on "The *Pisidium* Fauna of the Grand Junction Canal",¹⁴ point out that there is a difference in the appendiculae in the two forms. Strictly speaking they are not so much appendiculae present in *torquatum* as a discontinuous junction between the neponic and adolescent shell, somewhat similar to that in *Sphaerium lacustre*, resulting in crescentic ridges conformable to the "lines of growth"; whereas in *supinum* and *henslowanum* the shelly ridges, which are sometimes quite sharp, usually cut obliquely across the "lines

¹² Irish Naturalist, xxv, p. 101.

¹³ Ann. & Mag. Nat. Hist., ser. VIII, vol. xviii, 1916, p. 346.

¹⁴ Journ. of Conch., xv, 1918, p. 299.

of growth ", and may at times be exceedingly reduced or altogether wanting. It would be extremely interesting to know what modification of the mantle margin of the animal it is that gives rise to the formation of these appendiculæ at this stage of its growth, and, further, what possible purpose, if any, they serve.

Mr. Stelfox further points out a more subtle but equally important distinction, viz. that in *torquatum* the lateral teeth, p. i and p. iii, converge, whereas in *supinum* they remain parallel. Tested by these criteria it becomes evident that Mr. Phillips and Mr. Stelfox were right in their conclusions, and that my too great caution was not justified.

The bibliographic synonymy of *torquatum* is, therefore, as follows :

1898. *Pisidium parvulum*, Clessin : Johansen, Vidensk. Meddel. Dansk. Naturh. Foren., lxvi, pp. 152, 159, 160. [Non Clessin.]
1913. " " Woodward, Cat. Brit. *Pisidium*, p. 105, pls. ii, f. 6 ; iv, f. 8 ; xxvii, f. 3-6.
- " " *supinum*, A. Schum. [pars] : ib. pl. xv, f. 9a-f, 15a-f, 17a-f; xxvi, f. 3a-f. 12a, b; xxvii, f. 1a-f, j-o.
1918. " *henslowanum*, Shepp. [pars] : ib. pl. xxvi, f. 13a, b.
- " " *torquatum*, n.nov. : Stelfox, Journ. of Conch., xv, p. 299, pl. viii, f. 14-21.

Dr. Geyer writes that the species does occur in Clessin's collection mixed with three or four others under the name of *P. rivulare*, from Anrieder Bach, near Dinkelscherben, Bavaria. He has also lately sent me specimens coming from the River Neckar, at Altbach, near Stuttgart, and reports having it also from the Rhine near Rotterdam, and at Mannheim, as well as from the Bodensee, near Friedrichshafen. Whilst there are specimens from Bohemia in the Clessin Collection.

The list of occurrences so far as at present known is :—

RECENT.

ENGLAND.

Bedfordshire.—BD.

R. Ouse, Bromham [C. O.].

Berkshire.—BK.

R. Thames, Streatley [C. O.].

Buckinghamshire.—BX.

Grand Junction Canal, Cheddington [C. O.].

" " " Marsworth [C. O.].

" " " R. Ouse, Newport Pagnell [C. O.].

Cheshire.—CH.

Canal, Beeston Castle [C.O.].

Herefordshire.—HF.

R. Wye, Goodrich [C. O.].

Hertfordshire.—HT.

- Grand Junction Canal; Berkhamsted [C. O.]
 " " " Dudswell [C. O.] [J. E. C.]
 " " " Wilstone [C. O.]

Middlesex.—MX.

- R. Thames, Twickenham [C. O.] [J. E. C.]

Northamptonshire.—NO.

- Canal, Rothersthorpe [C. O.]

- Grand Junction Canal, Stoke Bruerne [C. O.]

Oxfordshire.—OX.

- R. Thames, Streatley [C. O.]

Surrey.—SR.

- Runney Mead [J. E. C.]

Wiltshire.—NW. and SW.

- Canal, Seend [C. O.]

Worcestershire.—WO.

- R. Severn, Stourport [C. O.]

- " Worcester [C. O.]

WALES.

Montgomeryshire.—MG.

- Canal, Welshpool [C. O.]

IRELAND.

Antrim.—AN.

- Canal, near Moira [C. O.]

Galway, South.—SG.

- R. Suck, Ballinasloe [C. O.]

HOLOCENE.

ENGLAND.

Bedfordshire.—B.D

- Bromham [C. O.] [K. & W.]

Hertfordshire.—HT.

- Watford [C. O.]

Oxfordshire.—OX.

- Clifton Hampden [K. & W.]

Surrey.—SR.

- Near Staines [K. & W.]

IRELAND.

Carlow.—CW.

- R. Barrow, Graiguenamanagh [R. A. P.]

Clare.—CL.

- R. Shannon, Plassy, near Limerick [R. A. P.] [K. & W.]

Kilkenny.—KK.

- R. Barrow, New Ross [R. A. P.] [C. O.] [K. & W.]

- Graiguenamanagh [R. A. P.]

- ? " Fiddown [R. A. P.] [C. O.] [K. & W.]

Limerick.—L.K

- R. Shannon, Plassy, near Limerick [R. A. P.] [K. & W.]

Tipperary, South.—ST.

R. Suir, Clonmell [R. A. P.].

Waterford.—WA.

R. Suir, Clonmell [R. A. P.].

,, Fiddown [R. A. P.] [C. O.] [K. & W.].

Wexford.—WX.

R. Barrow, New Ross [R. A. P.] [C. O.] [K. & W.].

PLEISTOCENE.

ENGLAND.

Cambridgeshire.—CB.

Barnwell [K. & W.].

Essex, North.—NE.

Clacton [K. & W.].

Essex, South.—SE.

Grays [C. O.] [K. & W.].

Kent, West.—WK.

Crayford-Erith [C. O.] [K. & W.].

CROMERIAN.

ENGLAND.

Kent, West.—WK.

Swanscombe [K. & W.].

Norfolk, East.—EN.

Mundesley [K. & W.].

Sidestrand [K. & W.].

The initials in [] are those of the several collectors who hold specimens, viz. : C. Oldham, J. E. Cooper, Kennard & Woodward, and R. A. Phillips.

PISIDIUM HIBERNICUM, Westerlund.

This proves to be a far more polymorphic species and far more widely distributed than was at first thought, as shown by Mr. Phillips and Mr. Stelfox in their important paper on it and its range.¹⁵

In the early days of one's study of the British Pisidia, whilst taking the forms from Lough Nagarriva, the type locality, as the standard, although recognizing they were probably abnormally inflated, one was unprepared for so wide a distribution and hence cautious about attributing to this species forms that might well be only varieties of other, better-known species. Decisions were then come to by me, which the authors of the above-named paper quote as final, that might have been modified had opportunity been courteously afforded for defence or recantation. In some instances it is even possible that the gatherings which were submitted to me from a given locality may not have contained representatives of the species at all, or only a few readily overlooked in the number.

¹⁵ Irish Naturalist, xxvii, 1918, pp. 33–50, 2 pls.

Opportunity having lately presented itself to carry out a long-deferred intention to reinvestigate the matter, I applied to Mr. Oldham, who most kindly lent me the whole of his valuable collection of the species, which is specially rich in examples from remote Welsh tarns. To him my thanks are due and hereby tendered, as well as to Mr. Cooper and Mr. Overton, for the chance of inspecting additional gatherings.

Studied thus in the bulk, a truer appreciation of the species as a whole is possible. The outstanding feature externally, in addition to its globular form, in which it comes nearest to *P. obtusale*, is the fact that the lines of growth are not only "regular, close, and well marked¹⁵ (p. 36)", but that they are present on the neponic shell. It differs in this respect from both *P. nitidum* and *P. pusillum*, in which the neponic shell is usually smooth, followed by a band of strongly marked, deeply incised lines, a feature noted by Jenyns as characteristic of the former, but overlooked by him in the latter species. In *P. hibernicum*, moreover, there is a suggestion when viewed under the microscope, of faint radial sculpture rarely present in other species. Internally the chief feature is the short hinge-line, just as in *P. obtusale*, and, in fact, all orbicular bivalves. This shortness of the hinge-line persists in most of its form mutations, although if the determination and drawings be correct, it is somewhat departed from in the specimens from Gortymadden figured by Phillips and Stelfox¹⁵ (pl. i, f. 7 and 8). In addition the points of the lateral teeth, when viewed sideways, stand up more sharply, as shown in the "Catalogue" than they do in other species of the genus. Diagrammatically expressed they are $\wedge\wedge$ rather than $\wedge\wedge$.

A thorough examination was made of all the samples in the Kennard-Woodward collection, with the result that a few Irish representatives were detected as misplaced, namely: under *obtusale*, examples from Lough Acapple (Donegal); Tully Lough (Fermanagh); and Lough Nalackan, Brandon Mt. (Kerry); whilst a tube of "*pusillum*" from Lough Nafeola (Fermanagh) proved divisible into *hibernicum* and *nitidum*. An equally careful research in the collections at the British Museum (Natural History) yielded no instance of any misidentified *hibernicum*.

List of occurrences so far seen and determined by the writer:—

RECENT.

ENGLAND.

Bedfordshire.—BD.

R. Ouse, Bromham [C. O.].

Buckinghamshire.—BX.

R. Thames, Denham Lock [J. E. C.].

R. Colne, Iver [J. E. C.].

Wendover Canal, Halton [C. O.].

Cambridgeshire.—CB.

R. Ouse, Ely [C. O.].

Cheshire.—CH.

Baguley Moor [C. O.].

Cumberland.—CU.

Dale Head Tarn (1,600'), Barrowdale [C. O.].

Knott's Dock Tarn, Borrowdale [C. O.].

Barrow Bay, Derwentwater [C. O.].

Blea Tarn, Eskdale [C. O.].

Deroke Water, Eskdale [C. O.].

Friar's Crag, Derwentwater [C. O.].

Gloucestershire, East.—GE.

Canal at Stroud [C. O.].

Hertfordshire.—HT.

Fishpond, Aldenham Abbey [C. O.].

Brook at Cassio Bridge, Watford [C. O.].

Lancashire, Mid.—ML.

Haweswater, Silverdale [C. O.].

Lancashire, South.—SL.

Canal at Reddish [C. O.].

Middlesex.—MX.

R. Colne, Harefield [J. E. C.].

Stanwell [J. E. C.].

Northamptonshire.—NO.

R. Nene, Northampton [C. O.].

Staffordshire.—ST.

Froghall [C. O.].

Great Barr Park, near Walsall [H. O.].

Suffolk, West.—WS.

Fen drain, Lakenheath [C. O.].

Surrey.—SR.

Chobham [C. O.].

Kew ditch [J. E. C.].

R. Wey, Woking [C. O.].

Warwickshire.—WW.

Sutton Coldfield district [H. O.].

Westmorland and Lake Lancashire.—WL.

Little Water, Bampton [C. O.].

R. Beetha, Beetham [C. O.].

Brother's Water [C. O.].

Elterwater [C. O.].

Esthwaite (217') [C. O.].

Grasmere (204') [C. O.].

Hawes Water [C. O.].

Lingmoor Tarn (1,300'), Langdale [C. O.].

Little Langdale Tarn (340') [C. O.].

Loughrigg Tarn [C. O.].

Reservoir at Patterdale [C. O.].

Nab Cottage, Rydal Water [C. O.].

West side of Rydal Water [C. O.].

Pull Wyke Bay, Windermere [C. O.].

Yorkshire, South-West.—WY.

Marsden [C. O.].

WALES.

Breconshire.—BR

Canal at Brecon [C. O.].

Carnarvonshire.—CR.

Llyn Anafon (1,630') [C. O.].

Llyn Diwaunedd (1,208') [C. O.].

Llyn Dwythwch (920'), Llanberis [C. O.].

Llyn Mymbyr (588'), Capel Curig [C. O.].

Llyn Ogwen (984') [C. O.].

Llyn Padarn (340') [C. O.].

Llyn Peris (340') [C. O.].

Denbighshire—DB.

Llyn Aled (1,740') [C. O.].

Glamorganshire.—GM.

Llandaff [C. O.].

Merionethshire.—MN.

Fairbourne, Barmouth [C. O.]

Llyn Cyri (1,200'), Cader Idris [C. O.].

Tarn on Y Garn (1,800'), Dolgelly [C. O.].

Llyn Dulyn (1,740'), Llanddwywe [C. O.].

Llyn Cwm Mynach (950') [C. O.].

Llyn Irddyn (1,029') [C. O.].

Llyn Lliwbran (1,500') [C. O.].

Llyn Y Bi (1,400') [C. O.].

Montgomeryshire.—MG.

Llyn Du Meiford [C. O.].

IRELAND.

Antrim.—AN.

Loughs (1,000') west of Carnlough [K. & W.].

Clare.—CL.

Lough Derg [C. O.].

Cork, West.—WC.

Lough Namaddrá (1,200') [C. O.] [K. & W.].

Down.—DO.

Ballyholme [C. O.].

Donegal, East.—ED.

Lough Acapple [K. & W.].

Fermanagh.—FE.

Awaddy Lough [K. & W.].

Lough Nafeola [K. & W.].

Tully Lough [K. & W.].

Galway, West.—WG.

Lough Gowlanagower, Inishbofin [K. & W.].

Lough Inch [J. E. C.] [K. & W.].

- Galway, South.—SG.
 Lough Derg [C. O.].
 Lough Rea [C. O.].
 Kerry, South.—SK.
 Lough Nagarriva (1,200') [J. E. C.] [K. & W.].
 Lough Nalackan (1,150') [K. & W.].
 Tipperary, North.—NT.
 Lough Derg [C. O.].
 Waterford.—WA.
 Lough Coumshingaun [C. O.].

HOLOCENE.

ENGLAND.

- Somersetshire, North.—NS.
 Burnham [K. & W.].

IRELAND.

Down.—DO.

- White Bog, Killough [C. O.]. [K. & W.].

The initials in [] are those of the several collectors who hold specimens, viz. : C. Oldham, J. E. Cooper, H. Overton, and Kennard and Woodward.

PISIDIUM STEENBUCHII, Möller.

To his paper on "The Pisidium Fauna of the Grand Junction Canal"¹⁶ Mr. Stelfox appended notes on some species which had not been found in those waters. Among these (p. 301) was *P. steenbuchii*, of which he received for study a single example from Boveney, from Mr. J. E. Cooper, and he suggested that this species is nothing more than a "rather uncommon variety of *P. nitidum*". Since then a second specimen has been detected among some other Boveney shells and placed in the same box.

The original determination of this and other examples from widely different localities was made after careful comparison with co-types of *steenbuchii* kindly sent me from the Zoological Museum at Copenhagen, but it has seemed well under the circumstances to check this conclusion. Accordingly having been favoured once again by Mr. Cooper with the loan of his specimens, I have compared his and my own examples anew with the co-types of *steenbuchii*, and can find no reason for altering my former determination.

Of course, looked at carelessly they do superficially resemble *nitidum*, save that they are somewhat larger and differ in their sculpturing. The dentition, too, is fairly similar in both species, but there are persistent differences observable by the careful student, which separate them, and the more important of these were duly set forth in the text (to which Mr. Stelfox never seems to refer) of the "Catalogue of the British species of *Pisidium*", and need not here be elaborated over again. Mr. Stelfox invites a com-

¹⁶ Journ. of Conch., xv, 1918, pp. 289–304.

parison of his figures with the diagram on pl. ii of the " Catalogue ", and vaunts the superiority of his method. This eulogy must surely have been penned ere the reproductions of his drawings had been received from the engraver, for if I was unlucky in having my excellent photographs spoilt as they were by bad collotyping, he has been still more unfortunate. Yet when the wrecks of his drawings are carefully examined by one acquainted with the two species it looks as if the draughtsman had detected and figured the differences in c. iii of the hinge.

Mr. Stelfox states that he has seen other examples of *P. nitidum* similar to the Boveney specimen from other localities. Is it possible that just as in the beginning I came to grief over *P. hibernicum* he has now missed the opportunity of extending our knowledge of the range of *P. steenbuchii* ?

ADDITIONUM.

Read 10th June, 1921.

REGRETTABLE though it be, the trivial names of two more species of *Pisidium* will have to be changed. Both *P. pusillum* and *P. obtusale* were taken by Jenyns at second and third hand from names given to species which prove indeterminate and consequently not available under our modern regulations as to nomenclature.

The following new names are consequently proposed :—

PISIDIUM PUSILLULUM, nom. nov., vice *P. pusillum*, Jenyns (of B. B. Woodward), *non* Gmelin, *nec* Turton.

What the *Tellina pusilla* of Gmelin (Linn. Syst. Nat., ed. 13, i, pt. 6, 1791, p. 3231) really was is not now ascertainable. The name was subsequently taken over by Turton in 1819 (Conch. Dict., p. 167) without reference to Gmelin, but in 1822 (Conch. Brit., p. 251, pl. xi, f. 16, 17) when changing the name to *Cyclas pusilla* he refers to Gmelin. Turton described the shell as " oblique tumid inequilateral ", and evidently included all the smaller species of *Pisidium* under the designation. Nine years later, Turton (Manual, 1831, p. 16, f. 7) modified this to " obliquely suboval, convex ". Jenyns, when he adopted the name from Turton in 1832 (Trans. Camb. Phil. Soc., iv, p. 302, pl. xx, f. 4–6), on the other hand, speaks of it as " Testa variabilis, plerumque orbiculato-ovalis, interdum suboblonga margine dorsali recto, vix inaequilateralis ". Jenyns evidently in the three varieties distinguished by him included more than one form which would to-day rank apart. Of the " two extreme varieties " figured by him, one was probably the *personatum* of Malm, as suggested by me (Catalogue, p. 7), and subsequently by Mr. Oldham (Journ. Conch. xv, 1918, p. 237), who further found direct evidence on other tablets in the Jenyns collection of the presence of Malm's species under Jenyns' name. Since, however, Jenyns' name is inadmissible, all further discussion as to what constituted his species is unnecessary.

The form to which, rightly or wrongly, I restricted the name *pusillum* of Jenyns, and which will have to take the new name, is a polymorphic one that seems to have puzzled malacologists, some of whom apparently regard it as an extreme form of *nitidum*. Truly it has much in common with that species; nevertheless, it appears to me to possess certain constant hinge characters, which justify its separation under a distinctive name. Its characteristics were duly set forth in the "Catalogue", p. 61, but the more salient features of typical examples may well be repeated here.

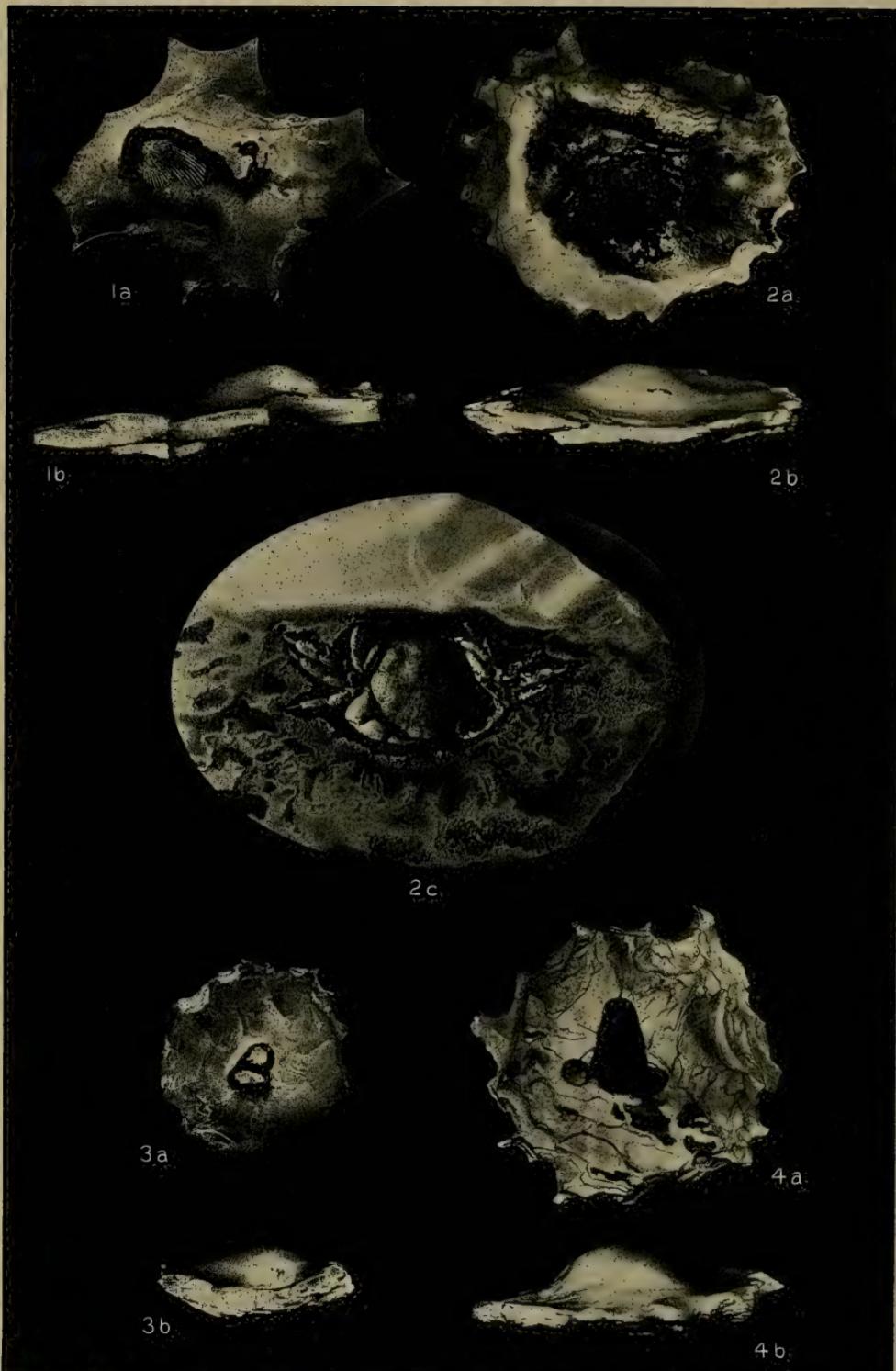
Externally the species is glossy, greyer than *nitidum*, more nearly equilateral than any of the other species, save *personatum*, with fairly prominent umbones; the neopionic shell is tolerably large, smooth, and frequently iridescent, and generally immediately followed by a series of concentric ridges as in *nitidum*, but much stronger.

Internally this form differs from all others in its hinge. The lateral teeth strike the eye at once as being somewhat longer, narrower, and less prominent than in most of the other species, while their apices are almost at the end furthest from the umbo. The paired laterals of the right valve are more equal in each pair in length than in other species, and stand out from each other and the shell margin. The cardinal teeth are flat-topped and practically parallel with the hinge line; the base of *c ii* is continuous with *aii* and *c iv* is mainly parallel with it; *c iii* is only slightly curved. The essential arrangement of the cardinals, therefore, recalls that in *subtruncatum*.

PISIDIUM OBTUSALASTRUM, nom. nov., vice *P. obtusale*, C. Pfeiffer
(of Jenyns non Pfeiffer) non Lamarck.

Jenyns (Trans. Camb. Phil. Soc., iv, 1832, p. 301, pl. xx, f. 1-3) identified his well-marked species with that described by C. Pfeiffer (Naturg. Deutsch. L.-u. Süssw.-Moll., i, 1821, p. 125, pl. v, f. 21, 22) who took the name from, whilst querying its identity with, the *Cyclas obtusalis* of Lamarck (Hist. Anim. s. Vert., v, 1818, p. 599).

There is no certainty as to the identification of either Lamarck's or Pfeiffer's shell, and neither adequately suggests Jenyns', consequently the name of Jenyns' shell has to be changed.

BLISTER PEARLS FROM *PINCTADA MAXIMA*.

NOTES ON PEARL FORMATION AND JAPANESE CULTURE PEARLS.

By T. H. HAYNES.

Read 10th June, 1921.

(PLATES VII AND VIII.)

THE study of pearl oysters and the problems presented by the formation of pearls demand an acquaintance with the distinction between pearls and "blisters", or excrescences on the shell surfaces. All pearls are formed within the tissues of the mollusc, but they frequently pass out and become included between the animal and the shell, when they are treated in the same manner as any foreign object in that position. They are joined to and embedded in the shell by successive layers of nacre, or other shell-substance. These excrescences are gradually reduced in height by the successive layers of nacre covering the foreign body, being thinner at the top than at the base or plane of the shell (Pl. VIII, f. 5). "Decreasing blisters" are represented on Pl. VII, Figs. 1, 2, and 3. Fig. 4 represents different features and represents an "increasing blister" or barrier raised as a defence against penetration by a boring bivalve from the outside; and the layers of nacre are thicker at the top than at the base. In the event of the borer working vertically the shell is usually pierced; but in most cases the borer works at an angle, and the pearl oyster is able to increase the height of the blister quickly enough to prevent complete penetration. When the borer is completely within the substance of the shell the entrance it has left behind itself often becomes choked with mud, which prevents the entry of sea-water, in which case the borer perishes and the pearl oyster then reduces the height of the blister in the same way as described in the three preceding instances. Small blisters are thus often completely levelled down in the growing shell.

If there is a hole at the back of the shell opposite to a blister the pearler takes no further interest in it; but if there has been no borer at work the pearler punches out the blister by a series of holes round it with a steel punch, and by smart but careful tapping with a hammer laterally the blister will disclose the nature of its contents by splitting in two at the point where the foreign substance which lodged against the shell surface was attached and covered by the successive layers of nacre. These true blisters may contain a crab (Fig. 2) or stray shell (Fig. 1) or stone or a pearl (Fig. 3) escaped from the tissues of the oyster, or they may be hollow and foul-smelling when opened—in which case an animal or vegetable object was entombed and has decomposed and left no trace of its identity.

There is no direct evidence as to the frequency of shell secretion. When young the lateral growth of the animal is so rapid that the secretion of layers of nacre, each overlapping the other outwards towards and over the horny lip of the shell and increasing the

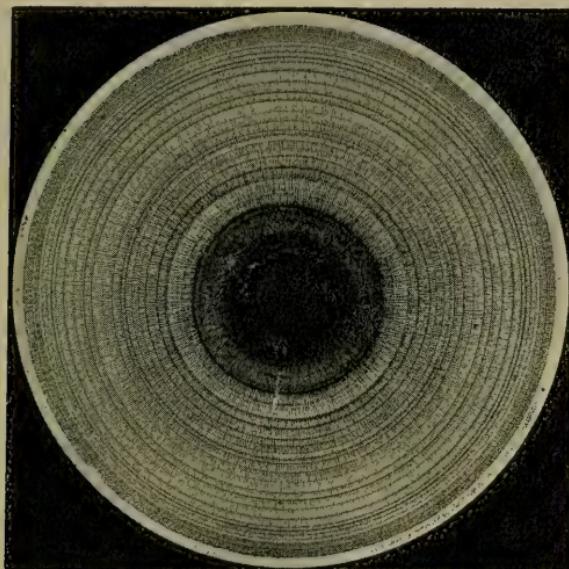
diameter of the shell, must be a continuous function ; but after full growth it may be doubted whether the layers follow one another so rapidly. If a pearl oyster perishes the animal quickly disappears, being eaten by fish, crabs and small molluscs, and within twenty-four hours in warm tropical waters the shell will lose its brilliancy and become quite dull or "dead" owing to the chemical action of the salt water. When the mother-of-pearl oyster is alive and open the two mantle lobes cling closely to the surfaces of the upper and lower shells, excluding the sea-water from direct contact with the shell, but leaving a considerable space for it to fill between the two mantle lobes. It is obvious, therefore, that the larval pearl-inducing parasite or any other intruding object must first enter between the mantle lobes and not between the mantle and the shell.

The mantle lobes' adhesion to the shell surfaces is so strong that considerable leverage with the blade of the knife has to be exerted to force them apart, and it is not improbable that a certain degree of suction action prevails, in addition to the presence of a slime of a mucilagenous character which promotes adhesion. It is quite obscure how a stray shell or dead crab or other object which is found in a blister attained access to the shell surface beneath the mantle lobe. Nothing is known of the activities of the oyster when it is closed, or what convolutions of the animal occur, but it is quite possible that occasionally each mantle lobe is turned inwards, bringing the slimy external epidermis into contact with the inner clean ciliated epidermis of the cavity in order to clear it of intruders, large or small. In this manner cestode larvae piercing the cavity lining would enter under different conditions to those piercing the outer lining.

The magnified section in Fig. 5 (Pl. VIII) of the artificially produced Japanese blisters represents a special adaptation of a custom amongst Chinese from time immemorial to produce figures of Buddha, and other objects, as blisters in shells : the same thing was done by Saville Kent in Australia. The configuration of the layers of nacre in this figure exemplifies the process of reduction in height.

Fig. 6 (Pl. VIII) is a highly magnified section of what there is reason to believe is actually what it is represented to be—a mother-of-pearl bead covered with layers of nacre within the tissues of a living pearl oyster and converted into a pearl. The remarkable difference between these layers both in thickness and in regularity and those in the two following Australian pearls is of importance. These new Japanese culture pearls vary of course in quality, but the one from which this section was cut was of about 5 grains much above the ordinary quality. Mr. Mikimoto, the originator of the enterprise, does not profess to produce anything much larger than 7 grains. According to the specification of his American patent, taken out in 1919, a portion of the shell-secreting epidermis is

taken from the mantle of a living oyster and formed into a little sac within which a bead of mother-of-pearl is inserted, the sac tied up and inserted into an incision made in a second oyster, the ligature being then removed, the wound treated with an anti-septic and an astringent, and the oyster returned to the sea. They are operated on when 3 years old, and opened for the result at 7 years, the maximum age being about 10 years. This artificial, grafted sac is in imitation of the cyst which experts declare is naturally made round the nucleus of all fine pearls. Obviously the artificial sac must be an inferior production to that formed by nature, and this would account for the irregularity of the concentric layers of pearly matter compared with the remarkable regularity shown in Fig. 7.



Section ($\times 11$) of a very perfect pearl, reproduced by the kind permission of its possessor, Mr. J. G. Bradbury.

There is no particular reason why an operation successful in making 7 grain pearls in the Japanese small 3-inch pearl oyster should not be adopted on the large Australian pearl oyster running up to 15 inches in diameter and producing pearls exceeding even 100 grains; but Mr. Mikimoto must improve his methods greatly before he can produce anything in the shape of a perfectly round pearl of say 40 grains, for which as much as £5,000 has frequently been paid. The deviation from the true spherical shape in the 5 grain (Fig. 6) would be of very serious detriment in a 40 grain pearl, which to fetch any fancy price must roll perfectly straight without wobbling a hair's breadth. (Cf. Text figure.)

It is difficult to understand why Mr. Mikimoto should have patented and thereby published the details of his process. The grafting operation is one of a very delicate nature, requiring quick and deft workmanship more likely to be attained in an Asiatic race in which the cultivation of the arts is instinctive, than in Western races; and the implantation of the artificial sac in the body proper or "under the liver" in the posterior part of the living oyster, where the secretion of pure white pearl is to be secured, is a much more difficult matter than in the mantle in the anterior region, where in *Pinctada martensi*, Dkr., there is great probability of the pearl being of a decidedly yellowish tinge. Nevertheless, the grafting of shell-secreting epidermis and its conversion into a pearl-secreting sac, marvellous as it may sound, is inferior in novelty to and less remarkable to pathologists than the experiments performed at Plymouth by Mr. G. H. Drew on *Pecten* and the formation of a cyst within the adductor muscle of one scallop by the conversion into columnar ciliated epithelium of the inner layer of fibroblasts, stimulated by the artificial introduction of a fragment of living ovarian tissue from a second scallop, such fragment (acting as a nucleus) degenerating in six days leaving a residue of a few blood cells and granular matter. This marks a new departure in metaplasia, as will be seen from the following conclusions culled from Mr. Drew's paper¹ :—

Ribbert, 1908. "Only tissues that, while externally different, possess nevertheless the same histogenetic capacities can undergo metaplasia one into the other."

On the other hand,

Leo Loeb, 1899, records that in cases of epithelial regeneration in vertebrates, he has observed epithelial cells migrate into underlying tissues, and take on the appearance of fibroblasts.

Drew, 1910, on *Cardium norvegicum*. Corpuscles coming into contact with a rough foreign body or injured tissue possess the power of agglutination and forming a compact plasmodial mass, and the same in *Pecten*.

Sir Ray Lankester, 1886-93, shows that certain corpuscles in *Ostrea edulis* have a phagocytic action on diatoms and minute green algæ.

Drew, 1910, Corpuscles of *Cardium norvegicum* have phagocytic action on bacteria and are attracted towards extracts of dead tissues.

From a pearl student's point of view Mr. Drew's experiments would have been more interesting if the insertion had been made in the body proper, or in the mantle lobes, rather than in the adductor muscle, the pearls from which in a pearl oyster are of

¹ Journal of Experimental Zoology, vol. x, 1911 (U.S.).

a different and valueless character as compared with those formed in the softer parts of the oyster; the former being more of the nature of concretions and the latter alone being cyst-pearls.

Dr. H. Lyster Jameson, who has made the nuclei of pearls his special study, says that apart from those of trematode origin they range from diatoms and fragments of radiolarian shells to sponge spicules.¹ He also is of opinion that "the immediate cause of the pearl is not the mechanical irritation caused by the body of the parasite, but rather the toxic properties of its secretions, which lead to the pathological changes (formation of the tumours that we call pearl-sacs) in the tissues."²

In a letter to the *Times* (7th May, 1921) Sir Arthur E. Shipley, in commenting on the new Japanese culture pearls, refers to the outer shell-secreting epidermis of the mantle, and remarked that "should the intrusive body press on into the interior of the mollusc it will in some cases carry with it a portion of the epidermis, which will in time form a little cyst around it", secretion of nacre following and the formation of a pearl. It is difficult, however, to accept this proposition if it is meant to cover all cyst-pearls.

On one occasion an Australian mother-of-pearl oyster was found which not only contained free pearls enough to fill a sherry glass, but both shell surfaces were studded thickly with embedded pearls of all sizes varying up to that of wrens' eggs. It is difficult to reconcile this as probable under Sir Arthur Shipley's proposition; and if endogenous larval reproduction, as vouched for by Mr. Southwell in Ceylon pearl oysters, accounted for this extraordinary amount of pearl formation, the suggestion occurs that such wholesale cyst formation was attributable to metaplastic action closely akin to Mr. Drew's experiences in *Pecten*. The same comment may be advanced touching the non-pearl-bearing, "fibrous," or "connective tissue cysts" containing cestode larvae, which predominate so largely in Ceylon oysters over the actual pearl-bearing epithelial or ectodermal sac.

It is not definitely stated by anyone that *foreign* blisters occur on the upper shell of a pearl oyster, but *pearl* blisters certainly occur there, and the fact is one of special interest. No biologist has explained how a pearl that has escaped from its sac passes through the inner or outer epidermis, but some new information may be expected to be published shortly as to foreign bodies being passed through the outer part of the body wall of oysters and "blistered".

The controversy that exists as to the identity of the parasite, or parasites to which the formation of fine Ceylon pearls is to be attributed is still acute. Cestode larvae are found within the tissues of the pearl oysters, but Dr. Jameson maintained (1912) that "no

¹ Nature, 26th May, 1921.

² Jameson, Proc. Zool. Soc., 1912, p. 329.

satisfactory instance is recorded of the cestode parasite being observed surrounded by an *epidermal sac*" (Proc. Zool. Soc., 1912, p. 273). It has been still more doubtful whether the larval intruder ever developed within a cyst, or within a pearl into the adult worm, whose proper final host was the devourer of the oyster. The precise identity of the worm or worms and the host in tropical waters are still unknown; but evidence has recently been found of a pearl containing the complete remains of what was supposed to be a fully developed worm within its nucleus. This pearl was sectioned, as shown in Fig. 8 (Pl. VIII), and the section revealed under the microscope the figure of the letter S. After the section was sent for a magnified photograph the lower bend of the S was found to have disappeared. Later, unsuspecting of danger, the same process was repeated, with the result that the upper part disappeared, leaving barely sufficient for identification of actual vermian remains. This disaster is undoubtedly attributable to heat engendered in the photographic process, but the original figure was seen by Dr. G. T. Prior at the Natural History Museum, as well as by others, one of whom asserted he saw the "horns" and tail—and he unhesitatingly picked out Fig. 70 on Plate IV of "The Parasites of the Pearl Oyster", by Sir Arthur Shipley, as of similar appearance. Fig. 70 represents the head and "horns" of the adult *Tetrarhyncus minimus*, but having regard to Figs. 19 and 22, representing the "oldest larval stage of *Tetrarhyncus unionifactor*, met with in the tissues of the pearl oyster", there is no certainty as to the specimen found being actually a fully developed worm. The similarity also between *T. minimus* and *T. unionifactor* in the "horns" renders precise identification from memory uncertain.

EXPLANATION OF PLATE VII.

Blister Pearls from *Pinctada [=Meleagrina] maxima* (Jameson).

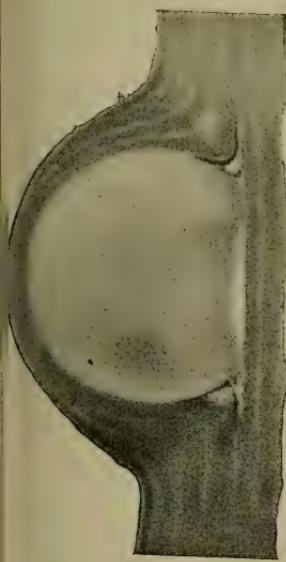
- Fig. 1a, b. Natural blister (nat. size) containing a stray shell.
- ,, 2a, b. " " " Pinnoteres.
- ,, 2c. " " " ($\times 3$) Reproduced by kind permission of Mr. A. Lanburn.
- ,, 3a, b. Natural blister (nat. size) containing a pearl.
- ,, 4a, b. " " " formed in the lower valve as a defence against the intrusion of a shell-boring bivalve.

EXPLANATION OF PLATE VIII.

Sections of Culture and Natural Pearls.

- Fig. 5. Section of artificially produced blister from Japanese pearl oyster (*Pinctada martensi*, Dkr.), sold largely hitherto as "Culture Pearls" and utilized as half-pears in cheap jewellery.
- ,, 6. Magnified section of a 5 grain Japanese culture pearl ($\frac{1}{8}$ in. in diam.) containing a mother-of-pearl bead centre.
- ,, 7. Magnified section of Australian pearl ($\frac{1}{4}$ in. in diam.) in a shell blister.
- ,, 8. Magnified section of Australian pearl ($\frac{1}{4}$ in. in diam. min.) of dull surface, showing removal of a number of skins by a knife on the straight side for the purpose of testing the quality of the skins below.

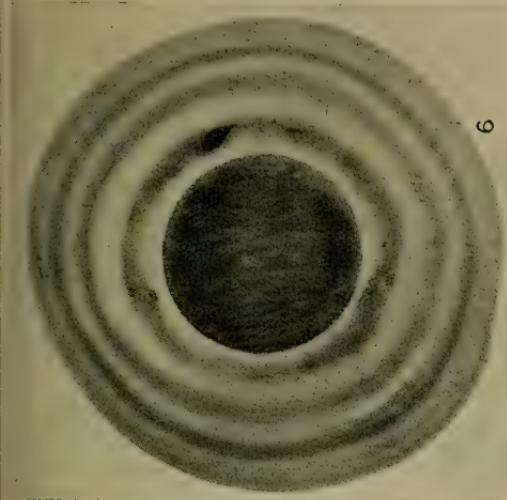
SECTIONS OF CULTURE AND NATURAL PEARLS.



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THE MOLLUSCA AS MATERIAL FOR GENETIC RESEARCH.

By GUY C. ROBSON, B.A., F.Z.S.

Read 10th June, 1921.

In the following pages I wish to comment upon some of the observations and experiments which have been made upon Mollusca that are of importance in the study of genetics. The advantage of such a survey, limited as it is to one group of animals, may not be apparent at first sight. The phenomena of segregation are now known to be almost universal among animals; but it will be, nevertheless, of advantage to know whether certain groups show peculiar types of segregation; whether there are special problems to be studied in certain groups; and whether a special technique is required for certain cases. Co-operation between the taxonomist and geneticist should thus prove to be of advantage.

The prominence given by authoritative workers to the selection hypothesis and to the discovery of unit characters and segregation has had the unfortunate result of making the average naturalist consider that these questions are settled one way or another, or, as an alternative, that both may be true. The phenomena of segregation and unit characters are almost universal, the number of instances of well-attested selective death-rates and the clear demonstration of natural selection at work are very few; yet some of the arguments adduced in favour of the latter hypothesis remain unrefuted, and many phenomena of heredity are only brought under a Mendelian interpretation by dint of considerable straining. There is room, therefore, for more work of an experimental character and great need for field naturalists to carry out supplementary observations according to systematic plans.

At first sight the Mollusca should be a highly satisfactory group for experiment. The shell is a sensitive index of genetic change, albeit susceptible to "fluctuating" variation. It is a permanent and easily visible source of reference. Furthermore, there are certain internal structures (the radula, the dart and jaws of Pulmonata, the mandibles of certain Prosobranchs, and the stomachal plates of Opisthobranchs), which afford admirable material for correlation with the shell characters. On the other hand, they are not quick-breeding animals, the land forms do not have very extensive families, and, though otherwise well suited for study, by reason of their monocious sex, peculiar copulatory habits, and the tendency among some to bury their eggs, are animals in which the business of exact affiliation is a troublesome matter. We have lastly to consider in detail a question raised by Lang's original work (12)¹ upon Helicidæ. In his first report upon crosses of *H. nemoralis* and

¹ Numbers in () refer to the bibliography at the end of the paper.

hortensis the latter considered that he had showed that self-fertilization did not occur. He found, however, that snails separated after copulation could reproduce themselves, even if *isolated* for three years. He considered this was due to the persistence of the spermatozoa derived from the original copulation in the vesicula seminalis for that period. In a later work (13), however, he announced that a probable case of self-fertilization had been observed ; and Künkel (11) stated that he had actually observed the process. There appears to be very little reason for doubting these observations, which, if they are finally endorsed, should be of great importance in the study of genetics. The question of delayed fertilization is, however, not finally disposed of ; and it is just possible that certain anomalous cases such as those recorded by Stelfox (16) and Collinge (5) may be due to this.

The amount of experimental work done upon Mollusca that satisfies the conditions of an orthodox genetic study is relatively small. A great many observations recorded by Pelseneer (15), some of them adduced by him as evidence against Mendelian heredity, have been made that in one way or another fail to fulfil these conditions. Uncertainty as to the actual parentage, failure to carry the experiments to the F_2 generation and other factors all combine to render these observations, otherwise of value, nugatory as evidence for or against the occurrence of segregation.

The experiments of Lang (12, 13, etc.), supplemented by Kleiner's work (10), and cytological studies by Baltzer (1), are the most important genetic researches upon Mollusca. Of almost equal importance are the results of Stelfox (16, 17) ; while that of Künkel (11) upon *Arion*, though less extensive, deserves mention. The earlier work of Collinge (5), criticized and given a Mendelian interpretation by Cockerell (4), is also worthy of notice.

It is impossible to give a detailed criticism of all this work. On the whole one would say that it affords ample evidence of the presence of unit characters, and segregation. There are several instances, however, in which the meaning of anomalous ratios is not clear, and the interpretation given by authors is not altogether satisfactory. For example, I venture to think that Lang's (13, p. 255) explanation of the proportions of pale-coloured banding in the F_1 and F_2 generations from (P) pale-banded \times pale-banded *H. hortensis* is not as satisfactory as some other interpretations of modified F_1 and F_2 ratios.

If the question were to be asked point-blank, "Do these results endorse the geneticist's point of view or do they suggest that some other mode of inheritance is operative ?" I think the answer would be that in such cases as have been carefully worked out the evidence favours the former hypothesis. If there are difficulties of interpretation, the subsequent history of such crosses does not in any case favour the earlier conception of the nature of intermediates.

In this context we may touch very briefly upon Pelseneer's criticisms (15). This is not a very welcome task, as all students of the Mollusca will unite in recognizing their indebtedness to the celebrated Belgian malacologist. But I cannot refrain from expressing the opinion that Professor Pelseneer has failed to exercise discrimination in his review of this subject. He adduces many cases which he considers are not conformable to the concept of unit characters and segregation. For reasons given above, however, the observations cited by him are not admissible as evidence. Furthermore, Professor Pelseneer appears to pin his faith to the F_2 3 : 1 ratio as evidence, and to disregard the well-known modifications of that formula. Again, he is scornful as to certain interpretations based upon imperfect dominance which he ranks among "complications verbales". Now imperfect dominance is a great deal more than this, when one considers how well its action may be tested; and, even if it may not explain all the cases of intermediacy, it cannot be lightly dismissed.

Much might be said on the wide subject of the correlation of the facts of adaptation, distribution, habits, and association with any theory of evolution. The geneticist's point of view has been well stated on this subject by Bateson (2), who draws *inter alia* upon the facts recorded by Coutagne in his account of the polymorphism of the Mollusca of France (6a). The distributional studies of Mayer (14), Gulick (9), Crampton (7) afford little evidence for the orthodox selectionist; and as far as Mollusca are concerned the evidence for a selective death-rate seems to consist only of Weldon's earlier work upon *Clausilia* (18). His later observations (19) were, however, negative. Other cases less well worked out (Boycott (3), Colton (6)) have been put on record, but these are scarcely conclusive. Although the phenomena of adaptation are apparent everywhere in the animal kingdom, it must be confessed that insufficient intensive study has been devoted to the adaptive significance of specific characters among the Mollusca. It is an incredible fact that since the publication of "The Origin of Species" sixty years have elapsed without a general concurrence of opinion on this subject being arrived at. And yet every naturalist must be familiar with numerous cases where it is hard to find an adaptive explanation of specific characters other than the customary appeal to ignorance. There is room in the study of the Mollusca for a great deal of observation and intensive study of this question. It cannot be settled without a wealth of observations made in the field upon habits, ecology, food, enemies, etc., and in such matters the general biologist awaits the verdict of the field naturalist. It has been said time after time, but is as true to-day as it was forty years ago, that our knowledge of animal ecology and habits lags far behind our descriptive taxonomy. This balance should be redressed. The experimental side of genetics,

as of any other concept of evolution, must be reinforced by field observations planned in advance to satisfy the many questions in which they may be employed as evidence. Why is a certain variety of *Helix nemoralis* found in locality A and never in locality B? Do its specific characters appear to be of advantage to it or not? Do the other snails in locality A tend to show analogous characters or are they different? If they are different, in what respect are they different? Do intermediates occur? If so, what are the offspring of the latter like when they can be bred from known parentage? These and similar questions the field naturalist should always be asking himself; and his note-book should be a treasury of information upon food, soil, enemies, habits, and other bionomic data.

Field observations are particularly needful in a special group of cases which in a general way are of considerable importance in genetic studies. Every malacologist has at one time or another been puzzled by certain groups in which structural modifications of an exuberant or bizarre form have been developed. For example, among the Lamellibranchia *Malleus*, *Brechites*, *Tridacna* (e.g. *T. squamosus*), and *Spondylus* are genera in which *bizarerie* of form or sculpture reaches a maximum. Among Gastropoda *Murex* and *Delphinula* have a fantastic exuberance of spines, certain apparently closely allied species of *Ennea* show a prolific variety of oral armature, while *Opisthostoma* and *Anostoma* exhibit a remarkable abnormality hitherto unexplained. Some of these cases seem to transcend the limits of functional adaptation and to illustrate the principle of momentum discussed by Dendy (8), and attributed provisionally by him to the failure or elimination of growth-controlling secretions. Others seem either to be adapted to very exceptional bionomic conditions or to have become subject to non-adaptive influences diverging very abruptly and eccentrically from the main tendencies of their groups.

Now some sort of adaptive explanation of such cases may be forthcoming. But an investigation in the field is most urgently needed. The elaborate spines of the various species of *Murex*, for example, are at present only explained on an assumption that they are "protective". If that is the case, what is the enemy that evokes such an elaborate defence absent from some species of the genus and from allied groups? Are the spines "protective" as a barbed-wire entanglement or do they serve to entangle seaweed and bottom débris so as to impart some sort of "protective resemblance"? Or can no such factor of special danger be discovered in the environment? Is it "momentum" or the result of some non-adaptive factorial change? We cannot dogmatize on such matters. They constitute a lacuna in our knowledge, and a complete and satisfactory account of evolutionary processes cannot be obtained while such cases remain unexplained.

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(Founded 27th February, 1893.)

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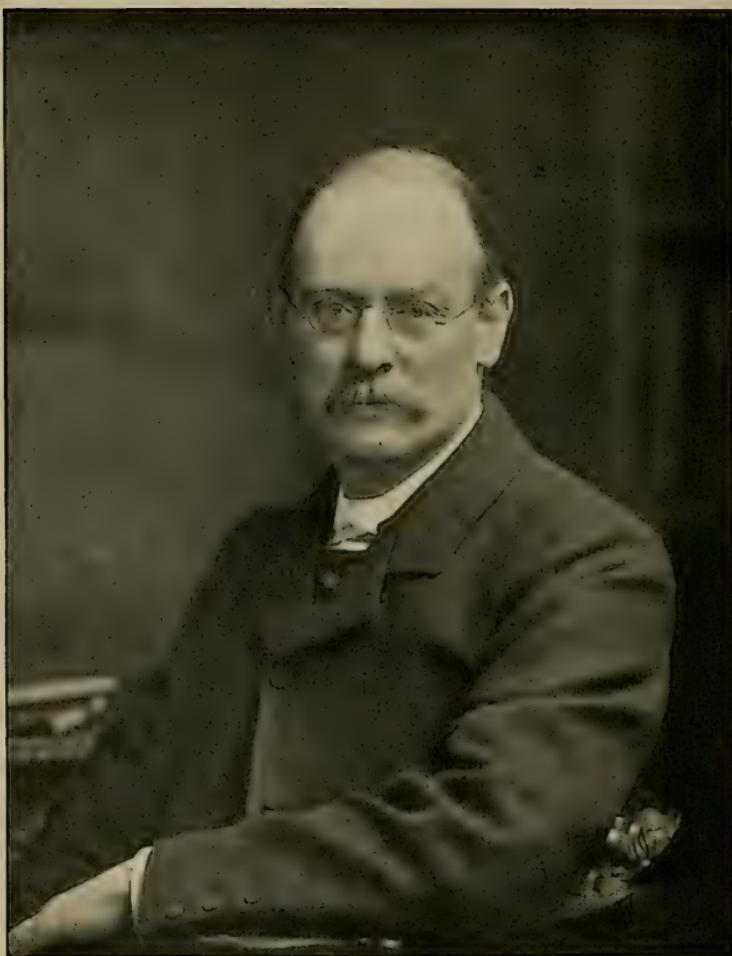
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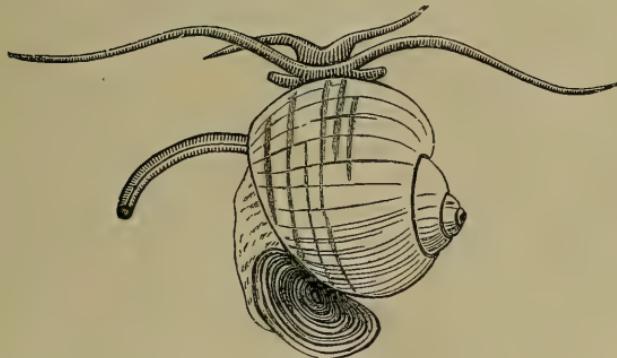
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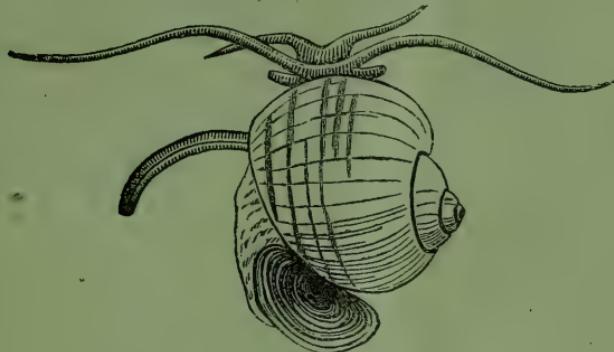
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PROCEEDINGS
OF THE
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ORDINARY MEETING.

Friday, 11th November, 1921.

G. K. GUDE, F.Z.S., President, in the Chair.

The Society received with great regret the news of the death of Dr. Henry Woodward, the first President and one of the founders of the Society, and also of Dr. W. G. Ridewood. The President read obituary notices.

The following communications were read :—

1. (a) "On the pseudo-genus *Pseudomarginella*." (b) "The Radula of the *Volutidae*." By the Rev. Dr. A. H. Cooke, F.Z.S.

2. (a) "Note on reproduction of *Turritella*." (b) "Some notes on Radulæ including that of *Columbarium*." By Lieut.-Col. Peile, R.A.

3. "A list of species and genera of recent mollusca first described in 'Le Naturaliste.'" By Hugh C. Fulton.

The following Exhibits were made :—

By Mr. Fulton : A scalariform specimen of shell of *Delphinula laciinata*, Lamk., and an abnormal specimen of the shell of *Cassis tuberosa*, L.

By Mr. B. B. Woodward : *Driessensia* encrusting shells of *Unio* obtained from the reservoirs at Barnes by Mr. A. H. Bishop, of the British Museum (Natural History).

By Mr. Salisbury : Specimens of *Patella* from Portland Harbour severely attacked by *Polidora*.

By Dr. Boycott : Sinistral *Limnaea pereger*, and *Pupa marginata* containing three young.

ORDINARY MEETING.

Friday, 9th December, 1921.

G. K. GUDE, F.Z.S., President, in the Chair.

The following were elected to membership of the Society : Stanford University Library, U.S.A., Mr. Shintaro Hirase, The Director of The Museo Nacional de Historia Natural, Buenos Aires, Professor T. D. A. Cockerell, Mr. A. E. Brookes, Professor Carlos de la Torre.

The following communications were read :—

1. "Note on British species of *Anomia*." By R. Winckworth, M.A., F.R.G.S.
2. "Nomination of 'Recent' Fossil Mollusca." By T. Iredale.
3. "Note on Holocene deposit at Penton Hook." By J. E. Cooper.
4. "Note on the Genera *Neptunia* and *Syncera*." By Dr. W. H. Dall.
5. "On the genera *Neptunia* and *Syncera*: A Reply." By T. Iredale.
6. "The status of *Helicella* and *Polita*." By Dr. H. A. Pilsbry.

The following Exhibits were made :—

By Mr. Cooper: Living *Pseudanodonta elongata*, Pot. et Mich., from the Thames.

By Col. Peile: A living specimen of *Macrochlamys indica*, Godwin-Austin, from Mauritius.

By Mr. Oldham: A series of *Limnaea pereger*, Müll., from Welsh Mountain Tarns.

ORDINARY MEETING.

Friday, 13th January, 1922.

G. K. GUDE, F.Z.S., President, in the Chair.

Mr. Oldham and Col. Peile were appointed Auditors.

The following communications were read :—

1. "On the crystalline Style of Gastropods and Lamellibranchs." By G. C. Robson, M.A., F.Z.S.
2. "On the Genesis of the designation of 'Types' among Malacological Writers." By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S., etc.
3. (a) "On the *Pisidium gassiesianum* of Dupuy." (b) "Report on the Gassies Collection of Pisidia in the Musée d'Histoire Naturelle de Bordeaux." By A. W. Stelfox.

Mr. Stelfox exhibited Drawings illustrating his papers.

ON THE PSEUDO-GENUS *PSEUDOMARGINELLA*, v. MALTZAN

By the Rev. Dr. A. H. COOKE.

Read 11th November, 1921.

ABOUT forty years ago H. von Maltzan and J. Carrière published¹ certain papers proposing a new genus *Pseudomarginella* for mollusca possessing the shell, but not the animal, of *Marginella glabella*, L. The papers attracted attention² at the time from the remarkable nature of the conclusions drawn, which amounted to this, that we are not justified in concluding that similar shells are inhabited by similar animals, or, stated in the reverse way, that two animals of absolutely different anatomical construction may develop shells which are indistinguishable from one another.

We know, of course, that a limpet-like form of shell is developed by molluscs whose internal anatomy is widely different, and that snails whose soft parts are quite dissimilar may be protected by shells whose spire is similarly coiled. But does the evidence adduced by Von Maltzan and Carrière justify their conclusions in this particular case?

In the bay formed by the Isle of Goree, off West Africa, in the latitude of the southern C. Verdes, Von Maltzan collected living shells of *Marginella glabella*, which he gave to Professor Schmidt of Strasburg, and Schmidt passed them on to Carrière (privatdocent of zoology in the University) for examination.

There were eleven shells in all, six of which, both in animal and shell, proved to be typical *M. glabella*. Of the remaining five, all of which possessed an operculum, which is quite unknown to *Marginella* proper, four had an operculum and radula (both figured), which suggested relationship with the "Buccinacea", while the remaining one had an operculum and radula which suggested relationship to the "Purpuracea". All five had the shell of a typical *M. glabella*, but their internal anatomy, so far as it was examined, differed utterly from that species.

Carrière, believing that the five last-mentioned specimens were genuine inhabitants of the *M. glabella* shells, and finding, too (as was not surprising), that they exhibited other points in anatomy differing from *M. glabella*, proposed the name of *Pseudomarginella leptopus* for the four specimens with a Buccinoid—he means unguiculate—operculum, the radula of which, according to Troschel, was closely

¹ Nachr. Malak. Ges., xii, 1880, pp. 106-8; Zool. Anz., iii, 1880, pp. 637-41; Zeitschr. Wiss. Zool., xxxvii, 1882, pp. 99-120. I deal with Carrière's later paper, as being by far the most complete.

² The editors of the Journ. de Conchyl., xxviii, 1880, pp. 375-6, state that one of these operculate *Marginella* has been sent to them, and that they propose soon to figure the operculum and radula. I have failed to discover that they ever did so.

allied to that of "*Pisania fusiforme*". The single specimen, with purpuroid operculum and radula, he called *Ps. platypus*. He admitted that animals so different anatomically ought to be classified in different "families", not genera or species, but strangely kept the same generic name for them both.

Inspection of the excellent figures which accompany the description shows at once that the radula of the purpuroid species is that of *Thais hæmastoma*, L., which differs decisively from that of any other species of *Thais*.¹ *Th. hæmastoma* is a common West African species, occurring in almost every record of collections from Mossamedes to the Mediterranean. The radula of the other species is that of a *Pollia*, and corresponds exactly with that of *P. maculosa*, Lam., a specimen of which from the Cape Verdes is in the Gwatkin collection. This latter result somewhat surprises me, for *P. maculosa* usually possesses a shell too small to correspond in size with that of *M. glabella*: *P. variegata*, Gray, or *viverrata*, Kien., would have better fulfilled the condition of size, but the evidence of the radula is decisive. The operculum of the shells with the *Pisania* (*Pollia*) radula is that of *Pollia*, that of the shell with *Th. hæmastoma* radula is that of *Th. hæmastoma*. Both *Th. hæmastoma* and *P. maculosa* inhabit the rock-zone below high-water mark, where the *Pseudomarginella* are stated to have been found. The true *M. glabella* were dredged in about 30 metres bottom green mud. Carrière employs this difference of station to account for the divergence of the two sets of forms, but it may be doubted whether the argument has any weight.

Carrière seems scarcely to be aware of the *a priori* difficulty of the thesis which he maintains, or of the improbability, on the face of it, that three species of mollusca, which, as he admits, differ essentially from one another in the anatomy of the soft parts, should all be capable of secreting a precisely identical form of shell. It is true that he bravely attempts to meet the obvious suggestion that the negroes, who collected the shells for v. Maltzan, extracted the soft parts of other mollusca and inserted them into the empty shells of *M. glabella*. His honesty is indisputable, but it will require stronger evidence than he is able to produce in order to make us believe in phenomena which, if true, would revolutionize our theories of development, and throw the deductions of biology into confusion.

There are three points in which Carrière's own evidence tells fatally, as it seems to me, against him: (1) He says that the operculum of the *Pseudomarginella* prevented the animal from drawing itself completely into the shell, and it is obvious from his own figures that the operculum could not be withdrawn within the shell's mouth. He does not see that this is strong evidence that the animal does not

¹ Proc. Malac. Soc., xiii, 1919, p. 95, fig. xvi (p. 90).

belong to the shell at all. *Marginella* proper has no operculum; *Pseudomarginella* has two different opercula, the one unguiculate, the other horny, with a medio-lateral nucleus, and neither fits the mouth of the shell. (2) The polished surface of the shell of *M. glabella* is produced, as in *Cypraea*, by extensions of the mantle-edge, which overlap and envelop the greater part of the shell. Carrière, in his notes on the anatomy, mentions their existence.¹ In the case of both his species of *Pseudomarginella*, he expressly records that there were no such prolongations of the mantle. But he does not seem to have asked himself how, in that case, the shell happens to carry a high surface-polish. He tells us that the five shells in question lived "in der felsigen Geröllzone nahe am Ufer", so that they cannot have developed their lustrous surface, as do many species of *Oliva*, *Mitra*, *Natica*, *Nassa*, etc., by ploughing about in wet sand. In the absence of either of these two conditions, the polish on the shells of *Pseudomarginella* remains unexplained. (3) He records, in the case of *M. glabella*, the fact that the four columella folds of the shell form strong indentations on the internal attachment muscle, as they do in all spiral shells furnished with similar folds. Carrière makes no such remark in discussing the anatomy of *Pseudomarginella*, except to say that the operculum prevented the complete retraction of the shell, and so made the indentations faint. Yet the columella folds continue to the top of the spire, and must have heavily indented any soft portion of a genuine animal which came in contact with them.

Before we can accept observations of the nature contained in these papers, or the theories built upon those observations, ample confirmation and illustration are required; neither are forthcoming. In the forty years which have since elapsed, nothing even remotely resembling the phenomena here recorded has been detected by observers, whose number has been multiplied by scores. It must follow, beyond a doubt, that in this case the observer was deceived; some mistake, it is both needless and impossible to determine its exact nature, must have occurred. The name *Pseudomarginella* must disappear from our catalogue of the mollusca.

¹ "Bei dem lebenden Thiere umhüllt der Mantel mit seinen grossen Seitenlappen die Schale, wodurch die Glätte derselben hervorgerufen wird."

THE RADULA OF THE VOLUTIDÆ.

By the Rev. Dr. A. H. COOKE.

Read 11th November, 1921.

THE radula in each of the following species of Volutidæ is known, either by description, or figure, or by both :—

Cymbium papillatum, Schum. (= *olla*, auctt., nec L.). Lovén (16), Troschel (27), Hogg (14), Schacko (21).

Melo diadema, L. Cooke (1).

„ *indicus*, Gmel. Fleure (9).

„ *nauticus*, L. Troschel (27).

„ sp. Macdonald (17).

Voluta ancilla, Sol. Woodward (29), Pace (18).

„ *anomala*, Marts. Thiele (25).

„ *arabica*, Mart. (= *pacifica*, Lam.). Hutton (15).

„ *concinna*, Brod. Schacko (21).

„ *dohrni*, Sowb. Dall (5).

„ *dubia*, Brod. Dall (2, 5).

„ *gouldiana*, Dall. Dall (2).

„ *junonia*, Hwas. Dall (5).

„ *mamilla*, Gray. Gatliff and Gabriel (10).

„ *musica*, L. Fischer (8), Pace (18).

„ *philippiana*, Dall. Dall (4, 5).

„ *pyrrhostoma*, Wats. Sowerby (24), Thiele (25).

„ *roadknightæ*, McCoy. Verco (28).

„ *scapha*, Gmel. Troschel (27), Dall (2).

„ *sparta*, Dall. Dall (5).

„ *stearnsii*, Dall. Dall (2, 5).

„ *vanhoeffeni*, Thiele. Thiele (26).

„ *vespertilio*, L. Troschel (27), Pace (18).

Lyria deliciosa, Montr. Fischer (7).

„ *nucleus*, Lam. Pace (18).

Amoria undulata, Lam. (= *turneri*, Gray). Gray (13), Troschel (27), Pace (18).

Volutilithes abyssicola, Ad. & Reeve. Sowerby (23), Woodward (29), Dall (4), Thiele (24).

Neptuneopsis gilchristi, Sowb. Sowerby (22), Thiele (24), Woodward (29), Pace (18).

Volutomitra grænlandica, Beck. Troschel (27), Sars (20), Dall (2), Pace (18).

Halia priamus, Meusch. Fischer (6), Poirier (19), Dall (3).

In all, thirty species, of which four, viz. *dohrni*, *dubia*, *gouldiana*, and *junonia* have lost the radula altogether.¹

¹ An operculum is known to exist in *V. africana*, *anomala*, *musica*, *stearnsii* (probably), *Lyria deliciosa*, *Nept. gilchristi*. Fischer (Manuel, p. 610) seems to imply that all species of *Lyria* are operculate.

To these the Gwatkin collection adds ten, viz. *Cymbium neptuni*, Gmel., West Africa, *Voluta africana*, Reeve, Natal, *ferussaci*, Don., Patagonia, *papillosa*, Swains., South Australia, *ponsonbyi*, Sm., ✓ Natal, *rutila*, Brod., Torres Strait, *sophia*, Gray, Torres Strait, *verconis*, Tate, South Australia, *Lyria mitræformis*, Lam., Adelaide, *queketti*, Sm., off Durban. *Cymbium diadema*, L., ought also to be counted here, as it was figured from a Gwatkin specimen.

In the Volutidæ, the base of the framework of the rhachidian tooth is sometimes almost straight (*V. papillosa*), sometimes deeply arched (as in *Amoria*), with every possible gradation of curve between these two extremes. It rarely bulges forward, as in *V. musica*. It is perhaps desirable to indicate the nature of this curve more precisely than by saying that the base is "slightly" or "deeply" arched. If we imagine the curve, or arc, set upon a chord by drawing a line to join the two ends, and describe angles in the segment thus formed, all these angles are equal. The term "segmental angle" will therefore serve to indicate the nature of the curve in each case, the size of the angle obviously increasing as the curve is less deeply arched, and diminishing as it is more so. In the Gwatkin specimens we have :

		Segmental angle	Number of rows, in all cases + nascent.
<i>Cymbium neptuni</i>	.	142°	73 (imperf.)
<i>Melo diadema</i>	.	100°	62
<i>Voluta africana</i>	.	120°	54
,, <i>ancilla</i>	.	138°	55
,, <i>arabica</i>	.	114°	53
,, <i>ferussaci</i>	.	132°	64
,, <i>mamilla</i>	.	112°	85
,, <i>musica</i>	.	—	61
,, <i>papillosa</i>	.	170°	29 (imperf.)
,, <i>ponsonbyi</i>	.	91°	53
,, <i>rutila</i>	.	107°	71
,, <i>sophia</i>	.	136°	58
,, <i>undulata</i>	.	70°	172, 167, 149
,, <i>verconis</i>	.	128°	57
,, <i>vespertilio</i>	.	101°	fragments only.
<i>Lyria mitræformis</i>	.	111°	52
,, <i>queketti</i>	.	123°	41
<i>Volutilithes abyssicola</i>	.	123°	82

The radula of the Volutidæ, as has been pointed out, especially by Dall (5), exhibits, perhaps, more than that of any other family of marine mollusca, a series of progressive modifications from a more elaborate to a simpler type, the series closing with the radula lost altogether. In a few species only (*V. concinna*, Brod., *Volutilithes abyssicola*, Ad. & Roe, *Neptuneopsis gilchristi*, Sowb.) the radula is normally rhachiglossate, consisting of a median tooth and two

laterals; in the great majority the rhachidian tooth alone remains.¹ Even in the rare cases in which laterals are present, they are markedly degraded, and, as it happens, in varying degrees. On the analogy of the radula of the Mitridæ,² a family nearly related to the Volutidæ, the primitive Volutidan lateral was probably furnished with a number of small sharp cusps. These, as in certain *Mitra*, have coalesced, in *V. concinna*, into a single large, but obviously degraded cusp, the base of which extends from one end of the framework to the other. In *Vol. abyssicola* further degradation has taken place, the single cusp is smaller, and stands on the inner end of the framework, the rest of the margin being bare. In *Nept. gilchristi* the laterals are greatly reduced in size, "probably quite functionless, of extreme tenuity compared with the very massive rhachidian tooth, and their contours are ragged" (Pace, 18).

A similar process of modification appears to have taken place in the case of the rhachidian tooth. Its primitive form, preserved in *V. musica* alone, was probably multicuspid, and a like process of coalescence has produced the normal tricuspid rhachidian. Even in *V. musica*, the two external cusps are much larger than the others, differently shaped, and bear a close resemblance to those of *Lyria* and (see below) one or two *Voluta* proper (Fig. 1). The instability of the smaller cusps in the rhachidian of *V. musica* is easily shown. Excluding the two large side cusps, Pace³ (18) figures a tooth with eleven cusps (ten large and one small), Fischer ("Manuel," p. 609) one with thirteen (ten large, three small). The "Mus. Brit." specimen in the Gwatkin collection has ten cusps at the nascent end (eight large, two small), twelve in the middle (eight large, four small), eleven near the front end.⁴

With this exception, and one to be noted below, all the known species of *Melo*, *Cymbium*, *Voluta* (including *Lyria* and *Volutolithes*, but not *Amoria*, *Halia*, and *Volutomitra*) have a tricuspid rhachidian (save where the tooth has vanished altogether). Here, however, we may distinguish four groups:—

Group A.—Cusps massive, long, and swordlike; framework thick, all deeply stained with red, brown, or orange (Fig. 2). To this group belong the great mass of the species of *Voluta*, with all the known species of *Cymbium* and *Melo*.

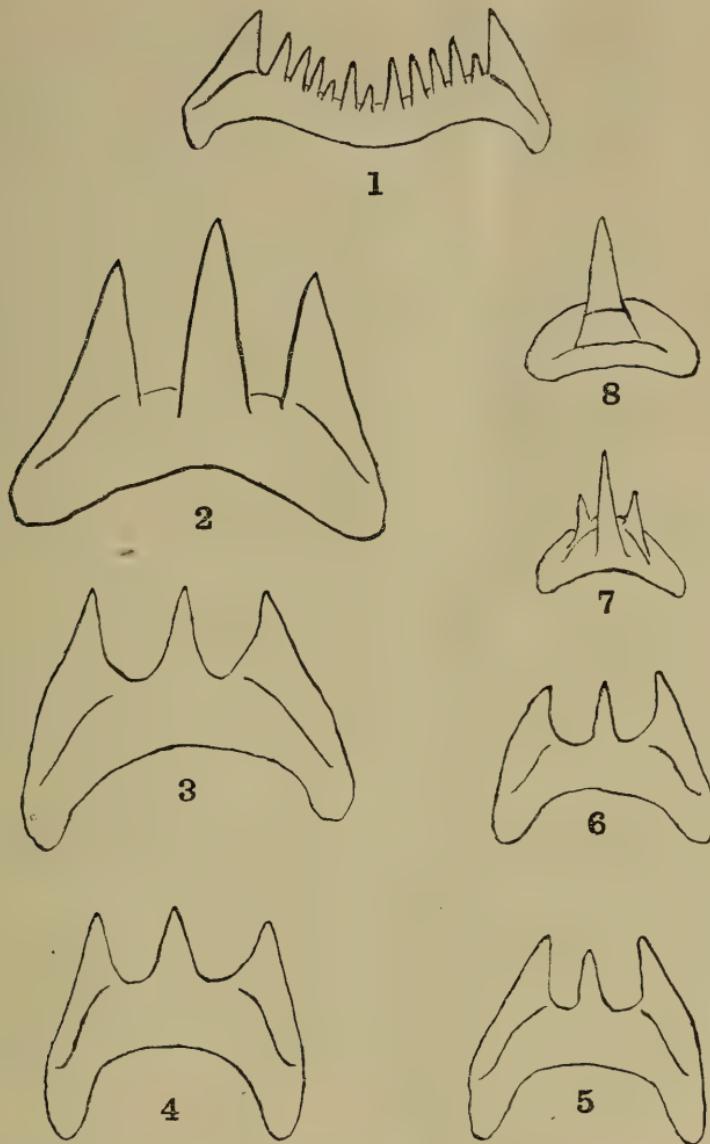
Group B.—Cusps rather short, thin, transparent, somewhat far apart; colour light yellow; the two outer cusps very broad at their

¹ Some day a *Marginella* with laterals will turn up.

² A. H. Cooke, Proc. Zool. Soc., 1919, pp. 405–22.

³ This author hints at the possible occurrence of "shapeless vestiges of lateral teeth" in *V. musica*.

⁴ In the "Mus. Brit." specimen one of the additional cusps originates as a denticle high up on the side of a cusp; in the succeeding rows this denticle gradually becomes larger and descends, until at last it disengages itself entirely. In another instance the new cusp starts, from the first, as a tiny separate denticle, and gradually becomes larger in succeeding rows.



RHACHIDIAN TOOTH OF—FIG. 1. *V. musica*.
 „ 2. *V. sophia*.
 „ 3. *V. africana*.
 „ 4. *V. ponsonbyi*.
 „ 5. *Ly. mitraformis*.
 „ 6. *Ly. queketti*.
 „ 7. *V. verconis*.
 „ 8. *V. papillosa*.

base, springing from the extreme ends of the framework, points often turned slightly inward; framework deep, often narrowing at the

ends into wings (Figs. 3, 4, 5, 6). To this group belong *V. africana*, Reeve, and *V. ponsonbyi*, Sm., and the four species of *Lyria* whose radula is known, viz. *deliciosa*, Montr., *nucleus*, Lam., *mitraeformis*, Lam., *Adelaide*, *queketti*, Sm., off Durban, the last two from the Gwatkin collection. The number of rows in this group is small : *africana* 54, *ponsonbyi* 53, *mitraeformis* 52, *queketti* 41, in each case + nascent.

Group C.—Rhachidian rather small, central cusp long, sharp, narrow ; side cusps much shorter, tending to draw in towards the central. Two species only fall under this heading, *vespertilio* and *verconis*. In *vespertilio* (Pace 18), the side cusps are not half the length of the central, and curve inward slightly, but are posited as in Group A. A specimen from the Gwatkin collection confirms Pace's figure. In *verconis* all the cusps are further reduced in size, the roots of the central cusp are planted deep in the framework, and the two side cusps are placed close to the central, leaving the ends of the upper margin bare (Fig. 7).

Group D.—Rhachidian unicuspид, cusp long, narrow, sharp at point, mounted on a sort of buttress which is deeply imbedded in the framework, base scarcely curved (Fig. 8).

V. papillosa alone exhibits this remarkable radula, in which the side cusps, which we have seen approximating to the central in Group C, are completely fused into it. The analogy with *Amoria* is remarkable. But the shape of the framework, and the number of teeth in the radula, both of which differ widely from *Amoria*, indicate quite a different line of development.

The group *Amoria*, *Volutomirita*, *Halia*, in which a unicuspид rhachidian is mounted on a strongly arcuate but very slender base, has been dealt with by Dall (3), and Pace (18). The latter is no doubt right in thinking that what P. Fischer (6) and Poirier (19) supposed were degraded laterals in *Halia* are "almost certainly the broken-off ends of the highly arched base of the rhachidian tooth". Troschel and others make the same mistake, with regard to *Volutomitra*. The rows in *Amoria* are twice as numerous as those of any *Voluta* proper, those in *Volutomitra* are more numerous still, those in *Halia* do not seem to be known.

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NOTE ON REPRODUCTION OF *TURRITELLA*.

By Lieut.-Col. A. J. PEILE.

Read 11th November, 1921.

RECENTLY, while breaking open specimens of *Turritella gunnii*, Reeve, for the purpose of obtaining radulæ, the animal being retracted far within the shell, it was found that two specimens out of three contained fry. The number of young in the shell in which development was more advanced was about 70, having about 4 whorls.

The anatomy of *T. communis*, Risso, was described in the Society's Proceedings, Vol. IV, p. 56, by Dr. W. B. Randles. There is no definite evidence in that paper as to the reproductive habit of *T. communis*, but it would appear possible that some of the anatomical peculiarities there described may be connected with a viviparous mode of reproduction.

The specimens of *T. gunnii* examined were kindly supplied by Mr. Tom Iredale from his Twofold Bay collection, which was dredged by Mr. Roy Bell in 5 to 20 fathoms.

Mr. Iredale informs me that since my discovery he has examined some quantity of *T. gunnii* and found fry therein and that the shells in which they are found are noticeably more swollen in contour than those, presumably males, which he found barren. He also informs me that examination of a number of specimens of an unnamed species, referable to the section *Colpospira*, from the same locality has resulted in no success.

SOME NOTES ON RADULÆ.

By Lieut.-Col. A. J. PEILE.

Read 11th November, 1921.

I HAVE to acknowledge the kindness of the authorities of the British Museum (Natural History), who have permitted me to study the Gwatkin collection of radulæ and to refer to the same in this paper.

I. COLUMBARIUM.

G. Schacko, in *Conchologische Mittheilungen*, vol. ii, 1881, p. 122, described and figured two teeth purporting to be from the radula of *C. spinicincta*, von Martens (= *pagodoides* (Watson)), a species having very close affinities with *C. pagoda* (Lesson). The teeth are stated to resemble those of *Defrancia*; as a result of this statement the genus has been ascribed by von Martens and subsequent writers to the family *Turridæ* (*Pleurotomidæ*) in the *Toxoglossa*.

The Gwatkin collection contains a specimen of a complete radula of *C. pagoda*, from which a figure is now given (Fig. 1). It has

102 rows of teeth, and one of the lateral cusps of the rhachidian is split throughout the series (See III below). Another radula of the same species from a specimen recently presented to the national collection by Mr. A. V. Insole agrees in the arrangement of the teeth, but exhibits a small denticle half way up one side of the centre cusp of the rhachidian.

Though the radula is not typically muricid, I have no hesitation in forming an opinion that the true position of *Columbarium* is in the Rhachiglossa near the *Muricidae*. On the evidence of shell and operculum *Columbarium* would undoubtedly come near the *ternispina* group. I am unable to find any trace of a pleurotomid groove in the shell. Chinks exist at the base of spines such as are found equally in *M. ternispina* and its allies.

Pending further evidence one can only surmise that the peculiar objects figured by Schacko are limbs of crustacea or some such remains associated with the body of his mollusc which was, admittedly, badly preserved. They do not resemble the teeth of any turrid radula known to me.

II. SOME TURRIDÆ.

From examination of the series in the Gwatkin collection it is evident that if the radulæ be considered in classification some changes will have to be made in the ascription of species to genera. Unfortunately, among the multitude of species, the radula is known in comparatively few.

One of the most remarkable radulæ, differing widely from the other forms already known, is that of *Spirotropis* as figured by Dr. Cooke in the Cambridge Natural History, vol. iii, p. 219, fig. 114. As far as I know it has hitherto been considered peculiar to this northern genus. Pending further research it is worthy of record now that almost identical radulæ are found in two species ascribed to *Drillia*, viz. *D. fucata* (Reeve), from Mauritius, and *D. persica*, Smith, from Karachi. No close affinity between these species and *Spirotropis* would be deduced from shell characters.

III. ABNORMAL RADULÆ.

Any malformation or want of symmetry in a radula is displayed throughout its whole length and evidently depends on some peculiar condition obtaining in the radula sac. This is well shown in simple radulæ such as those of *Marginellidæ*, where the single tooth often has more cusps on one side than on the other as well as small subsidiary cusps adjoining the others here and there. Examples of a malformation and of a subsidiary cusp have been given above in the radulæ of *Columbarium*.

A most surprising asymmetry is shown in the radula of a specimen of *Cypraea caput-serpentis*, L., here figured from the Gwatkin collection. Compared with a normal specimen the following peculiarities are found (Fig. 2, *a* and *b*) :—

- (a) There are twin rhachidians, rather smaller than the normal but having their main cusps longer and more pointed.
- (b) On one side there is a normal lateral but only one marginal instead of two.
- (c) The other side has *two* rather small laterals and the inner marginal is rather small.

Other records to hand include Gwatkin specimens of *Maizania wahlbergi* (Benson) and *Theodoxis jordani* (Sowerby), with no trace of a rhachidian, and, in my own collection, *Gena strigosa*, A. Adams, with four laterals on one side and the normal number five on the other.

IV. ACMÆA FLUVIATILIS, Blanford.

The Gwatkin collection contains a specimen of the radula of this species without locality, the type locality being the Irrawady River. Though it agrees with *Acmaea* in the number and arrangement of the teeth, their form is so remarkable as to warrant the creation of a new genus which I propose to designate:—

POTAMACMÆA.

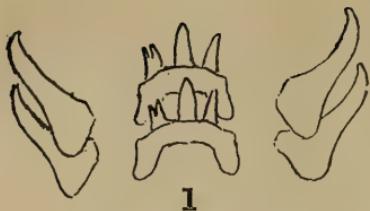
Type species *fluviatilis*, Blanford. Only the plan view of the teeth can be determined from the specimen examined and figured (Fig. 3). They differ from those of any other known in being broad and straight with saw edges. The habitat of the animal is peculiar in that, as far as is known, it does not live in salt water. Dr. Annandale informs me that a species lives under similar conditions in the Hoogly, and that his collectors have found it on human corpses. It will be interesting to discover whether this species is the same as that of the Irrawady and whether the latter is prone to a carnivorous diet.

V. SOME AUSTRALIAN RADULÆ.

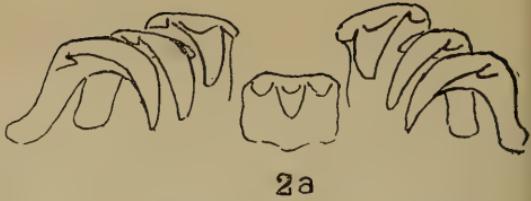
The material from which the preparations were derived was kindly put at my disposal by Mr. T. Iredale, who received it from Mr. Roy Bell, who obtained it at Twofold Bay, N.S.W. The slides of the radulæ figured are now in the Natural History Museum.

1. The shell described by Pilsbry as *Acmaea saccharina*, L., var. *perplexa*, Pilsbry, = ? *Patella octoradiata*, Hutton (vide Manual of Conchology, vol. xiii, p. 51), proves to be a *Patella* with a radula having a small but well-marked rhachidian (Fig. 4). The radula somewhat resembles a specimen in the Gwatkin collection labelled *P. pentagona*, Reeve, Manila, and specimens labelled *P. cretacea*, Reeve, Tonga. There is also some resemblance to *Patellidea granularis* (L.), as figured by Troschel in Thiele, vol. ii.¹

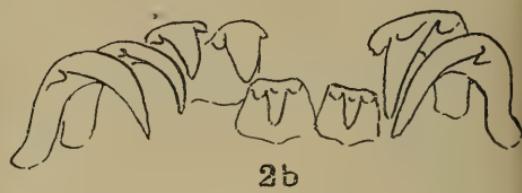
¹ This figure is not copied in Manual of Conchology, vol. xiii, pl. lii, fig. 6, as stated in the index, and in the text p. 172. Fig. 6 is a copy of Troschel's *Ancistromesus chitonoides* (Reeve).



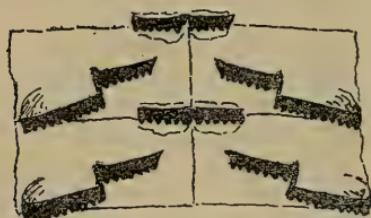
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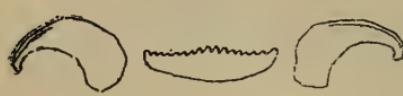
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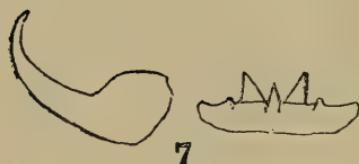
2b



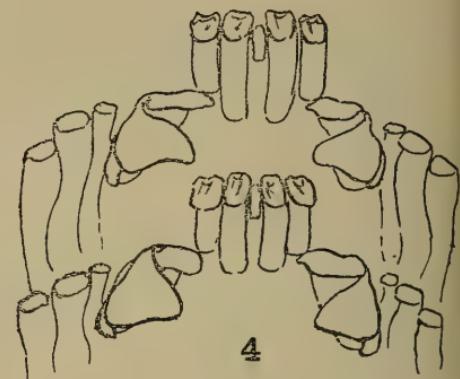
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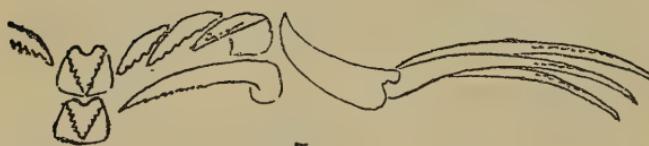
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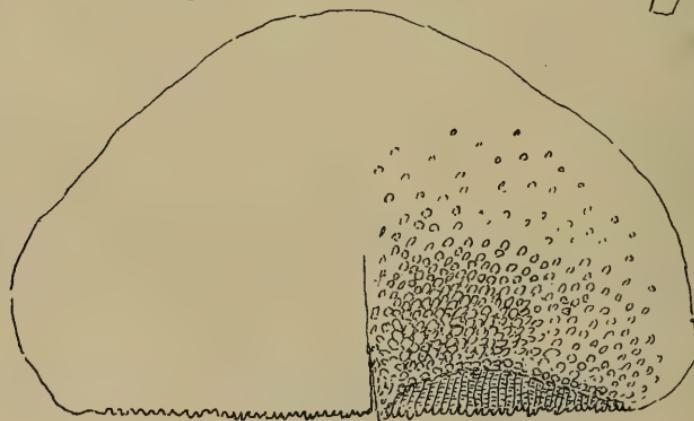
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5a



8



5b

[For explanation of Figures see opposite page.]

FIG. 1.—*Columbarium pagoda* (Lesson). $\times 230$.

FIG. 2.—*Cypræa caput-serpentis*, Lin. $\times 53$. (a) normal, (b) abnormal.

FIG. 3.—*Potamacmea fluviatilis* (Blanford). $\times 110$.

FIG. 4.—*Patella perplexa* (Pilsbry). $\times 110$.

FIG. 5.—*Minolia (?) philippensis*, Watson. (a) parts of two rows of the radula. $\times 110$; (b) mandible $\times 53$.

FIG. 6.—*Olivella nymphæ*, Adams & Angas. $\times 230$.

FIG. 7.—*Belloliva brazieri* (Angas). $\times 230$.

FIG. 8.—*Microvoluta australis*, Angas. $\times 470$.

Patella perplexa would therefore fall in the section *Scutellastra* (H. & A. Adams), as defined by Pilsbry, loc. cit., p. 94. The shell which provided our radula is completely covered with an evenly spread coralline growth. If its habit is to be so covered, this, coupled with its station being below ordinary low-water mark, may account for the animal remaining so long unknown though dead shells are common on New South Wales beaches.

2. One of the most interesting finds among the Twofold Bay material has been that of two species of *Minolia* (?), viz. *philippensis*, Watson, and *pulcherrima*, Angas, with very close affinity to *Machæroplax* (olim *Solariella*) of Northern Seas. Although the shells of *philippensis* and *pulcherrima* differ so that the two species might well be ascribed to different genera, the radulae and mandibles agree in every particular so far as can be judged in these small specimens which are unusually hard to disentangle. (Fig. 5, a and b.) The marginals naturally fold inwards so as to cover the rest of the teeth, and it is very difficult to spread them outwards without breaking up the specimen. However, after examining two specimens of each species I am able to determine the following points :—

(a) The rhachidian and laterals differ only in minor details from those of *Machæroplax varicosa*, Mighels, as represented in the Gwatkin collection and as figured in Thiele, vol. ii, pl. xxv, fig. 11.

(b) The sickle-shaped marginals are more slender than in *M. varicosa*, but, like them, diverge from the typical rhipidoglossate form.

(c) Locking with the bases of the marginals is a row of broad plates, very difficult to distinguish from the adjacent teeth. I have been unable to locate such plates in the species of *Machæroplax* I have examined.

Both radulae are comparatively broad and short, with about thirty rows of teeth. A Gwatkin slide of *Minolia* (?) congener, Sowerby, from South Africa, shows a radula of similar type.

Living alongside the above-mentioned Australian species is *Minolia* (?) *angulata*, auctt. The shell of this does not appear to differ greatly from that of a young *M. philippensis*. The radula, however, is of quite a different type, resembling that of *Ethalia*, with degenerate rhachidian and laterals and with marginals of a more normal rhipidoglossate form. Most of the species in the

Gwatkin collection labelled *Minolia* fall in this group, and so do some tropical species labelled *Solariella*, but there are exceptions which, it is hoped, may form the subject of future research.

3. Examination of three species of *Olivella* gives interesting results. *O. nymphæ*, Adams & Angas (Fig. 6), has a radula with multicuspid rhachidian, which appears to be the normal form in *Olivella*.

O. pardalis, Adams & Angas, and *O. brazieri*, Angas, however, have a tricuspid rhachidian, similar to that of *Oliva* but with a minute additional cusp outside each of the lateral cusps. These minute cusps are well marked in *brazieri* (Fig. 7), but very small and apparently sometimes missing in *pardalis*. A Gwatkin specimen of *brazieri* from Tasmania agrees with the Twofold Bay specimens. All three species are operculate.

I propose for these southern species with tricuspid rhachidians the genus:—

BELLOLIVA

(a name suggested by Mr. Iredale) type species *brazieri*, Angas.

4. The radula of *Microvoluta australis*, Angas, has affinities with those of some of the *Volutidæ*. It consists of a very long ribbon of single unicuspid teeth with deeply indented base and long, sharp-pointed cusp. (Fig. 8.) Evidently, therefore, this species is rightly placed in the *Volutidæ*, although the shell has suggested an affinity with the *Mitridæ*.

A LIST OF THE SPECIES AND GENERA OF RECENT MOLLUSCA
FIRST DESCRIBED IN "LE NATURALISTE".

Compiled by HUGH C. FULTON.

Read 11th November, 1921.

"LE NATURALISTE. Journal des échanges et des nouvelles" was first published on April 1, 1879. It was issued bi-monthly, and on March 1, 1887, three volumes had been completed. The journal was continued as a second series on March 15, 1887, but with a different subtitle, viz. "Le Naturaliste. Revue illustrée des Sciences Naturelles". Of this series 24 volumes were published, the last part bearing the date December, 1910. The Vols. I, II, and III of the two series are distinguished in this list by "(1)", "(2)" placed after the volume number.

The sequence of the families follows the "Manuel de Conchyliologie" of Dr. Paul Fischer.

Vols. XVII to XXIV do not appear to have any new species of recent mollusca described therein.

In some cases where the generic names differ from those now in general use the latter are placed between ().

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<i>Cypræa</i>	.	.	.	26	<i>HYDROBIIDÆ</i>	.	.	.	28
<i>CYPRÆIDÆ</i>	.	.	.	26	<i>Hypselostyla</i>	.	.	.	7
<i>CYRENIDÆ</i>	.	.	.	49					
					<i>Inornista</i>	.	.	.	25
<i>Dactylus</i>	.	.	.	43	<i>Issina</i>	.	.	.	46
<i>Daphnella</i>	.	.	.	19	<i>Jatava</i>	.	.	.	25
<i>Diplomorpha</i>	.	.	.	14					
<i>Dosinia</i>	.	.	.	48	<i>Lagocheilus</i>	.	.	.	30
<i>Drillia</i>	.	.	.	19	<i>Latiaxis</i>	.	.	.	25
<i>Drymaeus</i>	.	.	.	8	<i>Leptachatina</i>	.	.	.	15
<i>Dyakia</i>	.	.	.	7	<i>Leptopoma</i>	.	.	.	30
					<i>Libera</i>	.	.	.	6
<i>Endodonta</i>	.	.	.	6	<i>Limicolaria</i>	.	.	.	12
<i>ENDODONTIDÆ</i>	.	.	.	6	<i>Limnæa</i>	.	.	.	17
<i>ENIDÆ</i>	.	.	.	9	<i>LIMNÆIDÆ</i>	.	.	.	17
<i>Ennea</i>	.	.	.	2	<i>Lithodomus</i>	.	.	.	43
<i>Epiphragmophora</i>	.	.	.	7	<i>Lunella</i>	.	.	.	37
<i>ERYCINIDÆ</i>	.	.	.	46	<i>Lutraria</i>	.	.	.	52
<i>Euphyllus</i>	.	.	.	25	<i>Lyrapurpura</i>	.	.	.	25
					<i>Lyratyphis</i>	.	.	.	25
<i>Favartia</i>	.	.	.	25					
<i>FERUSSACIIDÆ</i>	.	.	.	13	<i>Mabilliella</i>	.	.	.	12
<i>Forreria</i>	.	.	.	25	<i>Macrochlamys</i>	.	.	.	5
<i>Fruticicola</i>	.	.	.	7	<i>Mactra</i>	.	.	.	52
					<i>MACTRIDÆ</i>	.	.	.	52
<i>Gracilopurpura</i>	.	.	.	25	<i>Malleus</i>	.	.	.	42
<i>Guildfordia</i>	.	.	.	37	<i>Malvufundus</i>	.	.	.	42
<i>Guppya</i>	.	.	.	5	<i>Mangelia</i>	.	.	.	19
					<i>Marchia</i>	.	.	.	25
<i>HALIOTIDÆ</i>	.	.	.	40	<i>Marginella</i>	.	.	.	21

MARGINELLIDÆ	.	.	21	PANDORIDÆ	.	.	.	56
<i>Martesia</i>	.	.	55	<i>Papuina</i>	.	.	.	7
<i>Mastogryra</i>	.	.	8	PARTULIDÆ	.	.	.	14
<i>Medyla</i>	.	.	5	<i>Pararhytida</i>	.	.	.	6, 7
<i>Melania</i>	.	.	27	<i>Patula</i>	.	.	.	6
MELANIIDÆ	.	.	27	<i>Paziella</i>	.	.	.	25
<i>Mesodesma</i>	.	.	51	<i>Pecten</i>	.	.	.	41
MESODESMATIDÆ	.	.	51	PECTINIDÆ	.	.	.	41
<i>Microcystis</i>	.	.	5	<i>Pectunculus</i>	.	.	.	44
<i>Micromphalia</i>	.	.	4	<i>Perotyphis</i>	.	.	.	25
<i>Microphyura</i>	.	.	4	<i>Petræus</i>	.	.	.	9
MITRIDÆ	.	.	22	<i>Phengus</i>	.	.	.	7
<i>Modiola</i>	.	.	43	PHOLADIDÆ	.	.	.	55
<i>Monomphalus</i>	.	.	4	<i>Pinna</i>	.	.	.	42
<i>Mörchlia</i>	.	.	39	<i>Pitys</i>	.	.	.	6
<i>Murex</i>	.	.	25	<i>Platyrhaphé</i>	.	.	.	30
MURICIDÆ	.	.	25	<i>Platystoma</i>	.	.	.	6
<i>Muricidea</i>	.	.	25	<i>Plectopylis</i>	.	.	.	7
MYIDÆ	.	.	54	<i>Plectotropis</i>	.	.	.	7
MYTILIDÆ	.	.	43	PLEUROTOMIDÆ	.	.	.	19
				<i>Poirrieria</i>	.	.	.	25
<i>Naquetia</i>	.	.	25	<i>Polygyrella</i>	.	.	.	7
NASSIDÆ	.	.	24	<i>Pomatias</i>	.	.	.	32
<i>Nanina</i>	.	.	5	POMATIIDÆ	.	.	.	32
<i>Napeus</i>	.	.	9	<i>Pollia</i>	.	.	.	23
<i>Nenia</i>	.	.	11	<i>Poropteron</i>	.	.	.	25
<i>Nevia</i>	.	.	20	PROSERPINIDÆ	.	.	.	35
<i>Nodularia</i>	.	.	45	<i>Pseudomphalus</i>	.	.	.	4
<i>Northia</i>	.	.	24	<i>Pterochelus</i>	.	.	.	25
				<i>Pterocyclus</i>	.	.	.	30
<i>Ochroderma</i>	.	.	12	<i>Pteropurpura</i>	.	.	.	25
<i>Ocinebrellus</i>	.	.	25	<i>Pupa</i>	.	.	.	10
<i>Ocinebra</i>	.	.	25	PUPIDÆ	.	.	.	10
<i>Odontostomus</i>	.	.	8	<i>Purpurellus</i>	.	.	.	25
OLEACINIDÆ	.	.	1	<i>Pusionella</i>	.	.	.	19
<i>Oligotoma</i>	.	.	19					
<i>Omphalotropis</i>	.	.	33	REALIIDÆ	.	.	.	33
<i>Oreohelix</i>	.	.	7	<i>Rhinus</i>	.	.	.	8
<i>Ostodes</i>	.	.	30	<i>Rhodina</i>	.	.	.	12
<i>Otopoma</i>	.	.	34	<i>Rhodonyx</i>	.	.	.	8
<i>Ottitoma</i>	.	.	19	RHYTIDÆ.	.	.	.	4
<i>Ovilia</i>	.	.	20	<i>Rhytidopsis</i>	.	.	.	6
<i>Ovula</i>	.	.	26					
				<i>Savignyarca</i>	.	.	.	44
<i>Pachydrobia</i>	.	.	28	<i>Scalptia</i>	.	.	.	20
<i>Paludinella</i>	.	.	28	<i>Segmentina</i>	.	.	.	17
<i>Pandora</i>	.	.	56	<i>Selenites</i>	.	.	.	3

SELENITIDÆ	.	.	.	3	<i>Tribia</i>	.	.	.	20
<i>Siphonochelus</i>	.	.	.	25	<i>Trichochloritis</i>	.	.	.	7
<i>Siratus</i>	.	.	.	25	<i>Triodopsis</i>	.	.	.	7
<i>Solariella</i>	.	.	.	38	TROCHIDÆ	.	.	.	38
<i>Solatia</i>	.	.	.	20	<i>Trochonanina</i>	.	.	.	5
<i>Solen</i>	.	.	.	50	<i>Trochomorpha</i>	.	.	.	5
SOLENIDÆ	.	.	.	50	<i>Tubicauda</i>	.	.	.	25
<i>Spirobulla</i>	.	.	.	1	<i>Tugonia</i>	.	.	.	54
<i>Stenogyra</i>	.	.	.	12	TURBINIDÆ	.	.	.	37
STREPTAXIDÆ	.	.	.	2	<i>Typhinellus</i>	.	.	.	25
<i>Streptaxis</i>	.	.	.	2	<i>Typhis</i>	.	.	.	25
<i>Succinea</i>	.	.	.	16	<i>Typhisopsis</i>	.	.	.	25
SUCCINEIDÆ	.	.	.	16	<i>Typhura</i>	.	.	.	25
<i>Sunneta</i>	.	.	.	48					
<i>Sunnetina</i>	.	.	.	48	UNIO	.	.	.	45
<i>Surcula</i>	.	.	.	19	UNIONIDÆ	.	.	.	45
<i>Sveltia</i>	.	.	.	20	<i>Uxia</i>	.	.	.	20
<i>Tatutor</i>	.	.	.	8	VENERIDÆ	.	.	.	48
TELLINIDÆ	.	.	.	53	<i>Venerupis</i>	.	.	.	48
<i>Thala</i>	.	.	.	22	<i>Ventrilia</i>	.	.	.	20
<i>Thaumastus</i>	.	.	.	8					
<i>Thaumatodon</i>	.	.	.	6	ZONITIDÆ	.	.	.	5
<i>Trachia</i>	.	.	.	7	<i>Zua</i>	.	.	.	13

1. Fam. OLEACINIDÆ.

Spirobula Ancey. Vol. i (1), p. 484. 1881. (n.g. for *Strebelia berendti* Pf.)

2. Fam. STREPTAXIDÆ.

Streptaxis plussensis Morgan. Vol. iii (1), p. 68. Mont Tchéhél. May, 1885.

Ennea kermoganti Ancey. Vol. i (1), p. 373. China. March, 1881.

3. Fam. SELENITIDÆ.

Selenites vancouverensis f. *hybrida* Ancey. Vol. ii (2), p. 188. Oregon. Aug., 1888.

4. Fam. RHYTIDÆ.

Micromphalia abax v. *panthera* Ancey. Vol. iii (2), p. 346. New Caledonia. Oct., 1889.

Micromphalia Ancey, new genus. Vol. ii (1), p. 87. 1882.

Monomphalus Ancey, n.g. Vol. ii (1), p. 87. 1882.

Microphyura Ancey, n.g. Vol. ii (1), p. 87. 1882.

Pseudomphalus Ancey, n.g. Vol. ii (1), p. 86. 1882.

5. Fam. ZONITIDÆ.

Helicarion thomsoni Ancey. Vol. iii (2), p. 19. West Australia. Jan., 1889.

- Guppya goyazensis* Ancey. Vol. xv, p. 82. Brazil. April, 1901.
- G. sericea* Ancey. Vol. xv, p. 81. Argentina. April, 1901.
- Microcystis mariei* Ancey. Vol. iii (2), p. 246. Tahiti. Oct., 1889.
- Nanina (Medyla) salmonea* Ancey. Vol. ii (1), p. 119. Cachar (*Macrochlamys*). Aug., 1882.
- Trochonanina fornicata* Ancey. Vol. iii (2), p. 19. Eua Id. Jan., 1887.
- T. livingstoniana* Ancey. Vol. i (2), p. 79. Mozambique. June, 1887.
- T. smithiana* Ancey. Vol. i (2), p. 80. Mozambique. June, 1887.
- T. spekiana* Ancey. Vol. i (2), p. 80. Mozambique. June, 1887.
- T. subjenysi* Ancey. Vol. i (2), p. 79. Mozambique. June, 1887.
- Trochomorpha subternatana* Dautz. Vol. xvi, p. 247. Obi Id. Nov., 1902.
- Helix swettenhami* Morgan. Vol. iii (1), p. 68. Kinta, Malay Peninsula (*Trochomorpha*).
- H. thieroti* Morgan. Vol. iii (1), p. 68. Kinta, Malay Peninsula (*Trochomorpha*). May, 1885.

6. Fam. ENDODONTIDÆ.

- Libera heynemannii* v. *spuria* Ancey. Vol. iii (2), p. 190. Tahiti. Aug., 1889.
- Endodonta garretti* Ancey. Vol. iii (2), p. 118. Society Ids. May, 1889.
- Paryrhytida* Ancey, n.g. Vol. ii (1), p. 87. 1882.
- Pitys hamayana* Ancey. Vol. iii (2), p. 84. April, 1889. Gambier Id. (*Thaumatodon*.)
- Patula glissoni* Ancey. Vol. iii (2), p. 50. Feb., 1889. Vaté Id. (*Charopa*.)
- P. monstrosa* Ancey (= *irregularis* Garrett non Semp.). Vol. iii (2), p. 71. Mar., 1889. Viti Levu. (*Charopa*.)
- P. marthæ* Ancey. Vol. ix, p. 44. Feb., 1895. Algeria.
- Platystoma* Ancey, n.g. Vol. ii (1), p. 87. 1882. (*Paryrhytida*.)
- Rhytidopsis* Ancey, n.g. Vol. ii (1), p. 87. 1882. (*Paryrhytida*.)

7. Fam. HELICIDÆ.

- Adelodonta* Ancey, n.g. Vol. i (1), p. 334. 1880. (= *Polygyrella* Binney.)
- Albersia omissa* Dautz. Vol. xvi, p. 242. Obi Id. Nov., 1902.
- Axina beloni* Jouss. Vol. viii, p. 186. Philippines. Aug., 1894. (*Helicostyla*.)
- Epiphramphophora estella* v. *centralis* Ancey. Vol. xv, p. 82. Hab. ? April, 1901.
- Helix amphiglypta* Ancey. Vol. ii (1), p. 44. China. Mar., 1882. (*Plectotropis*.)

- H. anceyi* (Mölldff.) Ancey. Vol. iii (2), p. 205. Setchuen. Sept., 1889. (*Trichochloritis.*)
- H. Bruneri* Ancey. Vol. i (1), p. 468. Montana. Sept., 1881. (*Oreohelix.*)
- H. canina* Ancey. Vol. ii (2), p. 188. Nahr-el-Kelb, Libau. Aug., 1888. (*Heliomanes.*)
- H. columbiana* v. *armigera* Ancey. Vol. i (1), p. 404. California. 1881. (*Triodopsis.*)
- H. facta* v. *oleata* Ancey. Vol. i (1), p. 334. California. Dec., 1880. (*Epiphragmophora.*)
- H. (Gonostoma) subobvoluta* Ancey. Vol. ii (1), p. 45. Inkiapo. 1882. (*Helicodonta.*)
- H. gonostyla* Ancey. Vol. ii (1), p. 119. Madagascar. Aug., 1882. (*Ampelita.*)
- H. hardouini* Morgan. Vol. iii (1), p. 68. Kinta. May, 1885. (*Trachia.*)
- H. (Plectotropis) hilberti* Ancey. Vol. ii (1), p. 485. Thibet. July, 1884.
- H. idahoensis* v. *peripherica* Ancey. Vol. i (1), p. 403. Utah. 1881. (*Oreohelix.*)
- H. lahatensis* Morgan. Vol. iii (1), p. 68. Lahat. May, 1885. (*Dyakia.*)
- H. (Acusta) physeta* Ancey. Vol. ii (1), p. 485. Thibet. July, 1884.
- H. semicarinata.* Vol. i (1), p. 374. Hab. ? Mar., 1881. (*Pararhytida.*)
- H. semihiispida* Ancey. Vol. ii (1), p. 119. China. Aug., 1882. (*Fruticicola.*)
- H. subchristinæ* Ancey. Vol. ii (1), p. 44. China. Mar., 1882. (*Cathaica.*)
- Papuina groulti* Dautz. Vol. xvi, p. 247. Obi Id. Nov., 1902.
- P. obiensis* Dautz. and v. *minor* Dtz. Vol. xvi, p. 248. Obi Id. Nov., 1902.
- Phengus groulti* Jouss. Vol. viii, p. 136. Philippines. June, 1894. (*Hypselostyla.*)
- Plectopylis villedaryi* Ancey. Vol. ii (2), p. 72. Tonkin. Mar., 1888.

8. Fam. BULIMULIDÆ.

- Bulimulus angostomus* v. *laminiferus.* Vol. ii (2), p. 15. Brazil. Jan., 1888. (*Anctus.*)
- B. (Rhinus) argentinus* Ancey. Vol. xv, p. 92. Argentina. April, 1901.
- B. luteolus* Ancey. Vol. xv, p. 82. Brazil. April, 1901.
- B. turritella* v. *pliculosa* Ancey. Vol. xv, p. 92. Brazil. April, 1901.
- Drymaeus andai* Jouss. Vol. xii, p. 14. Ecuador. Jan., 1898.
- D. (Oxychona) bifasciatus* v. *mimarum* Ancey. Vol. xv, p. 93. Brazil. April, 1901.

D. gereti Ancey. Vol. xv, p. 93. Brazil. April, 1901.

Hamadryas rabuti Jouss. Vol. xii, p. 14. Ecuador. Jan., 1898.
(*Drymæus*.)

Mastogyra Ancey, n.g. Vol. i (1), p. 484. 1881. (*Rhodonyx*.)

Odontostomus lemoinei Ancey. Vol. i (2), p. 178. Bolivia. Aug., 1892.

Tatutor, n.g. Jouss. Vol. i (2), p. 6. 1887.

T. tatutor Jouss. Vol. i (2), p. 6. Nouvelle-Grenada. 1887.
(*Thaumastus*.)

9. Fam. ENIDÆ.

Buliminus (*Napæus*) *alboreflexus* Ancey. Vol. ii (1), p. 45. China.
Mar., 1882.

Petræus ambouliensis Jouss. Vol. xiii, p. 91. Djibouti. April,
1899.

Buliminus aristides Ancey. Vol. ii (2), p. 189. Tunis. Aug., 1888.
(*Mauronapæus*.)

B. (Napæus) Armandi Ancey. Vol. ii (1), p. 59. China. April,
1882.

B. (Achatinelloides) artufelianus Ancey. Vol. ii, (1) p. 60. Socotra.
April, 1882.

B. compressicollis Ancey. Vol. ii (1), p. 44. China. Mar., 1882.

B. (Cerastus ? Scutalus ?) crispus Ancey. Vol. i (1), p. 510. Hab. ?
Nov., 1881.

B. haberhaueri v. *curta* Ancey. Vol. ii (2), p. 189. Turkestan.
Aug., 1888. (*Chondrulopsis*.)

B. herzensteini Ancey. Vol. iii (1), p. 270. Central Russia in Asia.
May, 1886.

B. kuschakowitzzi Ancey. Vol. iii (1), p. 270. Central Russia in
Asia. May, 1886.

B. lecouffei Ancey. Vol. ii (2), p. 189. Tunis. Aug., 1888.

B. pinguis Ancey. Vol. ii (1), p. 60. China. April, 1882.

B. pontaninianus Ancey. Vol. iii (1), p. 270. Central Asiatic
Russia. April, 1882.

B. (Napæus) prelongus Ancey. Vol. ii (1), p. 59. China. April,
1882.

Petræus schoukraensis Jouss. Vol. xiii, p. 8. Schoukra, Arabia.
Jan., 1899.

P. socialis Jouss. Vol. xiii, p. 8. Schoukra, Arabia. Jan., 1899.

Buliminus trigonochilus Ancey. Vol. iii (1), p. 270. Central Russia
in Asia. May, 1886.

B. uffaloyanus Ancey. Vol. iii (1), p. 270. Central Russia in Asia.
May, 1886.

10. Fam. PUPIDÆ.

Pupa damarica Ancey. Vol. ii (1), p. 200. Damara. 1888.

P. dorsata Ancey. Vol. i (1), p. 273. China. Mar., 1881.

P. glanvilleana Ancey. Vol. ii (2). Cape of Good Hope. 1885.

P. hebes Ancey. Vol. i (1), p. 389. Nevada. April, 1881.

P. indigena Ancey. Vol. i (1), p. 373. Guadaloupe. Mar., 1881.

P. sublubrica Ancey. Vol. i (1), p. 389. Nevada. April, 1881.

11. Fam. CLAUSILIIDÆ.

Clausilia calopleura Ancey. Vol. ii (2), p. 200. Libau. Sept., 1888.

C. calopleura var. *exilis* Ancey. Vol. ii (2), p. 200. Libau. Sept., 1888.

C. (Nenia) deyrollei Ancey. Vol. ix, p. 25. Ecuador. Jan., 1895.

Nenia orbignyi Ancey. Vol. vi, p. 178. Bolivia. Aug., 1892.

12. Fam. ACHATINIDÆ.

Achatina marioni Ancey. Vol. i (1), p. 414. Zanquebar. May, 1881.

A. raffrayi Jouss. Vol. ii (1), p. 324. Abyssinia. Aug., 1883.

Limicolaria habrawalensis Jouss. Vol. xiii, p. 91. Le Comal. April, 1899.

L. tulipa Jouss. Vol. i (2), p. 6. Congo. 1887.

Mabilliella Ancey, n.g. Vol. iii (1), p. 231. 1886. For *Bulimus notabilis* Smith, Ann. and Mag. Nat. Hist., 1881, p. 427; Fig. D, in Proc. Zool. Soc. Lond., 1881, pl. xxxii, fig. 8.

Rhodina Morgan, n.g. Vol. iii (1), p. 68. May, 1885.

R. perakensis Morgan. Vol. iii (1), p. 68. Kinta, Malay Peninsula. May, 1885.

Stenogyra tchelelensis Morgan. Vol. iii (1), p. 69. Malay Peninsula. May, 1885.

Ochroderma Ancey, n.g. Vol. iii (1), p. 93. June, 1885.

13. Fam. FERUSSACIIDÆ.

Cæcilianella advena Ancey. Vol. ii (2), p. 215. Sanghir Id. Sept., 1888.

Cryptazeca monodonta Folin and vars. *hyalina* and *subcylindrica* Folin. Vol. v, p. 264. Bayonne. (*Azeca.*) 1891.

Zua davidia Ancey. Vol. ii (1), p. 45. Inkiapa. Mar., 1882. (*Cochlicopa.*)

14. Fam. PARTULIDÆ.

Diplomorpha layardi v. *alticola* Ancey. Vol. iii (2), p. 266. Vaté Id. Nov., 1889.

15. Fam. ACHATINELLIDÆ.

Leptachatina approximans Ancey. Vol. xi, p. 222. Oahu Id. Oct., 1897.

L. columnna Ancey. Vol. iii (2), p. 266. Oahu Id. Nov., 1889.

Amastra durandi Ancey. Vol. xi, p. 178. Oahu Id. Aug., 1897.

16. Fam. SUCCINEIDÆ.

Succinea normalis Ancey. Vol. i (1), p. 484. 1881.

17. Fam. LIMNÆIDÆ.

- Ancylus lemoinei* Ancey. Vol. xv, p. 103. Brazil. May, 1901.
A. leucaspis Ancey. Vol. xv, p. 103. Brazil. May, 1901.
Limnea aulacospira Ancey. Vol. iii(2), p. 290. Maui. Dec., 1889.
L. crassilabrum Folin. Vol. v, p. 105. L'Adour River. May, 1891.
Segmentina newcombi Ancey. Vol. i(1), p. 468. Bahamas. Sept., 1881.

18. Fam. CONIDÆ.

- Conus mariei* Jouss. Vol. xiii, p. 8. Hab. ? Jan., 1899.

19. Fam. PLEUROTONIDÆ.

- Bela erythraea* Jouss. Vol. ix, p. 147. Suez. June, 1895.
Drillia cecchii Jouss. Vol. v, p. 232. Aden. Oct., 1891.
Mangelia anna Jouss. Vol. ii (1), p. 324. New Caledonia. Aug., 1883.
Oligotoma sirpata Jouss. Vol. v, p. 231. Aden. Oct., 1891.
Ottitoma ottitoma Jouss. Vol. xii, p. 106. Djibouti. May, 1898.
Surcula bouvieri Jouss. Vol. xii, p. 106. Hab. ? May, 1898.
Pusionella testabilis Jouss. Vol. x, p. 43. Aden. Feb., 1896.
 (A young *Daphnella rissoides* fide E. A. Smith.)

20. Fam. CANCELLARIDÆ.

- Cancellaria (Bivetia) mariei* Jouss. Vol. i (2), p. 163. Oct., 1887.
C. (Ventrillia) ventrillia Jouss. Vol. i (2), p. 164. Oct., 1887.
C. (Naronia) hidalgoi Jouss. Vol. i (2), p. 164. Oct., 1887.
Cancellaria, new sections by Jousseaume. Vol. i (2), 1887:
Bivetia p. 163, *Bivetopsis* p. 193, *Bonollitia* p. 223, *Brocchina* p. 221, *Calcarata* p. 214, *Nevia* p. 222, *Ovilia* p. 193, *Scalptia* p. 213, *Solatia* p. 222, *Sveltia* p. 214, *Tribia* p. 221, *Uxia* p. 222.
C. (Scalptia) maconkeyi Jouss. Vol. viii, p. 201. Aden. Sept., 1894.

21. Fam. MARGINELLIDÆ.

- Marginella denansiana* Ancey. Vol. i (1), p. 510. Australia. Nov., 1881.

22. Fam. MITRIDÆ.

- Cancilla beyerlei* Jouss. Vol. viii, p. 168. Andaman Ids. July, 1894.
C. innesi Jouss. Vol. viii, p. 167. Aden. July, 1894.
C. sura Jouss. Vol. xii, p. 106. Andaman Ids. May, 1898.
Thala malvacea Jouss. Vol. xii, p. 107. Djibouti. May, 1898.

23. Fam. BUCCINIDÆ.

- Pollia dautzenbergi* Bavay. Vol. x, p. 160. Senegal. July, 1895.

24. Fam. NASSIDÆ.

- Northia angulosa* Jouss. Vol. xii, p. 251. Hab. ? Nov., 1898.

25. Fam. MURICIDÆ.

- Acopurpurea carbonieri* Jouss. Vol. i (1), p. 349. Red Sea. Jan., 1881. (*Murex*.)
Chicoreus poirieri Jouss. Vol. i (1), p. 349. New Caledonia. Jan., 1881. (*Is M. microphyllus*, Lk.)
Cumella cumella Jouss. Vol. xii, p. 201. Sept., 1898. (? = *Purpura rugosus* Born.)
Muricidea caledonica Jouss. Vol. i (1), p. 349. New Caledonia. Jan., 1881.
Latiaxis couturieri Jouss. Vol. xii, p. 22. New Britain. Jan., 1898.

New sections of PURPURINÆ (*Muricinae*) Jousseaume, Vol. i (1), pp. 335–6. 1880. (Type species in parenthesis.)

- Arcopurpurea (brevispina* Lk.), *Bassia (stainforthi* Rve.), *Crassilabrum (crassilabrum* Gray), *Euphyllus (monodon* Sow.), *Favartia (breviculus* Sow.), *Forreria (belcheri* Hinds), *Gracilapurpura (Fusus strigosus* Lk.), *Hanetia (hanetia* Petit), *Heteropurpura (polymorphus)*, *Inormista (fasciatus* Sow.), *Jatova (jatou* Adanson), *Lyropurpura (crassicostatus* Desh.), *Marchia (clavus* Kien.), *Narquetia (triquetra* Born), *Ocinebrellus (eurypteron* Rve.), *Ocinebrina (corallinus* Scacchi), *Paziella (pazi* Crosse), *Poirrieria (zealandicus* Quoy & Gaim.), *Pterochelus (acanthopterus* Ad.), *Pteropurpura (macropterum* Desh.), *Purpurellus (gambiensis* Reeve), *Siratus (sirat* Adanson), *Tubicauda (brevispina* Lk.).

New Sections of TYPHIS :—

- Hirtotyphis (horridus* Brocchi), *Lyrotyphis (cuniculosus* Duch.), *Perotyphis (pinnatus* Brod.), *Poropteron (tubifer* Brug.), *Siphonochelus (arcuatus* Hinds), *Typhinellus (sowerbyi* Brod.), *Typhisopsis (coronatus* Brod.), *Typhura (belcheri* Brod.).

26. Fam. CYPRÆIDÆ.

- Cypræa amabilis* Jouss. Vol. i (1), p. 349. Hab. ? Jan., 1881. (Is *C. walkeri* Gray.)
C. arabica v. *gillei* Jouss. Vol. vii, p. 171. Tahiti. July, 1893.
C. clandestina v. *aberrans* Ancey. Vol. ii (1), p. 55. New Caledonia. April, 1882.
C. hirundo v. *rouxi* Ancey. Vol. ii (1), p. 55. New Caledonia. April, 1882.
Ovula laugieri Jouss. Vol. ix, p. 121. Suez. May, 1895.

27. Fam. MELANIIDÆ.

- Melania brazieri* Ancey. Vol. i (1), p. 334. Solomon Ids. Dec., 1880.
Hilacantha Ancey. Vol. iii (1), p. 292. n.n. for *Tiphobia* Smith. Non Pascoe. 1886.

28. Fam. HYDROBIIDÆ.

Paludinella darrieuxi Folin. Vol. iv, p. 200. Sainte-Jean. Sept., 1890.

Pachydrobia spinosa v. *acuminata* Ancey. Vol. ii (1), p. 69. Cambodia. May, 1882.

29. Fam. AMPULLARIDÆ.

Ampullaria brohardi Granger. Vol. vi, p. 97. Cambodia. April, 1892.

A. tenuissima Jouss. Vol. viii, p. 121. Ecuador. May, 1894.

30. Fam. CYCLOPHORIDÆ.

Aulopoma lowi Morgan. Vol. iii (1), p. 70. Malay Peninsula. May, 1885. (*Platyrhaphes*)

Cyclophorus baylei Morgan. Vol. iii (1), p. 69. Perak. May, 1885. (*Is Lagocheilus townsendi* Crosse.)

C. courbeti Ancey. Vol. ii (2), p. 93. Tonkin. April, 1888.

C. fulguratus v. *barniana* and v. *subflorida* Ancey. Vol. ii (2), p. 93. Tonkin. April, 1898.

C. kintanus Morgan. Vol. iii (1), p. 69. Malay Peninsula. May, 1885.

C. lowi Morgan. Vol. iii (1), p. 69. Malay Peninsula. May, 1885. (*Is C. aurantiacus* Schum.).

C. regelspergeri Morgan. Vol. iii (1), p. 69. Lahat. May, 1885. (*Pterocyclus*.)

C. sericatus Ancey. Vol. ii (2), p. 215. Sanghir Id. Sept., 1888.

C. theodorei Ancey. Vol. ii (2), p. 92. Tonkin. April, 1892.

C. vesconesi Ancey. Vol. xi, p. 250. Ecuador. Nov., 1897. (*Amphicyclotus*)

Hybocystis elephas Morgan. Vol. iii (1), p. 70. Perak. May, 1885.

H. jousseaumei Morgan. Vol. iii (1), p. 70. Perak. May, 1885.

Leptopoma altus Dautz. Vol. xvi, p. 248. Obi Id. Nov., 1902.

L. fulgurans Dautz. Vol. xvi. p. 248. Obi Id. Nov., 1902.

Ostodes liberatus v. *soluta* Ancey. Vol. iii (2), p. 291. Fiji Ids. Dec., 1889.

31. Fam. ALYCÆIDÆ.

Alycaeus chaperi Morgan. Vol. iii (1), p. 70. Malay Peninsula. May, 1885.

A. jousseaumei Morgan. Vol. iii (1), p. 70. Malay Peninsula. May, 1885.

32. Fam. POMATIIDÆ.

Pomatias euconus Ancey. Vol. ii (2), p. 216. Tunis. Sept., 1888.

33. Fam. REALIIDÆ.

Omphalotropis angulosa Ancey. Vol. iv, p. 11. Ponape. Jan., 1890.

O. garretti Ancey. Vol. iv, p. 26. Marshall Ids. Jan., 1890.

O. pœcila Ancey. Vol. iv, p. 12. Vaté Id. Jan., 1890.

O. setocincta Ancey. Vol. iv, p. 26. Vaté Id. Jan., 1890.

34. Fam. CYCLOSTOMIDÆ.

Otopoma artuffeli Jouss. Vol. ii (1), p. 139. Hab. ? Sept., 1882.

O. beyerlei Jouss. Vol. ii (1), p. 139. Hab. ? Sept., 1882.

35. Fam. PROSERPINIDÆ.

Cyane orbignyi Ancey. Vol. vi, p. 178. Bolivia. Aug., 1892.

36. Fam. HELICINIDÆ.

Helicina altivaga Ancey. Vol. iii (2), Upolu. Sept., 1889.

H. egregia var. *unifasciata*, v. *purpureorufa*, v. *albizonata*, v. *conoidalis* Ancey. Vol. iv, p. 216. Guadalcanar Id. Sept., 1890.

H. leptalea Ancey. Vol. xv, p. 103. Bolivia. May, 1901.

H. pumila Ancey. Vol. iv, p. 217. Fiji Ids. Sept., 1890.

H. rufocallosa Ancey. Vol. iv, p. 95. Pelew Id. April, 1890.

H. rugosiuscula Ancey. Vol. iv, p. 95. Ena Id. April, 1890.

H. spinifera v. *guadalcanarensis* Ancey. Vol. iv, p. 216. Guadalcanar Id. Sept., 1890.

37. Fam. TURBINIDÆ.

Guildfordia yoka Jouss. Vol. xiii, p. 48. Japan. Feb., 1899.

Lunella viridicallus Jouss. Vol. xii, p. 251. Red Sea. Nov., 1898.

38. Fam. TROCHIDÆ.

Solariella turritellina Ancey. Vol. i (1), p. 390. Sumatra. April, 1881.

39. Fam. CYCLOSTREMATIDÆ.

Mærchia mariæ Jouss. Vol. xii, p. 201. Ceylon. 1898.

40. Fam. HALIOTIDÆ.

Haliotis hanleyi Ancey. Vol. i (1), p. 414. New Caledonia. May, 1881.

41. Fam. PECTINIDÆ.

Pecten raffrayi Jouss. Vol. iii (1), p. 221. Zanzibar. Feb., 1886.

42. Fam. AVICULIDÆ.

Malvufundus irregularis Jouss. Vol. viii, p. 228. Japan. Oct., 1894. (*Malleus*.)

Pinna epica Jouss. Vol. viii, p. 229. Japan. Oct., 1894.

43. Fam. MYTILIDÆ.

Modiola sirahensis Jouss. Vol. v, p. 222. Aden. Sept., 1891.

Dactylus tripartitus Jouss. Vol. viii, p. 201. Aden. Sept., 1894. (*Lithodomus*.)

44. Fam. ARCIDÆ.

Savignyarca savignyarca Jouss. Vol. v, p. 222. Aden. Sept., 1891. (*Is Barbatia obliquata* Gray.)

Pectunculus guesi Jouss. Vol. ix, p. 187. Aden. Aug., 1895.
(Is *P. arabicus* H. Ad.)

45. Fam. UNIONIDÆ.

Unio baudoni Folin. Vol. ii (2), p. 274. France. Dec., 1888.
U. gladiator Ancey Vol. i (1), p. 468. Tonkin. Sept., 1881.
(*Nodularia*.)

U. moriscottei Folin. Vol. iii (2), p. 295. Biarritz. Dec., 1889.

46. Fam. ERYCINIDÆ.

Issina issina Jouss. Vol. xii, p. 22. Djibouti. Jan., 1898.
(n.g. near *Erycina*.)

47. Fam. CARDIIDÆ.

Cardium vulva Jouss. Vol. xii, p. 81. Japan. 1898.

48. Fam. VENERIDÆ.

Claudiconcha madreporica Jouss. Vol. ix, p. 187. Aden. Aug., 1895. (*Venerupis*.)

Dosinia spaldingi Jouss. Vol. viii, p. 131. Aden. June, 1894.

Sunetta clessini Ancey. Vol. i (1), p. 206. Hab. ? April, 1880.

Sunettina sunettina Jouss. Vol. v, p. 208. Aden. Sept., 1891.
(? = *Sunetta contempta* Smith.)

49. Fam. CYRENIDÆ.

Corbicula bavayi Ancey. Vol. i (1), p. 334. French Guiana. Dec., 1880.

50. Fam. SOLENIDÆ.

Solen digitalis Jouss. Vol. v, p. 183. Aden. Aug., 1891.

51. Fam. MESODESMATIDÆ.

Mesodesma subobtusa Jouss. Vol. ix, p. 187. Aden. Aug., 1895.

52. Fam. MACTRIDÆ.

Mactra zellwegeri Jouss. Vol. viii, p. 131. Zanzibar. June, 1894.

Lutraria turneri Jouss. Vol. v, p. 207. Aden. Sept., 1891.

53. Fam. TELLINIDÆ.

Arcopagia bertini Jouss. Vol. ix, p. 187. Ceylon. Aug., 1895.

54. Fam. MYIDÆ.

Tugonia adenensis Jouss. Vol. v, p. 201. Aden. Aug., 1891.

55. Fam. PHOLADIDÆ.

Martesia roseotincta Jouss. Vol. v, p. 183. Aden. Aug., 1891.

56. Fam. PANDORIDÆ.

Pandora edwardsi Jouss. Vol. v, p. 201. Aden. Aug., 1891.

NOTE ON THE BRITISH SPECIES OF ANOMIA.

By R. WINCKWORTH, M.A.

Read 9th November, 1921.

(PLATE I.)

THE object of the present note is to emphasize the distinctions between the four British species of Anomiidae. There is nothing new in this; Forbes and Hanley recognize four species, though *squamula* is placed with *ephippium* instead of with *aculeata*; abroad, Dautzenburg and Jensen among others distinguish them conchologically. Ridewood in Phil. Trans., vol. 195, 1903, describes the gill of *A. aculeata* and places this species with *Dimya* in a separate suborder *Dimyacea* (l.c., p. 185): he also figures *A. ephippium* and *A. laqueata*, the latter similar to *patelliformis*.

I have recently examined numerous examples of this group from Plymouth Marine Biological Association and elsewhere. All the species are very variable in shape, thickness, and sculpture: and the young of all four are discouragingly similar in appearance, while the muscular scars are often very faint in small examples; so that the soft parts and above all the gill are a valuable aid to identification. There is no need to section the gill or even to use a microscope; a good lens will at once show sufficient to determine the species, as summarized below.

ANOMIACEA. ANOMIIDÆ.

Genus ANOMIA, L., 1758. Type, *A. ephippium*, L.

1. EPHIPPİUM, L., 1758. Upper or left valve with three distinct muscular scars (Pl. I, f. 8). Gill W-shaped in section, and at once recognizable by a dependent membranous flap of the outer ascending lamella, the fifth lamella of Lacaze Duthiers (Pl. I, f. 1).

Genus MONIA, Gray, 1849. Type, *A. zelandica*, Gray, in Dieffenbach, 1843.

I do not like referring British species to a New Zealand genus, but as I have only seen the shell of *zelandica*, and can see no conchological reason for not including our species under the same genus, I must at present leave the two following species here.

2. PATELLIFORMIS, L., 1761. The original description in Fauna Svecica is not quite satisfactory, and suggests the next species, but the figure given in N. Act. Upsala 1773 confirms the usually accepted identification, and in each case the species is mentioned as received from A. R. Martin. Hanley states that the types in the Linnean cabinet were introduced by the younger Linné.

Upper valve with two muscular scars, which are separate and distinct (Pl. I, f. 9). The typical sculpture may be almost obsolete, and, indeed, is quite absent in very young examples, or may be

exaggerated into prickles. Gill, W-shaped, without the fifth lamella of flap of *ephippium* (Pl. I, f. 2). Further, in addition to the row of ciliated discs at the lower angles of the lamellæ, which are found also in *Anomia*, there are in *Monia* other intermediate rows of ciliated discs along the faces of the filaments. In this species there is one of these in the outer and two in the inner lamella.

3. SQUAMA, Gmelin, 1791 = *A. striata*, Lovén, non Bolten = *A. glauca*, Monterosato. Gmelin's species is based on Chemnitz, viii, 697, where the figure is recognizable and the description unmistakable, locality Drontheim. In this species the shell adductor immediately adjoins the byssal muscle on the left side of the animal, so that the two form one continuous scar on the upper valve (Pl. I, f. 10); this part of the shell is a deep green. The gill is of the same kind as that of the last species, but the filaments are typically very much finer and the number of intermediate ciliary rows is two and three, usually, instead of one and two, but may be more numerous in part or throughout (Pl. I, f. 3). Typical examples always show on the upper valve the peculiar striated sculpture of numerous crowded rows of minute radiating scales.

One form of this species to which I give the name of var. *crassa*, as I am unable to identify it with any of the numerous Anomiidae which have been described, is so different that I at first thought it a distinct species both from shell and animal characters. It is very much thicker, particularly in the coarse upper valve: the surface occasionally shows traces of the typical *squama* sculpture, but is usually much encrusted and devoid of sculpture (Pl. I, f. 13-18). It is markedly convex from its habitat on the convex side of *Pecten*. Muscular scar much as in type, but the shell adductor is comparatively more dorsal, forming an anterior prolongation of the byssal scar (Pl. I, f. 11). Gill similar, but the separate filaments larger and coarser, and the intermediate ciliary rows are highly irregular, usually three and four or more (Pl. I, f. 4), while in typical *squama* these rows are regular. The hinge process on the lower valve is enormously developed, and the border of this valve has a wide green margin within. But these and other differences do not seem to me essential, and I have no doubt as to its being a variety of *squama*, modified by its more exposed habitat.

Genus HETERANOMIA, nov. Type, *A. squamula*, L. = *A. aculeata*, Müller.

Anomiiform mollusca, in which the gill lamellæ have descending filaments only, each gill being therefore \cap shaped in section. The alimentary and circulatory systems show it to be allied to *Anomia* and *Monia*. The lateral asymmetry is strongly marked, so that the right gill is not much more than half the length of the other.

4. SQUAMULA, L. 1758 = *A. aculeata*, Müller. There is no doubt that this is the Linnean species from the habitat on seaweed and

crabs, and the locality, Swedish sea, where *ephippium* is not found. There is no distinction between the smooth and aculeate forms: I have taken wholly smooth, wholly aculeate and intermediate forms on the same *Chlamys opercularis*; nor can I find any essential difference in other varieties, such as *cylindrica*, Gmelin, from the arm of a crab *Inachus*. It is at once distinguished from all other Anomiidæ by the gills, which have no ascending lamellæ (Pl. I, f. 5). Two muscular scars in the upper valve, small adjacent but distinct (Pl. I, f. 12), not showing the radial furrows of *Monia*. The byssal plug is thin brown striate, as in *Monia* and quite different from that of *Anomia*. Jensen further points out (Danish Ingolf Exp., ii, 5, p. 1) that the notch of this species is small and oval and the umbo almost or entirely marginal, while the notch in *patelliformis* is large and triangular and the umbo always a little way off the margin.

EXPLANATION OF PLATE I.

SECTIONS OF GILL. (Diagrammatic. Dots indicate ciliary junctions.)

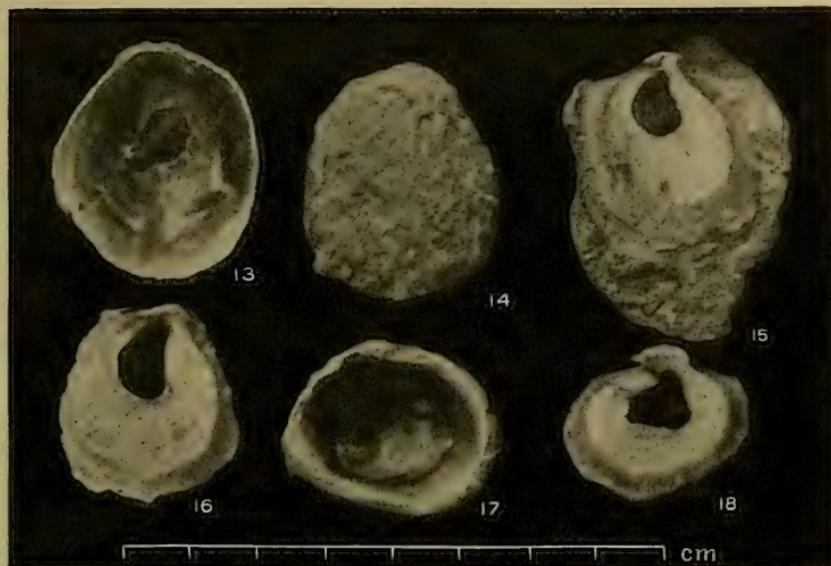
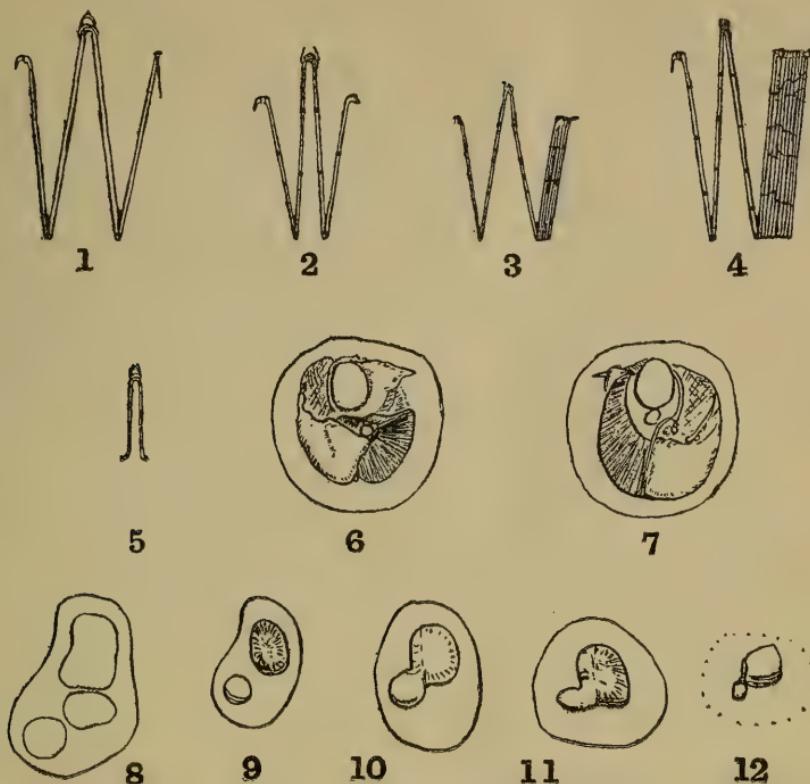
- FIG. 1. *Anomia ephippium*. $\times 5$.
- „ 2. *Monia patelliformis*. $\times 5$.
- „ 3. *M. squama*. $\times 5$.
- „ 4. *M. squama* var. *crassa*. $\times 5$.
- „ 5. *Heteranomia squamula*. Diagram of gill. $\times 5$.
- „ 6. *H. squamula*. Right side mantle removed, showing reduced gill. $\times 3/2$.
- „ 7. *H. squamula*. Left side, mantle removed. $\times 3/2$.

OUTLINES OF MUSCULAR SCARS IN LEFT VALVE.

- FIG. 8. *Anomia ephippium*. Poole.
- „ 9. *Monia patelliformis*. Firth of Forth.
- „ 10. *M. squama*. Oban.
- „ 11. *M. squama* var. *crassa*. Eddystone.
- „ 12. *Heteranomia squamula*. Brighton.

SHELLS.

- FIGS. 13-18.—*Monia squama* var. *crassa*. Eddystone.



BRITISH SPECIES OF ANOMIA.

[To face p. 34.]

NOTE ON A HOLOCENE DEPOSIT AT PENTON HOOK.

By J. E. COOPER.

Read 9th December, 1921.

THE section here described is at the middle of the U-shaped bend of the Thames at Penton Hook, on the Middlesex bank. Mr. W. J. Wintle called my attention to it some years ago, and if he had remained in London he would probably have described it.

The river bank is here about 7 feet above the normal water-level ; a section in the centre shows :—

Thin turf	A few inches.
Brick earth with a few shells	About 2 feet.
Coarse gravel and sand	About 15 inches.
Fine gravel and sand with <i>Plan. stræmii</i> , and abundance of shells	} About 18 inches.
Thin bed of fine sand without shells	A few inches.
Base hidden by talus, probably stiff clay as shown in the river bank close by	

The following mollusca were collected from the shell-bed containing *Planorbis stræmii* :—

<i>Vitrea crystallina</i> (Müll.).	<i>P. umbilicatus</i> Müll.
<i>Polita nitidula</i> (Drap.).	<i>P. vortex</i> (L.).
<i>Goniodiscus rotundatus</i> (Müll.).	<i>P. leucostoma</i> , Millet.
<i>Hygromia hispida</i> (L.).	<i>P. contortus</i> (L.).
<i>H. striolata</i> (C. Pfr.).	<i>Bithynia tentaculata</i> (L.).
<i>Vallonia excentrica</i> Sterki.	<i>B. leachi</i> (Shepp.).
<i>Helicigona arbustorum</i> (L.).	<i>Vivipara vivipara</i> (L.).
<i>Helix nemoralis</i> L.	<i>V. fasciata</i> (Müll.).
<i>H. hortensis</i> Müll.	<i>Valvata piscinalis</i> (Müll.).
<i>Cochlicopa lubrica</i> (Müll.).	<i>V. cristata</i> Müll.
<i>Pupilla muscorum</i> (L.).	<i>Theodoxus fluviatilis</i> (L.).
<i>Succinea putris</i> (L.).	<i>Unio pictorum</i> (L.).
<i>S. elegans</i> , Risso.	<i>U. tumidus</i> , Retz.
<i>Ancylus fluviatilis</i> , Müll.	<i>Anodonta anatina</i> (L.).
<i>Limnæa auricularia</i> (L.).	<i>Pseudanodonta elongata</i> Hol.
<i>L. pereger</i> (Müll.).	<i>Sphaerium corneum</i> (L.).
<i>L. palustris</i> (Müll.).	<i>Pisidium amnicum</i> (Müll.).
<i>L. truncatula</i> (Müll.).	<i>P. supinum</i> A. Schm.
<i>L. stagnalis</i> (L.).	<i>P. subtruncatum</i> Malm.
<i>Planorbis corneus</i> (L.).	<i>P. cinereum</i> Alder.
<i>P. albus</i> Müll.	<i>P. obtusalastrum</i> B. B. Woodw.
<i>P. stræmii</i> West.	<i>P. nitidum</i> Jenyns.
<i>P. crista</i> (L.).	<i>P. milium</i> Held.
<i>P. carinatus</i> Müll.	<i>P. torquatum</i> Stelf.

This list of mollusca is shorter than those for the Staines and Boveney sections, but it includes three species worth noting, viz. *Vivipara fasciata*, *Pseudan. elongata*, and *Pisid. torquatum*. The two last-named species live to-day in the river close by, and *V. fasciata* is plentiful in ditches a few miles up-stream.

Once again I have to thank Mr. B. B. Woodward for his kindly help in naming the *Pisidia*.

J. E. COOPER.

NOTE ON THE GENERA NEPTUNEA AND SYNCERA.

By Dr. W. H. DALL.

Read 9th December, 1921.

A PROPOS of a reference to the name *Neptunea* in the last number of the Society's Proceedings (p. 206) by Mr. Iredale, I would say that no one will deny the right of an author (given a heterogeneous assembly with no type named) to select one of the species as the type of a new genus. *N. despecta*, Bolten (not of Linnæus) is founded on a figure of Chemnitz, representing the ancient *Fusus antiquus* of British authors and the *Murex antiquus* of Linnæus. This same species was selected by Swainson as the type of his new genus *Chrysodomus* more than eighty years ago. It appears in his text as *C. argyrostomus*, and is specified as typical on page 90 of his Manual. So whatever species be nominated as type of *Neptunea*, Bolten, it cannot be the type of *Chrysodomus*. Also Mr. Iredale is quite mistaken in supposing that *Neptunea* has been used for *Chrysodomus* "without question" and commonly by British and American authors. From Carpenter in 1863 down to the present time the group of species in question has been in use as *Chrysodomus* in this country generally, except when the old term *Fusus* was employed.

I can leave Dr. Bartsch to deal with Mr. Iredale's assumption in regard to *Syncera*, but can hardly regard a species with four or five lines of diagnosis giving essential and (at that time) unique anatomical characters as a *nomen nudum*.

November 12, 1921.

W.M. H. DALL.

A REPLY ON THE GENERA NEPTUNEA AND SYNCERA.

By T. IREDALE.

Read 9th December, 1921.

THE statement that because *Murex antiquus*, Linné, as *C. argyrostomus*, was named as type of *Chrysodomus*, Swainson, it becomes unavailable for selection as type of *Neptunea*, Bolten, is not tenable. This particular point has been placed before the International Committee on Zoological Nomenclature, and is dealt with by Opinion No. 62, which has definitely decided against Dr. Dall's view. As to the validity of *Syncera*, I quote the full account, as the periodical in which it occurs is rare: " *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 sordered together".

I leave this to malacologists to decide if such a tentative statement with regard to a "new species" of "Nerita" of which no conchological features whatever are given is recognizable, and can be construed as anything else but a *nomen nudum*.

T. IREDALE.

THE NOMINATION OF "RECENT" FOSSIL MOLLUSCA.

By TOM IREDALE.

Read 9th December, 1921.

THE determination of some marine mollusca from Twofold Bay, New South Wales, necessitated the consideration of their fossil relations, and the lack of some means of indicating the suggested relationship was strongly impressed upon me. The facts concerning the distribution of the recent species in connexion with the fossils must first be displayed. Bass Straits differentiates two regions when the littoral mollusca are regarded, but when deep-water forms are examined the distinction is not so well marked; nevertheless, it is present with modifications. In a given locality the deep-water forms differ more or less appreciably from their littoral relatives, but in two localities while the littoral shells may differ their deep-water forms may be almost inseparable from each other. In other classes in zoology trinomials have been utilized with success to indicate geographical variation in the forms of a species. Extreme usage in ornithology has tended to the confusion of representative species with geographical subspecies, and in the case of marine mollusca great care must be exercised lest individual be mistaken for geographic variation. Still greater care must be taken in connexion with deep-water forms, and yet more when fossils are

criticized, for to be of any value the suggested nomination must be usable with wide limits. In some cases even subspecific distinction has been denied such forms, in others full specific value unhesitatingly accepted. The two extremes are probably incorrect, as the first is too little, and the second does not indicate any close relationship whatever. A mean course is the valuable one desired, and I would recommend the following method as available and suggestive.

For the littoral geographic forms I advise the usage of simple trinomials such as in common use in other classes, so that with this method we would be in agreement with usual conditions. For the deep-water forms I propose to continue the usage of a trinomial with a plain bracket enclosing the second name. For the fossil forms corresponding as closely as to be recognizable as of apparently direct lineage I would use again a trinomial, but in this case use a square bracket for the second name. To illustrate we will regard a special case which is partly true and partly fictitious. A shallow-water Sydney shell was named *Turritella sinuata*, Reeve. From 38-40 fathoms in Bass Straits, Watson named *Turritella runcinata*, *T. accisa*, and *T. cordismei*. Verco has regarded *accisa* as a deeper-water species than *runcinata* in South Australia, and I have suggested that *runcinata* is the deep-water form of *sinuata*, while *cordismei* is the shallow-water form in Bass Straits. A fossil species called *T. platyspira*, Tate, seems the ancestral form of *sinuata*. Granting these premises, I propose to show the facts by such a nomination as the following :—

- T. sinuata sinuata*, the Sydney shallow-water form.
- T. sinuata cordismei*, the Bass Strait shallow-water form.
- T. (sinuata) runcinata*, the Bass Strait deeper-water form.
- T. (runcinata) accisa*, the South Australian deep-water form.
- T. [sinuata] platyspira*, the fossil representative.

By this means the specific distinction is not impugned but the comparative relationship is expressed. The simplicity of this scheme is apparent, and the only argument against it is that I am suggesting a trinomial nomenclature instead of a binomial. I agree to this, but point out that the binomial scheme is incapable of expressing a series of relationships such as I have here outlined.

THE STATUS OF *HELICELLA* AND *POLITA*.

By Dr. HENRY A. PILSBRY.

Read 9th December, 1921.

IN the last number of these Proceedings the name *Helicella* Féruccac was discussed by G. K. Gude and B. B. Woodward. They conclude that it should displace *Polita* or *Hyalinia* for the well-known Zonitid genus typified by *Helix cellaria*, Müller, and that it cannot be used for the Xerophilous Helices grouped under *Helicella* by some authors, among them the present writer in the Manual of Conchology, vol. ix.

At the time that classification of Helices was published (1894-5), we were working under the old rules of nomenclature. Type species of composite genera were often selected by the method of "elimination". Now, under the international rules, we accept the first subsequent designation of a genotype in such cases. This change in the rules does not, I believe, affect the case of *Helicella*.

Beck's list virtually restricted the group to Zonitid snails, and other authors had used it for one part or another of Féruccac's assemblage; but Hartmann¹ was perhaps the first to expressly state that Féruccac had included in *Helicella* many heterogeneous species, and to restrict it to the group commonly known as *Xerophila*. Herrmannsen² evidently endorsed this restriction, as he cited Hartmann's work, followed by "Typus: *H. ericetorum*, Müll.". This was the earliest type designation, so far as I can ascertain. According to Herrmannsen's table, p. 507 of his work, was issued May 25, 1847. Gray's selection of *H. cellaria* as type of *Helicella* was later, in November, 1847. *Helicella* should therefore remain attached to the xerophile group of Helices, and not replace *Polita*.

For the Zonitid group of *H. cellaria* I have preferred to use *Polita* rather than *Hyalinia*. The names were proposed in the same year, 1837, the relative dates unknown; but *Hyalinia* would be considered a homonym of *Hyalina* Schumacher, 1817; by most nomenclators.

In the case of *Petasina* versus *Euconulus* we must accept the change, hoping that it is the last for this genus.

Some other decisions of this important paper seem to me open to question, among them the substitution of *Xeroclivia* for *Trochula*³

¹ Erd- und Süsswasser-Gastropoden der Schweiz, i, pp. 143-44, 1842.

² Indicis Generum Malacozoorum primordia, i, p. 507.

³ In the Manual of Conchology I raised the question whether *Trochula*, Schlüter, 1838, type *H. elegans*, Gmel., should be replaced by *Trochoidea*, Brown, Ill. Conch. Great Britain, 1827, monotype *Trochoidea terrestre*, Brown (= *H. elegans*, Gmel.). The identity of Captain Brown's genus rests upon his figures, which seem to me unmistakable, and in no way upon the identification of *Trochus terestris*, Pennant, as Gude and Woodward seem to infer. I did not have the 1827 edition of Brown at the time I was concerned with the matter, nearly 30 years ago. If there is any reason for rejecting Brown's name, I would be interested to see it brought out.

and the use made of *Xerophila*¹; but discussion of these and other cases may be deferred for the present, as the object of this communication is to testify on behalf of *Helicella* and *Polita*.

[POSTSCRIPT received since the foregoing paper was read, revoking the acceptance of *Petasina* in lieu of *Euconulus* :—]

Gude and Woodward substitute *Petasina* Beck, 1847, for *Econulus* Reinh., naming *Helix fulva* Müll. as type of the former, because that species has been selected as type of *Petasina* Beck, 1837. They assume that Beck proposed *Petasina* as a substitute for *Petasia*, hence it should have the same type. This is pure inference, since Beck does not mention his former name. However plausible such an inference may be thought, it does not place the name on the same basis with one stated to be offered as a substitute. *Petasina* has to be viewed like any other newly proposed generic group, and its type determined in the same way. So far as I know, the first type selection was that of Gude, 1911, who selected *Helix edentula*, Drap. (Proc. Malac. Soc. London, ix, p. 362). This type will hold; it cannot now be ignored. It is therefore proposed to retain *Euconulus* for the group of *Helix fulva*.

¹ The type of *Xerophila*, according to Herrmannsen, March, 1849, is *Helix pisana*, Müll. The name had better be forgotten in the *Helicella* association, as I concluded on other grounds in 1895. *Xerophila* is prior to *Euparypha*.

ON THE CONNEXION BETWEEN STYLE-SAC AND INTESTINE
IN GASTROPODA AND LAMELLIBRANCHIA.

By GUY C. ROBSON, M.A., F.Z.S.

Read 13th January, 1922.

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So much has been written in the past upon the crystalline style in the Mollusca that some excuse is necessary for a further excursion into this subject. Some observations which I have recently published seem, however, to be of sufficient interest to warrant fresh morphological discussion on this structure.

The problem for discussion is the significance of a narrow, longitudinal slit placing the sac of the crystalline style in communication with the pyloric part of the intestine. This communication between the sac and the intestine has been described previously in the Lamellibranchia, and I have been able recently to demonstrate its occurrence in the "Hydrobiid" genera of Gastropoda, *Paludestrina* and *Hypsobia* (Robson, 1920-21-22).

The relation between style sac and intestine in the Lamellibranchia has been very fully discussed by Matthias,¹² who distinguishes three groups within that class. In these we find a progressive separation of the pyloric and cœcal (style sac) elements of the stomach. In forms like *Leda* and *Yoldia Arca*, *Ostrea*, and the *Septibranchia* the pylorus and style sac are in wide and open communication with each other. In *Modiolaria* and *Jouannetia* this communication is very much restricted, only a narrow cleft remaining. Finally, in *Teredo*, *Pholas*, *Dreissensia*, and others, the sac and the pylorus are completely separated. E. Ghosh⁸ has described several apparent instances of the second condition in the Solenidæ, and has discussed them with regard to the Lamellibranchia as a whole. His account is a little puzzling in several cases. Under *Solen* (e.g. p. 52) he says: "Cœcum arising from the ventral aspect of the pylorus," and does not specify whether there is an open communication, though one might suppose from his introduction (p. 50) that there is not. The same lack of precision is to be noted under *Subcultellus* (p. 61).

Burne³ has described a condition representing the first of Matthias' stages in *Anatina elliptica*.

The occurrence of a style and style-sac in Gastropoda has been discussed by several authors, notably by Moore¹³ (1898) and M. F. Woodward²¹ (1893). A summary of the known distribution and modifications of these structures has not been given, so that I take this opportunity of drawing together all the records that have been accessible to me. The following list is probably not exhaustive, though it covers a wide enough field to give an idea of the distribution.

Docoglossa.

i. Style present in various forms ; Pelseneer.¹⁶ The only case I am acquainted with is that of *Patella* (Gibson, Trans. Roy. Soc. Edinburgh, xxxii, 1885), to which Professor Pelseneer has kindly drawn my attention. I have been unable to discover other cases in the fairly copious literature of this group.

Rhipidoglossa.

ii. Style present in *Fissurella* ; Haller⁹ (1888). There is apparently no special sac in this form, the style being pyloric in origin and position.

iii. (?) Style present in *Trochus turritus* (probably = *T. matoni*, Peyr.) ; Collier (1829). There is neither style nor sac recorded by Haller⁹ (1894) and Randles (1905) in their more exhaustive examination based upon several species, and though this case has figured in several textbooks, I am inclined to think some other form is indicated, as may well be the case in such an early writer as Collier.

Tænioglossa.

iv. A coecum more or less pyloric in position present in *Ampullaria* ; Bouvier.¹ No style is recorded, and Bouvier does not discuss the possibility of this coecum being a style-sac. But from its position it would seem likely to have this function.

v. A style present in the "conoid" part of the intestine (i.e. pylorus) in *Cyclostoma* ; Garnault.⁷

vi. A style present in *Lithoglyphas* ; Von Ihering.¹⁷ It is found "im magen" ; but no further details are given.

vii. A style present in *Bithynia* ; Moquin Tandon.¹⁴ It is found "dans l'estomac", and no further details are given. But the figure of *B. tentaculata* given by Simroth seems to show a definite sac.

viii. A sac present in *Rissoa* ; Simroth.¹⁹ No style has been recorded as far as I can find, but the figure given by Simroth seems to show a definite sac.

ix. A style and sac present in *Paludestrina*, Robson¹⁸ (1920-22).

x. A style and sac present in *Hypsobia*, Robson¹⁸ (1921). The sac is in communication with the pylorus by means of a narrow slit in ix and x. It is impossible to say whether such a connexion occurs in vii and viii, as only the surface anatomy is figured.

xi. A style and sac completely (?) separated from the pylorus in *Bythinella dunkeri* ; Bregenzer.²

xii. A style and sac found completely separated from pylorus in *Adeorbis* ; Woodward²¹ (1899), *Turritella* ; Randles¹⁷ (1902), *Typhobia*, *Spekia*, *Tanganyicia*, *Nassopsis*, *Paramelania*, *Chytra*, *Limnotrochus*, *Bythoceras* ; (Moore,¹³ 1898-9, Digby⁵), *Pterocera* (Huxley,¹⁰ Woodward,²¹ 1893).

I have been unable to find any satisfactory references to the

presence of a style or sac in the Rhachiglossa or Toxoglossa. From the figures of *Nassa*, *Buccinum*, and *Murex*, given by Simroth,¹⁹ there would appear to be no sac large enough to lodge a style, though the slight hollowing out between cardiac and pyloric orifices in *Murex* is referred to by him as a cœcum. Collier's statement that a style occurs in *Murex vertagus* may be regarded in the same light as his statement regarding *Trochus turritus*, though we have more positive evidence in this case, as *vertagus* is a well-known specific name of the *Vertagus* subgenus of *Cerithium* and at least one early author (*cf.* Tryon²⁰) has referred a *Cerithium* to *Murex*! We have seen above that a style is very largely restricted to the Tænioglossa, to which group *Cerithium* is referred.

We have now to discuss shortly a few ambiguous cases before proceeding to our general considerations. As a preliminary to this a certain amount of definition is necessary. We have considered so far cases where we find either a definite style or a sac lying alongside the pylorus, and sometimes communicating with the latter, which, for various obvious reasons, may be considered as the sac in which the style is formed. This definition is necessary because the style is a transitory structure, disappears under certain physiological conditions, and is rapidly dissolved by fixation reagents. In its absence we may argue from the presence of the characteristic sac. But on this point due discrimination should be exercised before all pyloric cœca are accepted as style sacs. For that reason I have qualified the case of *Ampullaria*. A similar caution has to be exercised with regard to the so-called *flèche tricuspidé*. Moore¹⁴ (1898) pointed out the error of identifying this structure with the crystalline style, though he fell into the error of assuming that the *flèche* of older authors really meant the whole cuticular lining of the stomach, which had become detached from the stomach wall. It would seem, however, that the *flèche* is the strongly marked cuticular ridge often found in the wall of the stomach of many Prosobranchs.

We have described several obviously doubtful cases above, such as *Lithoglyphus*, in which, although we know a style occurs, the precise position of the latter is doubtful. There are, in addition, certain cases in which we should suspend judgment as to whether a style occurs at all. In *Concholepas* Haller⁹ (1888, pp. 110, 111), apparently considers there is a style owing to the similarity between the area assumed to secrete the style in that genus and in *Fissurella*. He found no style, however, and there is apparently no cœcum.

There is, finally, a third category of doubtful cases. Collier states that there is a style in *Strombus*, and Haller⁹ (1893) refers to a cœcal outgrowth in that genus and in *Rostellaria*; though he does not refer to any style. Woodward (1893, p. 147) says that this cœcum is obviously the homologue of the crystalline style-sac of *Pterocera*. I do not consider that this is so obvious as Woodward thought.

If Haller's figures are studied the œsophagus will be seen to intervene between the cœcum and intestine and the former does not occupy the same position as it does in *Pterocera*.

With these reservations we may now consider these structures from a wider standpoint. We first of all see that the style, either enclosed in a sac or free, is a fairly widely distributed feature in Prosobranchs, though it is probably limited to the Docoglossa, Rhipidoglossa, and Tænioglossa. We next see that there is an extraordinary parallelism between the Gastropoda and Lamellibranchia in the ultimate separation of the style-sac from the pylorus and the occurrence of intermediate types in which the separation is incomplete. Thus *Yoldia*, *Arca*, and *Mytilus* on the one hand, and *Fissurella* and *Cyclostoma* on the other, represent the stage when the style is either free in the pylorus, or a specialized part of the latter is still in wide communication with the intestinal part. Next, we have *Modiolaria* among Lamellibranchia and *Paludestrina* and *Hypsobia* among Gastropoda in which the communication is very much restricted. Finally, we have *Pholas* and *Donax* on the one hand, *Adeorbis*, *Typhobia*, and *Pterocera* on the other, in which the style-sac is fully differentiated and completely separated from the intestine.

We have hitherto spoken as though the style-sac was differentiated off the pyloric part of the intestine. The reverse possibility is suggested by Ghosh.⁸ According to his view it is just as likely that the style-sac evolved as an outgrowth from the stomach independently of the pylorus, such a separate style-sac being "present in the ancestral forms before the evolution of the present class" (l.c. p. 73). Such a suggestion deserves serious consideration, though I do not consider it indicates the more likely course of events. In the Gastropoda the evidence seems to favour the view that the course of development was from original unity with the pylorus to subsequent separation. Thus we have a style only in *Fissurella* and *Cyclostoma*, while among the rest of the Tænioglossa we have the less specialized Paludestrinidae showing a partly differentiated sac and the more specialized *Pterocera* and *Turritella* with the sac separated. This part of the argument conceivably might be met by pointing out that *Adeorbis*, which has a separate style-sac, is considered to have affinities with the Rissoidæ, which are again fairly akin to the Paludestrinidae.

In the Gastropoda the morphological status of the various suborders and families is fairly clear, and one may be tolerably certain as to the position of a form used in such an argument as the above. With the Lamellibranchia, however, the matter is otherwise. We know that some of the Protobranchia are certainly primitive, but beyond that it is very difficult to be absolutely sure that the taxonomic position assigned to an animal is any index of its real morphological status. As a consequence, generalizations about forms exhibiting modifications of a certain character are apt to be very

misleading. Thus, from Matthias' account¹² we find that certain Eulamellibranchs agree with the Protobranchia in having the style-sac in open communication with the intestine, while a Filibranch like *Phaseolicama* has a separate sac; and the Septibranchia apparently are in the same condition with regard to this character as the Protobranchia. This, of course, leaves us with two alternative conclusions, either that the taxonomy of the Lamellibranchia is as far off as ever from a rational order, or that, as several authors have suspected, there has been independent evolution within the various groups. I hope to discuss these alternatives in another place; but in the meantime, while we are confronted with such a dilemma, we can only content ourselves by pointing out that the Protobranchia which are clearly the most primitive do not have a differentiated style-sac, and that they agree therein with the more primitive Gastropoda. That a good deal of independent evolution takes place in the smaller groups is evident from a comparison of *Paludestrina* and *Bythinella* among the Prosobranchs. But, having regard to the issue raised by Ghosh's suggestion, the most important point in the morphological series is the one in the Lamellibranchia and Prosobranchs, where we find the style-sac undifferentiated. Whichever course was followed by this structure in its evolution, we may safely assert in conclusion that there has been a remarkable and close parallelism between the Gastropoda and Lamellibranchia. We may, at this point, recall that a pyloric coecum is present in the Scaphopoda, though whether a style is secreted in it is very doubtful. Even if we may not bring the Scaphopoda into the argument, the remarkable similarity between Gastropoda and Lamellibranchia with regard to the evolution of the style-sac (a similarity called *homoplasy* by Lankester) is another instance of the fundamental unity that characterizes the Mollusca.

Many authors have constructed genealogical trees illustrating the relationships of the classes of Mollusca. I do not wish to add yet another sapling to that adventurous plantation. But I think we may allow ourselves the following conclusions from these observations:—

(1) The Gastropoda and Lamellibranchia which otherwise suggest by their structure a very remote ancestral point of separation have in respect of their digestive system retained in common (a) a singularly characteristic structure and (b) equal developmental potentiality with regard to it; and

(2) That with regard to the Lamellibranchia the general morphological importance of the style-sac as set forth above renders that structure an important factor in the classification of that group as Matthias has suggested. It has yet to be seen whether our taxonomy is wrong and the class requires regrouping, or whether there has been independent evolution on a large scale leading

to remarkable instances of convergence. Any future attempts to investigate the taxonomy of this group as a whole must deal with a large number of correlated characters, one of which should be the structure discussed above.

A fact of considerable interest for consideration under the first part of this conclusion is the very remarkable similarity between the longitudinal grooves found in the wall of the style-sac of *Bythinella* and *Paludestrina*, and in certain Lamellibranch genera (Nelson,¹⁵ Edmondson⁶). But the subject requires more investigation before it can be properly utilized in this context.

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- ¹ Bouvier, E., 1888, Mém. Soc. Phil. Paris (centenary volume).
² Bregenzer, A., 1916, Zool. Jahrb. (Anat.), xxxix, Hft. 2.
³ Burne, R. H., 1920, Pelecypoda (Anatomy), Mollusca, pt. iv, British Antarctic ("Terra Nova") Expedition.
⁴ Collier, C., 1829, New Philos. Journal, vii.
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⁶ Edmondson, C. H., 1920, Journ. Exp. Zool., xxx.
⁷ Garnault, P., 1889, Actes Soc. Linn. Bordeaux, xli.
⁸ Ghosh, E., 1920, Rec. Ind. Mus., xix, pt. i.
⁹ Haller, B., 1888, Morph. Jahrb., xiv; 1893, xix; 1894, Studien über Rhipidoglosse Prosobranchier, Leipzig
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¹³ Moore, J. E. S., 1898, Quart. Journ. Micr. Sci., xli; 1899, ib. xlvi.
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¹⁵ Nelson, T. C., 1918, Journ. Morph., xxxi.
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¹⁷ Randles, W. B., 1902, Anat. Anz., xxi; 1905, Quart. Journ. Micr. Sci., xlvi.
¹⁸ Robson, G. C., 1920, Ann. & Mag. Nat. Hist., ser. ix, vol. v; 1921, ib. vol. viii; 1922, Quart. Journ. Micr. Sci., lxvi, pt. 1.
¹⁹ Simroth, H., 1901, Bronn's Thierreich (2nd ed.), Bd. 3.
²⁰ Tryon, W., 1887, Man. Conch., ix (under *Cerithium aluco*).
²¹ Woodward, M. F., 1893, Proc. Mal. Soc., i; 1899, ib. iii.

ON THE GENESIS OF THE DESIGNATION OF "TYPES" AMONG
MALACOLOGICAL WRITERS.

By A. S. KENNARD, F.G.S., and B. B. WOODWARD, F.L.S.

Read 13th January, 1922.

THE International Rules of Zoological Nomenclature are rightly very insistent on the proper designation of types (Art. 30), especially in those "Cases in which the generic type is accepted not solely upon basis of the original publication (Art. 30, II g) that if an author, in publishing a genus with more than one valid species, fails to designate or to indicate its type, any subsequent author may select the type, and such designation is not subject to change. The meaning of the expression 'select the type' is to be rigidly construed. Mention of a species as an illustration or example of a genus does not constitute a selection of a type."

Under these conditions and in view of the confusion that appears to exist in regard to the matter, it becomes interesting and important to ascertain, as far as possible, which of the older writers on conchology conformed in any of their works to these requirements.

Lamarck, certainly, did no more than cite examples, indeed, he says in his "Système des Animaux sans Vertèbres", 1801, p. viii, "Pour faire connoître d'une manière certaine les genres dont je donne ici les caractères, j'ai cité sous chaque d'eux une espèce connue, ou très-rarement plusieurs, et j'y ai joint quelques synonymes que je puis certifier." Consequently he changes his examples. Thus in his earlier "Prodrome d'une nouvelle Classification des Coquilles", 1799, we find for *Cyclostoma*, *Turbo scarlaris*, Lin., and for *Helix*, *H. nemoralis*, Lin., whilst in the "Système" he gives as examples of these two genera, *Cyclostoma delphinus*, n., and *Helix pomatia*, Lin., respectively.

The first writer who may be said to have indicated "types" in the modern sense was D. de Montfort in his "Conchyliologie systématique", 1808-10, where to each genus, whether his own or adopted from a previous author, there is given "Espèce servant de type au genre".

To Montfort there succeeded the Rev. J. Fleming. In his article on "Conchology" in the "Supplement to the fourth, fifth, and sixth editions of the Encyclopaedia Britannica", vol. iii, which, though bearing date 1824 was really issued in February, 1818 (*vide* advertisement at the end of vol. vi), and again in the article "Mollusca" in vol. v of the same work, 1822, Fleming under each genus definitely states that such or such species "is the type of the genus", or "is regarded as the type of the genus". His designations can consequently be accepted.

Next in order comes J. G. Children's practically forgotten work on "Lamarck's Genera of Shells", published as a whole under his name in 1823, but originally printed without his name in the successive

numbers of the "Quarterly Journal of Science", etc., vol. xiv-xvi, between October, 1822, and January, 1824. This work consists of a translation of the diagnosis of the genera in Lamarck's "Histoire naturelle des Animaux sans Vertébrés", Tom. v-vii, 1818-22, with the designation of a type to each. These types are usually taken from the first species named under the genus by Lamarck in accordance with the custom then prevalent, but frequently Children selects some species other than the first, e.g. under *Corbula*, *Petricola*, *Calyptrea*, *Helix*, whilst under *Volvaria* he gives "Type *Volvaria bulloides*", and states in the note: "We have chosen this, though fossil, and the last of Lamarck's species, for our type, as most perfectly answering the characters of the genus, and as being the individual on which he originally established it. See his System, 1801." It is clear, therefore, that "Type" is here used in its modern signification. Children, moreover, was the first to illustrate Lamarck's genera, and it is unfortunate that the figures were not better drawn.

In 1825 C. Dubois published "An epitome of Lamarck's Arrangement of Testacea", on the same lines as Children; it was re-issued in 1828 with a new title-page, but otherwise unaltered. As he states in the Introduction (p. 8): "A catalogue of the recent species is subjoined to each genus . . . and illustrative examples selected from the system of Linnæus or others, with a reference to the author in whose work it is figured or described." There is, therefore, no question of true types in this work.

As regards figures, E. A. Crouch's "An illustrated Introduction to Lamarck's Conchology", 1827, has by far the advantage over Children's work, Crouch, however, names no types, and seems merely to have figured such species as were most accessible, relying chiefly on his own collection. He does not allude to Children's work although he thanks him for granting access to the British Museum collections.

Dr. W. Turton, in his "Manual of the Land and Freshwater Shells of the British Islands", 1831, pp. 2-11, gives a preliminary summary of the genera, and instances for each a "type". Since, however, he confines himself to British species, and there is nothing to show that he used the term otherwise than as a synonym for "example", we think his selections may be disregarded.

W. Swainson's "Treatise on Malacology", 1840, pt. ii, "Natural Arrangement" gives examples for each genus or subgenus. Frequently only one species is cited, but quite as often two or more appear, so that there is no possibility of regarding even the single examples as "types".

Incidentally it may be remarked that the sole exemplar under *Helicella* is *pellis-serpentis*, of Féruccac; whilst *fragilis*, with identical reference to Draparnaud's figure, appears under both *Eruca* and *Balia* [sic].

A. N. Hermannsen's celebrated "Indicis Generum Malacozoorum primordia", 1846-52, is frequently quoted as an authority for a "type". Owing, however, to the special plan on which this work was compiled, great circumspection is necessary before trusting to any individual instance, so much so, indeed, that for long we hesitated whether it could be validly accepted at all. To begin with types are not universally cited, and for many well-known genera (e.g. *Arca*, *Argonauta*, *Cypraea*, *Mytilus*, *Patella*) no "typus" is given. Sometimes, however, as under *Fusus*, where ten entries appear detailing the genus according to various authors, a "typus" is given for two: "*Fusus*, Schum.", "typus: *Fusus colus*, Lin.", and "*Fusus*, Swains.", "typus: *Fusus syracusanus*, Linn." When there is no "typus" to a genus as a whole, one is often given to each of the sections of the genus. Thus, under *Helicella*, Lamck. (whose work he had not seen) Hermannsen cites Féruccac and gives that author's subdivisions, but no type, yet on turning to these sections in their places in the general alphabet we find:—

Lomastomæ: "Typus: *Helix Carascalensis*, Fér."

Apostomæ: [No type to the group.]

Verticilli: "Typus: *Helix algira*, L."

Hyalinæ: "Typus: *Helix olivetorum*, Gmel."

Fasciatæ: "vid. *Apostomæ*."

Hygromanes: "Typus: *Helix cinctella*, Drap."

Heliomanes: "Typo sunt *Helix rugosa*, Lamck. et *Hel. pyramidata*, Drap."

So that, instead of one, Hermannsen selects several types for Féruccac's *Helicella*.

For the *Helicella* of Hartmann, which is restricted to a portion of Féruccac's *Heliomanes*, on the other hand, "Typus: *H. ericetorum*, Müll." is cited, thus accumulating three types for the section *Heliomanes*. As pointed out by Gude and Woodward, however, (Proc. Malac. Soc., xiv, 1921, p. 176), Féruccac himself indicated that the "*Helicella*, Lamarck", which formed the core of his extended *Helicella*, belonged to the *Apostomæ*. No subsequent writer, therefore, has the right to take the name and restrict it to any one of the other sections or portion thereof. Hartmann's *Helicella*, consequently, becomes *ipso facto* invalid and with it goes Hermannsen's type for it.

Frequently two or more species are cited as "typi", "ex typis", or "typicae species", amongst others:—

Helicogena, Risso.: "Typi: *H. pomatia*, *nemoralis*, etc."

Carocolla, Schum.: "Typica species: *Helix lampas* et *indiscreta*, Müll., et *Gualtierana*, Linn."

Chilostoma, Fitzinger: "Typicæ species: *Helix cornea*, Drap., et *Helix pulchella*, Müll."

Discus, Fitzinger¹: "Genus *Helicoideorum*, ex typis *Helicis rotundatæ, ruderatæ, crystallinæ.*"

Strange bedfellows, some of these, and hardly good instances of the selection of a type.

Again, one and the same species is not infrequently named, as "typus" to two genera. Thus, *Helix cellaria* appears for both *Oxychilus* and *Polita*; *H. fruticum* for both *Eulota* and *Fruticicola*; *H. pisana* for both *Euparypha* and *Xerophila*; *Arca noæ* for both *Byssoarca* and *Navicula*. Or we have two types for genera that are synonymous, as *Helix nemoralis* for *Cepaea*, and *H. hortensis* for *Tachea*.

The author's object was obviously to cite types for the various minor genera while leaving it to those who used his index to settle whether a given genus and consequently its type be valid or not.² As he himself says:—

"Nihil de novo condendo systemate hic loci dicam, nil de clavi Malacozoorum confienda, aut synonymia specierum elaboranda. Quae . . . maxime necessaria, aliis relinquere cogimur." (Proemium, p. iv.)

J. E. Gray, in his "List of the genera of recent Mollusca, their synonyma and types" (Proc. Zool. Soc., 1847, pt. xv, November, pp. 129–219), after insisting "in the importance of attending to the law of priority . . . now almost universally allowed" although "quite prepared for hearing several conchologists complain of the changes which the observance of this just law will force them to make", gives the following outline of his procedure as regards types: "The method I have followed is to observe the first name given to the genus and the type on which it was founded, and then to accumulate the synonyma around the genus. Where a succeeding author has referred to a different species as the type of the genus, I have given the name a new line, as at some future period that type may be proved really to belong to a different genus. . . In respect to . . . works which only give the genera, and simply mention one or two examples as the types of their genus, the species they give as types are here cited; but in works like Linnæus's "Systema Naturæ", and Lamarck's "Histoire", which give the species of Mollusca, it is not so easy to determine which species the author intended for the type of his genus. In these cases I have chosen either the best known species, or, if the author has given figures, the specimen which he has figured. . . In the Linnæan genera, in which there is room for doubt . . . I have considered the name as restricted to the type which the earliest author after Linnæus has quoted for

¹ Cf. Kennard & Woodward, Proc. Malac. Soc., xiv, 1920, p. 85.

² In this connexion it should be borne in mind that after Vol. ii, p. 232, "Peripatus," Herrmannsen's selected types may have been anticipated by Gray (Nov., 1847).

it." Hence it is apparent that Gray, following his former chief, J. E. Children, although he does not allude to his work (possibly because of the private quarrel he had with him), employed "type" in the modern sense.

His designations can, therefore, be accepted when not forestalled, due allowance being made for oversights and characteristic inaccuracies (e.g. he cites p. 169 *Limax ater* as the type of *Arion*, and its synonym *L. rufus*, p. 170, as that of *Limax*. Again, p. 173, *Helix fulva* is given as the type of *Conulus*, and its synonym *H. trochiformis* as that of *Petasia*).

S. P. Woodward, in his well-known "Manual", 1851-56, p. 61, gives it as his opinion that "the type of each genus *should be* that species in which the characters of its group are best exhibited, and most evenly balanced (Waterhouse)". He does not appear, however, to have followed a consistent method in his choice. Sometimes more than one "type" is given; occasionally none; while sometimes only an "example" is cited. Hence this manual cannot be taken as a guide for "types".

H. and A. Adams in their useful "Genera of Recent Mollusca," 1853-58, give examples of each genus which are really references to the specimens figured and not "types" in the present acceptation of the term at all.

With the publication of E. von Martens' edition of J. C. Albers' "Heliceen . . . Zweite Ausgabe", 1860 (wrapper dated, 1861), the practice of designating a definite type for each genus may be said to have become established, and most subsequent writers of repute have followed his careful method.

ON THE *PISIDIUM GASSIESIANUM* OF DUPUY.

By A. W. STELFOX, M.R.I.A.

Read 13th January, 1922.

By the majority of authors the name *Pisidium gassiesianum* of Dupuy has been applied to the species we now know as *P. milium*, Held, probably because of the excellent figure in Baudon's "Essai" (5), these authors apparently not contemplating the possibility that Baudon had figured a wrong species under this name.

Yet if the figure of Dupuy's *P. gassiesianum*, 1852, (3) be compared with *P. milium*, Held, discrepancies between the two will be obvious. Though often puzzled by these facts, it is only recently that I gave any thought to the matter, and it then became apparent that the *P. gassiesianum* of Dupuy, February, 1849, (1) had nothing to do with the *P. gassiesianum* of Gassies, March, 1849. (2) Reference to the *Journal de Conchyliologie* at once confirmed this conclusion and explained how the mistake had arisen.

Briefly this is my reading of the story. Dupuy visited Gassies in 1848 and the two spent considerable time in the field together. Gassies took Dupuy to Chantilly, and showed him a *Pisidium*, which he proposed to name *P. limosum* and Dupuy agreed that it was an undescribed species. Together they discovered at Ratier another *Pisidium*, which both at the time agreed was also new, but which Dupuy must subsequently have decided was not a new species. Dupuy returned home and reversed the labels attached to the two species (or as Gassies suggests, permitted them to be reversed by the printer); and so when he suggested to Gassies, in a letter, that he proposed to describe the new species from Ratier as *P. gassiesianum*, Gassies naturally did not understand that Dupuy referred to his own proposed *P. limosum* from Chantilly and *vice versa*. During this time Gassies also was preparing a paper which appeared a few weeks after Dupuy's and before Gassies had discovered Dupuy's error.

Consequently the *P. gassiesianum* of Dupuy, 1849, is a synonym of the *P. limosum* of Gassies, 1849, and takes precedence. This synonymy is correctly given by Dupuy in 1852. When Baudon published his *Essai* (1857) he allowed himself to be persuaded by Gassies (4) to apply the specific name *gassiesianum* to the *P. gassiesianum* of Gassies, and not to that of Dupuy. Subsequently Baudon under the influence of Normand, confessed his error; (6) yet one finds authors who refer to the *P. gassiesianum*, Dupuy, as a synonym of *P. milium*, Held.

Recently I have been enabled to examine authentic—"ex auctore"—examples of *P. limosum*, Gassies (i.e. *P. gassiesianum*, Dupuy), preserved in the Museum at Bordeaux. These prove to belong to the species brought forward as British in 1908 by Mr. B. B.

Woodward as *P. personatum*, Malm, 1855. Although they have priority over Malm's name, I do not suggest at the moment that either of these names—*P. gassiesianum*, Dupuy, or *P. limosum*, Gassies—should replace *P. personatum*, Malm. To do so would, I think, be to bring in what could only be a temporary name, as I have evidence, though not yet conclusive evidence, of a still older name, which eventually may have to be employed for this well-marked species.

The *P. gassiesianum* of Gassies, and many other authors, has, of course, been rightly referred to the *P. milium* of Held, with which also is synonymous the *P. pulchellum* var. δ of Jenyns, the *P. tetragonum* of Normand, the *P. arcaiforme* of Malm, and the *P. roseum* of Jeffreys.

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REPORT ON THE GASSIES COLLECTION OF PISIDIA IN THE
MUSEE D'HISTOIRE NATURELLE DE BORDEAUX.

By A. W. STELFOX, M.R.I.A.

Read 13th January, 1922.

THROUGH the kindness of Monsieur le Maire and Professor J. Chaine, of Bordeaux, I have recently been enabled to make a thorough examination of a small collection of *Pisidia* presented to the Museum of that city by J. B. Gassies, *circa* 1859.

The collection comprises thirteen card-tablets, upon which the shells are mounted with gum and labelled in Gassies's writing. Each tablet bears a number and these numbers correspond with the numbers attached by Gassies to the species recorded in his " Catalogue Raisonné des Mollusques terrestres et d'eau douce de la Gironde ", 1859. In his earlier papers—" Mollusques terrestres et d'eau douce de l'Agenais ", March, 1849, and " Description des *Pisidies* observées à l'état vivant dans la région Aquitanique de Sud-Ouest de la France ", 1855—Gassies described numerous new species of *Pisidium*, namely *P. limosum*, 1849, and *P. intermedium*, *P. pallidum*, *P. Jaudouinianum*, and *P. globulosum*, 1855. Of these five species only the two first mentioned are referred to in his paper of 1859, or represented in the collection. Likewise the following species—*P. Normandianum* Dupuy, referred to by Gassies in 1849, and *P. Dupuyanum* Normand, referred to in 1855—are neither represented in the collection nor mentioned in his 1859 paper. Whether Gassies had by the year 1859 given up these species, or whether he did not consider they lived in the restricted area of " La Gironde ", I am unable to discover. The fact remains that the collection throws no light on the question what these species were, with the exception of *P. limosum* and *P. intermedium*, both of which are represented in the collection, the latter as a separate species, the former as a variety of *P. casertanum*, Poli.

Some shells seem to have been removed from the cards subsequent (?) to their presentation to the Museum at Bordeaux, while in two cases additional shells mounted on blue strips of paper would appear to have been added. The whole collection would also seem to have been examined, either by the late Dr. J. Gwyn Jeffreys or by some one who considered he was well acquainted with this author's view of the *Pisidia*, as on the back of the cards are, in some cases, notes added in pencil, after which the words " Teste Jeffreys " frequently follow. Whether this means that Jeffreys expressed a personal opinion on the shells as the words would indicate, or whether we are to read them merely as meaning " according to Jeffreys in British Conchology ", I have no means of deciding.

The titles on the cards and a list of the *Pisidia* mounted thereon are as follows :—

Card No. 130. "*P. amnicum. Tellina*, Müller.

Eau Bourde, St. Médart, Garonne, Isle Moron."¹

Six shells in perfect condition.

Typical *P. amnicum* in various stages of growth.

Card No. 130B. "*P. amnicum*, var. *B. sulcata*, Gassies.

Esteys des Landes, de la Gironde."

One shell; perfect.

A half-grown shell of *P. amnicum* with no traces of sulcation: in fact, a particularly smooth example.

Card No. 131. "*Pis. intermedium*, Gassies. *Ex auctore.*

Marcamps, Bassens, Crémon."

Three specimens: perfect.

Typical of the shell usually known as *intermedium*; I have opened the two largest, and have no hesitation in referring this species of Gassies's to a large race of *P. casertanum*. The chief characters of the hinge of this form are the long, rather narrow ligament pit; the long sweeping laterals and the proportionately small cardinal teeth. I have made drawings of the left-hand shell (the largest of the three) on the card, and propose to regard it as Gassies's type of *P. intermedium*.

Card No. 132. "*Pis. casertanum*. Cardium. Poli.

Libourne, St. Emilion, Blaye, &c."

10 perfect shells; 3 perfect valves ($1\frac{1}{2}$ pair); and 2 partly broken shells. The right valve at the right-hand side of the bottom row (i.e. the last shell on the card) belongs to *P. nitidum*, Jenyns. All the rest are referable to *P. casertanum*; but various forms are represented and it is evident that the specimens are from various localities. On the back of the card is scribbled in pencil:

"Var. maj. / fontinalis. / Teste Jeffreys. / *P. fontinalis*

Nilss. 1822. / *P. casertanum* Poli / 1791 !!"

Card No. 132B. "*P. casertanum* var. *B.* = *P. limosum*, Gassies.

Libourne—St. Emilion—Blaye, &c."

6 shells in perfect condition.

Originally there would appear to have been three shells stuck on the card—the first of these has disappeared—and under these is written in ink a figure "1" where the first shell was and a figure "2" under each of the others. On the back of the card is written in ink (over pencil) "1. *Pusillum* Jen. / fid. Jeffr. 2. 2. *fontinalis* / fid. Jeffreyss [sic]. / *is. casertanum* / var. *limosum*? G." When (?) the first shell was removed the note "1" on back appears to have been struck out in ink. The two shells referred to as "2" "2" are both *P. personatum*, Malm,² 1855. Both belong to a

¹ I have copied the exact title on each card.

² Fide B. B. Woodward, Cat. Brit. Pisidia.

rather thin and fragile form. The right-hand shell I have made drawings of and propose as the type of Gassies's *limosum*; it may be known by the broken ventral edge of the left valve. 4 shells stuck on blue paper, are small *P. casertanum*. These, evidently a subsequent addition, make up the present total of six shells on the card.

Card No. 132C. "*P. casertanum*, var. C. = *P. cinereum*, Alder.
Pont de la Maye—Gradignan."

5 perfect shells and 1 left valve.

Under the fourth is a figure "3", and on the back of the card is written in ink (over a pencil scribble "nitidum") "3. nitidum Jen. / (Fide Jeffr.)" This fourth shell ("3") certainly did look like *P. nitidum* before I opened it, as did also the next shell to it (the third), but upon examination of the hinges they both proved to be small very equilateral examples of *P. casertanum*, and I have but little doubt that they are river-shells. The other three shells and the odd left valve are ordinary *P. casertanum*, similar to the smaller shells on the card No. 132. They are, of course, equally referable to *P. cinereum* of Alder, which is synonymous with *P. casertanum*.

Card No. 133. "*Pis. pulchellum*, Jenyns [sic]."

Bruges—Allées Boutant, &c."

6 shells: perfect.

All the six shells are *P. subtruncatum*, Malm, but as Jenyns included this species as a var. of his *P. pulchellum*, they are not therefore wrongly named.

Card No. 134. "*P. Henslowianum*, Typus. *Tellina*, Shepp.
Cycl. appendiculata Leach. La Garonne. Paillet-Langon."

6 perfect shells and 1 odd right valve.

The first shell on the card is a beautiful example of the veritable *P. pulchellum* of Jenyns. The second is a very thickened, small shell, referable to *P. supinum*, A. Schmidt (= *P. conicum*, Baudon). The third is a small (not adult) *P. henslowanum*, Sheppard. The remainder, including the odd valve, are all *P. subtruncatum*, Malm. On the back of the card is scribbled "fontinalis", in pencil.

Card No. 134B. "*P. Henslowianum*. Var. B. nonappendiculée Gass.
Langoiran. Rare."

4 perfect shells and a space where a fifth had been.

The first shell is a remarkable example of *P. nitidum*, Jenyns, referable to a large oval form of my var. *crassa*. The second shell is a beautiful *P. casertanum* var. *ponderosa* mihi.¹ The third and fourth are correspondingly thickened shells of *P. subtruncatum*, Malm.

¹ See Journal of Conchology, vol. xv, 1918, p. 294, pl. vii, f. 31-34

Langoiran is situated on a small tributary of the Garonne, and these four examples are evidently river-shells.

Card No. 135. "*P. obtusale*. Cyclas. Lk.

Libourne—Paillet—le Teich."

7 perfect shells.

What the *P. obtusale* of Lamarck really was is unknown, but none of the seven shells is referable to the *P. obtusale* of Jenyns and more recent authors. The first shell on the card is a thickened elongate, rather quadrate, *P. casertanum*. The remaining six shells are all *P. personatum*, but larger, and rounder, than one normally finds it. On the back of the card is scribbled in pencil "pusillum", and over this in ink "Pusillum, Jennyns" [sic]; a perfectly correct determination as Jenyns's *pusillum* included both *personatum* and *casertanum*.

Card No. 136. "*P. Gassiesianum*, Dup.

Bègles—Blanquefort—le Taillan.

All shells broken.

Card No. 137. "*P. nitidum*, Jennyns [sic].

Bègles—la Tresne—Coutras."

All shells broken.

Card No. 138. "*P. pusillum*. *Tellina*, Gml.

Les fontaines, les Esteys, les Ruiss [-eaux]."

9 perfect shells; also 1 broken.

Of the nine perfect shells 8 are *P. subtruncatum*, Malm, and one, the largest (eighth from the left) on the card is *P. casertanum*. The broken shell (the tenth on card) cannot be named. On the back of the card is scribbled in pencil "fontinalis", and over this in ink is written "fontinalis, Pfr. / fide Jeffr."

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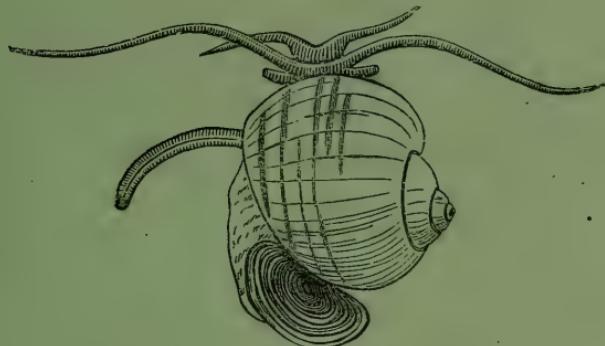
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INCOME AND EXPENDITURE ACCOUNT.

	Dr.	£ s. d.	Cr.	£ s. d.
To Balance, January 1st, 1921	.	41 9 6	By Cost of <i>Proceedings</i> , Vol. XIV, Pt. 4—	
" Annual Subscriptions for 1921	87 11 1		Printing and £ s. d.	
" Arrears	3 15 0		Postage 45 8 6	
" Entrance Fees		91 6 1	Illustrations and Blocks 15 17 1	£ s. d.
" Sale of Publications		7 7 0		61 5 7
" Advertisement		59 9 2	Parts V and VI (payment pending)	
" Donation towards cost of Illustrations		5 0		77 19 9
		7 6	" Printing and Stationery	139 5 4
			" Linnean Society—	
			Expenses of Rooms 3 3 0	
			Gratuities to Attendant 2 0 0	
				5 3 0
			" Postages and Cheque-book	4 10 5
			" Balance, being excess of Income over Expenditure	44 19 0
				£200 4 3
			LIFE MEMBERSHIP FUND.	
To Amount of Fund, January 1st, 1921	160 14 6	By Brokerage and Stamp 10 6		
" Income Tax recovered	2 5 0	," Amount of Fund, December 31st, 1921 170 13 0		
" Dividends on Investments	8 4 0			
				£171 3 6

BALANCE SHEET.

<i>Liabilities.</i>	<i>£ s. d.</i>	<i>Assets.</i>	<i>£ s. d.</i>
Annual Subscriptions paid in Advance . . .	11 6 6	<i>Investments—</i>	
Due to S. Austin & Sons for <i>Proceedings</i> , Vol. XIV, Pts. 5 and 6	77 19 9	£50 Metropolitan 2½% Consolidated Stock, valued at .	25 0 0
Life Membership Fund	170 13 0	£154 0s. 6d. 5% War Loan,	
Balance of Income and Expenditure Account	44 19 0	at cost	135 4 0
		Cash at Bankers	160 4 0
			144 14 3
	<hr/> £304 18 3		£304 18 3

Assets in addition to those shown in the Balance Sheet are (a) Stock of unsold publications; (b) Annual Subscriptions in arrear.

R. BULLEN NEWTON, Hon. Treasurer.

Audited and found correct, February 3rd, 1922.

CHAS. OLDHAM } Auditors.
A. J. PEILE }

ANNUAL GENERAL MEETING.

FRIDAY, 10TH FEBRUARY, 1922.

G. K. GUDE, F.Z.S., President, in the Chair.

Mr. H. Fulton and Mr. G. Young were appointed Scrutineers.

The following report was read :—

REPORT OF THE COUNCIL.

“ Your Council present their twenty-ninth annual report and are pleased to state that the work of the Society is well maintained. The usual monthly meetings have been held, and the attendance has improved during the last twelve months, the communications being of their usual high standard. Among the losses that the Society has to deplore the Council desire to mention the names of Mr. G. B. Sowerby (III), one of the original members of the Society, Dr. Henry Woodward, the first President and one of the founders of the Society, Dr. W. G. Ridewood and Mr. Hinckley.

“ The Council regret that the membership roll has decreased again this year, the following being the numbers of the various classes of Members :—Honorary Members, 2 ; Ordinary Members, 54 ; Corresponding Members, 62 ; Life Members, 15, of whom 8 are Ordinary and 7 are Corresponding Members, making a total of 133, as against 144 at the time of the Council’s last report. The Council would therefore ask all Members to do their utmost to induce any friends interested in Malacology to apply for membership.

“ During the year one single and one double number of the *Proceedings*, forming Vol. XIV, Parts 4 to 6, were issued in June and October respectively.

“ They comprised 120 pages of text, including the Index, with four plates and eight sets of figures. Drawing and blocks for the illustrations were furnished by Dr. A. E. Boycott, Professor T. D. A. Cockerell, H. C. Fulton, J. H. Gatliff, and C. J. Gabriel, T. H. Haynes and H. Watson.

“ Once again the cordial thanks of the Society are due to the Council of the Linnean Society for their continued kindness in allowing the meetings of the past year to be held in their apartments.”

The Treasurer presented the statement of income and expenditure for the year ended 31st December, 1921.

On the motion of the President, seconded by Mr. Fulton, the foregoing report and statement of accounts were adopted.

The following were elected Officers and Council for the year 1922 :—
President.—A. S. Kennard, F.G.S.

Vice-Presidents.—J. R. Le B. Tomlin, M.A., F.E.S. ; Dr. A. E. Boycott, F.R.S. ; G. K. Gude, F.Z.S. ; C. Oldham, F.L.S., F.Z.S.

Treasurer.—R. Bullen Newton, I.S.O., F.G.S.

Editor.—B. B. Woodward, F.L.S.

Secretary.—A. E. Salisbury.

Six other Members of the Council.—Rev. Dr. A. H. Cooke; H. O. N. Shaw, B.Sc., F.Z.S.; Lieut.-Col. A. J. Peile; T. Iredale; Dr. E. W. Bowell; Hugh Watson, M.A.

The newly elected President then took the Chair, amid acclamations, and the usual vote of thanks to retiring Officers and Members of the Council, the Auditors, and Scrutineers concluded the proceedings.

ORDINARY MEETING.

FRIDAY, 10TH FEBRUARY, 1922.

A. S. KENNARD, F.G.S., President, in the Chair.

Mr. Edwin Ashby was elected to membership of the Society.

The following communications were read:—

1. On a small collection of Mollusca from the Northern Transvaal.
By Major M. Connolly.

2. Notes on the Taxonomy of Nudibranchiate Mollusca from the Pacific Coast of North America.

Part I. On *Cavolina crassicornis* and *Cavolina subrosacea* of Eschscholtz.

Part II. On the Genus *Triopha*, Bergh.

Part III. On *Flabellina (Æolis) iodinea*, Cooper, and *Thecacera velox*, Cockerell.

By Chas. H. O'Donoghue, D.Sc., F.Z.S. (communicated by G. C. Robson, B.A.).

The following exhibits were made:—

By Mr. Kennard, on behalf of Mr. B. B. Woodward, a very thick example, in section, of a Pleistocene *H. nemoralis*, and an example of *Patella depressa*, Pen., attacked by *Polidora*; both of the above being collected by Mr. W. J. Wintle at Caldey, South Wales.

By Mr. Tomlin, Pfeiffer's own annotated copy of his "Monographia Pneumonoporum viventium".

ORDINARY MEETING.

FRIDAY, 10TH MARCH, 1922.

A. S. KENNARD, F.G.S., President, in the Chair.

Dr. B. Prashad was elected to membership of the Society.

The following communications were read:—

1. "Book Notes." By T. Iredale.
2. Notes on the Taxonomy of Nudibranchiate Mollusca from the Pacific Coast of North America.

Part IV. On *Janolus (Æolis) barbarensis*, Cooper, and on the *Æolidia herculea* of Bergh.

Part V. On the Family *Doriopsidæ* (*Doridopsidæ*).

By Chas. H. O'Donoghue, D.Sc., F.Z.S. (communicated by G. C. Robson, B.A., F.Z.S.).

A photograph of Dr. S. P. Woodward, taken in all probability by Lovell Reeve, was exhibited by the President, Mr. A. S. Kennard.

A demonstration was given by Mr. Robson on the genetic interpretation of intermediate forms, which was followed by a short discussion.

ORDINARY MEETING.

FRIDAY, 7TH APRIL, 1922.

A. S. KENNARD, F.G.S., President, in the Chair.

Mr. T. J. Evans, M.A., F.L.S., was elected to membership of the Society.

The following communications were read :—

1. On the radulæ of three species of *Mitra*. By Lieut.-Col. A. J. Peile.
2. On British Littorinids. By R. Winckworth, M.A., F.R.G.S.
3. Note on the genus *Vortex* of Oken. By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S.
4. Notes on the Taxonomy of Nudibranchiate Mollusca from the Pacific Coast of North America.

Part VI. On *Fiona marina*, Forskal.

Part VII. On *Melibe (Chioræra) leonina*, Gould.

By Chas. H. O'Donoghue, D.Sc., F.Z.S. (communicated by G. C. Robson, M.A., F.Z.S.).

ORDINARY MEETING.

FRIDAY, 12TH MAY, 1922.

A. S. KENNARD, F.G.S., President, in the Chair.

Capt. C. R. P. Diver, M.A., F.R.G.S., was elected to membership of the Society.

The following communications were read :—

1. A new (?) British *Vitrina*. By Dr. A. E. Boycott, F.R.S.
2. Note on Terrestrial Mollusca from a blown sand deposit on Caldey. By W. J. Wintle, F.Z.S.
3. A résumé of the genera *Cypraea* and *Trivia*. By Dr. F. Schilder (communicated by H. O. N. Shaw).
4. Notes on Non-Marine Shells from Lord Howe Island. By Tom Iredale.

The following exhibits were made :—

By Mr. Woodward, on behalf of Mr. W. J. Wintle. A sectioned shell of *Helix nemoralis* from a sand deposit at Caldey, together with a specimen of *H. nemoralis* having an abnormal growth towards the mouth.

This *H. nemoralis* was found in hibernation in the early spring of 1921, and lived in captivity throughout the year, feeding well and keeping active. It hibernated in November and was found to be dead in the first week of 1922.

When found, the shell was complete to the first break in the band on the body whorl. In captivity it quickly completed its shell, but made an incomplete lip—a trace of the colouring being seen on the inner lip. It then developed during the summer months the abnormal growth. It is interesting to note the weakening of the band at the beginning of captivity; and also that a trace of the band is to be seen on the abnormal growth when held to the light, and that the growth is lined with nacre.

Mr. Woodward also exhibited sectioned specimens of *H. nemoralis* from Dogs Bay Connemara and from Huccombe, South Devon, for comparison with the Caldey specimen.

By Dr. Boycott, a literary exhibit from "Pearson's Magazine" showing the use made of the locality of a well-known but uncommon shell in the tracing of a criminal.

ORDINARY MEETING.

FRIDAY, 9TH JUNE, 1922.

A. S. KENNARD, F.G.S., President, in the Chair.

The following communications were read:—

1. Notes on several forms of the genus *Paeциlozonites*. By Lieut.-Col. A. J. Peile.
2. On the Chiton Fauna of Australia. By Edwin Ashby, F.L.S., M.B.O.U.

[Abstract.]

Mr. Edwin Ashby showed a very fine collection of Polyplacophora representing the Chiton fauna of Australia. He explained that the Pacific Coast of the American Continent and Australia were competitors for the position of the Metropolis of the world's Chiton fauna. At the present time Australia holds the premier position in number of species, but in both regions there are still no doubt many new forms awaiting discovery.

Some very large chitons were shown, from 4 to 5 inches in length, but it was stated that for beauty of design and delicacy of tracery the sculpture of the rare and minute members of the genus *Acanthochiton* far surpass the sculpture of the larger forms. The habits of the various forms were referred to, and it was shown that many were only found at quarter-tide or half-tide, as the case may be, their habitat being restricted to that particular depth of water, so that on searching only 6 inches or so deeper that species would not occur at all, but would be replaced by another species. This regularity of depth distribution has led some zoologists to define the various zones in which certain marine life is to be found by the respective chitons that inhabit that particular depth of water.

Mr. Ashby then referred to some strange organs he had described under the name of "Spearhead spicules", occurring consistently on the girdle of *Loricella angasi*, H. Ad. & Ang. On this species these coarse branching bristles are surmounted with swollen heads shaped like the head of a spear, and white in colour, whereas the stalks are brown. These spear-headed bristles occur round the girdle opposite the finger-like processes that fringe the girdle. Smaller "spear-heads" were pointed out pushing their way through the girdle scales down the centres of these finger-like extensions of the girdle.

The speaker then showed organs somewhat analogous to these, which he had discovered on the girdles of the representatives of the genus *Kopionella*, Ashby. He pointed out that in both genera these organs were evidently deep seated, and while the exact purpose they serve in the life of the animal is not yet known, he suggested that they probably have some connection

with the nerve-fibres that find their way in canals between the tegmentum and articulamentum of the shell into the girdle tissues.

He next showed various forms of *Stenochiton*, a genus that has for its host various forms of sea grasses, *Posidonia*, *Cymodocea*, etc. One form lives in the brown sheath of the long ribbon leaves, buried several inches in the sand. The habits of the other forms were also alluded to.

While all the known species have been described from the State of South Australia and up to the present only recorded from three Australian States, Mr. Ashby expressed the opinion that ultimately they will be discovered in all the other States, and, in fact, *Stenochitons* or some kindred form will be found throughout the world, wherever these marine plants, known as *sea grasses* occur. He showed that until the habits of the *Stenochitons* were understood most of the recognized species were either quite unknown or considered extremely rare.

3. A list of the Nudibranchiate Mollusca recorded from the Pacific Coast of North America, with a note on their Distribution. By Chas. H. O'Donoghue, D.Sc., F.Z.S., and Elsie O'Donoghue, B.A. (communicated by G. C. Robson, M.A., F.Z.S.).

4. Note on *Trochus flavidus*, *T. pallidulus*, and *T. flammiger* of Dunker. By J. R. Le B. Tomlin, M.A., F.E.S.

The following exhibits were made:—

By Col. Peile and Mr. Kennard. Specimens illustrating Col. Peile's paper.

By Mr. Ashby. A very complete collection of the Australian Polyplacophora illustrating his paper.

By Mr. Iredale. An unique edition of Lammarck's "Animaux sans vertèbres".

By Mr. Spence. Land shells from South Africa, including *Achatina* and species of *Ceras*.

By Dr. Boycott. Abnormal specimens of *Limnaea peregrina*, one of which is of planorboid shape.

OBITUARIES.

GEORGE BRETTINGHAM SOWERBY, F.L.S. Third of the Name.
1843-1921.

An original member of this Society and a stalwart representative of the noted family of naturalist-illustrators, G. B. Sowerby, third of the name, was born 18th September, 1843, being the eldest son of George Brettingham Sowerby, second of the name.

After the usual preliminary education, and when but seventeen or eighteen years of age, he joined his father in business as a conchologist at their house in Great Russell Street, London, W.C. Some three years after his father's death in 1884, the business was removed to Fulham Road, London, S.W., and twelve years later to Kew, whilst from 1897 he was joined in partnership by Mr. H. C. Fulton, Sowerby finally retiring from the business in January, 1916. He retained his interest in conchology, however, to the end, and at the time of his death on the 31st January, 1921, his last paper was passing through the press for our *Proceedings*.

His earliest work was one of collaboration with his father on the well-known "Thesaurus Conchyliorum", and he was responsible for its completion, for he wrote the "Appendix (second supplement) to Monograph of the genus *Conus*", finished the monographs on *Voluta* and *Melo*, and was sole author of that on the genus *Turbo*. He also published a second edition of his father's "Illustrated Index of British Shells" in 1887, and a work on the "Marine Shells of South Africa" in 1892.

Some ninety-five papers, almost entirely on systematic lines, were contributed by him to various societies' publications and scientific journals. Of these forty-eight appeared in our own *Proceedings*, the more important being "Notes on the Family Ampullariidae" (in Vols. VIII, IX, and XII) and "Notes on *Magilus*" (in Vol. XIII). To most of these he furnished his own illustrations.

Sowerby was elected a Fellow of the Linnean Society in 1888, but seems to have retired in 1920. He joined the Conchological Society of Great Britain in 1886, and served as one of its vice-presidents in 1889. Joining this Society on its foundation in 1893, he served on the Council from that date till 1898, and again during 1918 and 1919.

He had married in June, 1867, Miss Rose Wilkie, who with their son and two daughters survive him. The son, now in Australia, carries on the patronymic as "Fourth of the name", and there is yet a "Fifth of the name" to perpetuate the tradition.

A man of genial and generous nature, as well as of strong character, Sowerby was also something of an athlete, for until late years he was

one of the all the year round bathers, at first in the Serpentine, Hyde Park, and afterwards in the Thames at Kew, and twice finished in the first six in the long distance swimming championship in the Thames, for which he received medals.

[Much of the foregoing information was kindly supplied by Mr. H. C. Fulton.]

B. B. W.

DR. HENRY WOODWARD, F.R.S., ETC.¹ 1832-1921.

Read by the President, 11th November, 1921.

SINCE this Society last met it has sustained the grievous loss of one of its most prominent Members, Dr. Henry Woodward, who was amongst the most active of its founders, its first President, and the first nominated of the three Honorary Members elected at the beginning of the present year.

Dr. Woodward's great achievements in the palaeontological world are so well known and have been so well set forth elsewhere with full biographical details, that only a brief allusion to the more important is here necessary. He was born at Norwich 24th November, 1832, and was the fifth son of Samuel Woodward, the celebrated Norfolk geologist and antiquarian. Leaving school in 1846, he went to reside with his brother, Dr. S. P. Woodward, the far-famed malacologist, who was then a Professor at the Royal Agricultural College, Cirencester, and it was there, whilst attending the lectures and making field excursions, that young Henry developed his love of natural history. When his brother was appointed in 1849 to the British Museum, Henry came with him to town, but after an interval of temporary employments of a scientific nature, went to Norwich and spent the years between 1851 and 1858 in the East of England Bank there. In the latter year he obtained a junior post in the Geological Department of the British Museum under the Keepership of Mr. G. R. Waterhouse. Successive promotions followed till, on the death of his brother in 1865, he succeeded as First Class Assistant, and on Mr. Waterhouse's retirement in 1880 became Keeper of the Department.

On him devolved the task of organizing and superintending the removal of the geological collections to the then new Natural History Museum at South Kensington, and their display in their new quarters. His arrangement persists to this day, and with the excellent guide books he wrote, or superintended, is a standing testimony to the able way in which the work was carried out. So highly were his services appreciated that, with Treasury sanction, he was retained in his post for four years beyond the normal limit, and was then employed on work in his old department for yet another four

¹ A portrait of Dr. Woodward was published as frontispiece to these *Proceedings*, Vol. VI.

years, finally quitting the scene of his labours in 1904, thereby terminating forty-six years of continuous service.

A Fellow of many of the principal Societies, besides the Royal Society to which he was elected in 1873, and Member of many other scientific bodies at home and abroad, he both served on their governing bodies and in turn as President of many of them besides our own, whilst in 1878 the University of St. Andrews conferred upon him the honorary degree of LL.D. Albeit, however, that these and other honours came to him, he will probably be yet best remembered for his long connection with the "Geological Magazine", which he founded in 1864 and edited from then to almost the close of his life.

To the "Geological Magazine" and many other scientific serials he contributed largely, some 350 papers, mostly on the fossil Crustacea, coming from his pen, besides a few distinct works, to say nothing of his official publications. We, however, are primarily concerned with those bearing on our particular subject: these are as follows:—

- 1864. With R. MacAndrew "Species of Mollusca obtained in Corunna Bay, in May, 1863". Ann. & Mag. Nat. Hist., ser. III, vol. xiv, p. 232.
- 1866. { "On the form, growth, and construction of Shells." (Edited from the manuscript of S. P. Woodward.) Intellectual Observer, x, p. 241; xi, p. 18.
- 1867. "Economic uses of Shells, and their Inhabitants." Id., xi, p. 161.
- 1868. "On *Actinoceras baccatum*, a new species of Orthoceratite from the Woolhope Limestone." Geol. Mag., 1868, p. 132.
- 1869. "The Pearly Nautilus, Cuttle-fish, and their allies." [Embodying notes by S. P. Woodward.] Student & Intellectual Observer, iv, pp. I & 241.
- 1870. "Distribution of the Cephalopoda in Silurian countries; being a review of M. Barrande's work." Geol. Mag., 1870, p. 486.
- 1871. "On the structure of the Shell of the Pearly Nautilus." Rept. Brit. Assoc., 1870 (1871), p. 128.
- 1871. "The Tertiary Shells of the Amazons Valley." Ann. & Mag. Nat. Hist., ser. IV, vol. vii, pp. 59 & 101.
- 1872. "On a new species of *Rostellaria* from the Gray Chalk, Folkestone." Geol. Mag., 1872, p. 97.
- 1872. "On the structure of Camerated Shells." Popular Science Review, xi, p. 113.
- 1879. "Notes on a collection of Fossil Shells, etc., from Sumatra." Geol. Mag., 1879, pp. 385, 441, 492 & 535.
- 1881. Article "Mollusca" in Cassell's Natural History, v, p. 154.
- 1883. "On a new genus of Fossil 'Calamary' [*Dorateuthis syriaca*, n. gen. & sp.] from the Cretaceous formation of Sahel Alma, near Beirut, Lebanon, Syria." Geol. Mag., 1883, p. 1.
- 1885. "On some Palaeozoic Phyllopod-shields [some of which were probably Aptychi of Goniatites], etc." Geol. Mag., 1885, p. 345.
- 1885. "On a new species of *Helminthochiton* [*H. Grayiae*] from the Upper Bala (Silurian) of Girvan, Ayrshire." Id., p. 352.
- 1885. "On Recent and Fossil Pleurotomariae." Id., p. 443.
- 1885. [On a specimen of *Pinnotheres* [sic] in a Pearl in *Meleagrina*.] Proc. Zool. Soc., 1885, p. 176.
- 1894. "An address delivered at the Anniversary Meeting of the Malacological Society . . . 1894." Proc. Malac. Soc., i, p. 178.

1896. "On a Fossil Octopus (*Calais Newboldi*, J. de C. Sby. MS.) from the Cretaceous of the Lebanon." Quart. Journ. Geol. Soc., lii, p. 229. [Name changed to *Palaeoctopus Newboldi*, Geol. Mag., 1896, p. 567.]
1901. "Note on the discovery of a very fine example of *Pleurotoma prisca*, Solander, sp. (1766), at Barton, Hants." Geol. Mag., 1901, p. 409.
1910. "On some supposed *Pholas*-borings from the shores of Birket el Qurûn, the ancient Lake Moeris, of the Fayûm, Egypt." Geol. Mag., 1910, p. 398. [They were decided to be the casts of Plant remains.]
1910. "A fragment of a Fossil [a water-worn fragment of the chambered portion of a Radiolarite] in a Chalk Flint Pebble from the Sherringham Beach, Norfolk." Geol. Mag., 1910, p. 483.
1918. "Notes on some Fossil Arthropods from the Carboniferous rocks of Cape Breton, Nova Scotia." Geol. Mag., 1918, p. 462. [Gives on p. 465 the figure of *Anthracomyia arenacea*, Dawson, found in association with the above.]

It is easy thus to limn in outline Dr. Woodward's history and works, but a more difficult task to pay just tribute to his many endearing qualities. His geniality and bonhomie were familiar to all who were privileged to know him, but he had more enduring characteristics. In this connection we may be allowed to quote the words which Professor Bonney addressed to him on the "Coming of Age" of the "Geological Magazine" in December, 1885 :—

"It is possible for an editor to nip early aspirations in the bud and to petrify the neophyte in science by a cold breath of disapproval or sarcasm. All, however, who, like myself, have made in the pages of the 'Geological Magazine' their first venture in scientific authorship, will be ready to testify to the kind welcome and friendly encouragement which we received from you. Many, I feel sure, have thus been animated to further efforts; so that you may with just pride assert that under your auspices the 'Geological Magazine' has enlisted many recruits for the great army of scientific workers. Yet more, not only in its pages, but also at your place in the British Museum, you have been ever ready to help the student, and to place at his disposal, with unvarying kindness and courtesy, the full stores of your ripe knowledge."

Many, moreover, had practical experience of his generosity when need arose.

Although the long seclusion of his later days, when he was no longer able to attend our meetings, has somewhat softened the blow, his passing will be greatly felt by us all, especially those of the older generation, albeit we shall ever treasure his memory as a precious possession.

B. B. W.

DR. WALTER GEORGE RIDWOOD, F.L.S., ETC. 1867-1921.

DR. W. G. RIDWOOD, one of our Life Members, joined this Society in 1900 and served on the Council in 1903-05 and 1909-11, besides being one of its Vice-Presidents in 1906-08.

He was educated at Enfield Grammar School, of which his father was head master. From 1883 to 1887 he studied at the Royal College of Science, becoming an Associate and taking first classes in both Biology and Geology. In 1888 he took his B.Sc. degree in the University of London, with first-class honours in Zoology, and in 1897 became D.Sc. Meantime, in May, 1888, he had been appointed Assistant to the Director at the British Museum (Natural History), a post from which he retired in 1917 to the great regret of all his friends. There he was employed in making the wonderful series of anatomical preparations exhibited in the Central Hall of that institution, a kind of work in which he was without rival. He also organized and prepared several special exhibitions.

In addition to, and for the most part as the result of his work in the Museum, Dr. Ridewood published a long series of valuable memoirs, chiefly dealing with the Vertebrata. His most important paper relating to the Invertebrata was the "Monograph on the Gills of the Lamellibranchia" (*Phil. Trans., Ser. B, vol. cxcv, 1903, pp. 147-284*). Of this he gave a résumé (illustrated by lantern slides) to our Society on 11th March, 1904. His other contribution to our meetings was in May, 1908, when he exhibited and commented on two specimens of "*Phænicurus*", the separated cerata of Nudibranch Mollusca (*Tethys* or *Melibe*), from Ceylon and Japan (*Proc. Malac. Soc., viii, 1908, pp. 121-122*).

Ridewood was for twenty-three years Lecturer on Biology in the Medical School of St. Mary's Hospital, London, and was Reader in Zoology in the University of London. He was a Life Member of the Linnean, Geological, and Zoological Societies, besides ours. During the war he drove a Red Cross ambulance in France for nearly two years.

A man of singularly quiet and retiring disposition, whose hobby was music, he being an extremely good player on the flute, Ridewood was gifted with a spirit of genuine kindness, which often showed itself in the great amount of trouble he would take to help anyone who asked for his advice and assistance. Hence his sudden and tragic end on 19th September last came as a great shock to his numerous friends, to whom his useful and brilliant career had seemed far from nearing its close.

[For further details see "Nature", 29th September, 1921, p. 160, to which obituary notice we are largely indebted for the foregoing facts.]

B. B. W.

ON A SMALL COLLECTION OF MOLLUSCA FROM THE NORTHERN
TRANSVAAL.

By Major M. CONNOLLY.

Read 10th February, 1922.

A SMALL collection of land shells, made in the Shilwane and Sibasa districts by the Rev. H. A. Junod in 1919 and 1920, is of unusual interest, for the reason that no systematic collecting has been done in the Northern Transvaal since the late seventies of last century, when valuable work was carried out there by A. E. Craven, and the results published in two or three papers by himself and the late Edgar Smith.

Craven's shells were for the most part gathered on the east slope of the Drakensberg range in the vicinity of Lydenburg goldfields, and the Shilwane district is also on the east slope of the Drakensberg, only 60 miles north of Lydenburg. As might be expected, therefore, several of the same species occur in both collections, and comparisons are important as bearing on the correctness of Craven's identifications, which were made at a time when only a hundred species of land shells had been described from South Africa, and nearly every new find referred to one of the old names.

Craven's complete list, subject to the latest generic classification, is as follows :—

<i>Gulella crassilabris</i> (Crvn.).	<i>Achatina dimidiata</i> , Smith.
„ <i>infans</i> (Crvn.).	„ <i>smithi</i> , Crvn.
<i>Mikrokerkus symmetricus</i> (Crvn.).	„ <i>transvaalensis</i> , Smith.
<i>Helicarion transvaalensis</i> (Crvn.).	<i>Euonyma lineata</i> (Krs.).
„ <i>vandenbroecki</i> (Crvn.).	„ <i>turriformis</i> (Krs.).
<i>Trachycystis planti</i> (Pfr.).	<i>Tropidophora kraussianum</i> (Pfr.).
<i>Edouardia drakensbergensis</i> (Smith).	

Nine of the foregoing species were new to science, and at least two of the remainder were probably misnamed.

Details of Junod's collection, with descriptions of new species and notes on others, are given below :—

Genus *GULELLA*, Pfeiffer.

Gulella sibasana, sp. nov. Pl. II, Fig. 5.

Shell comparatively large and solid, somewhat tubby, rimate, silky, pale olivaceous. Spire produced, sides slightly convex about the fifth whorl; apex (four whorls) rounded to a blunt point. Whorls 9, almost flat, the first five gradually increasing, remainder almost equal in size; the first two smooth, remainder covered with strong, close, regular, curved, oblique transverse striae. Suture shallow. Aperture subquadrate, rounded at base, with a strong sinus at the top of the outer lip. Peristome white, shining, expanded and slightly thickened. Rima shallow but well defined. Dental

processes consisting of a deeply inset and hardly noticeable unpointed columellar fold; a strong, moderately entering, concave plait at the outer angle of the paries; a rather small tooth, single in the Type but occasionally found with a smaller, second denticle above it, half-way up the outer lip, corresponding to a single, small exterior cavity; and a very small tubercle on the extreme left of the base.

Long. 9·8, lat. 5·0; apert. alt. 3·2, lat. 1·8; last whorl 4·5 mm.

Hab.—Luvimbi, Sibasa (Junod); Pepiti Falls (Harries).

Of five specimens from Luvimbi, two have a single tooth on the outer lip, as described in the Type; in two this tooth is bifid, there being a smaller cusp just above the other; while in the fifth, the upper cusp is represented by a minute swelling, only visible under a strong lens. The shells vary in size from about $10\cdot1 \times 5\cdot2$ to $9\cdot8 \times 5\cdot0$ mm.

Through the kindness of W. Falcon and H. C. Burnup a further series of the same species has been available for examination, strengthening considerably its specific value. It was collected by C. Harries at Pepiti Falls, also in the Sibasa district, and consists of ten shells, in nine of which the tooth on the outer lip is single and in the other bifid; while all show a distinct basal tubercle. They represent a rather larger race than the Type set, ranging from $10\cdot9 \times 6\cdot25$ up to $12\cdot5 \times 6\cdot3$ mm., but are absolutely conspecific.

In order to effect a thorough understanding of the new species, it is necessary to discuss at some length the small group of rather conspicuous shells to which it belongs, whose distribution appears to be restricted to the Northern and Western Transvaal. I have been most kindly assisted in my study of this group by Mr. H. C. Burnup, whose opinion, in which I fully concur, adds greatly to the value of the following conclusions.

Four species have so far been differentiated: *crassilabris*, Craven, 1880; *distincta*, M. & P., 1893; *eximia*, M. & P., 1898; and *euschemon*, M. & P., 1909.

I have already¹ had occasion to unite *euschemon* with *crassilabris*; it now becomes necessary to place *eximia* in the synonymy of *distincta*. Both these names were applied to a species remarkable for possessing a minute sinual denticle near the top of the outer lip, opposite the parietal plait, a feature by which, if constant, it may be readily recognized. *Distincta* was described as being $12 \times 4\frac{1}{2}$ mm. in size, with two other teeth on the outer lip and a small one on the base; *eximia* as a rather smaller form, 9×4 mm., with either one or two teeth on the outer lip and no mention of any on the base. There is, however, a basal swelling, or tubercle, which in some specimens of the smaller form becomes a distinct denticle, while intermediates in size occur which completely bridge the gap

¹ Ann. South African Mus., xi (1912), p. 70.

between the forms as originally described, and it appears impossible to retain *eximia* as even a varietal name, unless, indeed, it be allowed to stand for the smaller shells with a single tooth on the outer lip and little appearance of a basal swelling.

The group is now, therefore, reduced to three species, which may be distinguished as follows :—

Gulella crassilabris (Crvn.) (= *euschemon*, M. & P.): One parietal lamella ; one tooth on outer lip ; a slight swelling, sometimes obsolete, at the base.

Gulella sibasana, Conn. : One parietal lamella ; one tooth, sometimes bifid, on outer lip ; one basal tubercle of varying development.

Gulella distincta (M. & P.) (= *eximia*, M. & P.): One parietal lamella ; one sinular denticle ; one tooth, sometimes bifid with cusps more or less widely separated, on outer lip ; one basal swelling or tubercle of greatly varying development.

In addition to the difference in dentition set forth above, in *G. sibasana* the basal tubercle is situate slightly more to the left, or higher up on the columellar lip, and the rima is rather more open than in either *crassilabris* or *distincta* ; the geographical distribution, moreover, tends to confirm the conchological grouping, *distincta* (cum *eximia*) being known, so far, from Middelburg and Barberton in the east ; *crassilabris* (cum *euschemon*) from Belfast, Pruizen, Pietpotgietersrust, and Lydenburg in the north centre, and *sibasana* from the extreme north of the Transvaal.

It may be noticed that in this revision there is no mention of *G. infans* (Crvn.) or its numerous allies. The explanation is that they are not represented in Junod's collection, and that, although *infans* is an almost perfect miniature of *crassilabris*, its group seems to be entirely distinct and need not enter into the foregoing calculations.

Genus KERKOPHORUS, Godwin-Austen.

Kerkophorus perfragilis, sp. nov. Pl. II, Figs. 4a-c.

Shell subnautiloid, flattened, imperforate, extremely thin, glossy, transparent, pale olivaceous-corneous ; in the Type there is a very faint, narrow, pale rufous band just above the periphery, but this is absent in the generality of specimens. Spire almost flat ; apex submammillate. Whorls $3\frac{1}{2}$, rapidly increasing, the first microscopically rather sparsely punctate, remainder covered with very faint, somewhat irregular transverse striae, corresponding with the lines of growth. Suture shallow. Aperture elongate-ovoid ; peristome simple, acute, projecting far more above than at the base ; columella weak, concave, margin not sufficiently reflexed to form a rima.

Diam. maj. 15.5 ; min. 12.3 ; alt. 7.8 ; apert. alt. 7.5 ; long. 8.9 mm.

Hab.—Shilwane district.

Type in my collection.

A flatter, proportionately more elongate form than *K. phædimus* (M. & P.), which appears to be its nearest relative among known species of *Peltatinæ*.

Genus **TRACHYCYSTIS**, Pilsbry.

Trachycystis planti (Pfeiffer).

Hab.—Shilwane district.

The Natalian shell to which this name has usually been applied of late years is remarkable for the expansion of the peristome in adult examples, a feature peculiar, among South African species of *Trachycystis*, to itself and to *T. caloroma*, M. & P. There is no mention of such expansion in any early description of the species, nor does it occur in any of the earlier series in the British Museum; on the other hand, the latter are not as large as more recently collected individuals, and may easily be slightly immature.

Junod's shells are of rather a rufous shade, while Craven's, in the British Museum, are of paler yellow, but all appear to be conspecific. None are quite adult or show any trace of expanded peristome, and I cannot separate them from the older typical examples of *planti* from Natal.

Trachycystis junodi, spec. nov. Pl. II, Figs. 1a-c.

Shell small, subglobose, narrowly rimate, very thin, not very glossy, semitransparent, greenish corneous. Spire just raised sufficiently for each whorl to project above the next; apex sharp. Whorls 5, rather convex, last very rounded; rather rapidly increasing, protoconch (first whorl) microscopically punctate, remainder covered above and beneath with close, regular, curved transverse striae, crossed by equally close spiral striae. Suture narrow but well defined. Aperture very slightly flattened lunate; peristome simple, acute. Columella very weak, margin narrowly reflexed, almost concealing the narrow, but deep, rima.

Diam. maj. 8·3; min. 7·1; alt. 5·5; apert. alt. 5; lat. 4·2 mm.

Hab.—Mt. Manotsuri, Shilwane district, 4,000 feet.

Type in Kimberley Museum.

A fine new species, with no very close allies.

Trachycystis shilwaneensis, spec. nov. Pl. II, Figs. 3a-b.

Shell small, subconic globose, narrowly umbilicate, very thin, rather dull, semitransparent, pale rufous-corneous. Spire somewhat exserted, sides slightly convex, meeting at an angle of 95°. Whorls 5½, rather flat, last very round; rather gradually increasing; protoconch (1½ whorl) microscopically punctate, with very faint transverse striation when nearing the other whorls, which are covered all over with very close, faint, transverse, crossed by finer, equally close, spiral striae. Suture small, but clear. Aperture lunate; peristome simple, acute. Columella weak, margin narrowly

triangularly reflexed, half concealing the narrow, but deep, umbilicus.

Diam. maj. 5·7 ; min. 5·0 ; alt. 4·2 ; apert. alt. 2·7 ; lat. 2·7 mm. The largest specimen seen measures : Diam. 6·2×5·2 ; alt. 4·5 mm.

Hab.—Mt. Manotsuri, 4,000 feet ; Elim ; Sibasa.

Type in Kimberley Museum.

Not unlike *T. inclara* (Morel.), in which, however, the umbilicus is far less open and the spiral sculpture hardly visible under a magnification of fifty, which shows this important feature very clearly in the new species.

Trachycystis subpinguis, sp. nov. Pl. II, Figs. 2a-b.

Shell small, depressed-conoid, perforate, thin, smooth, glossy, transparent, pale corneous. Spire but little raised, sides straight, apex sharp. Whorls 6, slowly and regularly increasing, rounded, bluntly subcarinate on the upper portion of the periphery and sloping thence to the base ; the 1½ apical microscopically densely, but faintly, punctate, remainder sculptured all over with faint, rather distant, nearly straight, transverse striæ interspersed with closer, much fainter ones crossed by extremely close and faint wavy spiral striæ ; suture simple, well defined. Aperture oblique, lunate ; peristome simple, acute ; outer lip practically straight in profile and hardly receding ; columella short, weak, concave, margin shortly and narrowly reflexed, not concealing the minute umbilicus.

Diam. maj. 5·7 ; min. 5·2 ; alt. 3·6 ; apert. alt. 2·6 ; lat. 3·0 mm.

Hab.—Natal. Pietermaritzburg (Connolly ; Burnup).

Transvaal. Mt. Manotsuri (Junod).

This is the species mentioned in my Revised Reference List (1912) as having been mistaken for the *Helix pinguis* of Krauss, which, however, is described as having only 4½ whorls in a diameter of about 7 mm., and if properly represented in the British Museum is a larger form of darker colour. The occurrence together of the three Natalian species, *T. planti*, *T. subpinguis*, and *Lauria dadion*, so far north of the limits which might be expected to their distribution, is distinctly remarkable.

Genus EDOUARDIA, Gude.

The full reasons for the adoption of this generic name for nearly all the African species heretofore placed in *Pachnodus* or *Conulinus* will be given in a work now in course of publication ; they may therefore be omitted from the present article.

Edouardia drakensbergensis (Smith). Pl. II, Figs. 6a-b.

This species has never been figured, so by kind permission of the Assistant Keeper of the Mollusca, I append an illustration of the Type set in the British Museum. It was collected near Lydenburg

and consists of two shells, hardly mature, one dark corneous and the other pale fulvous in colour.

The species is rather widely diffused in the neighbourhood of Shilwane, with the darker coloured shells greatly predominating. They vary a little in diameter, but the generality of specimens are about 17 mm. in height and $13\frac{1}{2}$ in breadth. In its typical form *E. drakensbergensis* is therefore more slender than *natalensis*, Krs., a typical example of which is 17×15 mm., and less carinate than *carinifera*, M. & P., but the less slender examples approach very nearly the unicoloured mutation of Krauss' species.

Edouardia mcbeaniana (Bnp.).

1905. *Ena (Pachnodus) mcbeaniana*, Bnp., Proc. Malac. Soc. vi, p. 302, pl. 16, figs. 1-2.

Hab.—Shilwane, 2,000 feet.

A single typical example from the above locality marks the most northern limit yet recorded for this species, whose southern boundary seems to be near Pretoria.

Subsp. *lemanensis*, nov.

A small series from Lemane, in the Spelonken district, are so considerably more slender than the typical form that I think it desirable to give them a varietal name. My reason for this is because it appears that, although examples of the *Edouardia* and *Rhachis* groups may differ enormously within each species in coloration and marking, they remain remarkably constant in contour. Since contour, therefore, rather than coloration, must be accepted as the gauge of specific value, any noteworthy departure from the normal is of considerable importance.

The local race differs from Type in comparative diameter, which is only $11\cdot2 \times 10\cdot0$ mm. in a shell $16\cdot1$ mm. long, whereas it attains $13\cdot0 \times 11\cdot3$ mm. in a typical example $15\cdot0$ mm. in length; the columellar margin, also, is rather less broadly reflexed and the umbilicus more narrow than in the normal form, but the bluntness of the carination agrees with that of *mcbeaniana* rather than any other species.

Edouardia transvaalensis (M. & P.).

1893. *Buliminus transvaalensis*, M. & P., Ann. Nat. Hist. xii, p. 105, pl. 3, fig. 6.

Hab.—Elim.

Two examples, agreeing perfectly with the Type. This is an arboreal species, which in live condition is usually found coated with pith or mud. It must be very nearly akin to *Pachnodus herbigradus*, Pilsbry, which inhabits the Belgian Congo.

Genus RHACHIS, Albers.

Rhachis chiradzuluensis (Smith).

1899. *Buliminus* (*Rhachis*) *chiradzuluensis*, Smith, Proc. Zool. Soc., p. 586, pl. 33, fig. 40.

Hab.—Mt. Manotsuri, Shilwane district, 4,000 feet, on a bush.

A noteworthy new locality for this beautiful little species, which was described from Nyasaland and has also been collected as far north as Mombasa. The Type set are all bandless above the periphery, the markings being confined to two narrow rufous bands, one on or just beneath the periphery, the second about $1\frac{1}{2}$ mm. below it. In Junod's examples these bands are double the breadth, and there is a narrow third band above the periphery, midway between the sutures; in other respects the shells are perfectly conspecific and easily recognizable from Smith's figure.

As the generic name *Buliminus* is no longer available, and *Ena*, which replaced it, is not applicable to the South African genera, I leave this species in the remaining group in which Smith placed it; it will, however, probably be found to be quite distinct when the anatomy of the various members of the *Rhachis* group becomes better known.

Genus PUPISOMA, Stoliczka.

Pupisoma orcula (Bs.).

Hab.—Luvimbi, Sibasa; Elim; Mt. Manotsuri, 4,000 feet.

Genus LAURIA, Gray.

Lauria dadion (Bs.).

Hab.—Mt. Manotsuri, Shilwane district, 4,000 feet.

A single specimen, taken alive, gives a remarkable extension to the limited range of this species. In *L. dadion*, as well as in its near allies *L. farquhari* and *L. tabularis* (M. & P.), there is frequently a slight, bluntly pointed swelling half-way up and rather deep-set on the columella, showing through the shell as a white line observable within the umbilicus: in Junod's shell this swelling is more prominent than in any other of twenty which I have examined from Cape Town and Karkloof, and seems to be represented by a clear furrow, rather than a white line, in the umbilicus; it will be interesting to see whether this variation is constant if further examples are ever collected in the same neighbourhood.

Genus ACHATINA, Lamarck.

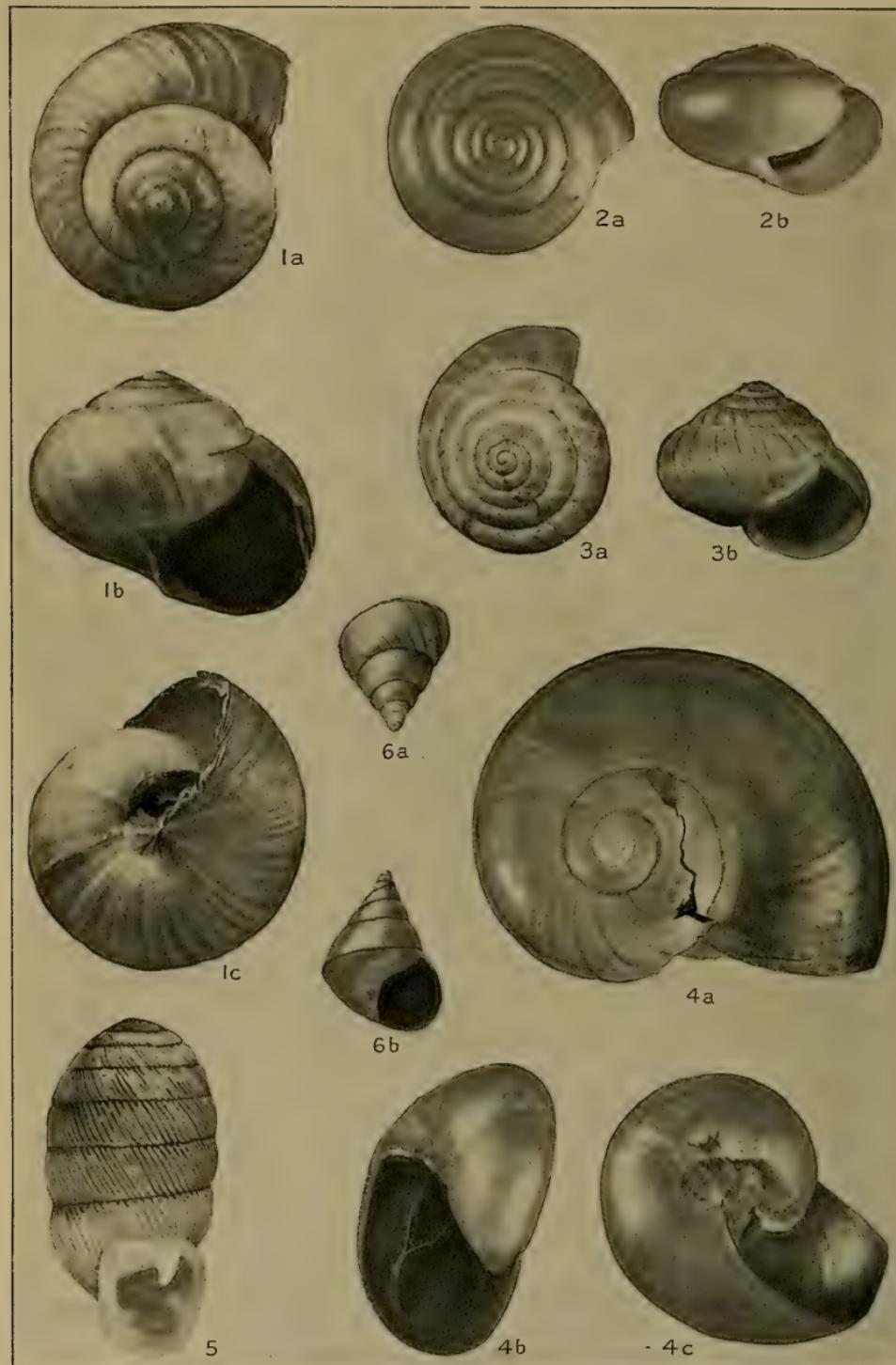
Achatina dimidiata, Smith.

1878. *Achatina dimidiata*, Smith, Quart. Journ. of Conch. i, p. 348.

1904-5. *Cochlitoma dimidiata*, Smith, Pilsb., Manual, xvii, p. 95, pl. 32, fig. 6.

Hab.—Shilwane district.

The northernmost record for this species, whose southern known limit is Majuba.



LAND MOLLUSCA FROM NORTHERN TRANSVAAL.

To face p. 77.]

Achatina cf. *greyi*, Da Costa.

1907. *Achatina greyi*, Da Costa, Proc. Malac. Soc. vii, p. 226, pl. 20, fig. 1.

Hab.—Sibasa.

Two examples, apparently conspecific with the single shell from Salisbury, which I recorded in 1912 under the above name. The fresh material, however, casts considerable doubt on the correctness of that record, though not affecting the synonymy which accompanied it. The shells are much larger (85×52 mm.) than any of the Types of the *greyi* group, and if it can be proved that the latter are a truly small race, rather than merely immature shells, it will not be possible to retain the name for the Rhodesian and Transvaal specimens.

I hope to survey the puzzling *cravini* group, to which all the foregoing belong, in a work now in course of completion, but the whole subject is an extremely difficult one, partly owing to the multiplication of new specific names on insufficient material, and partly owing to the great alteration which takes place in the appearance of an Achatinoid shell between the times when it is fresh and comparatively young, and when it is old, dead, and bleached, and it would be futile to embark on such an undertaking without long preparation.

Genus TROPIDOPHORA, Troschel.

Tropidophora insulare (Pfr.).

Hab.—Shilwane district.

Craven's *T. kraussianum*, Pfr., doubtless refers to this common species.

EXPLANATION OF PLATE II.

FIG.

- | | | |
|--------|--|-------------------------|
| 1a-c. | <i>Trachycystis junodi</i> , sp.n. | $\times 4\frac{1}{4}$. |
| 2a, b. | <i>T. subpinguis</i> , sp.n. | $\times 5\frac{1}{4}$. |
| 3a, b. | <i>T. shilwaneensis</i> , sp.n. | $\times 5$. |
| 4a-c. | <i>Kerkophorus perfragilis</i> , sp.n. | $\times 3\frac{1}{3}$. |
| 5. | <i>Gulella sibasana</i> , sp.n. | $\times 4\frac{1}{4}$. |
| 6a, b. | <i>Edouardia drakensbergensis</i> (Smith). | $\times 1$. |

BOOK NOTES.

By TOM IREDALE.

Read 10th March, 1922.

SUMMARY.

On P. L. S. Müller's Molluscan Names.
 Pennant's British Zoology.
 Wodarch and Mawe.
 Lamarck's "Hist. Anim. s. Vertèb."
 Lessons on Shells.
 Da Costa.
 Renier.
 Reeve's "Elements of Conchology".
 Wood's "General Conchology".
 O. G. Costa : "Oss. Zool. Is. Pantelleria."

ON P. L. S. MÜLLER'S MOLLUSCAN NAMES.

WHEN Sherborn drew up his first part of the "Index Animalium" he included many doubtful names. This was the correct policy because the recognition of many books was *sub judice*. Since then practically all the outstanding items have been settled, and the present note deals with one such.

In his Bibliography (p. xxxii) Sherborn included

"Knorr, G. W. Les Delices des yeux, ou Coll. gén. Coquill. 6 vols.						
4to.	Nuremb.	1760-1773.	[No n.spp.]			
—	Delic. nat. Selectæ. (Ed. Müller)	2 pts.	8vo.			
		Munich.	1766-67.			
—		(Ed. Walch) fo.	Nürnb.	1778."		

From this entry the first-named well-known work would appear to have been re-edited by Müller, and consequently many new names might be anticipated. In Sherborn's index one meets with such entries as "Cylinder P. L. S. Müller, Del. Nat. i. 1766, 129.—G.

Turris P. L. S. Müller, Del. Nat. i. 1766, 129.—G."

The latter entry recently attracted the attention of my friend, Mr. Chas. Hedley, who wrote for information since the book was not available to him.

I was deputed to investigate, and give my results herewith. Knorr published a series of paintings of shells with descriptions in vernacular. On account of their favourable reception a second series was issued, and then a third, to which he added a "Postface" apologizing for lack of systematic treatment because most "amateurs" followed their own system. A fourth series was called for, and then he co-ordinated the shells previously figured with Rumph's System and also with Linné's System, of which the tenth and twelfth editions were both quoted. Two more parts were published, and then the shells in these two systematized as before.

As noted by Sherborn, no new specific or generic names appear. The Mullerian work has nothing much to do with this. The title-page begins "Deliciæ Naturæ Selectæ . . . von G. W. Knorr fortgesetzt von Dessen Erben von Philipp Ludwig Statius Müller 'with French translation by M. V. de la Blaquiere.' " It is a work in two large folio volumes, published at Nürnberg in 1766–1767. The work covers every branch of the animal and mineral kingdom, and is not solely a conchological work as the well-known Knorrian work is. The text is in parallel columns in German and French, and only pp. 33–60 deal with shells, explaining plates B to B vi.

Pages 127–132 are devoted to a "Register" in German, a "Table" in French, while p. 129 covers the seven plates dealing with shells. Throughout the work no systematic treatment appears, and though Müller writes of genera, he was not using the word in our sense.

The explanations to the figures of shells on p. 129 are all in the vernacular, but sometimes a Latin equivalent is given and these were quoted by Sherborn as already cited.

The complete list of figures is forty-eight, and the following Latin equivalents are added: *Nautilus crassus Rumphii*, *Nautilus papyraceus*, *Harpago Rumphii*, *Pecten R.*, *Buccinum*, *Lagena R.*, *Rapa R.*, *Chama squamata R.*, *Mitra episcopalis R.*, *Voluta musicalis R.*, *Tellina violacea R.*, *Alata*, *Cylindrus* (in the other column *Cylinder*) *maximus*, *Porcellana montosa R.*, *Turris babylonica R.*, *Avicula*, *Ostreum plicatum majus R.*, *Pinna*, *Fusus brevis*, *Tribulus R.*, *Voluta arenata R.*, *Patella*, *Buccinum tutonis R.*, *Cymbium R.*, *Cymbium*, *Buccinum ampullatum List. Ellis*, and *Vespertilio* and *Melicera R.*

It is obvious that Müller is simply quoting the Rumphian Latin name, and that none of these names has any validity in our modern nomenclatural usage.

Walch's edition is also different, though a reprint of the preceding. After Müller's name on the title-page appears: "von neuen übersehen, verbessert, und mit einer Vorrede begleitet von Johann E. J. Walch." It is all in German, and was published at Nürnberg in 1778. The text is rewritten with a full synonymy to previous workers, such as Aldrovandi, Rumph, Pallas, Linné, etc., but is no more systematic in the text than the previous one. The plates are the same and the "Register" is the same, but to each figure is added the Linnean name. No new names appear, and when the Linnean ones are seen alongside the Rumphian ones the latter were never considered at all.

A Dutch translation of Knorr's work was published at Amsterdam in 1770–5, and there is also apparently a Dutch translation of Müller's work as shown by the following entry:—

"Knorr (G. W.) and Müller (P. I. S.). Deliciæ Naturæ Selectæ, of Uitgeleezen Kabinet van Natuurlyke Natur Zeldzaamheden. About 90 large coloured plates, large folio, calf. Dordrecht, 1771."

PENNANT'S BRITISH ZOOLOGY.

The fourth edition of this work contains many new species of mollusca, and as there may be trouble in connection with the quotations cited, I have drawn up this note.

In the Bibliography of the "Index Animalium", 1758-1800, Sherborn included—

"Pennant, T. Brit. Zool. Ed. 4. 4 vols. 8vo. Warrington, 1776 and 1777. [In vol. 4 P. uses binominals.]"

Upon referring to the copy in the British Museum (Natural History), which was an octavo as cited by Sherborn, I found my references did not agree with Sherborn's as given in the body of the work. I then found there was also a quarto edition, and, strangely enough, a copy of this had been examined by Sherborn in making up his index. The page quotations entirely disagree, and I made out a complete list of the new names from the Brit. Mus. 8vo edition, and have collated them with a quarto copy kindly lent me by my friend Mr. A. E. Salisbury.

In the Catalogue of the Library of the British Museum (Natural History) Mr. B. B. Woodward has carefully noted the two editions, and in his synonymy of British Non-Marine Mollusca he tells me he is carefully noting each reference. As the Library Catalogue is not in the hands of every conchologist, I give here the pagination of the principal entries.

In the Journal of Conchology, vol. xiv, April, 1913, E. A. Smith gave an account of the Pennant Collection of British Shells (pp. 38-41), noting the types still extant, and now preserved in the British Museum (Natural History).

With regard to this fourth edition the frontispiece of vol. i is headed "British Zoology. Class I Quadrupeds. London. Printed for Benj. White. MDCCCLXXVI," while the title-page states: "British Zoology. | Vol. i. | Class I. Quadrupeds. | II. Birds. | Fourth Edition. | Warrington: | Printed by William Eyres, | for | Benjamin White, at Horace's Head, Fleet-Street, London. | MDCCCLXXVI."

The Preface, covering eighteen pages, is dated Downing, 1st March, 1776. The titles of vols. ii and iii agree with different classes indicated and without the words Fourth Edition.

Salisbury's copy is interesting because in the first volume on the back of p. xxix is a list of "Errata", and then the words below: "The Book-binder is requested to place the Plates according to the numbers affixed to the figures which refer to the descriptions," and then there is a duplicate p. xxix with, on the back, a longer list of "Errata" and "The Book-binder . . ." omitted. Then follows "Plates to British Zoology. Vol. I Quarto", and positions given. At the end of vol. iii, on the back of p. 371, is a list of "Errata" and the notice: "In May next will be published, British Zoology, Class V, By Thomas Pennant Esq; containing about Ninety

Elegant Plates of the Shell and Crustaceous Animals of Great Britain, with descriptions. N.B. This work will be published both in Quarto and Octavo," and another p. xxix and errata for the first volume. There is no title-page like those of the preceding volumes, but instead a page like the frontispieces of the former, but differing in that it states vol. iv, and the date is "London, Printed for Benj. White, MDCCCLXXVII," and this is followed by a dedication "To the Dutchess Dowager of Portland, this work is dedicated, as a grateful acknowledgement of the many favors conferred by Her Grace on her most obliged, and most obedient humble servant, Thomas Pennant. Downing, March 1, 1777." There is no list of plates, but at the end of the index, p. 136, is added: "N.B. The Binders are requested to place all the Plates at the End."

The names I have noted read :—

			Qto ed.	8vo ed.
			page	page
<i>Chiton crinitus.</i>	Tab. xxxvi, f. 1	Aberdeen.	60	71
<i>marginatus.</i>	2.	Scarborough.	60	71
<i>lævis.</i>	3.	West Ross-shire.	61	72
<i>Pholas parvus.</i>	xl,	f. 13. Common.	65	77
<i>Mya dubia.</i>	xliv.	Weymouth. P.C.	69	82
<i>Solen pellucidus.</i>	xlvi,	f. 23. Anglesea. B.M.	71	84
<i>Tellina fragilis</i> L.	Not figured.	No loc.	73	86
<i>depressa.</i>	Tab. xlvii, f. 27.	—	73	87
<i>crassa.</i>	xlviii, f. 28.	— B.M.	73	87
<i>rugosa.</i>	lvii,	f. 34. Weymouth.	75	88
<i>cornubiensis.</i>	Based on Borlase, tab. xxviii, f. 23.		75	89
<i>Venus rugosa.</i>	Tab. lvi,	f. 50.	81	95
<i>undata.</i>	lv,	f. 51.	81	95
<i>sinuosa.</i>	lv,	f. 51A. Weymouth. P.C.	81	95
<i>rhomboides.</i>	lv,	f.	B.M.	83
<i>ovata.</i>	lvi,	f. 56.	B.M.	83
<i>Pecten subrufus.</i>	lx,	f. 63.	B.M.	86
<i>obsoletus.</i>	lxii,	f. 66.	B.M.	87
<i>lævis.</i>	Not figured.	Anglesea.	87	102
<i>Mytilus incurvatus.</i>	Tab. lxiv,	f. 74. Anglesea.	95	111
<i>pellucidus.</i>	lxiii,	f. 75. Anglesea. B.M.	95	112
<i>umbilicatus.</i>	lxv,	f. 76. Anglesea. B.M.	95	112
<i>curtus.</i>	lxiv,	f. 76A. Weymouth. P.C.	96	112
<i>Pinna fragilis.</i>	lix,	f. 80. Weymouth. P.C.	97	114
<i>ingens.</i>	Not figured.	Farther Hebrides.	98	115
<i>Bulla cylindracea.</i>	Tab. lxx,	f. 85.	B.M.	100
<i>patula.</i>	lxx,	f. 85A. Weymouth. P.C.	101	117
<i>Voluta jonas.</i>	lxxi,	f. 87. I. of Jona.	101	117
<i>Buccinum striatum.</i>	lxxiv,	f. 91.	105	121
<i>minutum.</i>	lxxix.		105	122
<i>Murex carinatus.</i>	lxxxvii,	f. 96.	P.C.	107
<i>costatus.</i>	lxxix.	Anglesea.	108	123
<i>acuminatus.</i>	lxxix.		108	123
<i>Trochus exasperatus.</i>	lxxx,	f. 108. Cumberland.	109	126
<i>terrestris.</i>	lxxxii,	f. 110. Cambridgeshire.	111	127
<i>Turbo tumidus.</i>	lxxxii,	f. 111. Coast of Northum- berland. B.M.	112	128
<i>tuberculata.</i>				

			Qto ed.	8vo ed.
	Tab.	page	page	page
<i>Turbo albus.</i>	lxxix.	113	130	
<i>lævis.</i>	lxxix.	113	130	
<i>fasciatus.</i>	lxxii, f. 19.	Anglesea.	113	130
<i>ulvae.</i>	lxxxvi, f. 120.	Anglesea. B.M.	114	131
<i>Helix nana.</i>	lxxxiii, f. 125.	Flintshire. B.M.	114	132
<i>rufescens.</i>	lxxxv, f. 127.	B.M.	116	133
<i>hortensis.</i>	lxxxiv, f. 129.	B.M.	118	136
<i>pellucida.</i>		Shropshire.	120	138
<i>lævigatum ? L.</i>	lxxxvi, f. 139.	Inhabits ponds.	121	140
<i>Patella depressa.</i>	lxxxix, f. 146.	B.M.	124	142
<i>intorta.</i>	xc,	f. 148. Anglesea.	125	143
<i>lævis.</i>	xc,	f. 151. Banff.	125	144

The letters "P.C." I have attached to those Pennant definitely stated were in the Portland Cabinet, while the letters "B.M." have been placed against those which Smith definitely recognized as the figured specimens, now in the British Museum. As Smith observed, probably many of the missing shells were figured from the cabinets of other collectors, of which one instance is noted, i.e. of *Pinna ingens*, which was in the collection of Dr. Walker, at Moffat. As recorded in these *Proceedings* (Vol. XI, 1915, p. 333), Laskey wrote concerning *Voluta jonensis*: "it is well known Pennant figured his shell from this collection."

An interesting case, comparable with the now historical one of *Helix rufescens* Pennant (Ann. Mag. Nat. Hist., Ser. VIII, vol. xi, pp. 263-4, 1913), is that of "*Helix lævigatum ?*" Pennant refers to "Lin. Syst. 1250, No. 709." Linné's *Helix lævigata* was described from unknown habit, and no figure was cited, and has been rejected as indeterminate. In the Conchological Society's List of British Marine Mollusca, 2nd ed., 1902, No. 391, Pennant's name is used as the basis of *Velutina lævigata*, an extraordinary conclusion. If Linné's name were unacceptable, Pennant's name was inutile, but, moreover, Pennant's data reads "Inhabits ponds", and the figure seems to be that of a *Lymnæa*, i.e. *peregrer*. Further, before Pennant's usage, O. F. Müller in the Zool. Dan. Prodr., 1776, p. 242, had provided *Bulla velutina* based on a Danish shell for the *Velutina*, and, consequently, the name would be *Velutina velutina* (O. F. Müller, 1776), and this is in accord with the usage of the best continental workers.

It may be as well noted here that "A New Edition" was published in 1812 under the signature of "The Editor". The identity of the editor has been guessed at, so that it is important to record that the proofs of this new edition are preserved in the British Museum (Natural History) Library, and that the editor was Thos. Pennant's son, David Pennant. This edition is also in four volumes, published in London, and I have only seen it in octavo.

The Mollusca occur in the fourth volume, and the whole of Montagu's discoveries are included, as well as those of J. Adams and other writers, but I have not noticed anything of novelty.

The plates appear to be the same re-drawn with the vernacular names and references inscribed thereon.

WODARCH AND MAWE.

As an episode in the study of conchology the works of these two writers may be cited.

In 1820 appeared : “ An | Introduction | to | The Study of Conchology, | describing | The Orders, Genera, and Species | of | Shells ; | their most prominent characteristics, and usual | mode of classification. | With | observations on the nature and properties | of the animals ; | and | directions for collecting, preserving, and | cleaning shells. | By | Charles Wodarch. | London : | Published by Longman, Hurst, Rees, Orme, and Browne, | Paternoster Row ; | and by J. Mawe, No. 149, Strand. | 1820.”

My copy is in the original boards, and on the back of the cover is labelled : “ Introduction to Conchology. Coloured Plates, Price 12s.”

It is a small octavo, the preface, contents, introduction, and classification occupying twenty-four pages, the text proper 120 pages, and there are four coloured plates showing sixty-three figures.

There is a couple of pages of advertisement sewn in at the front from which I note : “ Just published, By J. Mawe 149, Strand. A Treatise on Shells, with plates, price 7s., written strictly after the system of Linnæus, describing the characters of the orders, genera, and species ; with an extensive catalogue of names under each genus : to which is added, the best mode of cleaning and preserving shells.” This work seems at present unavailable.

Then appeared “ Wodarch’s Introduction . . . Second Edition, Revised and considerably Enlarged by J. Mawe . . . 1822 ”, with an “ Advertisement to the Second Edition. The alterations in this edition, consist in the introduction of some species which were unknown at the time of Linnæus ; the division of the genera into classes, whereby the different characters of the genus may be more readily recognised : the addition of the English names to many of the species ; a comprehensive nomenclature of the terms used in Conchology ; and lastly, by the embellishment of three new plates ; the Frontispiece showing four genera of spiral shells, and the two others exhibiting the hinges of Bivalves, and displaying the peculiarities of some particular shells. J. Mawe. 149 Strand. Feb. 1822.”

The contents and glossary of terms used in conchology take up fifteen pages ; the introduction, classification, and text proper extending to 152 pages. My copy in original boards is lettered on the back : “ Elementary Treatise on Conchology with Plates, colored.”

The frontispiece has seven coloured figures : *Buccinum dimidiatum*, *B. subulatum*, *Strombus fusus*, *Murex colus nicobaricus*, *M. colus*,

Turbo imbricatus, and *T. exoletus* or *cinctus*. Of the plates at the end the first has been re-drawn, the second to fourth are the same as in the first edition but differ in the coloration, whilst the fifth and sixth are new.

Then there is a "Third Edition, with considerable Additions and Alterations", dated on the title-page 1825.

The contents and glossary run to only thirteen pages; there is no advertisement; the classification appears as chapter iii of the introduction, and this and the text proper occupies 140 pages only. The frontispiece is the same as in the preceding, and so are the other six plates, although the first plate has been modified and the coloring of many shells differs appreciably.

In 1827 was published "A New Edition, with considerable Additions and Alterations", the only alteration I have noted being a new frontispiece with five figures, *Voluta lyrata*, *Voluta zebra* (two varieties), *Conus zebra*, and *Conus coccineus*, the text and other plates being the same.

I also have the "Fourth Edition, with considerable Additions and Alterations", dated 1832, which has an "Advertisement to the Fourth Edition". This, with the title-page, blank pages, etc., and two pages of contents, occupies pp. i-xii. Then the glossary, introduction, and text proper are continuously paged from 1-149, and the six plates at the end are the same as in the preceding edition. There is an entirely new frontispiece, showing three figures only, of *Murex foliatus*, *Murex regius*, and *Murex radix*. These figures are very fine and appear to be the work of a Sowerby, but are not signed, but the plate is lettered: "Published by J. Tennant, late S. Mawe, 149, Strand."

There also seems to be a fourth edition, dated 1831, which may be the same as this or may be different.

LAMARCK'S "HIST. ANIM. S. VERTÈB."

The above abbreviation is about the best known in malacological literature, so that a note on the "Troisième Edition", hitherto unrecorded, seems of sufficient importance for publication.

The first and second editions constitute the basis of recent conchological work and are well known, the first in seven volumes dating from 1815 to 1822, the second by Deshayes and Milne-Edwards dates from 1835 to 1845. Both are published in Paris and are in small octavo.

I have acquired a "Troisième Edition, revue et augmentée de notes présentant les faits nouveaux dont la science s'est enrichie jusqu'à ce jour; par MM. G. P. Deshayes et H. Milne Edwards", published at "Bruxelles. Meline, Cans et Compagnie". It is in three volumes, large octavo in double column, and bears dates 1837, 1839, 1839. The authorship suggests this may be simply a reprint of the well-known second edition, but the dates appeared

peculiar. I have not yet collated it page by page, but I think that it must have been published in livraisons, and that these appeared after the Paris print, probably without any addition. The date 1837 on the title-page of the first volume may be the date of the first livraison, as the date 1839 on the title-page of the third is certainly not the date of the completion of that volume. Towards the end Reeve's "Conchologica Systematica" and his "Conchologica Iconica" are quoted, the former being first published in 1842, the latter in 1843. Apparently the project was not a success, since this third volume completes the work, a general index to the three volumes being given, yet the whole of the Mollusca have not been treated of. Upon examination I find that these three volumes may coincide with the nine volumes of the second edition, the ninth volume being published in November, 1843, and its end agreeing with the completion of the third. The reconciliation is more difficult than it appears at first because the volumes of the second edition appeared somewhat erratically. The dates of publication of the first two editions appear in Sherborn's Bibliography to the second part of his Index Animalium, but I here reproduce the dates of acknowledgement from the Bibl. France :—

	Ackn'd B.F., 1st ed.	2nd ed.	3rd ed.
Vol. I.	June 3, 1815.	March 7, 1835	
II.	April 13, 1816.	Aug. 15, 1835	Vol. I, title-page, 1837.
III.	Sept. 7, 1816.	Feb. 8, 1840	
IV.	April 5, 1817.	Jan. 2, 1836	
V.	July 25, 1818.	Dec. 30, 1837	Vol. II, title-page, 1837.
VI.	{ Pt. I. July 31, 1819. Pt. II. May 4, 1822. }	March 7, 1835	
VII.	Sept. 21, 1822.	Jan. 23, 1836	Vol. III, title-page, 1839.
VIII.		June 23, 1838	
IX.		Nov. 18, 1843	
X.		Nov. 9, 1844.	
XI.		Jan. 3, 1845.	

The inclusion of the matter for the third volume of the second edition, which did not appear until 1840 in the first volume of the third edition, which bears the date 1837, is just as puzzling as the date of the third volume, 1839, with contents dating to 1843.

"LESSONS ON SHELLS."

A little book was published with the title "Lessons on Shells, as given to children between the ages of eight and ten, in a Pestalozzian School, at Cheam, Surrey", by the author of "Lessons on Objects, illustrated by Ten Plates, drawn from Nature", in 1832. The Preface is signed by "C. Mayo, Cheam, June 15, 1832". Among the list of books consulted appears "The Conchologist's Companion". The lessons are really good and the children must have been precocious who digested the matter provided, if of the ages stated. The plates are quite well drawn, and on this account are quoted by Deshayes in Lamarck's Histoire. On discovering this I prepared this note as

being of interest. I also can add that I have acquired a "Second Edition", published in 1838, which has a little more technical matter added, the intelligence of the children having apparently been thought capable of comprehending still more difficult items. "The Conchologist's Companion," by Mary Roberts, was published in 1834, with a Baxter type frontispiece, but I have not hitherto heard of an edition in 1832.

DA COSTA.

In these *Proceedings*, Vol. XI, p. 307, 1915, I published a note entitled "On Humphrey's Conchology", wherein I gave some details of a scrap of a "Conchology" which had been credited to "Humphrey" or to "Da Costa" or to both, and concluded that I leaned to the authorship by Da Costa.

In the Scientific Monthly for January, 1922, pp. 67-82, our member Professor J. D. A. Cockerell has published a delightful account of "Dru Drury, an Eighteenth Century Entomologist", reprinting correspondence of great interest. Since the article is not likely to be seen by many malacologists, I have ventured to transcribe a note regarding Da Costa which seems to explain some of the mystery regarding the above publication. It is unfortunate that this information is of a scandalous nature, but I think its importance will suffice for apology.

Writing to Dr. Pallas on 12th November, 1767, Drury stated : "Another piece of news I must inform you of is M. Da Costa is going to publish plates of nondescript animals—shells, insects, etc., in periodical numbers, five plates, with their descriptions being a complete number." Later, again writing to Dr. Pallas under date 28th February, 1768, Drury commented : "I sincerely lament with you ye fall of ye Aurelian Society, there wanted but two or three good members to have made it become respectable, but Da Costa's temper and principle was sufficient to overturn a Kingdom. I imagine ere this you have heard of his *Fate*. If not, I will tell you. He is no longer Librarian to ye Royal Society. He is dismissed from thence with ignominy and disgrace. (Here Drury gives details.) Hence ye periodical work he intended to publish, which I mentioned in my last, is entirely stopt; the circumstance I must own I am very sorry for on account of Natural History in general. But if it can not be promoted by men of better principles than him it is better perhaps for it to lye dormant."

However, on 14th January, 1770, when writing to Dr. Pallas, Drury added : "I mentioned in one of my letter's Da Costa's affair. He is now confined in ye King's Bench Prison at ye instance of Royal Society, and has been there near a year, from whence, I imagine, he will never return. He is at present engaged in writing a history of shells which he hopes will make its appearance this summer."

Apparently this "history of shells" refers to the "Numbers of a Conchology" published anonymously, which I was inclined to credit to Da Costa. From the fact that Elements of Conchology was issued in 1776, and the British Conchology in 1778, both under Da Costa's name, it is possible that Da Costa did get his release from the King's Bench Prison, though I cannot, at present, assert that as a fact.

RENIER.

Although some of Renier's species appear in the British List, no malacologist in the last fifty years has confirmed the data, and this is not surprising since the only known copies appear to be in the Library of the University of Padua, Italy. These were loaned to Sherborn for use in the preparation of the second part of his Index Animalium, and under his supervision photographic copies were made.

These copies have been used by me at my leisure in the preparation of the following notes. Three items are included: the first being entitled "Tavola alfabetica delle Conchiglie Adriatiche, nominate dietro il Sistema di Linneo, edizione di Gmelin". The title-page and flyleaf are missing or blank leaves, the Tavola first page being followed by p. vi and the pages numbered to xiii. The Tavola is a list of specific names numbered consecutively as to species and varieties, species, and new species, the totals reading 588, 444, and 95 respectively. The majority of the new names are *nomina nuda*, footnotes identifying these new species sometimes citing recognizable figures, but more often stating "Non descritto, né figurato", and in many cases "Prossimo al" or "Assomiglia al", which I treat as *nomina nuda*. Since some of the latter have been utilized as valid names, I have collated the ninety-five names claimed as new by Renier, placing together the *nomina nuda* and citing separately the valid names. The *nomina nuda* are *Chiton subdivisus*, *Mya punctulata*, *Solen candidus*, *Solen conversus*, *Tellina aperta*, *Tellina muricata*, *Tellina orbiculata*, *Tellina senata*, *Cardium clodiense*, *Cardium fornicatum*, *Cardium planatum*, *Mactra triangula*, *Venus bottarii*, *Ostrea foliacea*, *Ostrea nivea*, *Ostrea elongata*, *Mytilus dentatus*, *Mytilus denticulatus*, *Mytilus zonarius*, *Conus epaticus*, *Voluta buccinata*, *Voluta conoidea*, *Voluta minima*, *Voluta terna*, *Buccinum granulatum*, *Buccinum immaculatum*, *Buccinum trochiforme*, *Murex costulatus*, *Murex maculatus*, *Murex politus*, *Murex roseus*, *Murex vulpeculus*, *Trochus chienichinus*, *Trochus hyacintinus*, *Trochus spiralis*, *Trochus triquierter*, *Turbo amatistinus*, *Turbo craticulatus*, *Turbo fasciatus*, *Turbo lævis*, *Helix littoralis*, *Helix strigilata*, *Helix triquierter*, *Patella fissa*, *Patella lævissima*, *Patella membranacea*, *Patella squamulata*, *Dentalium lineare*, *Serpula colon*, *Serpula tetragona*, *Sabella calamus*, *Sabella gelatinosa*, and *Sabella membranacea*.

The valid names, as to introduction, appear to be :—

<i>Lepas perforata</i>	based on Ginnani, p. 42, T. xxx, f. 178.
<i>Tellina subtilissima</i>	" <i>Ela Tellina angulata</i> di Olivi."
<i>Arca gualtieri</i>	Gualtieri, T. 87, f. G.
<i>Conus errosus</i>	Gault., T. 825, f. G.
<i>fortis</i>	Described.
<i>listeri</i>	Lister, Tav. 765, f. 14.
<i>Bulla haliotoidea</i>	<i>Bulla spelta</i> Olivi (not Gmelin).
<i>Buccinum costulatum</i>	Gault., T. 43, f. P.
<i>craticulatum</i>	List., T. 967, f. 22.
<i>denticulatum</i>	List., T. 962, f. 15a et Kirc. 3, f. 35.
<i>sudarovich</i>	List., T. 964, f. 49.
<i>Murex bicolor</i>	Gault., T. 55, f. c. Ottimissime.
<i>carinatus</i>	List., T. 927, f. 14a.
<i>elabiatus</i>	List., T. 924, f. 16b ; T. 939, f. 34a.
<i>exasperatus</i>	Gault., T. 56, f. L.
<i>granulosus</i>	List., T. 836, f. 62.
<i>oblongus</i>	List., T. 1024, f. 90.
<i>reticulatus</i>	Gault., T. 56, f. F.
<i>varicosus</i>	Described.
<i>Trochus agiliotti</i>	Gault., T. 52, f. H. Ottima.
<i>areolatus</i>	List., T. 926, f. 20.
<i>attenuatus</i>	Argenv., T. 33, f. A. 7. Abbastanza buone.
<i>strigilatus</i>	List., T. 1019, f. 82.
<i>turbinatus</i>	Gault., T. 63, f. 1.
<i>virescens</i>	List., T. 618, f. 4 ; T. 648, f. 43.
<i>Turbo tessellatus</i>	List., T. 648, f. 42.
<i>unidentatus</i>	Gault., T. 61, f. M.
<i>Helix aurita</i>	Gault., T. 62, f. I.
<i>conica</i>	Gault., T. 61, f. I.
<i>conoidea</i>	Gault., T. 62, f. G.
<i>costulata</i>	Gault., T. 4, f. R.
<i>dimidiata</i>	List., T. 20, f. 16.
<i>fabria</i>	Gault., T. 4, f. I.
<i>incurva</i>	List., T. 61, f. 58.
<i>lineata</i>	List., T. 116, f. 11.
<i>olivi</i>	Gault., T. 6, f. I, F.
<i>terebra</i>	Born vignette, p. 364, f. C.
<i>turgidata</i>	Ginn., Tom. ii, T. 1, f. 5. Buona.
<i>vianelli</i>	Argenv., T. 61, f. 10. Ottima.
<i>Nerita fasciata</i>	Combina bene arco con la figura di
<i>Dentalium incurvum</i>	Gault., T. 5, f. 4, seconda.
	List., T. 85, f. 85.
	É l' <i>Helix Petholata</i> di Olivi.
	List., T. 110, f. 4. Argenv., T. 65, f. 4, 5.
	List., T. 139, f. 44, 45.
	List., T. 78, f. 79, 78.
	List., T. 561, f. 8.
	Described.

Some of the preceding names are invalid, being preoccupied, but their usage in every case must be worked out from the data given. Thus, in the British List appears *Eulima incurva* (Renier), on whose authority I know not. Renier's *Helix incurva* refers to three figures, which are those of species of *Lymnaea*, and in his later

Tavola there is included a *Lymnaea incurva* (Renier), which fixes it. How the name ever became attached to a species of *Eulima*, a shell so different, I do not at present understand. Some names otherwise in use are *nomina nuda* in Renier.

The second item is headed "Prospetto della Classe dei Vermi nominati e ordinati secondo il Sistema di Bosc", and is consecutively paged with the preceding, pp. xv-xxvii, p. xiv being blank. B. B. Woodward in the Cat. Books Brit. Mus. (Nat. Hist.) gives a note: "These two were issued together in 1804, and are the sole parts extant of a projected 'Prodromo' (Meneghini's introduction to Renier's 'Osservazioni postume', etc., q.v. *infra*). According to Bonola ('Della Bibliog. Malacol. Italiana dissert. inaug.', p. 39), the former had been issued previously in 1788." Bonola's statement is quite wrong, because this Tavola is founded on Gmelin, whose work was not published until 1791, moreover Olivi is quoted throughout, and Olivi's work appeared in 1792.

In this second item the Mollusca (*i.e.* shell-less molluscs) include the new genera *Discoides* and *Aglaia*, the latter of which is in usage, but the former does not appear to be described sufficiently for exact recognition at this place.

Among the Vermes Renier included *Serpula*, *Spirorbis*, a new genus *Scolixedion* and *Dentalium*.

The third item consists of eight tables with the title-page missing, but B. B. Woodward quotes it from Engelmann as "Tavola per servire alla classificazione e connoscenza degli Animali", 1807. The first table is headed "Regno Animale. Classificazioni Generali di Linneo, di Cuvier, di Lamarck, e di Virey". The second is entitled "Regno Animale. Classificazione generale secondo i caratteri zoometrici". This is apparently Renier's own scheme, and eleven classes are diagnosed, Politrimi, Polipi, Radiale, Vermi, Molluschi, Crostacei, Insetti, Pesci, Rettili, Uccelli, and Mammali.

The prior six tables deal with the first five, Molluschi following in two tables, *Dentalium* remaining with *Serpula* and *Spirorbis* among the Vermi.

The two tables covering the Molluschi are remarkable in that a scheme like that of Poli is utilized, a separate generic name being used for the animal and shell. While Poli named the animal and added *-derma* for the generic name of the shell, Renier has preserved the name given previously for the shell, and has named the animal separately by adding *-genus* to the shell, thus he wrote:—

I conclude such nomination is unacceptable in systematic work based on a binomial or binary scheme. All the names ending in *-genus* are new, but in addition there are a few entirely new names such as *Hirundigenus* for *Avicula*, *Arenarigenus* vel *Scolixedion* for

Arenaria and *Marginelligenus*, *Marginella*, *Cystigenus*, *Cystia*, *Imisisigenus*, *Imisia*, *Planospirigenus*, *Planospira*, quoting the last as of Fauj. He also included Lamarck's *Marginelligenus*, *Marginella*, but his own name was given to a bivalve placed between *Plancuna* and *Lima* and followed by *Pedum*, *Cystia*, and *Imisia*. Renier also includes his Mollusca, previously placed under Vermes, in this class *Molluschi*.

The reference of many names to Renier appears to be based on essays by Nardo, but of course the names can only be attributed to the later introduction, and cannot be carried back to the date of Renier, when they are not recognizable by the data given by Renier himself. Thus *Tellina serrata* Renier appears as a doubtful constituent of the British fauna, but *Tellina serrata* Renier is a *nomen nudum*; a second instance is *Solen candidus* Renier, often quoted in connection with *Solecurtus scopula*, Turton, but now rejected, which also proves to be a *nomen nudum* in Renier.

REEVE'S "ELEMENTS OF CONCHOLOGY".

In these *Proceedings*, Vol. XII, 1916, p. 44, Reynell gave some notes concerning the first publication of this work. He pointed out that ten parts came out, then ten years elapsed and then six more parts completed the work. He gave the title-page and contents of the parts and dates of publication as then known. I have now procured the original ten parts as issued complete save the front wrapper of part ix. The advertisements on the wrappers prove to contain much information of value. Thus on the wrapper of No. 1 is published: "To be completed in Twelve numbers. No. 1 on the 1st of March," and includes the title-page "Initiamenta Conchologica. 1846" and the preface dated Feb. 20, 1846. The wrapper of part iv bears different advertisements "in twelve monthly parts" "three of which are now published." On the wrapper of part vi the same appears, but an inset states "a moiety is before the public". Advertisements of the "Conchologica Iconica" provide better data, as it is stated that this was "Published monthly on 1st day of every month, the first part on Jan. 1, 1843", and this appears to be correct. From criticism of these and other announcements, it appears that the "Elements" soon suffered for I reckon out the dates of publication approximately as follows: Pt. i, 1st March, 1846; Pt. ii, 1st April, 1846; Pt. iii, 1st May, 1846; Pt. iv, June, 1846; Pt. v, July, 1846; Pt. vi, December, 1846; Pt. vii, May, 1847; Pt. viii, January, 1848; Pt. ix, August, 1848; and Pt. x, January, 1849.

It is fortunate that the names are practically all *nomina nuda*, the few requiring attention being those of the figured specimens. No species credited to Reeve himself appears until Part v, when *Cyllene grayi*, p. 65, pl. iii, f. 12, and *Phos cumingii*, p. 67, pl. iii, f. 16, are included. In Part vi *Oriscia dennisoni*, p. 84, pl. vii, f. 35, is figured.

Part viii includes *Fasciolaria persica*, p. 119, pl. xi, f. 45; *Turbinella imperialis*, p. 121, pl. x, f. 48; *Fastigiella* (n.g.) *carinata*, p. 122, pl. x, f. 46; *Cerithium nobile*, p. 125, pl. xii, f. 59; and *Triphoris grandis*, p. 127, pl. xii, f. 55.

Part ix includes: *Stylifer pyramidalis*, p. 129, pl. xii, f. 56; *Turritella picta*, p. 131, pl. xi, f. 51; *Phasianella venusta*, p. 132, pl. xii, f. 58; *Elenchus circulatus*, p. 113, pl. xii, f. 57; *Bankivia purpurascens*, p. 133, pl. xii, f. 61; *Littorina pulchra*, p. 135, pl. xii, f. 60; *Margarita pulchella*, p. 136, pl. xiv, f. 69, 70; *Trochus modestus*, p. 139, pl. xiii, f. 67; *Morulus*, p. 140; *M. cidaris*, p. 141, pl. xiii, f. 63; and *Solarium maculatum*, p. 144, pl. xiii, f. 62.

Part x includes *Monoptygma cinerea*, p. 148, pl. xv, f. 76; *Rissoa cumingii*, p. 151, pl. xv, f. 75; and *Tornatella coccinata*, p. 154, pl. xiv, f. 72.

Probably the most interesting item is Reeve's introduction of *Bankivia* as of Deshayes, figured in the *Traité Élem. de Conch.*, pl. lxx, f. 8, years previously (plate dated 1839), but never named. It is usually credited to Krauss, who published it as of Beck in the same year as Reeve, but undoubtedly earlier. S. P. Woodward (*Man. Moll.*, p. 144) in 1851 attributed *Bankivia* to Menke.

WOOD'S "GENERAL CONCHOLOGY".

This is a well-known work, dated 1815, but it does not appear generally known that it was issued in parts. I have before me a front cover, 4 pp. advertisement dated April, 1814, 16 pp. letterpress, and five coloured plates. The wrapper bears the wording: "No. 1. | Price Five Shillings. | General | Conchology; | or, | a description of | Shells, | arranged according to the Linnæan System, | and | Illustrated with Plates, accurately Drawn and Coloured from Nature, | By William Wood, F.R.S. and L.S., etc. | London: | Published by John Booth, Duke Street, | Portland Place. | A few Copies are printed upon a larger Paper, Price 7s. per Number. | Printed by B. R. Howlett, 10, Frith Street, Soho. |" The text deals with part of the genus *Chiton* only, the first three plates figuring Chitons, the last two *Lepas*. Apparently this part was issued in April or May, 1814.

Further information as to the issue of this work is now required, since new species occur throughout.

O. G. COSTA: " OSS. ZOOL. IS. PANTELLERIA."

Some years ago I endeavoured to trace this reference without success, no copy being available at the British Museum (Natural History), and Agassiz referred it to "Ann. Sci. Nat.", 1830, vol. xix. I could not find any mention of such a paper as Costa's in any "Ann. Sci. Nat." available. Mr. Tomlin has now shown me a copy of the tract and allowed me to make the following notes, for which I thank him.

The title-page bears the wording : “ Osservazioni Zoologiche | intorno | ai Testacei | dell’Isola di Pantelleria. | Lettera | del dottor Oronzio-Gabriele Costa | al chiarissimo | signor D. Giovanne Gussone | Botanico de ’ Giardini di Casa e Siti Reali di S.M. il Re | delle Due Sicilie, ec. ec. | Napoli, | Dallo Tipografia della Minerva | 1829. | ”

There is no suggestion as to any other publication than as a separate tract. It consists of twelve pages, the first eight covering the title-page and introduction, the pages 8–12 dealing with a “ Catalogo de’ Testacei dell’ I. di Pantalarea ”. This Catalogue contains some new species, and I have collated the following : p. 8, *Lucina decussata* ; p. 10, *Emarginula elongata*, *Emarginula solidula*, *Ancylus ? gussonii* ; p. 11, *Littorina cærulea* = *basterotii* Payr. = *cærulescens* Lam., and *Sigaretus ? vitreus* ; and on p. 12 is a new species of *Pleurotomia* described, but unnamed specifically.

The variation in the spelling of *Pantelleria* is remarkable, for, in addition to the two quoted, two or three more variants occur.

NOTE ON THE *TROCHUS FLAVIDUS*, *T. PALLIDULUS*, AND *T. FLAMMIGER* OF DUNKER.

By J. R. LE B. TOMLIN, F.E.S.

Read 9th June, 1922.

THESE three species were described by Dunker in the Proceedings of the Zoological Society for 1856, pp. 354–5, from unique specimens in the Cuming Collection, all of unknown locality.

All three types belong to *Calliostoma* and have a familiar Mediterranean facies, and a careful examination leaves room for but little doubt that they have been “ doctored ”, or, at any rate, very drastically cleaned.

Trochus flavidus, which Dunker compares with *dubius*, Phil., is inseparable from this latter. Similarly, *T. pallidulus* is the same as *laugieri*, Payr.—the species with which Dunker compares it. *T. flammiger* is compared with *pallidulus*; it is merely another unnecessary synonym of *laugieri*.

THE RADULA IN SOME MITRIDÆ.

By Lieut.-Col. A. J. PEILE.

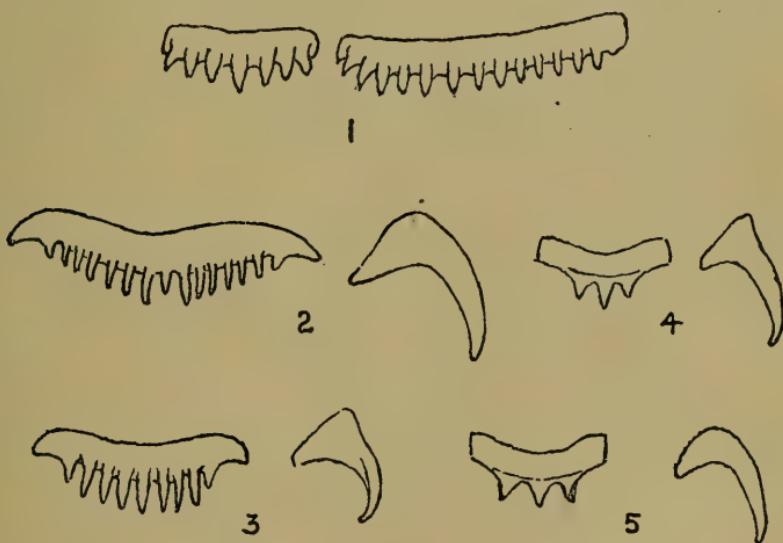
Read 7th April, 1922.

THE radula of the Mitridæ formed the subject of a paper by the Rev. Dr. A. H. Cooke in Proc. Zool. Soc., 1919, pp. 405 to 422. The object of the present note is principally to put on record the form of the radula in a few additional species. I have to thank the officials of the British Museum (Natural History) for permission to study the collections in their charge and refer to the same in this paper.

1. MITRA.

M. solida, Reeve. Two specimens from Twofold Bay, New South Wales, kindly provided by Mr. T. Iredale from his Roy Bell Collection, furnished radulæ having 64 and 61 rows respectively. Number of cusps on rhachidian 9. Number of cusps on laterals : 13 and 14 in one specimen, 15 and 16 in the other. (Fig. 1.)

M. fusca, Swainson. Madeira. A specimen in the British Museum Collection agrees fairly well with the figure in Troschel.



2. VEXILLUM.

V. costellaris, Lamarck. A specimen from Singapore, in the Gwatkin Collection (not recorded by Cooke), has 47 rows plus nascent. Rhachidian is bow-shaped with 15 cusps and is peculiar in that the centre cusp is smaller than the rest, which diminish slightly outwards. Lateral rather blunt. (Fig. 2.)

A Twofold Bay specimen furnished a radula similar to that of its ally *tasmanica*, T. Woods, but base of rhachidian is less arched. Number of rows 57. Number of cusps on rhachidian 9.¹ Laterals stouter than those of *tasmanica* except at the distal end. (Fig. 3.)

3. PUSIA.

P. merula, Sowerby. An immature specimen from Durban, kindly provided by Mr. J. R. Le B. Tomlin. Somewhat resembles that of *hizenense*, Pilsbry, from Japan. Number of rows 64 plus nascent. (Fig. 4.)

P. tricolor Gmelin. A specimen from Malta, in the Gwatkin Collection (not recorded by Cooke), has about 55 rows. It is very like the radula of *ebenus*, Lamarck, but laterals are rather broader. (Fig. 5.)

The species with radulæ of this type are placed by Cooke in a "Group 2" under *Vexillum*. One of these species is *porphyreticum*, Reeve, which has a squat costulate shell having all the characters of that of *microzonias*, Lamarck, the type species of *Pusia*, but of which the radula is not known. Of the remainder, though *ebenus* and *tricolor* have longer, smooth shells, their varieties, *defrancii*, Payr., and *savignyi*, Payr., respectively, are costulate. *Hizenense* and *merula* form another group with shells slightly costulate, but it is significant that Sowerby in his description of *merula* (Journal of Conchology, vi, p. 8) draws attention to the resemblance of the shell to that of *ebenus*. *Australis* differs somewhat from the others, having a smooth shell with much higher spire.

On the evidence of the radula it seems desirable that *Pusia* be given generic rank and the above-mentioned species be included therein.

4. CYLINDRA.

The radula of *C. nucea*, Meuschen, is figured in Troschel among those of the Marginellidæ, no doubt because of the absence of laterals. The rhachidian, however, is very like that of *Vexillum*, with 9 cusps, but these are smaller and further apart than is usual in that genus. The British Museum Collection contains a specimen of the radula of *C. dactylus*, L. It is in bad condition, but evidently lacks laterals. The rhachidian appears to be almost rectangular, with slightly incurved base reminiscent of *Mitra* and *Marginella*. The number and form of the cusps cannot be determined.

¹ The rhachidians of three other specimens have 8, 9, and 11 cusps respectively.

NOMENCLATURE OF BRITISH *LITTORINIDÆ*.

By R. WINCKWORTH.

Read 7th April, 1922.

THE species formerly included under *Littorina* seem sufficiently distinct in methods of reproduction to merit separation into distinct genera. It has long been known that *L. littorea* has pelagic egg capsules and passes through a free veliger stage, while *L. rufus* is viviparous, and *L. littoralis*, like the species of *Lacuna*, deposits eggs in ootheca on seaweeds.

Dr. Dall and others in recent years have assumed the type of *Littorina*, Féruccac, to be *littoralis*, L., presumably following Rang's selection in 1829. But this species is not included in Féruccac's original description, which is found in the Tableau, 1822, p. xxxiv :—

" *Paludina* . . . 5e S. G. *Littorine*, *Littorina*, Férucc. ; *Turbo*, Lin. ; *Trochus*, Adanson ; *Kruck*, Ocken."

Of these three references the first, *Turbo*, L., is too wide to give any indication ; we may note, however, that it includes *littoreus*, *neritoides*, and *obtusatus*, but not *littoralis*, which is described under *Nerita*, L. The second, *Trochus*, Adanson, pl. xii, includes four species : Marnat = *Turbo punctatus*, Gm., allied to *saxatilis*, Olivi ; Boson = *Turbo muricatus*, L., a *Tectarius* ; Daki and Rifet, included in Gmelin's *Turbo afer*, and both, I think, indeterminate. The last reference is to Oken, Lehrbuch Naturg. iii, 1, 1815, p. 257, where we find : 4 Gattung, Kruck ; 1 *Turbo littoreus* ; 2 *Turbo punctatus*.

Thus the species available for selection as type are *punctatus*, *muricatus*, *afer*, and *littoreus* ; and the selection is made by Blainville, 1828, in Dict. Sci. Nat., lvi, p. 98, where he refers to " le genre *Littorine* ayant pour type le *T. littoreus* ". So, too, Deshayes, 1843, in Lamarck, Hist. Anim. s. Vert., ed. 2, ix, p. 198, note ; and, again, Gray in Proc. Zool. Soc., 1847, definitely designate *littoreus* as type of *Littorina*. *Algaroda*, Dall, 1918, with the same type is an absolute synonym.

For the *littoralis* group, Brown's name *Neritoides*, in Illust. Brit. Conch., 1827, pl. xliii, with sole species *littoralis*, is available. The previous *Neritoides*, Meuschen, 1779, does not invalidate Brown's name, since it occurs in an article in Naturforscher, xiii, p. 78, in which the author has not applied the principles of binary nomenclature (Rule 25b).

L. neritoides is usually referred to the genus *Melarhaphe*, Menke, which occurs in synonymy in his Synopsis Methodica Molluscorum, 1828, p. 23 : " *Paludina glabrata*, Zgl. (*Turbo cærulescens*, Lam., *T. rupestris*, Chabr., *Melarhaphe glabrata*, Mhlfd.)." *Paludina glabrata*, Zgl., is described by C. Pfeiffer, 1828, in Naturg. Deutsch. Moll., iii, p. 46, and from the figure must be *Turbo neritoides*, L. ; these names in the second edition of Menke's Synopsis, 1830, are all

included under *Littorina Basterotii*, Payr., which removes any doubt as to the species intended.

For *Littorina rufa* (Maton), which must take the earlier name of *saxatilis*, Olivi, we can use *Littorivaga*, Dall, 1918, in Proc. Biol. Soc. Washington, xxxi, p. 137. The type is *L. sitchana*, Philippi, a form scarcely distinct from *L. groenlandica*, Menke.

In view of the small number of British species of Littorinidae, it may be considered convenient to sink these names as subgenera of *Littorina*; but it may be pointed out that malacologically the recognized genus *Lacuna* is closer to *Neritoides* than *Littorivaga* is to *Littorina*. Accordingly I would group our species as under.

Genus LITTORINA, Féussac, 1822. Type: *Turbo littoreus*, L.

1. LITTOREA (L.), 1758. Normally, the angle of the spire is about 90°. Some northern forms have a more acute spire and more elongated body whorl. The form *brevicula*, Jeffreys, 1865 (= *conoidalis*, Locard), is more globose, with a less produced spire, which forms an angle of about 120°. The estuarine form *paupercula*, Jeffreys, is scarcely distinct from *brevicula*.

Genus LITTORIVAGA, Dall, 1918. Type: *L. sitchana*, Philippi.

2. SAXATILIS (Olivi), 1792 (as *Turbo*). The variation of this polymorphous species has been fully discussed and beautifully illustrated by Dautzenberg and Fischer in Rés. Camp. Sci. Monaco, xxxvii, 1912, pp. 187–201. Their arrangement is convincing, and is quoted here for convenience of reference:—

- (a) Subsp. *saxatilis*, typica, with v. *lugubris*, D. & F., and v. *nervillei*, D. & F.
- (b) Subsp. *tenebrosa*, Mont., 1803, with v. *elata*, D. & F., and v. *similis*, Jeff.
- (c) Subsp. *jugosa*, Mont., 1803, with v. *bynei*, D. & F.
- (d) Subsp. *patula*, Thorpe, 1844, with v. *attenuata*, D. & F.
- (e) Subsp. *nigrolineata*, Gray, 1839, with v. *compressa*, Jeff., and v. *matoni*, D. & F.
- (f) Subsp. *rufa*, Maton, 1797, with v. *globosa*, Jeff., and v. *rudissima*, Bean.
- (g) Subsp. *groenlandica*, Menke, 1830.

The form *tenebrosa* can hardly be ranked as a distinct species, since there are intermediate forms connecting with *jugosa* through *similis*, while other examples approach *saxatilis* and even *rufa*. The northern race *groenlandica* is certainly to be included in this species, and I have taken a series of graded forms in Orkney ranging from *similis* at ordinary high-water through *jugosa* above high-water to *groenlandica*, which may be found even 40 or 50 feet higher still, as described by Dacie in Journ. of Conch., xv, 1917, p. 179, where he gives this form the name of *altilcola*, which should be rejected as a synonym of *groenlandica*.

Genus MELARHAPHE, Menke, 1828. Type: *Paludina glabrata* = *Turbo neritoides*, L.

3. NERITOIDES (L.), 1758. Linné's species is the Mediterranean shell, and if a name is required to distinguish our race, which only differs slightly from it, we can use Montagu's name *petræa*.

Genus NERITOIDES, Brown, 1827. Type: *Nerita littoralis*, L.

Dautzenberg and Fischer, in Journ. de Conchyl., Ixii, 1915, pp. 87-128, have given a full account of the species *obtusata* and *littoralis* and their variation. *Littorina æstuarii*, Jeffreys, seems a good species, and Dautzenberg, in correspondence 1920, regards it as distinct.

4. OBTUSATA (L.), 1758. The type specimen is figured by Hanley in Ipsa Linnaei Conchylia. It is the same as *Litorina arctica*, Möller, and the American race is *L. palliata*, Say. Occurrence in Britain doubtful.

5. ÆSTUARII (Jeffreys), 1869.

6. LITTORALIS (L.), 1758. The northern subspecies is v. *compacta*, Jeffreys. The typical subspecies includes v. *pachychila*, D. & F., and v. *retusa*, Lamarck; the former is the thick heavy shell common on both sides of the English Channel, the latter is the same as *neritiformis* of Brown.

My thanks are due to Mr. Iredale and Mr. Tomlin for help with literature.

* * * Note added after reading by permission of the Publication Committee.

Although I have followed M. Dautzenberg above in regarding *Turbo saxatilis*, Olivi, as conspecific with *T. rufus*, Maton, I think it better to retain the latter name for our British forms, until Olivi's species has been examined anatomically. The very close resemblance between the isolated Venetian colony and some forms of our species may be only convergence of shell form, when we recall how close some forms of *rufus* and *littorea* are in shell characters, so that they are not easily distinguished without examining the soft parts.

Another point raised in discussion was that as the distinctions between the genera were mainly methods of reproduction, they were ecological, and should have no place in a classification based on morphology. The two closest groups are *Littorina* s.s. and *Neritoides*, and to my mind the distinction between a mollusc with a free veliger stage and one that does not pass through this stage still seems of generic importance; while in the other groups the genera could be separated on anatomical and conchological distinctions. Those who do not see with me in this may regard the names as of subgeneric rank. .

This seems a good opportunity for killing the name *Bacalia*, Gray, 1840, a *nomen nudum* which becomes valid in 1854 when H & A. Adams introduced it in synonymy in Genera, i, 312. I choose as type *littorea*, Linné; it thus becomes an absolute synonym of *Littorina*, Féussac.

CONTRIBUTIONS TO THE KNOWLEDGE OF THE GENERA
CYPRÆA AND *TRIVIA*.

By Dr. FRANCIS A. SCHILDER.

(Communicated and edited by H. O. N. Shaw, F.Z.S.)

Read 12th May, 1922.

I. NOTES ON THE NOMENCLATURE OF SOME SPECIES.

IN former years authors did not always strictly follow the rules of nomenclature and the laws of priority, which has caused recent workers much trouble and confusion.

Linnæus (1758, *Syst. Nat.*, 10th ed.) is the beginning of the binomial system.

Lamarck (1810, *Ann. du Mus.*, xvi, p. 92), to quote only one case, called a species *C. rufa* (sp. nov.), and added *C. pyrum*, Gmel. (1790), as a synonym.

Gray (1824–28, *Zool. Journ.*, i, iii, and iv) gave the name *Cypræa diluviana* to a “new” species, though he knew that its var. *minor* was identical with *C. fabagina*, Lam. (1810), and he unhesitatingly used *C. cervina*, Lam. (1810), and *physis*, Broc. (1814), as specific names, and *C. cervus*, Linn. (1771), and *pyrula*, Lam. (1810), as synonyms; but the same author (1824, op. cit., i, p. 380) changed the name *Cypræa pulchella* given by himself to a new species (1824, op. cit., i, p. 143) into *C. pulchra*, finding the former word pre-occupied by Swainson (1823) for another species, and he recognized (1828, op. cit., iv, p. 66, etc.) that *C. princeps*, *gibbosa* (both are called by him sp. nov.), and *melanostoma*, Sow., must be named *C. valentia*, Perry, *leporina*, Lam., and *camelopardalis*, Perry, which are prior names, but little known at that time.

Gray knew that the name *Cypræa similis* had been used by Gmelin (1790) for a species considered by him (1828, op. cit., iv, p. 85) as a synonym of *C. erosa*, Linn.; but three years later (1831, *Zool. Miscel.*, p. 36), he called another species *Cypræa similis*, and this name was accepted by all following writers till 1909!

It must also be borne in mind that conchologists occupied only with the study of recent shells did not trouble about specific names given by palæontologists, and vice versa.

Many authors did not examine the original descriptions, but copied errors from the previous writers, and thus the word *californica*, erroneously printed in Sowerby's “Conchological Illustrations” (1832) instead of *californiana*, Gray (1827, op. cit., iii, p. 365), was adopted by all writers (except Carpenter in 1872) to Hidalgo (1906). All authors since Dillwyn (1817) were of opinion that *Cypræa cruenta*, Gmel., which evidently belongs to a variety of *C. errones*, Linn., is the same species as *variolaria*, Lam., which opinion has been corrected by Martens (1879), Weinkauff (1881), and then again by Hidalgo (1906), for Roberts (1885) had renewed the false synonymy.

The frequent change of a specific name by the authors of the nineteenth century may be illustrated by the following example: the famous Orange-Cowry was called *Cypræa aurantium* by Martyn (1780), Gmelin (1790), Reeve (1845), Jay (1850), Roberts (1885), Melville (1888), Dautzenberg (1902), and Hidalgo (1906); *C. aurantia* by Roberts (1870), Garrett (1879), and Rossiter (1882); *C. aurantiaca* by Simroth (1907), and *C. aurora* by Chemnitz (1795, as of Solander), Lamarck (1810, 1822), Dillwyn (1817), Gray (1824), Sowerby (1825, 1837), Deshayes (1830, 1844), Donovan (1834), Reeve (1842), Chenu (1844, 1847), Kiener (1845), Adams (1858), Sowerby (1870), Weinkauff (1881), and Paetel (1887). The first is correct, the others are synonyms. The interesting change of the names *arctica*, *europaea*, *coccinella*, and *pediculus*, given to the common European *Trivia*, can be looked up in Dautzenberg and Fischer (1912, Rés. camp. scient. Albert de Monaco, xxxvii, pp. 160-5).

Deshayes (1844, Anim. sans. vert., 2nd ed., pp. 480, etc.) changed his *Cypræa* (now *Trivia*) *lamarckii* into *pedicularis*, being preoccupied by Gray, and published on pp. 501 and 504 interesting remarks on the invalidity of names given only in manuscript works or preoccupied by older homonyms.

Reeve (1845, Conch. Icon., *Cypræa*, spec. 65) changed *C. undata*, Lam. nec Chem., into *diluculum*, nov. nom.; the latter name must undoubtedly stand, though one cannot approve of Reeve's arguments: *C. undata*, Chem., is not valid, and Gmelin cited it as *C. undulata*. Lamarck first described (1810) *C. ziczac*, Linn., as *undata*, and *undata* (= *diluculum*) as *zigzag*; in a following work (1822) he exchanged the two names.

Mörch (1852, Catal. Conch. Yoldi, p. 113, etc.) proposed the following changes:—

<i>Cypræa amarata</i> , Meusch. (1787)	nomen pro	<i>C. scurra</i> , Gmel. (1790).
„ <i>arlequina</i> , Chem. (1788)	„	<i>histrio</i> , Gmel. (1790).
„ <i>succincta</i> , Linn. (1758)	„	<i>cinerea</i> , Gmel. (1790).
„ <i>pardus</i> , Bolten (1798)	„	<i>pantherina</i> , Dill. (1817).
„ <i>crenata</i> , Bolten (1798)	„	<i>variolaria</i> , Lam. (1810).

All these names must be refused; *amarata* and *arlequina* are created by invalid authors, *succincta* is a variety of *C. onyx*, as Hanley (1855) showed, and the two species named by Bolten contain also *C. tigris*, Linn., and *caurica*, Linn.

Orbigny (1852, Prodr. Paléont., iii) changed the names of some fossil species as preoccupied by recent ones: *Cypræa ambigua*, Grat., *atomaria*, Grat., *ovum*, Grat., etc., were called *C. subambigua*, *subatomaria*, *subovum*, etc. Bayan (1870, Études faites École d. Mines, i, p. 57) did the same: *Cypræa jousseaumei*, nov. nom. pro *marginata*, Fuchs nec Gask.

Roberts (1870, Amer. Journ. Conch., v, App., p. 189, etc.) tried to show that the ancient names given by Rumphius (1705), *Porcellana montosa*, *salita*, etc., must be used instead of the names given by Linnæus, and Brazier (1881, Proc. Linn. Soc. New South

Wales, v, pp. 502 and 503) approved of it. Roberts also changed *Trivia sulcata*, Gask. nec Dill., into *T. gaskoinii*.

Weinkauff (1881, Syst. Conch. Cab., v, 3) did not cite Roberts' catalogue, and omitted many names in his monograph, such as *C. annæ*, *fuscomaculata*, *helenæ*, *semiplota*, *spadix*, *venusta*, etc. Other words are written incorrectly (*pellicula*, *cicatricosa*); he "corrected" some specific names (*costatopunctata*, *sauliæ*), but left valid prior names as synonyms of later ones, as *C. aurora*, Sol. nomen pro *aurantium*, Martyn, *melanostoma*, Sow., n.p. *camelopardalis*, Perry, *princeps*, Gray, n.p. *valentia*, Perry, *T. tremenza*, Ducl., n.p. *exigua*, Gray, etc. His greatest merit lies in his having pointed out that *C. teres*, Gmel., is not the slender species called *subteres* nov. by himself, but = *tabescens*, Gray nec Dill. (cf. Zool. Journ., iii (1827), p. 316, and Proc. Malac. Soc. London, viii (1909), p. 304).

The next monographer, Roberts (1885, in Tryon, Man. of Conch., vii, p. 153, etc.), also omitted some varietal names (*consobrina* and *propinqua*, Garrett, 1879; *aberrans* and *rouxi*, Ancey, 1882; *alveolus*, Tapparone, 1882), but paid more attention to the rules of nomenclature. The following specific names used by Weinkauff are changed by Roberts. In these notes the proposed changes when in brackets have, in their turn, been turned down by later authors.

<i>C. (adelinae nov.)</i>	n.p. <i>fuscomaculata</i> , Sow. (1870) nec Pease (1868).
„ <i>aurantium</i> , Martyn (1789)	n.p. <i>aurora</i> (Sol.), Lam. (1810).
„ <i>camelopardalis</i> , Perry (1811)	n.p. <i>melanostoma</i> (Leathes), Sow. (1825).
„ <i>(tabescens</i> , Dill., 1817)	n.p. <i>teres</i> , Gmel. (1790; as of Weinkauff, 1881).
„ <i>(teres</i> , Gmel., 1790)	n.p. <i>subteres</i> , Weink. (1881).
„ <i>venusta</i> , Sow. (1847)	n.p. <i>thatcheri</i> , Cox (1869).
<i>T. insecta</i> , Migh. (1845)	n.p. <i>hordacea</i> , Kien. (1845).
„ <i>(sulcata</i> , Gask., 1848)	n.p. <i>gaskoinii</i> , Rob. (1870).

Roberts left *C. macula*, Angas, *princeps*, Gray, *undata*, Lam., *T. europaea*, Montg., and other names, and refused those given by Rumphius (1705), beginning the valid names with Linnæus, 1767 (not 1758!).

Melvill (1888, Mem. Proc. Manchester Lit. Phil. Soc., (4) i, p. 184, etc.) recommended the following changes:—

<i>C. diluculum</i> , Reeve (1845)	n.p. <i>undata</i> , Lam. (1822).
„ <i>(honoluluensis</i> , nov.)	n.p. <i>madagascariensis</i> , Gmel. (1790).
„ <i>(ovata</i> , Perry, 1811)	n.p. <i>turdus</i> , Lam. (1810, Melvill stated 1822).
„ <i>valentia</i> , Perry (1811)	n.p. <i>princeps</i> , Gray (1824).

Sacco (1894, Moll. terr. terz. del Piemonte, xv) wanted to establish the following:—

<i>C. achatidea</i> , Sow. (1837)	n.p. <i>physis</i> , Broc. (1814; only the recent specimens).
„ <i>(flavicula</i> , Lam., 1810)	n.p. <i>elongata</i> , Broc. (1814).
„ <i>(minor</i> , Grat., 1845)	n.p. <i>ovum</i> , Grat. (1845), <i>subovum</i> , Orb. (1852).
„ <i>utriculata</i> , Lam. (1810)	n.p. <i>physis</i> , Broc. (1814; the fossil specimens).
<i>T. lamarckii</i> , Desh., 1836	n.p. <i>pedicularis</i> , Desh. (1844).

He adopted *subatomaria*, Orb., *jousseaumei*, Bayan, etc., as specific names, but thought that *Trivia grayi*, Mich., *subrostrata*, Gray, etc., might be left, since *Trivia* was separated as a distinct genus. Sacco also changed the subgenus *Tigris*, Troschel (1863), into *Vulgusella*, Jouss. (1884), but without cause. Linnæus used *Tigris* for a genus of *Mammalia* in 1735, but in 1758 it had only specific rank; therefore the genus *Tigris* is not cited by Sherborn (1902, Index Animal., i, p. 977), and cannot be regarded as valid. *Tigris*, Klein (1753), a genus of mollusca (cf. Agassiz, 1848, Index universalis, p. 1070), is likewise not valid.

Cossmann gave new names to fossil species preoccupied by previous authors. In 1896 (*Feuille de jeunes naturalistes* (3), xxvi, p. 1) he changed *Basterotia*, Jouss. (1884) nec Hoern. (1859), into *Cavicypræa*, nov. subg., and in 1903 (*Essais paléoconch. comp.*, v, p. 143, etc.) he proposed the following:—

<i>C. (polysarca, nov.)</i>	n.p. <i>gibbosa</i> , Borson (1820) nec Linn. (?)
„ <i>tatei, nov.</i>	n.p. <i>amygdalina</i> , Tate (1890) nec Grat. (1845).
„ <i>ventripotens, nov.</i>	n.p. <i>pinguis</i> , Conr. (1855) nec Mich. (1838).

He separated *C. flavicula*, Lam., from *elongata*, Broc., and called the fossil *Trivia, pedicularis* and not *lamarckii*.

Hidalgo (1906–7), in his classical “Monographia del Género Cypræa” (*Mem. R. Acad. Cienc. Madrid*, xxv), published many changes of specific names, some of which are challenged by various writers. Hidalgo believed the not strictly binominal Meuschen to be valid, and also incorrectly interpreted some of the oldest descriptions. The names changed by him are as follows:—

<i>C. (amarata, Meusch., 1787)</i>	n.p. <i>scurra</i> , Gmel. (1790).
„ <i>chinensis</i> , Gmel. (1790)	n.p. <i>cruenta</i> , Dill. (1817) nec Gmel. (1790).
„ <i>(dautzenbergi, nov.)</i>	n.p. <i>fuscomaculata</i> , Pease (1868 nec 1865).
„ <i>(fragilioides, Meusch., 1778)</i>	n.p. <i>cinerea</i> , Gmel. (1790).
„ <i>fuscomaculata</i> , Pease (1865)	n.p. <i>adelinae</i> , Rob. (1885).
„ <i>gillei, Jouss. (1893)</i>	n.p. <i>intermedia</i> , Redf. (1847) nec Kien. (1845).
„ <i>(hirundo, Linn., 1758)</i>	n.p. <i>neglecta</i> , Sow. (1837).
„ <i>(kieneri, nov.)</i>	n.p. <i>hirundo</i> , Sow. (1837) nec Linn. (1758).
„ <i>(melvilli, nov.)</i>	n.p. <i>ursellus</i> , Kien. (1845) nec Gmel. (1790).
„ <i>notata, Gill (1858)</i>	n.p. <i>macula</i> , Angas (1867).
„ <i>(errones, var.) ovum, Gm. (1790)</i>	n.p. <i>sophiae</i> , Braz. (1876).
„ <i>(punctulata, Gmel., 1790)</i>	n.p. <i>tabescens</i> , Dill. (1817).
„ <i>robertsi, nov.</i>	n.p. <i>punctulata</i> , Gray (1824) nec Gmel. (1790).
„ <i>turdus, Lam. (1810)</i>	n.p. <i>ovata</i> , Perry (1811).
„ <i>vinosa, Gmel. (1790)</i>	n.p. <i>pantherina</i> , Dill. (1817).
<i>T. arctica, Pult. (1799)</i>	n.p. <i>europaea</i> , Montg. (1808).
„ <i>californiana, Gray (1827)</i>	n.p. <i>californica</i> , Sow. (1832 as of Gray).

But he, again, left names for later writers to change.

Dall (1909, *The Nautilus*, xxii, p. 125) changed *Cypraea sowerbyi*, Kien. (1845) nec Ant. (1839), into *C. annettæ*, nov.

Shaw (1909, *Proc. Mal. Soc. London*, viii, p. 288, etc.) examined the validity of some authors in an excellent revision of the genera *Cypraea* and *Trivia*, and he also proposed many changes of names, as follows :—

<i>C. cineræa</i> , Gmel. (1790)	n.p. <i>fragilioides</i> , Meusch. (1778).
„ <i>friendii</i> , Gray (1831)	n.p. <i>scottii</i> , Brod. (1831) (Menke in 1847 recognized the priority of the former).
„ <i>fuscomaculata</i> , Pease (1865 n.p. <i>dautzenbergi</i> , Hid. (1907). and 1868)	
„ <i>fuscorubra</i> , nov.	n.p. <i>similis</i> , Gray (1831) nec Gmel. (1790).
„ <i>gambiensis</i> , nov.	n.p. <i>nebulosa</i> , Kien. (1845) nec Gmel. (1790) (Taylor neglected this change in 1913).
„ <i>hidalgoi</i> , nov.	n.p. <i>leucostoma</i> , Gask. (1843) nec Gmel. (1790).
„ <i>hirundo</i> , Linn. (1758)	n.p. <i>kieneri</i> , Hid. (1906).
„ <i>neglecta</i> , Sow. (1832)	n.p. <i>hirundo</i> , Hid. (1906) nec Linn. (1758).
„ (<i>obtusa</i> , Perry, 1811)	n.p. <i>pantherina</i> , Dill. (1817).
„ (<i>prestoni</i> , nov.)	n.p. <i>interrupta</i> , Gray (1824) nec Bolten (1798).
„ <i>scurra</i> , Gmel. (1790)	n.p. <i>amarata</i> , Meusch. (1787).
„ <i>subteres</i> , Weink. (1881)	n.p. <i>teres</i> , Sow. (1832) nec Gmel. (1790).
„ <i>teres</i> , Gmel. (1790)	n.p. <i>punctulata</i> , Hid. (1906) nec Gmel. (1790), <i>tabescens</i> , Gray (1824).
„ (<i>variolaria</i> , Lam., 1810)	n.p. <i>chinensis</i> , Hid. (1906) vix Gmel. (1790).
„ <i>zonaria</i> , Gmel. (1790)	n.p. <i>zonata</i> , Chemn. (1788).
<i>T. aperta</i> , Swains. (1822)	n.p. <i>oniscus</i> , Lam. (1810) nec Bolten (1798).
„ <i>corinneeæ</i> , nov.	n.p. <i>affinis</i> , Marr. (1867) nec Duj. (1837).
„ <i>edgari</i> , nov.	n.p. <i>grando</i> , Gask. (1848) nec Potiez (1838).
„ <i>gaskoinii</i> , Rob. (1870)	n.p. <i> sulcata</i> , Gask. (1848) nec Dill. (1817).
„ <i>lathyrus</i> , Blainv. (1826)	n.p. <i>pulex</i> , Gray (1827).
Subg. <i>Monetaria</i> , Trosch. (1863)	n.p. <i>Aricia</i> (Gray), Adams (1858) nec Savigny (1817), etc. See also op. cit., x (1912), p. 26.

Iredale (1916, *Proc. Mal. Soc. London*, xii, p. 93) changed *C. umbilicata*, Sow. (1825), into *hesitata*, nov., but Verco (1918, *Trans. Proc. R.S. South Austr.*, xlvi, p. 148) pointed out that the unfortunately chosen name *armeniaca* (= an apricot, not ex Armenia !) given by himself (1912, op. cit., xxxvi, p. 211) to a variety must be applied to the species.

Hedley and Hidalgo (1907) described a *Trivia* from Australia as a survival of the fossil *avellanoides*, MacCoy. In 1918 (Proc. R. Soc. New South Wales, li) the former recognized it to be distinct, and called the recent species *T. caelatura*, nov.

Having been occupied these last few years with the study of

the genera *Cypræa* and *Trivia*, and whilst preparing a catalogue containing all species, varieties, and synonyms, recent as well as fossil, and the interpretations given to them by the various authors, I have found many names which require changing either on account of older homonyms, omitted by previous authors, or from other reasons. All these changes are included in this paper, and I shall treat them in alphabetical order as Shaw did, for no really satisfactory system of grouping has so far been found.

I propose the six following new names, my reasons for so doing will be found in the notes on the names by which the species are now known:—

<i>C. dillwyni</i>	nov. nom. pro	<i>C. margarita</i> , Gray.
„ <i>liliputana</i>	„	<i>T. scabriuscula</i> , Koenen.
„ <i>massauensis</i>	„	<i>C. gemmula</i> , Weink.
<i>T. antillarum</i>	„	<i>T. subrostrata</i> , Gray.
„ <i>nix</i>	„	„ <i>nivea</i> , Sow.
„ <i>occidentalis</i>	„	„ <i>pulla</i> , Gask.

CYPRÆA ANNULATA, Gray (1828).

Hidalgo (1906, Mon. gén. Cypræa, pp. 24 and 146) says that *Cypræa annulus*, Linn., is figured in the "Encyclopædia Metropolitana" (1810) on tab. xiv under the name *C. annulata*. If this name be regarded as a valid synonym, *C. annulata*, Gray, should then receive a new name, for there is no synonym nor varietal name to supply it.

CYPRÆA CAMELOPARDALIS, Perry (1811).

Sowerby and Vigors (1828, Zool. Journ., iii, p. 315; iv, pp. 218–20) contested the validity of Perry's "Conchology", for the author gave many superfluous names to species already described by previous writers. It is now generally admitted that the names given by Perry must be accepted.

CYPRÆA CINEREA, Gmelin (1790), and CITRINA, Gray (1825).

The names of these species must not be changed, for *cinerea*, Meuschen (1787, = ?), and *citrina*, Humphreys (1797, = *cicerculata*, Linn.), since neither author is accepted as valid (*vide* Shaw, Proc. Malac. Soc., 1909, p. 292).

CYPRÆA DESHAYESII, Binkhorst (1861).

This name (Monogr. Gastr. Ceph. du Limbourg, p. 17) was pre-occupied by Gray (1828, Zool. Journ., iv, p. 83), whose *Cypræa deshayesii* is now considered as a *Gisortia*; the name given by Binkhorst must therefore be changed into *C. strombecki*, Kaunhowen (1898, Paläont. Abhandl., Neue Folge, iv, pars. i, p. 75).

Cypræa deshayesiana, Rouault (1848, Bull. Soc. Geol. France, (2) v, p. 207), was afterwards changed by its author (1848, Mem. Soc. Geol. France, (2) iii, p. 501) into *C. koninckii*; the former being a *nomen nudum*, there is no doubt that *koninckii* is the valid name of the species.

* *No cinerea in the Zoophylacium, 1781,*

I do not propose to use the word *hoernesiana* for designating *Cypraea globosa*, Duj.

CYPRÆA ELONGATA, Brocchi (1814).

This name, given by Brocchi, was preoccupied by Perry (1811, = *C. caurica* var.). *Cypraea flavigula*, Lam. (1810), was identified by Cocconi (1873), Sacco (1894), and Cerulli (1911), who added "elongata ?". Sacco only used this name for designating the species from the Italian Miocene. Being a species from the French Oligocene, *flavigula* cannot be identical with *elongata*. Cossmann (1903) and many previous authors have separated the two. *Cypraea subelongata*, Orb. (1852), also scarcely belongs to *elongata* (cf. Sacco, 1894, pp. 21, 31, 32). Therefore Brocchi's species must be changed into *Cypraea longiscata*, Mayer (1875, Journ. de Conch., xxiii, p. 66).

CYPRÆA ERRONES, Linnæus (1758).

The name given by Linnæus (1758, Syst. Nat., 10th ed., p. 723) is not, as Dunker (1852) believed, a typographical error; for it is printed in the same way by Linnæus in 1764 (Mus. Lud. Ulr.) and 1767 (Syst. Nat., 12th ed.). If it were only an error, the name ought to be changed into the more classical form *erronea*, which name is published for the first time by Müller (1775, Des C. v. Linné Natursystem, vi) and then by Born (1780), Schröter (1783), Sowerby (1825), Menke (1843), Mörcz (1852), Schaufuss (1869), all of whom give *erronea* specific rank instead of *errones*.

CYPRÆA EXANTHEMA, Linnæus (1767).

Lamarck (1810) recognized that *Cypraea zebra*, Linnæus (1758, Syst. Nat., 10th ed., p. 719), was a young shell of *C. exanthema*, Linnæus (1767, op. cit., 12th ed., p. 1172), and Hanley (1855) confirmed it. This common West Indian species must therefore be called *Cypraea zebra*, Linn.

CYPRÆA FABAGINA, Lamarck, var. BROCCII, Desh. (1844), etc.

It is obviously permissible to correct the names *brochii*, Desh. (1844, = *fabagina*, Lam., var.), *gratteloupi*, Orb. (1852, = ? *flavigula*, Lam., var.), and *orbigniana*, Grat. (1845), into *brocchii*, *grateloupi*, and *orbigniana*, i.e. in the same way as these names were written by their owners. Certain writers have already done so, but without drawing attention to their changes.

Many Latin names as originally given are not strictly correct, and writers from Michelotti (1846) to Vredenburg (1919) on purpose always wrote *pirum piriformis* instead of *pyrum pyriformis*. If these philological quibbles are to be upheld, which I do not think should apply to Latin descriptive names, then many other names should be changed, for instance, *annulus* and *annularia* into *anulus* and *anularia*, etc.; and perhaps a future writer will discover some new name for this genus. The more correct classical spelling *Cypria*, as pointed out by Jeffreys (1867) and Melvill (1888), has

been used by Simroth (1910, Deutsche Südp. Exped., xii, part iii, p. 158) for another genus of mollusca.

Corrections made by an author to the name given by himself should only be accepted if they were published, at the same time as the wrongly written name, as "errata", but not afterwards. *Pantherinaria*, Sacco (1894, p. 67), has to stand, not *Panterinaria* (op. cit., p. 10), also *childreni*, Gray (1825, Zool. Journ., i, p. 603), not *childrini* (op. cit., p. 518), etc.; and Lamarck had no right to change in 1822 his own *Trivia ovulata* (1810) into *T. ovula* (cf. Shaw, 1909, p. 312).

CYPRÆA GANGRANOSA (Solander MSS.), Dillwyn (1817).

Most authors wrote *gangrenosa*, Roberts (1885, in the index, p. 215), and Shaw (1909) *gangrænosa*; but Dillwyn (1817, Descr. Cat., pp. 462 and 465) wrote *gangranosa* three times, which spelling must be retained.

I may here add that the following names must be written *Cypræa saulæ*, Gask. (1843), *sophia* (Bernay), Desh. (1866) (not to be confounded with *sophiæ*, Braz., 1876 = *ovum*, Gmel.), *Trivia maugeri*, Gray (1832), and the subgenus *Bernaya*, Jouss. (1884), and not *sauliæ*, *saulii*, *sophiæ*, *maugeriæ*, *maugeræ*, and *Bernayia*, auctt.

CYPRÆA GEMMULA, Weinkauff (1881).

Gould (1845, Proc. Boston Soc. Nat. Hist., ii, p. 27) described a *Cypræa gemmula*, which is a synonym of *Trivia exigua*, Gray. Weinkauff (1881, p. 163) was aware of this; nevertheless, he gave the same name to another species closely allied to the West American *C. arabicula* (1881, p. 54). There are no synonyms or varietal names; therefore I propose *Cypræa massauensis*, m., nov. nom., for the species inhabiting the Red Sea and western part of the Indian Ocean.

CYPRÆA GIBBOSA, Borson (1820).

Cossmann (1903, p. 154) substituted the name *polysarca*, nov. nom., for this species, believing *gibbosa* to be preoccupied by Linnæus. But *gibbosa*, Linn. (1758), is described by Linnæus, Gmelin, and Dillwyn as a *Bulla*, by Lamarck as an *Ovula*, and never as *Cypræa* (now it is considered as *Cyphoma*). *Cypræa gibbosa* (Schröter), Schmidt (1818, Versuch beste Einrichtung Conch. Samml., p. 220), which was not known to Cossmann, is only a *nomen nudum*, and also does not touch the validity of the name given by Borson, which must be used for the species belonging to the subgenus *Mandolina*. Cossmann, at all events, had no right to give a new name, for at least two of the varietal names given by Sacco (1894, *mucronatoides* and *pergibba*) could have been used for designating the species.

CYPRÆA GLOBOSA, Dujardin (1837).

Cypræa globosa, Sow., now considered a *Trivia*, was described in 1832 (Conch. Illustr., fig. 34); therefore the fossil species

described by Dujardin must receive another name. I propose *parvodenitculata*, Sacco (1894, p. 15), because this variety is common in some parts of France whence Dujardin received his types. I prefer it to *hoernesiana*, Sacco, which is named after a figure drawn by Hoernes (1852) of a specimen from the Miocene basin of Vienna, and which also (*vide* Sacco) is closely allied to Dujardin's type. This latter name is not preoccupied. *Cypraea hörnisi*, Neugeboren (1854, *Zeitschr. Deutsch. Geol. Ges.*, v, p. 675), is a *nomen nudum* proposed for a species never afterwards described under this name; *Gisortia hörnisi* (not *hoernesiana*), Lefèvre (1878), is an *Ovula* and not *Cypraea*.

Cypraea globosa, Sow. (1840), was changed to *C. globularis* by Edwards in 1854.

CYPRÆA LISTERI, Gray (1825).

Gray described two *Cypraea* under this name. First, in 1824 (*Zool. Journ.*, i, p. 384) a variety of *C. felina*, now considered a species or, at least, a subspecies (= *melvilli*, Hid.), then in 1825 (*op. cit.*, i, p. 507) a species belonging to the group of *C. erosa*, Linn., and identical with *C. marginalis*, (Sol. MSS.), as pointed out by Dillwyn (1827, *Zool. Journ.*, iii, p. 317). *Cypraea marginalis*, (Sol. MSS.) Dill., must therefore take the place of Gray's name.

CYPRÆA LYNX, Linnæus (1758).

Cypraea vanelli, Linn. (1758, p. 720), is published one page before *C. lynx* (p. 721). Lamarck (1810) believed at first the former to be his *C. turdus*. Gray (1824) recognized its true synonymy, = *lynx*, which is afterwards confirmed by Hanley (1855). Notwithstanding the antedating by one page, the well-known name, *C. lynx*, Linn., I think should be retained.¹

CYPRÆA MADAGASCARIENSIS, Gmelin (1790).

This name must not be changed to *honoluluensis*, as Melvill (1888, p. 245) proposed, but must remain, in spite of the erroneous locality implied, and *honoluluensis* becomes a synonym.

CYPRÆA MARGARITA, Gray (1828).

Gray (1825, *Zool. Journ.*, i, p. 516) described a species as *C. margarita*, which he afterwards regarded (1828, *op. cit.*, iv, p. 87) as a young shell of *C. cicercula*. On the same page he then described another species as *C. margarita* (as of Humphreys), believing presumably that this name was now available. It is clear that the name of the latter species, which has neither synonyms nor named varieties, must be changed. I propose *Cypraea dillwyni*, m. nov. nom. This author had already described in 1817 a *C. margarita* which is

¹ This view is not in accordance with the International Rules on Zoological Nomenclature, and if synonymous *C. vanelli* should be substituted for *C. lynx*. —H. O. N. S.

identical with *C. margarita*, Gray (1825 nec 1828), and *C. margarita*, Wood (1828).

CYPRÆA MELVILLI, Hidalgo (1906).

Cypræa ursellus, Gmel. (1790), is a decorticated shell of *C. hirundo*, Linn., but *C. ursellus*, Kiener (1845, non Gmelin), is a good species, or, at least, a subspecies, of *C. felina*; the latter therefore had been changed by Hidalgo (1906) into *C. melvilli*, and Shaw (1909) accepted this name. But this *Cypræa* had been described already by Gray (1824, Zool. Journ., i, p. 384) as *Cypræa felina*, var. *listeri*. Therefore *C. listeri* must supersede *C. ursellus*, Kien., and *melvilli*, Hid. (see note under *C. listeri*, Gray).

CYPRÆA MINOR, Grateloup (1845).

Orbigny (1852, Prodr. Paléont., iii, p. 48) changed *C. ovum*, Grat. (1845, Conch. foss. bassin Adour, tab. 40, fig. 1), into *C. subovum*, for this name was preoccupied by Gmelin (1790, = *errones*, Linn., var.). Sacco (1894, p. 10) pointed out that the name *minor*, given by Grateloup to a variety of his *ovum* (op. cit., tab. 40, fig. 16), has priority. I prefer to retain *C. subovum*, for Grateloup had already described a *C. annularis* var. *minor* as fig. 10. Cossmann (1903) cited this species erroneously as *C. ovum*, Grat.

CYPRÆA OBESA, Deshayes (1866).

Hidalgo (1906, pp. 50, 158) cites a *Cypræa obesa*, Carpenter (1857, Rep. pres. state of knowl. Moll. West Coast of North Amer., p. 235), the description of which he did not see. He had possibly seen the Index of Carpenter's "The Moll. of Western North America" (1872), where on p. 45 a *Cypræa* is called *obesa*. But this is evidently an error in Carpenter's manuscript, for in the treatise which Hidalgo did not know (to be found in Rep. Brit. Assoc. Adv. of Sci., 1856, not 1857), Carpenter, after a list of *Cypræa*, enumerates a *Cancellaria obesa*, Sow., while there is no *Cypræa* of this name. *C. obesa*, Carp., is therefore a *nomen nudum*, and *C. obesa*, Desh., may remain.

CYPRÆA OBTUSA, Perry (1811).

I agree with Hidalgo's opinion (1906, p. 178) that *Cypræa vinosa*, Gmelin (1790, Syst. Nat., 13th ed., p. 3421), is really identical with the species afterwards called *guttata*, Lam. (1810), *pantherina*, Dill. (1817), *tigrina*, Lam. (1822), or *pardus*, Mörcz (1852). Shaw (1909, p. 301) doubted this, and proposed the name *C. obtusa*, Perry (1811, Conchology, tab. 19, fig. 1), for *C. pantherina* as being given six years earlier. Unfortunately this name had been given to the rather rare dark-chestnut variety (= *theriaca*, Melv.), which would rank as a species, while the more common whitish shells would be considered as a variety. Moreover, the word *obtusa* is not quite fitting. Compared with its closely allied *C. tigris*, Linn., *C. obtusa* is more slender, its extremities are attenuated, produced, and

often recurved up, but never obtuse, as it is in *C. tigris*; the description of this latter species given by Linnæus twice contains the word "obtusa"!

I contend that *C. vinosa* is identical with *C. pantherina*; Gmelin, in describing it, says:—

"*C. testa supra ex albo vinosa*"—many specimens of the extremely variable species are suffused with a slightly reddish or rose colour, which never happens in *C. tigris*.

"*Ocellis purpascentibus circulo nigro cinctis*"—the author wanted to describe the dark, often bluish-shaded, spots, as in *C. tigris*.

"*Lineaque horizontali alba*"—regarding the figure cited (Bonnaï, *Recreatio*, iii (1684), fig. 253), it is clear that Gmelin intended to mention the whitish dorsal line.

"*Intus cærulea.*"

"*Habitat in mari mediterraneo*"—this habitat does not prove that my opinion is false; *C. pantherina* is the largest *Cypræa* living in the Red Sea, therefore its shell was well known to the ancient Egyptians, Greeks, and Romans, and was spread by them to all the peoples inhabiting the shores of the Mediterranean Sea and beyond. One must not, therefore, wonder that Gmelin believed it to live in the Mediterranean, as was held by some conchologists almost a century later regarding *C. moneta*, *annulus*, etc.

"*Testæ margine niveo*"—the spots disappear on the margin, for it is pressed down towards the flattened base of the shell; in *C. tigris*, on the contrary, the base is more rounded, the margin therefore is displaced towards the dorsum, and lies still in the zone of the big marginal spots.

The figure of Bonnani, cited by Gmelin, shows a specimen of *C. pantherina* very well, and I do not understand how Shaw could call it "practically useless". It could scarcely be taken for *C. lynx*, Linn., for the spots are all of the same size. Gmelin also did not mention the red interstices between the teeth, so characteristic of the latter species.

Therefore there is no doubt, I think, that *Cypræa vinosa*, Gmel., must stand, *C. obtusa*, with its synonym *C. theriaca*, Melv., becoming a variety.

CYPRÆA PRESTONI, Shaw (1909).

Cypræa interrupta, Gray (1824), was changed by Shaw into *C. prestoni*, nov. nom., as being preoccupied by *interrupta*, Bolten (1798). But it was superfluous to create a new name, for there is a variety of it, *C. rhinoceros*, Souverbie (1865, Journ. de Conch., xiii, p. 156), and this name must be used to designate this species. *C. interrupta* becomes a variety the synonym of which is *prestoni*.

The name *rhinoceros* is not unsuited to this species, for there is always a callous thickening on the back of the anterior extremity, and very decorticated shells can easily be distinguished from *C.*

teres, Gmel. (= *tabescens* aut.), by it. But it is rarely so swollen as in the typical *C. rhinoceros*.

CYPRÆA PRISCA, Deshayes (1866).

Oliva prisca, Binkhorst (1861, Monogr. Gastr. Ceph. du Limbourg, p. 71), is perhaps a cretaceous *Cypræa*, as its author and Heilprin (1882, Proc. Ac. N. Sci. Philadelphia, p. 209) believed. If that should be confirmed by future investigation, it would be necessary to give a new name to Deshayes' species from the French Paleocene.

CYPRÆA ROSTRATA, Zekeli (1852).

Grateloup (1845) called a miocene shell *Cypræa columbaria*, var. *rostrata*, which by future investigation will perhaps be proved to belong to *C. leporina*, Lam.; no author has afterwards cited it. Names given as varietal ones do not hinder their repeated use for other species of the same genus, if the former never were considered as species or subspecies, therefore the name of Zekeli's very interesting cretaceous *Cypræa* must not be changed.

CYPRÆA STERCORARIA, Linnæus, var. RATTUS, Lamarck (1810).

Long before Lamarck, the same variety was already described twice by Gmelin (1790, Syst. Nat., 13th ed.), first on p. 3405 as *C. conspurcata*. The type of Born's fig. 1 in his "Test. Mus. Cæs. Vindob." (1780), tab. 8, cited by Gmelin, is preserved in the Museum of Natural History in Vienna and agrees very well with Lamarck's description. Again, on p. 3413, Gmelin described a *C. nebulosa*, the identity of which with *C. ratus* was acknowledged by Gray (1824). The variety therefore must be called *conspurcata*, Gmel. *C. nebulosa*, Gmel., and *C. ratus*, Lam., are synonyms.

CYPRÆA VARIOVARIA, Lamarck (1810).

Gmelin (1790, Syst. Nat., 13th ed., p. 3421) described a *Cypræa chinensis* which was interpreted by many authors (Gray, Menke, Cuvier, Anton, Roberts, and Melvill) as a *C. lynx*, and by Hidalgo (1906) as a *C. variolaria*. Shaw (1909) contested its identity with the latter, holding it doubtful as Dillwyn (1817) had done. In this case I am of the same opinion as Hidalgo; Gmelin's description ("oblonga solida variegata; labiis aurantiis") and, above all, the cited figure (Argenville, Conchyl. (1772), tab. 18, fig. 2), which is well recognizable, do not allow any other interpretation but that his specimen was a *C. variolaria*. *C. chinensis*, Gmel., therefore, should stand for this species.

TRIVIA AFFINIS, Dujardin (1837).

This species, described by Dujardin as a *Cypræa*, must receive another name, for Gmelin (1790) had called by this name a shell afterwards proved to be *C. globulus*, Linn. Following Sacco (1894), its var. *pseudoasulcata*, Sacco, should supply the preoccupied name. But future investigation may perhaps prove that other fossil *Trivia*

now considered as distinct must be united with it. Cocconi (1873) and Couffon (1902) believed *T. avellana*, Sow. (1823), not to be separable as a good species. Then a prior and, I hope, a shorter name will be found than *pseudoasulcata*, Sacco, for this species.

Cossmann (1903, p. 157) mentions a *Cypraea (Bernaya) affinis*, Duj.; it is surely only a slip, probably instead of *globosa*, Duj.

TRIVIA ARCTICA, Pulteney (1799).

This species was called by various writers *arctica*, Pult. (1799), or *arctica*, *pediculus* and *bullata*, Montg. (1803), *europaea*, Montg. (1808), or *coccinella*, Lam. (1810). Dautzenberg and Fischer (1912, Rés. camp. scient. Albert de Monaco, xxxvii, p. 168) wanted to prove that *arctica*, Humphreys (1797), must be taken to designate the species, but the eight words in his "Museum Calonnianum", p. 7, can never be regarded as a name or description, being non-binomial. The name *monacha*, Costa (1778, British Conchology, p. 33), also cannot be taken as valid, not on account of the designation "*pediculus seu monacha*", but because its author does not follow binominal nomenclature on pp. 12, 14, 120, 130, 133, and 238. Therefore *arctica*, Pult., must be retained as the name of this common European *Trivia*.¹

TRIVIA ATOMARIA, Dall (1902).

Hidalgo included this species as well as all other *Trivia* in the genus *Cypraea*. Though there is an older *Cypraea atomaria*, described by Gmelin in 1790, the name of Dall's species has to remain, for it is described as *Trivia*, and belongs, without doubt, to this genus.

TRIVIA LATHYRUS, Blainville (1826).

Formerly this species was well known under the name *Trivia pulex*, Gray (1827, Zool. Journ., iii, p. 368; 1828, which, as Shaw says, is incorrect). Shaw (1909, p. 311) pointed out that it was described as *Cypraea lathyrus*, Blainville, in 1826, and not for the first time in 1830; but he omitted that it had been called *Cypraea sulcata* var. D. (partim), and *Cypraea pulex* (Solander MSS.) by Dillwyn (1817, Descr. Cat., i, pp. 466, 467), which is preoccupied by *Cypraea pulex*, Bolten (1798, = ?). *Trivia lathyrus*, Blainv., therefore remains.

TRIVIA NIVEA, Sowerby (1832, 1837).

The name of this species, described as a *Cypraea*, is preoccupied by *Cypraea nivea*, Bolten (1798, = ?), *nivea*, Dill. (1817, = *Trivia oryza*, Lam.), *nivea*, Gray (1824, = *Cypraea eburnea*, Barn., or *turdus*, Lam., var.), *nivea*, Sow. (1825, = *Trivia oryza*, Lam.), and *nivea*, Wood (1828, = *C. lutea*, Gron., var.). Therefore it must

¹ The author of this paper appears to have overlooked the note by T. Iredale (Proc. Malac. Soc., XI, 1915, p. 333) on *Trivia jonensis*, Pennant. Iredale clearly proves that the correct name for this species should be *jonensis*, Pennant (Brit. Zool., 2nd 8vo ed., iv, 1777, p. 117, pl. lxxi, f. 8).—H. O. N. S.

be changed; the species having only one synonym, *scabriuscula*, Kien. (1845) nec Gray (1827), I propose *Trivia nix*, m. nov. nom.

TRIVIA PEDICULARIS, Deshayes (1844).

Deshayes (1844) changed his own *Cypræa* (now *Trivia*) *lamarckii*, described in 1836, into *pedicularis*, for Gray had used this word for a species in 1825; Sacco (1894, p. 50) had no right to again accept the former name, though at that time both belonged to distinct genera. Cossmann (1903 and 1911) cites this fossil species as *Trivia pedicularis*, Desh., which name must stand.

TRIVIA PULLA, Gaskoin (1846).

This species, which has no synonyms or named varieties, is described by Gaskoin as *Cypræa*. Therefore its name is preoccupied by Gmelin (1790, = *onyx*, Linn., var.) and must be changed. I propose *Trivia occidentalis*, m. nov. nom.

TRIVIA SCABRIUSCULA, Koenen (1890).

Koenen (1890, Abhandl. z. geol. Spezialkarte v. Preussen, x, pars. ii, p. 565) described a very small shell from the German Oligocene as *Trivia scabriuscula*, and it is evidently allied to the living *Cypræa childreni*, Gray, in having the anterior extremity carinately winged beneath. Cossmann (1903) cited it as *Pustularia*. Koenen did not observe that Gray (1827) had already given this name to a recent species of *Cypræa*, though afterwards always quoted as a *Trivia*. Therefore I propose *Cypræa liliputana*, m. nov. nom., for Koenen's species, which is evidently a good one; it seems that it connects the ribbed *C. childreni* with the pustulated *C. cicercula*.

TRIVIA SUBROSTRATA, Gray (1827).

Gray described two *Cypræa subrostrata*: one (1824, Zool. Journ., i, p. 369) is a fossil species of *Cypræa*, the other (1827, op. cit., iii, p. 363) is the recent *Trivia* from the West Indies. Obviously the second must be renamed. The var. *alba*, Roberts (1885, p. 201, as of Krebs, *ubi?*), scarcely belongs to this species, as Roberts himself says. Therefore, I propose for *Trivia subrostrata*, Gray (1827), *Trivia antillarum*, m. nov. nom.

The following notes may be of use to workers on this group, but, it is hoped, without giving rise to the thoughtless creation of many new names which future examination might prove to be superfluous.

GISORTIA.

depressa, Sow. (1840): Is described as a *Cypræa*, but must not be changed, for *Cypræa arabica* var. *depressa*, Gray (1824), never was considered a distinct species or good subspecies.

CYPRÆA.

attenuata, Johnson (1899): Preoccupied by *attenuata*, Edwards (1865).

- cancellata*, Edwards (1865) : Preoccupied by *cancellata*, Gmelin (1790).
- cincta*, Martin (1899) : Must not be changed, for *cincta*, Meuschen (1787), is not valid, and *cincta*, Sol. MSS., is cited by Dillwyn (1817) and all following writers as a synonym of *cinerea*, Gmel., therefore it was never established as a species.
- dalli*, Aldrich (1894) : Preoccupied by *dalli*, Cossmann (1893); both belong to the subgenus *Cyprædia*, but come from different parts of the world.
- elongata*, Archiac and Haime (1853) : Described as *Ovula* and scarcely belonging to *Cypræa*; preoccupied by *elongata*, Perry (1811), and *elongata*, Brocchi (1814).
- expansa*, Archiac and Haime (1853) : Described as *Ovula*, but Mayer-Eymar (1904) believes it to be perhaps a *Cypræa*; preoccupied by *expansa*, Grat. (1845), which is described as var. of *annulus*, now considered as var. of *fabagina*, but by many authors (Sismonda, 1847, Archiac and Haime, 1853, etc.) as a distinct species.
- martini*, Schepman (1907) : Preoccupied by *martiniana*, Anton (1839), though this species is now considered as = *gangranosa*, and is called after Martini, the author of the "Systematisches Conchyliencabinet", not after Martin, professor in Leyden.
- ovata*, Martin (1890) : Preoccupied by *ovata*, Gmel. (1791), and *ovata*, Perry (1811).
- prælonga*, Bellardi (1852) : Must not be changed, for *leporina* var. *prælonga*, Grat. (1845), never was considered to be of specific rank.
- retusa*, Parona (1909) : Preoccupied by *Trivia retusa*, Sow. (1823), which was described as a *Cypræa*.
- rugosa*, Grat. (1845) : Preoccupied by *rugosa*, Brod. (1827), which is probably a *Cyprædia*.
- smithi*, Aldrich (1886) : Preoccupied by *smithi*, Sow. (1881), which, in a postscript, is considered by the author as a variety of *pyriformis*, Gray. *Trivia smithi*, Martin (1883), must not be changed on account of its being described as *Trivia*.
- striata*, Zekeli (1852) : A dubious Cretaceous species, described as *Ovula* and perhaps allied to *Cypræa ventricosa* (Reuss), Orb.; it is preoccupied by *striata*, Gmel. (1790), which = *helvola*?
- subcylindrica*, Sow. (1870) : Scarcely a good species. This name was given by Gray (1828) to a variety of *leporina*.
- vaughani*, Maury (1913) : Preoccupied by *vaughani*, Johns. (1899).

TRIVIA.

- grayi*, Michel. (1847) : It is described as *Cypræa*, and therefore preoccupied by *grayi*, Kien. (1845), which is = *achatidea*.
- intermedia*, Kien. (1845) : Described as *Cypræa*, but not being admitted as a good species must not be changed, for *intermedia*,

Gray (1824), was described as var. of *arabica*, and can be regarded neither as a species nor a subspecies. *Intermedia*, Redfield (1847), described as var. of *reticulata*, is not quite identical, and also contains *arabica* subsp. *gillei*. *Reticulata* var. *intermedia*, Roberts (1885), is a synonym of *gillei*.

minor, Grat. (1845): Described as a variety of *Cypræa spæriculata*, is raised to the rank of a distinct species by Sacco (1894); it is preoccupied by two varietal names given by its author (see note on *Cypræa minor*, Grat.).

I add to the preceding list three names, the older homonyms of which are the result of typographical mistakes and can scarcely hinder the validity of the following.

C. amygdalina, Grat. (1845): This spelling was not used by Brocchi, and is perpetrated only once by Brongniart (1823) instead of *amygdalum*, Broc.; but Brongniart also wrote *amygdalum* correctly.

C. lucida, Grat. (1847): *Lucida*, Linn., cited by Blainville (1830), is evidently printed by error instead of *C. lurida*, Linn.

C. pumila, Koenen (1890): *Pumila* is wrongly written by Weinkauff (1881) instead of *pumilio*, which is the name given by Brusina to a new species of *Voluta*, now considered to be a young shell of *Cypræa*.

II. ON SOME VARIETAL NAMES GIVEN BY GRAY.

The first "Monograph on the Cypræidæ" was published by J. E. Gray in seven parts, which were issued as follows:—

- (A.) Zoological Journal, i, pp. 71–80, 1824 (March).
- (B.) " i, pp. 137–152, 1824 (June).
- (C.) " i, pp. 367–391, 1824 (October).
- (D.) " i, pp. 489–518, 1825 (January).
- (E.) " iii, pp. 363–370, 1827 (November).
- (F.) " iii, pp. 567–576, 1828 (April).
- (G.) " iv, pp. 66–88, 1828 (July).

These are abbreviated in this paper by the letters A.—G., which, in conjunction with a figure and page, will make it easy to find the original passage in any of the above three volumes.

Gray described in this monograph 127 species of recent and fossil *Cypræa*, some of which now belong to the genera *Trivia* and *Gisortia*. Of these, thirty-eight were new species as stated by Gray. He also described the young, incomplete, and decorticated shells of most of the species, and many colour, shape, and size varieties.

Since Sowerby (1832–7, Conchological Illustrations), subsequent authors have cited the varieties described by Gray as "... var. Gray", as if being nameless in his monograph; but I venture to point out that Gray called many by proper varietal names. Only one previous writer was of the same opinion as myself, Redfield (1847, Ann. Lyc. Hist. Nat. New York, iv, p. 477, etc.), but he mentioned only the varieties of *Cypræa arabica*, and therefore

introduced only two of Gray's varietal names, *C. arabica* var. *intermedia* and var. *depressa*.

Two of Gray's varietal names were afterwards used for designating the same shells, but raised to specific value.

Cypraea algoensis B. *edentula* is identical with the shell described as "*Cypraea edentula nobis*" by Sowerby in 1837 (*Conch. Illustr.*, Cat. *Cypraea*, p. 10). Gray's words, "with the teeth more or less obliterated," cited by Sowerby, are not found in the *Zool. Journ.* (D. 498); they must be taken from Gray's "*Descr. Cat.*" (1832, only a manuscript work!), where *edentula* must have been cited only as "*algoensis* var." (without any name). The name given by Gray was, I presume, well known to Sowerby, and he therefore used it, but he was right to add "*nobis*", for he raised the name previously suppressed by its first author, Gray, to specific rank.

Cypraea pediculus B. *suffusa* (E. 370) is identical with *Cypraea* (now *Trivia*) *suffusa* of Gray's "*Descr. Cat.*" and of Sowerby's "*Conch. Illustr.*" (1832, fig. 41) and his "*Cat. rec. sp. Cypraea*" (1837, p. 13). Contrary to *edentula*, the name given to the variety *suffusa* in 1827 was adopted by its author in 1832 as of specific rank, and subsequently by Sowerby and all later writers.

Gray's named varieties are as follows:—

CYPRÆA.

C. MAPPA, Linn., var. *ROSEA*, Gray (1824).

A. 75.—The description and Sowerby's figure prove it to be the same as var. *subsignata*, Melv. (1888), which latter becomes a synonym of var. *rosea*. Born's figure represents quite another shell, which is allied to var. *panerythra*, Melv.

C. ARABICA, Linn., var. *INTERMEDIA*, Gray (1824).

A. 77.—A slight variety of the typical *arabica*, to be distinguished by the thickened margin and the dorsal markings; it connects *arabica*, s. str., with its subsp. *reticulata*, Martyn.

C. ARABICA, Linn., var. *HISTRIO*, Meuschen (1787).

A. 77.—Gray's variety contains two subsp. of *arabica* now considered as distinct, viz. *histrio* (Meusch.), Gmel. (1790), and *reticulata*, Martyn (1789).

C. ARABICA, Linn., var. *DEPRESSA*, Gray (1824).

A. 77.—A slight variety of *arabica*, subsp. *histrio*, Gmel.; it agrees with it by the shape, the straight aperture, and the similar drawing on the back of the shell; but the thickened margins remind one of subsp. *reticulata*, Martyn. *C. arabica*, subsp. *gillei*, Jouss., has the anterior extremity very broad and almost square, but *depressa* is attenuated and triangular.

C. STERCORARIA, Linn., var. *RATTUS*, Lam. (1810).

A. 80, B. 137.—To be now known as *stercoraria* var. *conspurcata*, Gmel. (1790) (see note on *C. stercoraria*).

C. EXANTHEMA, Linn., var. ANGUSTATA, Gray (1824).

B. 139.—A slight variety of *C. zebra*, Linn. (= *exanthema*, Linn.), being a little more cylindrical, the white spots not so large as in typical specimens, but also ocellated. It seems to be an intermediate variety connecting *zebra* with its subsp. *cervinetta*, Kien. No wider aperture being mentioned, it must be placed with the typical *zebra* and not with *cervinetta*. I have had no opportunity of seeing the figure in Favanne's "Conchyliologie" (tab. 29, fig. B, 1), cited by Gray.

C. ARGUS, Linn., var. VENTRICOSA, Gray (1824).

B. 141.—This variety is described by Hidalgo (1907, Mon. gén. *Cypræa*, p. 270) as *argus* var. 1. The slight difference in colour can be neglected.

C. ISABELLA, Linn., var. FULVA, Gray (1824).

B. 142.—This variety is not identical with var. *fulva*, Rous (1905, The Nautilus, xix, p. 77), but being fulvous as well as pellucid, it connects *fulva*, Rous, with var. *limpida*, Melv. (1888, Mem. Proc. Manchester L. Ph. Soc., (4) i, p. 231).

C. LURIDA, Linn., var. MONSTROSA, Gray (1828).

G. 72.—Not a variety, but a monstrosity of *C. lurida* and not of *C. pulchra*, Gray (see Hidalgo, 1906, Mon. gén. *Cypræa*, p. 176); it is a synonym of *kunthii*, Audouin (1827, in Savigny, Descr. Egypte, xxii, p. 190), which was described as a species, but unknown to Gray, in 1828. Both names were established on the same specimen of *lurida*, figured by Savigny ten years before (1817, Mem. Coq. Egypte, tab. 6, fig. 27).

C. CINEREA, Gmel., var. FULVA, Gray (1824).

B. 145.—A slight colour variety, the interstices between the teeth of which are colourless, as it was in the shell described by Gmelin. Hidalgo's *cinerea*, which has reddish interstices between the teeth, must be considered as a variety, though most adult shells belong to it. Gray's *cinerea*, s. str., which has the margins sprinkled with black, also belongs to a common variety, while his var. *fulva*, having white margins, was perhaps not quite full grown.

C. CINEREA, Gmel., var. SUBFOSSILIS, Gray (1828).

G. 72.—No description is given, only the manuscript-name *C. eburnea*, König, is added as a synonym. This shell must be left as dubious, but it scarcely belongs to *cinerea*, which is found in fossil condition only in Costa Rica (Roberts, 1885, in Tryon, Man. of Conch., vii, p. 166) and in the Bahama Islands (Dall, 1905, Fossils of the Bahama Isl., p. 26). König's shell was found, I suppose, in Europe, probably in the British Tertiary, and might have been a (young ?) *Bernaya*, sp.

C. LEPORINA, Lam., var. SUBLONGA, Gray (1828).

G. 73.—A little larger, but otherwise identical with Gray's typical shell, which was described on B. 149 as *C. gibbosa*, nov. sp.; *sublonga* may be considered as a synonym of *leporina*.

C. LEPORINA, Lam., var. SUBCYLINDRICA, Gray (1828).

G. 73.—This shell was, I presume, an almost cylindrical specimen of *leporina* var. *sublyncoidea*, Brongniart (1823), which was unknown to Gray; *lyncoidea* often has the extremities somewhat produced.

C. LEPORINA, Lam., var. MINOR, Gray (1828).

G. 73.—Gray's shell belonged without doubt to *C. leporina*, s. lat., for he particularly described the concavity of the columella (Gray forgot to give the size of the shell!); *C. annularia*, Brongn. (1823), which is cited as a synonym of it, though Gray did not know its description, is not identical, but belongs to quite another group (= *C. fabagina*, Lam., var.). *C. minor*, Gray, and *annularia*, Gray (nec. Brongn.), may be considered as synonyms of *leporina*.

C. DILUVIANA, Gray, var. MINOR, Gray (1824).

B. 149.—This is a synonym of *C. fabagina*, Lam., while *diluviana*, s. str., may be considered not as a synonym of it (as most authors have believed), but as a variety of abnormal size (45 mm.!); it surely belongs to *fabagina* and not to its subsp. *amygdalum*, Broc.

C. TIGRIS, Linn., var. FLAMMEA, Gmel. (1790).

C. 367.—Must be considered as a synonym, not as a variety, on account of its being an incomplete shell; it was considered as such by Schröter (1783, Einleitung, p. 148, No. 52).

C. TIGRIS, Linn., var. NIGRESCENS, Gray (1824).

C. 367.—This rather rare variety was called *russitonens* by Melvill (1888, Mem. Proc. Manchester L. Ph. Soc., (4) i, p. 212), and also perhaps *aethiops*, though a *nomen nudum* by Orbigny (1847, Dict. d'hist. nat., x, p. 433). This name was used already by Menke (1830, Synops. Mus. Menkean., p. 81), but not as varietal name. Both become synonyms of var. *nigrescens*, Gray.

C. PANTHERINA, Sol., var. β , Gray (1824).

C. 368.—This variety is the same as *C. vinosa*, Gmel., var. *obtusa*, Perry (1811), and *theriaca*, Melv. (1888). *C. obtusa* is not mentioned in Gray's monograph. There is a fossil variety of *C. vinosa* named *fossilis* by Sacco (1894).

C. ONYX, Linn., var. FULVA, Gray (1828).

G. 76.—Although described as pellucid, this variety may be considered as identical with *onyx* var. *carnicolor*, Mörcz (1852, Cat. Conch. Yoldi, p. 116); the citing of Reeve's figure (1845, Conch. icon., *Cypraea*, fig. 39b) suffices to establish it. In Jay's Cat. of Shells,

3rd ed. (1839), it is a *nomen nudum*. It is placed with *nymphæa*, Sow. (1870, Thes. Conch., *Cypræa*, fig. 212). In Jay's Cat. of Shells, 4th ed. (1850), it is cited as a *nomen nudum* instead of *carnicolor* (?), but the latter is a little more whitish-rose than fulvous. Both names may be considered in future as synonyms of var. *fulva*, Gray.

C. PYRUM, Gmel., var. *FOSSILIS*, Gray (1824).

C. 371.—Sacco (1894, Moll. terr. terz. Piem., xv, p. 25) cited *pyrum* (Gmel.), Gray (Sacco quoted 1825), as a synonym of *C. porcellus*, Broc. Lamarck's fossil *C. rufa*, which is identical with Gray's var. *fossilis* as its author stated, therefore adding no further description, was considered by Sacco (p. 26) as a synonym of *porcellus* var. *plioglobosa*, Sac. Gray's variety without doubt belongs to this species. I do not, however, recommend the use of this name in place of *plioglobosa*, for their identity is not fully established.

C. ASELLUS, Linn., var. *FLAVESCENS*, Gray (1824).

C. 375.—This name must be given to Hidalgo's var. 1 of *asellus* (1907, Mon. gén. *Cypræa*, p. 274), but many specimens assigned to this variety with reddish or yellowish bands are only decorticated, I think. Two of the three figures cited by Gray, viz. the ones drawn by Gualtieri, probably belong to *C. felina*, Gmel., or *hirundo*, Linn., but certainly not to *asellus*.

C. HIRUNDO, Linn., var. *FORMOSA*, Gray (1824).

C. 377.—This varietal name must be considered as a synonym of *C. cylindrica*, Born (1778). Lamarck described this shell as *hirundo* var. (nameless), for he did not know the name given by Born. Gray copied Lamarck's description (omitting the indication of size) and called the variety *formosa*, though he knew Born's species and described it some pages later as *Cypræa cylindrica*. One must not wonder that Gray described the same species twice, for he only saw two specimens of *cylindrica*, as he himself said—one specimen a long time before he wrote his monograph, and another, decorticated, at the time he was writing it.

The name given by Gray does not touch the validity of *Cypræa* (now *Trivia*) *formosa*, Gask. (1835), for Gray's *formosa* was published as a variety and never considered as a specific name.

C. HIRUNDO, Linn., var. *PULCHELLA*, Gray (1828).

G. 78.—This is the shell afterwards called by Sowerby (1837, Cat. rec. spec. *Cypræa*, p. 6) *Cypræa hirundo* var. *oweni*, which is now considered a good species. But its name must remain *C. oweni*, for *pulchella* is preoccupied by Swainson (1823) and Gray himself (1824) for other species.

C. PUNCTATA, Linn., var. DECOLORATA, Gray (1824).

C. 380.—This variety must be placed among the synonyms of *punctata*, s. str., for it also has short whitish teeth, as they were in Linnæus' type (1771, *Mantissa plant.*, ii, p. 548; 1767, as quoted by Hidalgo, is incorrect!). Gray's *punctata*, s. str., having the teeth reddish and extended somewhat over the base, is a nameless variety, though it is considered by many authors as the typical shell.

C. PUNCTATA, Linn., var. MACULATA, Gray (1824).

C. 380.—Such a variety has never appeared again; perhaps it was like Sowerby's fig. 281 in his "Thes. Conch., Cypræa" (1870), or maybe it belonged to quite another species (a decorticated *C. fuscomaculata*, Pease?). It is a doubtful shell, and the name could never be applied to a species, being preoccupied by Perry (1811).

C. CRIBRARIA, Linn., var. Gray (1828).

G. 79.—On account of the comma in the description (see above), I take it for nameless; Gray's shell might have been a *C. esontropia*, Ducl.

C. FELINA, Gmel., var. GIBBOSA, Gray (1824).

C. 384.—It may be considered as a variety of *C. felina*, subsp. *fabula*, Kien. (1845), which is described by its author as "peu convexe en dessus", while Roberts' (1885) *fabula* is identical with Gray's variety. The name *gibbosa* cannot designate the subspecies, being preoccupied by Borson (1820).

C. FELINA, Gmel., var. LISTERI, Gray (1824).

C. 384.—This variety is identical with *ursellus*, Kien. (1845) nec Gmel. (1790), and therefore also with *melvilli*, Hid. (1906); the name given by Gray must be used for this shell, but reduced to the rank of a subspecies of *C. felina*.

C. listeri, Gray (1825, D. 507), which belongs in the group of *C. erosa*, must be changed to *C. marginalis*, Dillw. (1827).

C. ERRONES, Linn., var. OVATA, Gray (1824).

C. 385.—Becomes a synonym of *errones*, subsp. *ovum*, Gmel. (1790), which is more pyriform, more gibbous, thickened on the margins, the callosity of which extends high up on the dorsum, and has orange interstices between the teeth, but never spots on the back or on the anterior extremity. It was described by Brazier (1877) as *C. sophiae*.

C. ERRONES, Linn., var. BIMACULATA, Gray (1824).

C. 385.—This name must be used for typically shaped shells of *C. errones*, s. str., which have the base and the margins yellow, but the aperture whitish; there are two blackish spots on the anterior extremity. It is figured by Sowerby (1837, *Conch. Illustr.*, fig. 132),

whose *errones*, s. str. (fig. 129), belongs to another variety; it is identical with *bimaculata*, but has no spots on the anterior extremity, and is also allied to var. *chrysophaea*, Melv.

C. MONETA, Linn., var. ROSEA, Gray (1828).

G. 82.—A very striking variety which has never been described afterwards. It is fleshy white, with two reddish purple bands. It can hardly have been a decorticated shell, for Gray always recognized such specimens.

C. OBVELATA, Lam., var. VITELLUS, Gray (1825).

D. 493.—I doubt whether this fulvous variety really belonged to *C. obvelata*, which I consider to be a subspecies of *C. annulus*, Linn., while *C. moneta* is, I think, quite separable. Its margins are described as somewhat depressed. I possess pinkish orange specimens which are intermediate between *annulus* and *obvelata*, and otherwise agree with Gray's description of his *vitellus*. It may perhaps be allied to *moneta* var. *aurea*, Shaw (1909), which also comes from the South Seas.

C. ANNULUS, Linn., var. FOSSILIS, Gray (1828).

G. 83.—It is identical with *C. fabagina* var. *brocchii*, Desh. (1844), but being preoccupied by two fossil varieties of Gray (C. 371, D. 496), I do not recommend the use of Deshayes' well-known name.

C. MUS, Linn., var. TUBERCULATA, Gray (1828).

G. 83.—This is the heavy shell with one or two tubercles on the back, afterwards called by Sowerby (1870, Thes. Conch., *Cypræa*, fig. 321) var. *bicornis*, which name therefore becomes a synonym of *tuberculata*.

C. MUS, Linn., var. FOSSILIS, Gray (1825).

D. 496.—This shell is identical with Lamarck's fossil *C. mus*, I presume, as Gray cited it from "Fiorenzola in Plaisantin, Lamarck"; therefore it belongs to *C. porcellus*, Broc., var. *pseudotypica*, Sacco (1894, Moll. terr. terz. Piem., xv, p. 25).

C. ALGOENSIS, Gray, var. EDENTULA, Gray (1825).

D. 498.—This is the well-known shell which was believed by all previous writers to have been named *edentula* by Sowerby (1832 and 1837). It is a distinct species or at least a good subspecies of *C. algoensis*, for I do not know of any intermediate specimens which might link up *algoensis* to *edentula*. On the contrary, in the collection of shells brought by Dr. Penther from Port Alfred (South Africa) and preserved in the Museum of Natural History in Vienna, there are many hundred *edentula*, a few of which have slight indications of teeth on the anterior part of both lips, but all are quite different from the true *algoensis*, which is not represented in this large collection from South Africa.

C. SPURCA, Linn., var. ELLIPTICA, Gray (1825).

D. 501.—This name must take the place of var. *elongata*, Dautzenberg & Fischer (1906, Rés. camp. scient. Albert de Monaco, xxxii, p. 40), if one considers such slight modifications to be varieties.

C. EROSA, Linn., var. INOCCELLATA, Gray (1825).

D. 504.—It connects the typical *erosa* with its var. *phagedaina*, Melv. (1888, Mem. Proc. Manchester L. Ph. Soc., (4) i, p. 223), for the dark eyes in the white dorsal spots are almost absent, as well as the large dark square spot on each margin.

C. EROSA, Linn., var. Gray (1828).

G. 84.—Gray cited Sowerby's description from "Tank. Cat." (1825, p. 84), but the words "sub-albida", printed instead of "subtus albida" by mistake, made Gray's description quite obscure. There is a large open space after the "var."—perhaps Gray intended giving a name to this variety resembling var. *nebrites*, Melv. (1888), but did not do so.

C. OCELLATA, Linn., var. BRUNNEA, Gray (1825).

D. 505.—This variety is cited without any name by Hidalgo (1907, Mon. gén. *Cypræa*, p. 449) as *ocellata* var. 1; it seems that it has not been found since Gray's time. Its sides and base are darker than in typical shells, and therefore it is somewhat allied with var. *calophtalma*, Melv. (1888).

C. LAMARCKII, Gray, var. INOCCELLATA, Gray (1825).

D. 508.—Must be considered as a synonym of *C. miliaris*, Gmel. (1790), which was not treated in Gray's monograph as a species, but mentioned as a synonym of *C. erosa*, Linn., of *lamarckii* var. *inoccellata*, Gray, and of *listeri*, Gray (= *marginalis*, Dillw.), according to the three figures cited by Gmelin. But Shaw (1909, Proc. Mal. Soc. London, viii, p. 300) was right, I think, in upholding the validity of the name proposed by Gmelin for the species closely allied to *C. lamarckii*.

C. LAMARCKII, Gray, var. β , Gray (1828).

G. 85.—Was it also = *miliaris*, Gmel.? Its description is very short and dubious.

C. LAMARCKII, Gray, var. γ , Gray (1828).

G. 85.—Appears to be a variety of *C. miliaris*, Gmel.; it might belong to its var. *diversa*, Kenyon (1902, Journ. of Conch., x, p. 184), a synonym of which is var. *nivea*, Preston (1909, The Nautilus, xxii, p. 121); var. *intermedia*, M. Smith (1913, The Nautilus, xxvii, p. 69), connects it with the typical shell.

C. STAPHYLÆA, Linn., var. LIMACINA, Lam. (1810).

D. 513.—Is the shell described by Lamarck as *C. limacina*. I consider it a subspecies of *C. staphylæa*, though Troschel found both quite distinct as regards their radulæ, but he examined only one specimen of *limacina*, which may have been abnormal.

C. STAPHYLÆA, Linn., var. ATRATA, Gray (1825).

D. 513.—Though this variety having black extremities is not mentioned in Hidalgo's monograph, it cannot belong to any other species; specimens with somewhat darker extremities do exist (cf. Sowerby, 1870, Thes. Conch., *Cypræa*, fig. 228).

C. CICERCULA, Linn., var. TIMORENSIS, Gray (1825).

D. 515.—It is no variety, but only a young shell of *C. cicercula*; Gray also put a “?” before its name.

The following species now belong to the genus *Trivia* :—

C. SCABRIUSCULA, Gray, var. MINOR, Gray (1827).

E. 364.—Described as ovate-oblong, subrostrate, and only 5×2.5 mm. in size. I cannot place this shell; was it perhaps a *T. insecta*, Migh.?

C. EUROPÆA, Mont., var. IMMACULATA, Gray (1827).

E. 366.—“Testa immaculata alba.” It may be considered as identical with the typical *T. arctica*, Pult., as the added synonym *arctica*, Mont., proves. Considering only the description and the other synonym, *pediculus (anglica)*, Linnæus, one could take it as identical with the pure white variety described by Dautzenberg and Fischer (1912, Rés. camp. scient. Albert de Monaco, xxxvii, p. 168) as var. *alba* (as if by Hidalgo).

C. QUADRIPIUNCTATA, Gray, var. IMMACULATA, Gray (1827).

E. 368.—It is described by Hidalgo (1907, Mon. gén. *Cypræa*, p. 496) as the nameless var. 3 of *T. quadripunctata*.

C. PEDICULUS, Linn., var. SUFFUSA, Gray (1827).

E. 370.—Identical with *Cypræa (Trivia) suffusa*, Sow. (1832, 1837); Gray and not Sowerby must in future be credited as author of this good species.

C. AVELLANA, Sow., var. MINOR, Gray (1828).

F. 568.—It may, I think, be a variety of *T. affinis*, Duj. (1837), for its ribs are close and slender; its length is 15 mm. The word *minor* cannot rank as the specific name, for its identity with *T. affinis* is very problematical.

C. CARNEA, Gmel., var. OBLONGA, Gray (1828).

F. 569.—A very slight variety of *Trivia costata*, Gmel.; its shape is more oblong than globular.

The following species now belongs to the genus *Cypræa*, subgenus *Cyprædia* :—

C. dactylosa, Lam., var. *GEORGII*, Defr. (1826).

F. 574.—This variety must be considered as a synonym of *C. gervillii*, Sow. (1820, Genera rec. foss. Shells, fig. 8), which is probably a variety of *Cypræa (Cyprædia) sulcosa*, Lam. (1802). (*C. dactylosa*, Lam., a synonym of *sulcosa*, is described in 1810 !) Gray's description agrees very well with Sowerby's figure, which is also cited as representing *georgii*, while the name *gervillii* is put by mistake among the synonyms of *C. dactylosa*, s. str.

VITRINA MAJOR IN BRITAIN.

By Dr. A. E. BOYCOTT, F.R.S.

Read 12th May, 1922.

ON 22nd April last, while searching for *Azeca tridens* in Cusop Dingle, near Hay, among stones and dead wood on a mossy bank, about 6 feet on the Breconshire side of the stream, which here forms the Herefordshire boundary, I picked up a *Vitrina*, which on subsequent examination appeared to be new to the British fauna. In a straight line on the map the spot is about 4,200 yards south-east of Hay Railway Station. This upper part of the narrow Cusop valley is wild, semi-cultivated land, and the valley soon runs out above on to the open moor of the Black Mountains. There are two or three small hill farms in the neighbourhood. The land around the stream is rough, open scrub, used for grazing, with a good many wet boggy places. It lies on the Old Red Sandstone, and the locality is apparently moderately calcareous; there are a number of ash-trees, and close by the remains of an old lime-kiln. Besides the *Vitrina*, a short search yielded *Limax maximus*, *Agriolimax agrestis*, *Arion ater* (black, red, and chocolate forms), *A. subfuscus*, *A. hortensis*, *A. circumscriptus*, *Vitrina pellucida*, *Hyalinia cellaria*, *H. alliaria*, *H. nitidula*, *H. pura*, *Vitreola crystallina*, *Conulus fulvus*, *Punctum pygmaeum*, *Pyramidula rotundata*, *Hygronia hispida*, *Helix nemoralis*, *H. hortensis*, *Arianta arbustorum*, *Azeca tridens*, *Cochlicopa lubrica*, and *Carychium minimum*; the place is evidently favourable to molluscan life.

During life the new *Vitrina* was not examined with as much care as it deserved. The shell seemed rather flat, the animal was very dark-coloured, and it crawled about with unusual vivacity—characters which by a lucky chance made me curious enough to examine its anatomy along with that of two other specimens of *Vitrina* more closely resembling *pellucida*, which were taken at the same time. It may be said at once that these latter corresponded in all respects to *V. pellucida* in shell, genitalia, and radula. The genitalia of the other, however, showed at once that it was neither *pellucida* nor the Irish species called *pyrenaica* or *hibernica*¹ (Fig. 1 a–c). The feature which attracts attention is the presence on the oviduct of a large, globular, hard, glistening swelling, partly enveloped in its upper part, i.e. away from the genital orifice, with

¹ There seem to be no good reasons for separating the form first found by Mr. P. H. Grierson in Co. Louth from the French form known as *pyrenaica*, but it should be clearly understood that in talking of “*pyrenaica*” I am referring to Irish specimens. These do not seem to differ from pickled specimens of *pyrenaica* from Pau which Mr. H. Watson kindly gave me. See J. W. Taylor, *Irish Naturalist*, xvi, 1907, p. 225, *Monograph*, pt. xv, 1908, p. ii of cover, vol. iii, 1914, p. 449; E. W. Bowell, *Irish Naturalist*, xvii, 1908, p. 94, xxiii, 1914, p. 210; A. E. Boycott, *Irish Naturalist*, xxiii, 1914, p. 205.

soft glands. No such structure occurs in *pyrenaica* or *pellucida*, the former having the strange organ (Fig. 1 B, x) opening into the oviduct at about the same level as the penis, while in the latter the genitalia are without either sort of accessory organ. In *pellucida* (Fig. 1 A) the duct of the spermatheca joins the oviduct immediately above the entrance of the penis, in *pyrenaica* the junction is a good deal (about 1 mm.), and in the new species (Fig. 1 C) much (about $2\frac{1}{2}$ mm.) higher up. In *pellucida* the terminal part of the vas deferens

Fig. 1

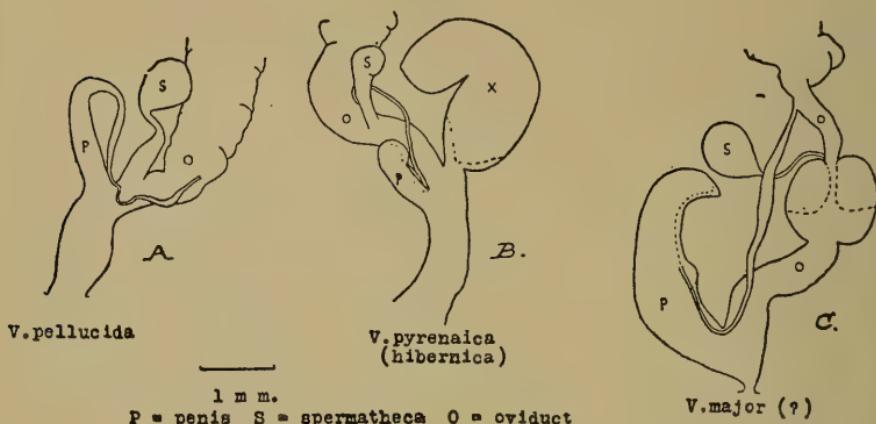


Fig. 3

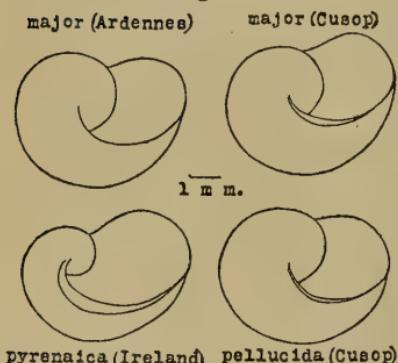
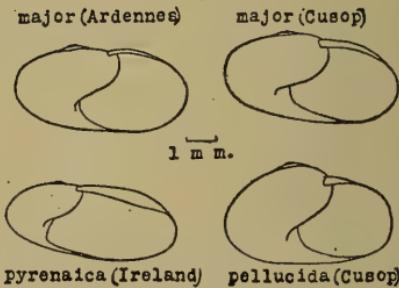


Fig. 2



is rather firmly bound to the penis by a connective tissue sheath, but the two are easily separated by dissection; in the new form, as in *pyrenaica*, the vas disappears from view near the base of the penis, but microscopical sections show in both cases that it runs up in the wall of the penis, and is continuous with the lumen of that organ only at the apex.

The radula of the new form is of the same general type as in *pyrenaica*, and is easily distinguished from that of *pellucida* by the

absence of the comb-like external serrations on the outer externals, which are simple aculeate teeth as in *pyrenaica*.¹ These multicuspitate outer externals seem to be constant in *pellucida*, and their presence has been verified for the present inquiry in specimens from Shetland, Hereford (three localities), Brecon, Radnor, Surrey, Herts (six localities), Cheshire, Sussex, and Glamorgan. As far as I have been able to find, they occur in no other described European *Vitrina*, though a similar type of tooth appears to be present in the North American forms (*alaskana*, *limpida*), which are doubtfully distinct from *pellucida*. In the Cusop snail the ectocones of the inner externals are relatively much smaller than in *pellucida*, in which the two cones are almost equal in size; in *pyrenaica* the ectocones are still smaller.

The shell (Figs. 2 and 3) is not strikingly different from that of *pellucida*; the spire is flatter and the mouth rather longer, the colour and texture identical. From *pyrenaica* it is as distinct as is *pellucida*.

It is evident, then, that the Cusop form is quite different from both *pellucida* and *pyrenaica*. But it is more difficult to say what it is than what it is not. The genital anatomy corresponds as well as can be expected with Moquin-Tandon's description and figures² of *V. major*, a widely spread French species; his description of the dilatation on the oviduct as "demi-cartilagineuse" is particularly striking, for that is just what it looks and feels like under the lens and needle. The shell does not correspond so well. He divides his six species of *Vitrina* into two groups: (a) with the columellar lip flattened ("bord columellaire aplati"), *semilimax* (= *elongata*), *diaphana*, *pyrenaica*; (b) columellar lip sharp, *major* (= *draparnaldi*), *pellucida*, *annularis*. The Cusop shell has a slight but definite border stretching from the columella along the lower margin where the edge of the shell is bent inwards, that is, it has in a small degree what is a prominent shell character in *pyrenaica*. The specimens of *major* in the British Museum all have a sharp edge without the flattened border; so has a specimen of *major* from the Ardennes, which Mr. J. W. Taylor has been good enough to give me. But I am not inclined to attach to this character (at any rate, when slightly developed) the same importance that Moquin-Tandon does. For I find that it is present in a few *pellucida*, noticeably in those found with the new shell in Cusop Dingle, and plainly in several Hertfordshire specimens; Taylor³ mentions the occasional presence in *pellucida* of an "apertural film", and Eckardt⁴ figures

¹ For figures of *pellucida* see Taylor, *Monograph*, iii, 1906, p. 6, and of *pyrenaica* the same, iii, 1914, p. 453; and Bowell, *Irish Naturalist*, xvii, 1908, p. 94.

² *Histoire Naturelle*, vol. ii, 1855, p. 51, pl. vi, figs. 26, 27.

³ *Monograph*, vol. ii, 1906, p. 5.

⁴ *Jenaische Zeit. f. Naturwiss.*, vol. li, 1914, p. 225, fig. 4: a fine monograph on the anatomy of the central German species with a copious bibliography.

pellucida with the whole free lip edged with a periostacal membrane. While, then, the flattening of the columellar lip is a definite character in species such as *pyrenaica*, in which it is highly developed, I doubt whether its presence to a degree which is just plainly perceptible and which fades off into filmy extensions of uncalcified periostracum is of much moment. Apart from the lip, the new shell does not obviously differ from specimens of *major* in the British Museum, except that these are, with one exception, a good deal larger; it is indistinguishable from Mr. Taylor's French specimen identified as *major*, which is the same size. Moquin-Tandon's figure of the radula is too indefinite to be of any help. A genital anatomy which is apparently substantially the same as that of the Cusop snail is figured by A. Schmidt¹ for *draparnaldi* from Bonn, which is generally held to be synonymous with *major*, and by C. Pollonera² for *stabilei* from Italy, the latter remarking on the affinity of this species to *major*, which does not occur in Italy; he figures both *stabilei* and *major* with a small flattening of the columellar lip. Mr. P. Hesse, who is engaged on a monograph of the palaeartic Vitrinidæ, has been good enough to allow me to see drawings of the genitalia of *major* from the Rhine valley; they correspond very well with the Cusop form.

The anatomy of many species being unknown to me, it is hardly possible to reach a certain diagnosis. Judging from the shell alone, the new form might be *reitteri* (Bosnia), *angelicæ* (Greenland), or *penchinati*³ (Pyrenees), as these are represented in the British Museum. By the same criterion it seems certain that it is not *elongata*, *brevis*, *diaphana*, *nivalis*, *alpina*, *glacialis*, *villæ*, or *annularis*. On anatomical grounds it is plainly different from *diaphana*, *brevis*, and *elongata* (Eckardt),⁴ and from the Italian *gæotiformis* and *pegorarii* (Pollonera).⁴ On one ground and another, therefore, of the six species described by Moquin-Tandon it can only be *major*, of the eleven dealt with by Pollonera only *major* or *stabilei* (which may not be really different from *major*), of Germain's⁴ ten species (with five other described forms sunk as synonyms) only *major*, of Geyer's⁵ seven species only *major*. This very dangerous method of exclusion brings us to the same conclusion as does such positive evidence as is available, and there appear to be fairly satisfactory grounds for a provisional conclusion that the Cusop species is *Vitrina major*. It is just possible that it is a new species altogether: this can only be settled by an intimate comparison with authentic

¹ "Geschlectsapp. d. Stylomm.": *Abhandl. Naturw. Ver. f. Sachsen & Thuring.*, Halle, i, No. 1, 1855; p. 49, and fig. 106.

² *Atti R. Accad. Sci. Torino*, xix, 1884, p. 412, pl. x, fig. 46.

³ Germain (*Mollusques de la France*, ii, 1913, p. 62) says *penchinati* = *pyrenaica*.

⁴ Loc. cit.

⁵ *Land- und Süsswasser-Mollusken*, 1909, pp. 18 ff.

Continental examples of *major*, which I have not yet been able to obtain.

Vitrina major is described by Germain (p. 62) as common almost everywhere in France, especially in the west and south, and by Geyer (p. 20) as extending from France and Belgium into western Germany as far east as Bremen and Aschaffenburg. There seems to be no reason why it should not occur in this country, and this is, in fact, not the first time that its occurrence has been reported. Nearly a hundred years ago Gwyn Jeffreys¹ identified as *Vitrina draparnaldi* (which appears to be universally regarded as synonymous with *V. major*) a form which he found in abundance at the roots of *Rosa spinosissima* on Swansea Burrows; it differed from *pellucida* in having the aperture "elliptico-lunata" instead of "subrotundata" and the body "griseum" rather than "albo cinereum"; he notes, too, that in *pellucida* the spire is "more central and produced" and the "animal not so disproportionately large". These characters are hardly diagnostic, but they are suggestive, and it seems likely that his youthful enthusiasm was more correct than the maturer caution which led him thirty years later² to include his *V. draparnaldi* with var. *depressiuscula* of *pellucida*. J. W. Taylor³ says: "I have never seen a British specimen of the true *Vitrina major* Féér. (*V. draparnaldi* Cuvier), yet Continental authors almost universally describe it as a British species," and J. R. Le B. Tomlin and E. D. Marquand⁴ note that in the Channel Isles the *pellucida* "all belong to a form which is flatter and proportionately more elongate than the type".

The form and function of the remarkable swelling on the oviduct require further consideration. It is singularly firm and hard, with a smooth shining surface, and at first sight reminds one of a gizzard of some sort. On section (Fig. 4) it has a thick muscular coat externally which encloses a mass of glandular tissue. The oviduct narrows somewhat where it enters at the upper end and then expands into an irregular cavity lined with the glandular tissue, which consists of large clear cells, probably with a mucoid or albuminous secretion; there are, at any rate, no histological signs of the secretion being calcareous. Towards the lower end the cavity becomes lined with regular epithelium, and, passing below the glandular tissue, has a close muscular investment and finally, the lumen becoming smaller and smaller, opens into the lower oviduct through a narrow orifice, which projects into the oviduct like a spout. Fig. 4 shows diagrammatically a longitudinal section through the

¹ *Trans. Linnean Soc.*, vol. xvi, 1830, p. 326: paper dated "Swansea, 1st September, 1828," i.e. when the author was about 19.

² *British Conchology*, vol. i, 1862, p. 157.

³ *Monograph*, vol. iii, 1906, p. 8.

⁴ *Journ. Conch.*, vol. x, 1903, p. 285.

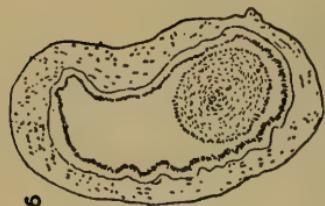


Fig. 6

"Spout" of major
0.1 mm.

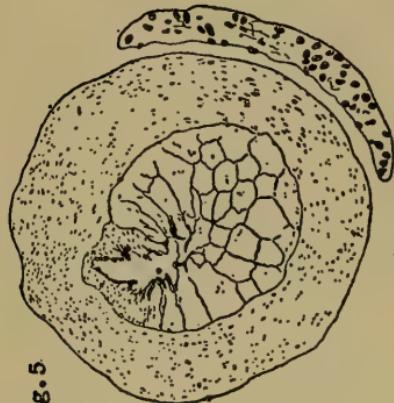


Fig. 5

Oviducal mass of major
0.1 mm.

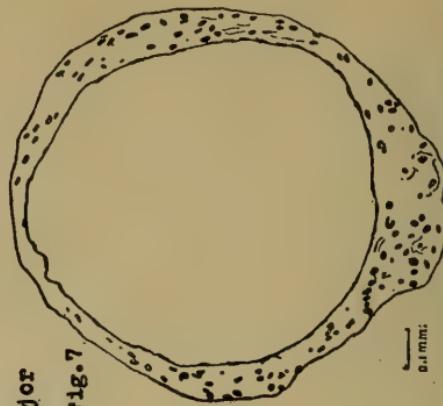


Fig. 7

"X" organ of pyrenaica
0.1 mm.

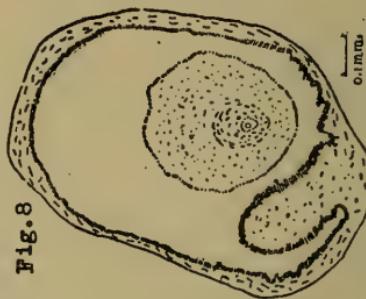


Fig. 8

"Spout" of pyrenaica
0.1 mm.

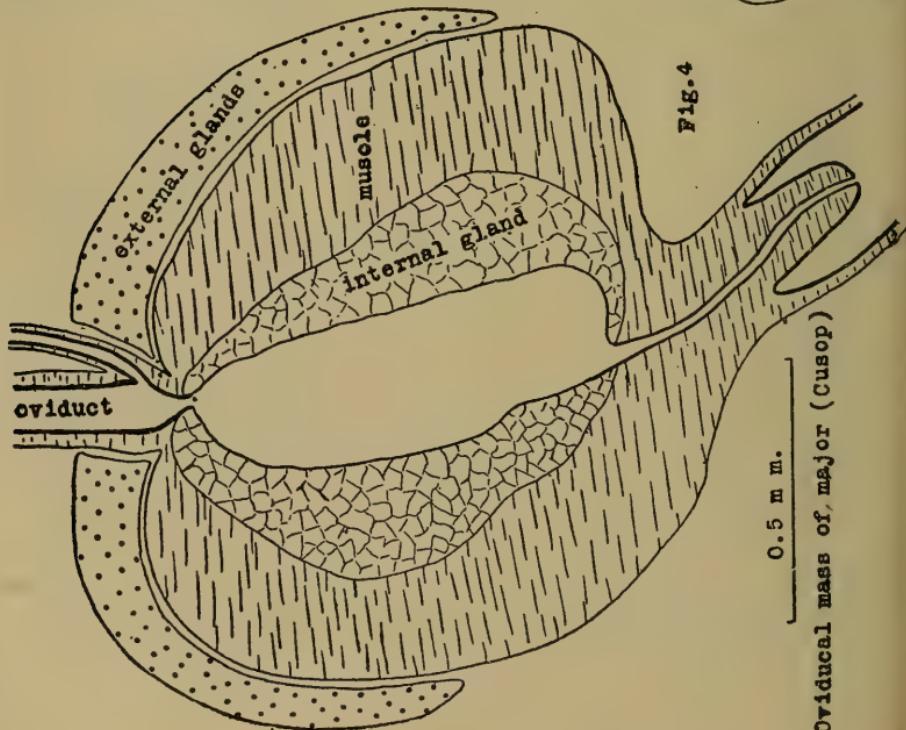


Fig. 4

0.5 mm.

Oviducal mass of major (Cusop)

mass reconstructed from transverse sections, Fig. 5 a transverse (slightly oblique) section a little below the middle, and Fig. 6 a similar section showing the projection of the spout into the lumen of the oviduct. The loose investing glands covering the upper part of the mass (shown on one side in Fig. 5) consists of large cells with enormous nuclei (if they really are nuclei), which stain deeply with haematoxylin; their cytoplasm also suggests that their secretion is calcareous. Where and how these external glands discharge their product I have not been able to determine. The lumen of the spout is, in fixed specimens, only about 0·01 mm., and the orifice by which it finally opens into the oviduct is smaller still. The eggs of *major*¹ are about 0·33 mm. in diameter, those of the North American *limpida*² about 1 mm. It seems at first sight extraordinary that so narrow a passage should be interposed on the course which the eggs have to follow, and I searched in vain for some alternative route, until I reflected that no one dissecting the human genitalia for the first time would from the structure think it possible that a baby should get through the cervical canal of the uterus. The muscular tissue which forms the spout is no doubt responsible for contracting the lumen to such small dimensions, but such tissue is capable also of great expansion. As Dr. Bowell suggests, the whole arrangement appears to be well adapted for retaining each egg until it has been coated by the internal glands. Hence the species may be found to lay eggs singly at rather long intervals. As to this I have no information; Moquin-Tandon says only that there are eight to fifteen eggs stuck together in small masses.

This oviducal mass of *major* has in some ways a striking resemblance to the x organ of *pyrenaica* (Fig. 1). This latter opens into the oviduct, but the eggs do not pass through it. The walls (Figs. 7 and 8) have very little muscle except at the lower end, where there is a spout quite similar to that of *major*, with a narrow opening to the oviduct. Most of the substance of the wall is made up of glandular tissue similar to that of the loose investing glands of *major*. The cavity is relatively much larger, and nothing more definite than amorphous granular material has been found in it. I have not seen anything in the x organ corresponding to the internal gland of the mass in *major*. It is quite possible, however, that it is the function of both organs to contribute to the coats of the egg, in *major* as it passes through and in *pyrenaica* as it travels along the oviduct past the opening. The thick walls of the penis in both *pyrenaica* and *major* contain a considerable quantity of calcareous (?) glandular tissue, in appearance identical with that in the x organ and external glands respectively.

Simroth and others³ boldly solve the tangle of these various

¹ Moquin-Tandon, loc. cit., p. 51.

² G. H. Clapp, *Nautilus*, xvii, 1903, p. 91.

³ See Eckardt, loc. cit.; Taylor, *Monograph*, iii, 1914, p. 453; Bowell, *Irish Naturalist*, xxiii, 1914, p. 210.

organs by making them homologous or analagous with the dart sac apparatus of the Helices, and the glandular tissue which is present in all of them is plainly called "dart gland". For this assumption I can see no sort of justification; morphologically, in a group which those who know more about the past than they do about the present describe as of polyphyletic origin, it is at the best a dubious speculation, functionally it is impossible. Apart, however, from terminology, it forms the basis of a useful classification of the genus into—

(a) Without glands :

pellucida.

(b) With glands :

(a) Incorporated with the penis only, e.g. *diaphana*.

(β) Incorporated with the oviduct, e.g. *major*.

(γ) Free, e.g. *nivalis*, *brevis*, *elongata*, *pyrenaica*.

The next thing to do is to extend our knowledge of the British distribution of the species. It cannot, I think, be identified from the shell, at any rate without much more experience. Any specimens of *Vitrina* with relatively large dark bodies and rather flat-spired shells should be examined anatomically; the swelling on the oviduct is easy to see on rough dissection, and any radula in which the outer marginals have not got the multicuspids of *pellucida* is very suggestive. I should be glad of the opportunity of examining any specimens; they are most instructive if seen alive, failing which they should be preserved in alcohol, *not* formalin; dried bodies are sufficient for the radula.

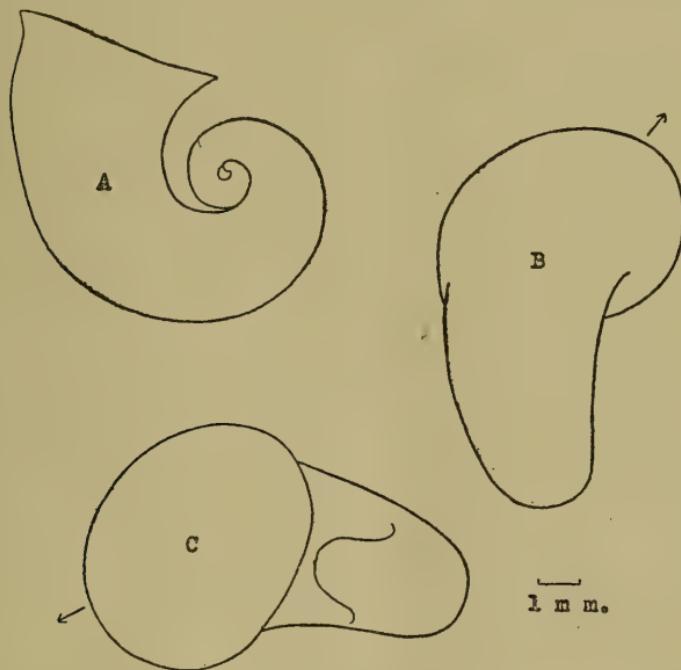
Addendum.—On 21st July, while we were collecting *Acanthinula lamellata* in Mr. J. E. Cooper's locality at Burnham Beeches, Bucks, Dr. E. J. Salisbury found another dark-bodied vivacious *Vitrina*, which in genitalia and radula is identical with the Cusop snail, except that the external glands on the oviducal mass are much smaller; the columellar lip is sharp. In my experience, full-grown *pellucida* are unknown at this time of year, which may be another difference between the two species. The locus here was a ditch with beech and some holly leaves, the ground not calcareous; *A. lamellata* was the predominant species, and we found also *Arion ater*, *A. minimus*, *A. hortensis*, *A. circumscriptus*, *Hyalinia cellaria*, *H. alliaria*, *H. pura*, *H. radiatula*, *Conulus fulvus*, *Pyramidula rotundata*, *Punctum pygmaeum*, *Acanthinula aculeata*, *Vertigo edentula*, and *Acme lineata*.

A SPECIMEN OF *LIMNÆA PEREGER* COILED ON THE FLAT.

By Dr. A. E. BOYCOTT, F.R.S.

Read 9th June, 1922.

A PAIR of sinistral *Limnæa pereger*, derived ultimately from the classical locality near Leeds, which I owe to the kindness of Mr. J. W. Taylor, M.Sc., produced in 1920 a brood of 350 sinistral offspring. A pair of these were put in a jar by themselves when quite small on 4th November, 1920. Eggs were seen on 24th May, 1921, and when the brood was sorted out and examined carefully on 12th July, 1921, I found twenty-eight sinistral young, three dextral, and one which was coiled on the flat. At this time it was about 2 mm. in diameter. With a jar to itself it grew fairly quickly, and by the autumn was about 8 mm. in its greatest diameter. It started growing again the following April, and did well till 5th June, 1922; in the morning it seemed quite well, but my hopes of a self-fertilized progeny were doomed to disappointment, for in the afternoon it was found out of its shell, dead.



The shell is shown from the side in Fig. A, dorsally in B, and ventrally in C. It is coiled very nearly on the flat; indeed, the appearance of a slight inclination to coil in a very extended sinistral spiral is due to an obliquity of the growth of the lip, which appeared in the spring growth of 1922. The coil is mostly but not entirely

open, the whorls being in contact about half a turn from the apex. The shell sometimes lay along the axis of the body of the crawling snail, but it was generally held obliquely to the right, the direction of the snail's head being indicated by the arrows in B and C.

During life it was ascertained that the rectum opened on the left side of the head. Luckily the body was obtained in good condition, and dissection showed that the genital orifices were also transposed to the left side. Anatomically, therefore, the specimen is sinistral. As might be expected, its organs showed no gross abnormalities, though I could not be sure of the asymmetry of the pallial ganglia on the visceral loop, due to the osphradium, which is generally plain enough,¹ the right or left being the larger in dextral or sinistral individuals respectively. The radula was normal. The genitalia were well developed, but in serial sections I could find no eggs or spermatozoa, the hermaphrodite gland being represented by a mass of loose connective tissue. This may have been the result of senility, but the presence of fairly normal lower genitalia is apparently compatible with the absence of sexual cells, as was found in the *og* form of *Cochlicopa lubrica*, described by Bowell.² From an early age it could be seen that the apical 2 or 3 millimetres of shell was empty of viscera, which suggests that the gonads failed to develop. The apical viscera were small and looked wasted as they do in elderly *pereger*; histologically, the liver and intestine were in good order. The snail probably died of old age. It was just about 12 months old, and my experience as far as it goes of similar *pereger* in captivity is that they generally die between 10 and 18 months, which corresponds to what one deduces from observations in the field.

P. Pelseneer³ has seen shells without any spiral twist in *Paludina vivipara*, *Littorina rufa*, *Purpura lapillus*, *Limnaea stagnalis*, *Physa ancilla*, and *Ph. fontinalis*, but only in embryos, and he says (p. 401) that such forms are not viable. Unfortunately I do not know what the condition of the embryos was in the present case. Among 4,782 cousins which hatched and were examined, I found only two more abnormal shells, one scalariform and one which started in a normal sinistral spiral and then began to expand on the flat; both died young. Of the three dextral brothers two have survived, and in them the rectum opens on the right; similarly, the survivors of the twenty-eight sinistrals defaecate on the left. They are, therefore, presumably complete dextrals and sinistrals, and afford no evidence that this flat shell is objective evidence of hyperstrophy.⁴

¹ See fig. 423 in Taylor's *Monograph*, vol. i, 1897, p. 214, for *L. pereger*, or fig. 102 in A. H. Cooke's "Mollusca", Cambridge Natural History, 1895, p. 204, for *L. stagnalis*.

² These *Proceedings*, vol. xii, 1917, p. 313.

³ *Les variations et leur hérité chez les mollusques*, 1920, p. 354, and especially fig. 234, p. 342.

⁴ J. W. Taylor, *Monograph*, vol. i, 1895, p. 110.

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

By CHAS. H. O'DONOOGHUE, D.Sc., F.Z.S. (Communicated by
G. C. Robson, M.A., F.Z.S.)

Read February, March, and April, 1922.

I. ON CAVOLINA CRASSICORNIS AND C. SUBROSACEA, OF
ESCHSCHOLTZ.

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.

A. *Carolina crassicornis.*

The second of these he named *Carolina crassicornis*, and in view of the rarity and consequent inaccessibility of his work it may be permissible to quote from it in some detail.

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

"An der Nordwestküste Africa'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; letztere sind an ihrer Wurzel sehr dick und übertreffen die hintere stark geringelten braunen Fühler, welche eine gelb, Spitze haben, an lange beträchtlich. Auf der obren Fläche der vordern Fühler beginnt von der Spitze ein gelber Streifen und setzt sich auf den Nacken fort, wo er sich sehr breit wird und allmälig eine perlblaue Farbe annimmt; auf der mitte des Nackens eine brennend oranger Streifen, an gleicher an jeder Seite; jeder orange Streifen ist von einer weisen Linie eingefasst. Auf der Mitte des hell hornfarbenen Rückens bemerkt man eine Stelle unter welcher das Herz pulsirt; über den ganzen Rücken bis zur Schwanzspitze erstreckt sich ein perlmutterfarbener Streifen. Der kiemenartiger Fortsätze an den Seiten des Leibes unterscheidet man vier bis fünf Bündel; jeder einzelne Fortsatz ist 2-4 Linien lang, an der ganzen untern Seite hornfarben, oben schwarz mit einem breiten weissen Längsstreifen und breiter oranger Spitze. Auf dem platten weissen Schwanzte bemerkt man ausser der mittlern Linie noch zwei weisse Längsstreifen. Auch der hornfarbige Fuss hat eine weisse Randlinie.

"Die abgefallenen kiemenartigen Fortsätze, welche sich leicht lostrennen . . ."

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.

Gray (8) in 1857 placed this form in the genus *Facelina*, but Trinchesa (13, p. 31) pointed out in 1881 that this was not justified

for several reasons. The same author criticizes Eschscholtz's account of the species, and concludes, "Evidentemente, la figura di Eschscholtz è falsa, e deve perciò essere eliminata dal materiale scientifico." This sweeping statement is hardly necessary, and, as will be pointed out below, the description furnished by Eschscholtz was the most complete in some respects that was given for seventy years.

In 1862 Cooper (5, p. 205) described a species *Aeolis* (*Flabellina*) *opalescens* with an opaline colour on the dorsal tentacles and an orange stripe between them (cf. Eschscholtz). 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. cerata).

Bergh in 1878 (1, p. 573), and again in 1879 (2, p. 81), formed a new genus *Hermisenda* 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 *Hermisenda* *opalescens*, the only member of the genus. The rhinophores are stated to be yellow with an orange stripe between them (cf. Eschscholtz). The papillæ are yellow with the purple red liver diverticulum shining through.

Cockerell in 1901 (3, p. 122) also described the same form, calling attention to the two "opal blue" lines on the back 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 cerata possess an "orange subterminal ring", and that they are "easily deciduous" (cf. Eschscholtz).

The same author in conjunction with Eliot in 1905 (4, p. 50), but strangely enough without reference to his previous paper, again dealt with this species. 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 (9, pp. 201, 202), but at the time the paper was written the author had 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 (10) deals with the range of colour variation met with in the same species. In the two papers practically every point in regard to colour mentioned by 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-coloured 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 a deep 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 by 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 more precise account of the colour of the living animal I think the identity of *Cavolina crassicornis* and *Hermisenda opalescens* 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 name *crassicornis* substituted for it.

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

Family ÆOLIDIDÆ, Eliot, 1910.

Genus HERMISSENDA, Bergh, 1878.

Species *Hermisenda crassicornis*, Eschscholtz, 1831.

Synonymy: *Cavolina crassicornis*, Eschscholtz, 1831.

Facelina (Cavolina) crassicornis, Gray, 1857.

Æolis (Flabellina) opalescens, Cooper, 1862.

Flabellina opalescens, Cooper, 1863.

Hermisenda opalescens, Bergh, 1878, 1879.

Facelina (Cavolina) crassicornis, Trinchesse, 1881.

Hermisenda opalescens, Cockerell, 1901.

“ “ “ Cockerell & Eliot, 1905.

“ “ “ O'Donoghue, 1921, 1922.

“ “ “ O'Donoghue &

O'Donoghue, 1922.

B. *Cavolina subrosacea*.

This was the third of the Alaskan forms described by Eschscholtz, and was also found on Sitka Island. The figure of this species is poor and the description very brief. From this account it is only necessary to quote the following points: "Die vordern Fühler fein" (i.e. oral tentacles)—"die hintern Fühler sehr schwach geringelt" (i.e. the rhinophores)—"das vorderer Ende der Fussplatte ist jederseits mit einem flügel-artigen anhange versehen."

The original genus *Cavolina*, Cuvier, comprised forms with non-perfoliate rhinophores and rounded angles on the foot, so that this species was not accurately referred to the genus by Eschscholtz. Gray (8) included this with the foregoing species in the genus *Facelina*, and in the same way Trinchesse (13, p. 31) pointed out "Nemmeno la *Cavolina subrosacea* di Eschscholtz deve essere

compressa nel genere *Facelina* ", but he does not suggest where it should be placed.

The original description is incomplete, and the illustration also is not good, but the form does not appear to have been found subsequently, and so we have only this to go upon. In the absence of further details, particularly of the radula, it is hardly possible to place this form accurately, but in the possession of fine oral tentacles, produced angles on the foot, and feebly perfoliate rhinophores, it agrees with certain members of the genus *Coryphella*. Pending its rediscovery and more accurate description, it would seem advisable to include it in this genus.

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

Family ÆOLIDIDÆ, Eliot, 1910.

Genus CORYPHELLA, Gray, 1857.

Species *Coryphella subrosacea*, Eschscholtz, 1831.

Synonymy : *Cavolina subrosacea*, Eschscholtz, 1831.

Facelina (Cavolina) subrosacea, Gray, 1831.

" " " " Trinchese, 1881.

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II. ON THE GENUS TRIOPHA, Bergh.

In 1863 Cooper (7, p. 59) described a new form of Nudibranch from Catalina Island, and referred it to the genus *Triopa* (presumably of Johnston) with the name *T. catalinæ*. Ten years later Stearns

(12, p. 78) described an allied form from Monterey, which he named *Triopa carpenteri*.

Abraham also cites these two species as *Triopa catalinae* and *carpenteri* in 1877 (1, p. 230).

Bergh in 1880 (2, p. 112) discussed the generic characters of the second of these forms, and pointed out that, while it agrees with the *Triopa* of Johnston in certain characters, it, nevertheless, differs in certain important particulars, and he created for it a new genus *Triopha*, which has subsequently been accepted. At the same time he described another species *T. modesta*, but suggested that further examination might show that it was identical with *T. carpenteri*. The same author in 1894 (3, p. 184) gave a fuller description of the animal and here definitely placed *T. carpenteri* as a synonym, though I cannot understand why he did this, for obviously if the forms were identical, then the name of the species would have to be *T. carpenteri*, for this name was applied in 1873 and, therefore, had priority. However, subsequent work showed that he was in error, and the two forms are distinct.

MacFarland, in 1905 (8, p. 48), gave a preliminary account and in 1906 (9, p. 135) a more detailed description of *T. carpenteri*, in which he shows clearly that the animal, while similar to *T. modesta* in many ways, is undoubtedly specifically distinct, and both names, therefore, stand as representing valid species. In the same papers MacFarland described two new species, namely, *Triopha maculata* (8, p. 49, and 9, p. 137) and *T. grandis* (8, p. 50, and 9, p. 139).

The next authors to deal with the genus were Cockerell and Eliot in 1905 (6, p. 42), who described a specimen from San Pedro which they referred to the genus *Triopha*, but did not give any specific name, as they lacked notes on the living animal. The former author in a brief list of the Mollusca of La Jolla (5, p. 107) appends a note to say that he recovered the notes on the external characters and proposed to name the species *T. aurantiaca*. Cockerell, again, in 1915 (4, p. 228) describes yet another species, calling it *Triopha scrippsiiana*, and mentions *T. aurantiaca* without, however, giving any reference to his previous paper.

In 1921, O'Donoghue (10, p. 165) examined a number of specimens of a *Triopha* which was found to be identical with the *Triopha* sp. ? of Cockerell and Eliot, and the additional data there given was thought sufficient to merit its being retained as a species under the name *T. elioti*. This name was also used in dealing with the species subsequently (11). When the above were written, the author was unaware of the note appended by Cockerell to his list of the Mollusca of La Jolla, but it is obvious from this that the true name of the species is *Triopha aurantiaca*, and *T. elioti* is to be regarded as a synonym.

The genus *Triopha* has so far only been recorded from the Pacific coast of North America, where it is represented by a series of forms

ranging from Unalaska to the south of California. Of these, *T. catalinæ* is very inadequately described, and, on the one hand, it may not belong to the genus or, on the other, it may be one of the species described subsequently. It is here included for the sake of completeness in the following list of the known members of the genus:—

Genus *TRIOPHA*, Bergh, 1880.

Species: *T. aurantiaca*, Cockerell, 1908 (synonyms: *Triopha* sp.? Cockerell & Eliot, 1905; *T. elioti*, O'Donoghue, 1921).

T. carpenteri, Stearns, 1873.

T. catalinæ, Cooper, 1863.

T. grandis, MacFarland, 1905.

T. maculata, MacFarland, 1905.

T. modesta, Bergh, 1880.

T. scrippsiana, Cockerell, 1915.

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III. ON FLABELLINA (*ÆOLIS*) IODINEA, COOPER, AND ON THECACERA VELOX, COCKERELL.

A. On *Flabellina* (*Æolis*) *iodinea*, Cooper.

In 1862 Cooper (5, p. 205) described briefly a species of Nudibranch from San Diego, which he termed *Æolis* (*Phidiana* ?) *iodinea*, noting

the "rich violet purple" colour, "orange red branchiæ," i.e. cerata, and the "orange red" rhinophores. The following year (6, p. 60) he again treated of this species, and referred it definitely to *Phidiana iodinea*.

Bergh in 1873 (1, p. 615) also dealt with it as *Phidiana iodinea*, calling attention to the slight and meagre description furnished by Cooper. Again, in 1879 (2, pp. 79–80), when he was able to examine an actual specimen, he referred it to the genus *Flabellina*, Cuvier, again noting the "violet purple" body colour, "orange thinophores," and "orange red" cerata. He also gave a description of the radula and drawings of the teeth.

In 1901 Cockerell (3, p. 121) also described the same species, remarking on the body colour as "brilliant purple" and the rhinophores and papillæ he describes as "pale salmon colour". The description he gives of the teeth agrees closely with that of Bergh, whose paper, however, he does not mention, and he concludes that it belongs to the genus *Coryphella*, Gray.

There are several points of difference between these two genera, the most obvious being—

Coryphella.

Rhinophores generally smooth.
Anterior corners of foot
angulated or rather produced.
Penis unarmed.

Flabellina.

Rhinophores perfoliate.
Anterior corners of foot pro-
duced into tentacles.
Penis armed with a style.

In all these points the specimen agrees with *Flabellina*, according to Bergh's account, and even Cockerell speaks of the tentacles of the foot, so that there seems little doubt that it really belongs to this genus.

The classification and synonymy of this form is, therefore :—

Genus FLABELLINA, Cuvier, 1830.

Species *Flabellina iodinea*, Cooper, 1862.

Synonymy: *Æolis (Phidiana ?) iodinea*, Cooper, 1862.

Phidiana iodinea, Cooper, 1863.

"", Bergh, 1873.

Flabellina iodinea, Bergh, 1879.

Coryphella iodinea, Cockerell, 1901.

B. On *Thecacera velox*, Cockerell.

In Cockerell's paper in 1901 (3, p. 87) he also describes a new species of Nudibranch from La Jolla, under the name *Thecacera velox*, but he gives no references to other literature, merely remarking that it is very similar to *T. pennigera*. He again refers to the species in 1908 (4, p. 106).

The genus *Thecacera* was established in 1828 by Fleming (8, p. 283) for a species described by Montagu in 1807 (9, p. 17) as

Doris pennigera. This is the form referred to by Cockerell, and there seems little doubt that the specimen he describes is referable to the genus of which *T. pennigera* is the type. It stands, therefore :—

Genus THECACERA, Fleming, 1828.

Species *Thecacera velox*, Cockerell, 1901.

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IV. ON JANOLUS (ÆOLIS) BARBARENSIS, COOPER, AND ON THE
ÆOLIDIA HERCULEA OF BERGH.

A. On *Janolus (Æolis) barbarensis*, Cooper.

Cooper in 1863 (5, pp. 59 and 60) describes a nudibranch from Santa Barbara under the name *Æolis barbarensis*. Like most of his descriptions this one is extremely brief, and hardly sufficient to enable an accurate determination of its identity to be made. He says: "Rose-red, longer tentacles tipped with yellow, branchial ciliæ simple, in six longitudinal rows, all short, the middle rows longest and tipped with blue, anterior tentacles small, above the mouth, dorsal tentacles club-shaped, a white streak extending from the median line between them to the mouth. Length nearly an inch."

Later, Cockerell and Eliot in 1905 (4, pp. 48–50) describe a form from Dead Man's Island, San Pedro, giving it the name *Janolus cœruleopictus*. The account was based upon a preserved specimen, and the authors state that the rhinophores are "large, stout, almost spherical", which means that in the living condition and slightly extended they would be close to Cooper's "dorsal tentacles club-shaped". The same authors also say: "the anterior end of the animal somewhat distorted, but there appears to have been a fold over the mouth with a distinct cylindrical tentacle on each side"; and, again, this seems to correspond with Cooper's "anterior tentacles small, above the mouth". Thus Cooper's form was probably a *Janolus*.

The latter author describes the colour as "rose-red", while Cockerell and Eliot picture it as tawny yellow, perhaps sufficiently near to be within the limits of variation. The striking point, however, is Cooper's statement that the larger cerata are tipped with blue, which agrees exactly with the figures in Cockerell and Eliot, who show the larger cerata with blue tips, which the smaller cerata lack. It seems very probable from the evidence furnished above that the forms are identical, particularly when it is borne in mind that they come from approximately the same area, and are the only forms so far recorded from the whole coast with blue-tipped cerata. Sir Charles Eliot informs me that he is inclined to agree with this decision. The animal thus stands as *Janolus barbarensis*, Cooper.

The classification and synonymy is therefore :—

Family JANIDÆ.

Genus *JANOLUS*, Bergh, 1884.

Species *Janolus barbarensis*, Cooper, 1863.

Synonymy : *Aeolis barbarensis*, Cooper, 1863.

Janolus cæruleopictus, Cockerell & Eliot, 1905.

B. On the *Aeolidia herculea* of Bergh.

Bergh in 1894 described a form as *Aeolidia herculea*, and gave a moderate account of its anatomy. He concludes : "Diese Form scheint durch die Form der Kiefer von der in pacifischen Ocean vorkommenden Varietät der *A. papillosa* verschieden ; vielleicht ist sie aber auch nur eine local Varietät" (3, p. 129).

There appears to be no difference in other respects. If one examines the figure of the mandible of *Aeolidia papillosa* given by Bergh in 1879 (1, pl. i, fig. 1) and that of *Aeolidia herculea* by the same author in 1894 (3, pl. i, fig. 8), it will be found practically impossible, allowing for the slightly different style of drawing and size, to distinguish between them. In his description of *A. herculea* he states it is "gerundet und gewölbt wie bei keiner der anderen bisher bekannten ächten Aeolidien". The difference, however, is not sufficient to show in camera lucida drawings.

In view of Bergh's proclivity for creating species and varieties without sufficient justification, I have no hesitation in identifying these two forms as one and the same species. It should stand, therefore :—

Family AEOLIDIDÆ.

Genus *AEOLIDIA*, Cuvier, 1798.

Species *Aeolidia papillosa*, Linnæus.

Synonym *Aeolidia herculea*, Bergh.

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V. ON THE FAMILY DORIOPSISIDÆ (DORIDOPSISIDÆ).

Pease in 1860 (19, p. 32) created a new genus which he termed *Doriopsis*, but the definition that he gave was not a very concise one. Four years later Alder and Hancock (2, pp. 124–130) established another genus *Doridopsis*, and in view of its peculiar characters separated it off as a distinct family, the Doridopsisidæ. It is closely allied to the Dorididæ, but among other differences is decidedly noteworthy in lacking a radula, while this organ is well developed in the other family. This raising to family rank was adopted by Hancock in 1865 (16, pp. 189–207) and by all subsequent workers. Pease in 1871 (20, p. 279) reaffirmed his genus *Doriopsis*, maintaining that it was slightly different from that of Alder and Hancock, and proposed for the latter the name *Haustellodoris*. As Bergh points out, however (1875, pp. 82–94), there is not much doubt that all Pease's species would fall within Alder and Hancock's genus, a statement with which Abraham (1, p. 240) is in agreement. Thus what Alder and Hancock virtually did was to redefine the genus more accurately. The validity of the genus and family is not now questioned, but the name appears in dispute. It is obvious that Pease's name has priority, and it was adopted by Bergh in a series of papers from 1875 to 1884 (3–8). Abraham (1, p. 240) adopts Alder and Hancock's name, stating: "We cannot follow him (*i.e.* Bergh) in adopting 'Doriopsis' as the generic name, not only because none but Mr. Pease's own species, about which we cannot always feel sure, will fall under that species as defined by him, but also because the root of 'Doris' is 'Dorid' and not 'Dori', so that 'Doridopsis' is more correct etymologically than 'Doriopsis'." Eliot (13, p. 660, and 14, p. 7, etc.) also employs the former of these two names.

In answer to the first of Abraham's objections, it may be pointed out that it not infrequently happens that the definition of a genus as originally given has to be modified, usually to exclude but sometimes to include other forms. The second is not a strong objection either, for we are not, it may be unfortunately, primarily concerned with questions of etymology, and it would not be difficult to cite cases where the names of genera and species are etymologically incorrect.

It seems obvious that the constituent species of the two genera are almost identical or, at any rate, can be made so by a slight

change of definition; indeed, if *Doridopsis* be used, *Doriopsis* disappears as a genus. Secondly, *Doriopsis* has been adopted subsequently by a number of workers, e.g. Bergh (3-8), Farran (15), MacFarland (17 and 18), Vayssi  re (21), and others. On the whole, then, it seems advisable to retain the term *Doriopsis*, originally used by Pease, with its definition amended, and employ it in the sense used by Bergh in 1880 (6).

The latter author in this paper added to the family a new and closely allied genus *Doriopsilla*, which has since been accepted. In this connexion it is to be noticed that if the second of Abraham's objections has weight, then this genus should be termed "Doridopsilla", a proceeding that no one has suggested.

The following species from the Pacific Coast of North America have been referred to the family.

In 1803 Cooper (12, p. 58) described a form under the name of ?*Doris albopunctata*, and later in 1905 (10, p. 41) Cockerell and Eliot describe a *Doridopsis reticulata*, but at the same time point out that it is probably identical with Cooper's form. If this be the case, as seems not improbable, then the name of the animal should have been given as *Doriopsis albopunctata*. However, a re-examination of specimens convinced Eliot later (13, p. 660) that it really belongs to the genus *Doriopsilla*, so that the name stands as *Doriopsilla albo-punctata*, with Cockerell and Eliot's name *D. reticulata* as a synonym.

These two authors (10, p. 46) also describe a *Doridopsis vidua* (?), which they point out is probably identical with the *D. vidua* of Bergh, 1878, but if it should prove distinct they propose for it the name *D. nigromaculata*. In a list provided by Cockerell in 1908 (9, p. 106), this author gives *D. nigromaculata* (?) = *vidua*, Bergh, but obviously if it is = *vidua*, Bergh, then it is *Doriopsis vidua*, and *D. nigromaculata* is only a synonym.

Lastly, we have MacFarland in 1905 (17, p. 245) and 1906 (18, p. 130) describing a *Doriopsis fulva*.

Cooper in 1862 (11, p. 204) described a species as *Doris (Actinocyclus) sandiegensis*, and this Abraham (1, p. 246) suggests should probably be regarded as *Doridopsis sandiegensis*. This, however, was afterwards shown by Bergh, 1880 (7a, p. 41), to be *Diadumene sandiegensis*, an identification about which there seems to be no doubt. The members of this family are, therefore:—

Family DORIOPSIDÆ.

Genus DORIOPSIS, Pease, 1860.

Species : *Doriopsis fulva*, MacFarland, 1905.

Doriopsis vidua, Bergh, 1878 (recorded from California by Cockerell and Eliot, 1905).

Synonym : *D. nigromaculata*, Cockerell and Eliot, 1905.

If *D. nigromaculata* should ever be shown to be a separate species, then the two names would stand.

Genus *DORIOPILLA*, Bergh, 1880.Species *Doriopsilla albopunctata*, Cooper, 1863.Synonymy: ? *Doris albopunctata*, Cooper, 1863.*Doridopsis reticulata*, Cockerell & Eliot, 1905.*Doriopsilla reticulata*, Eliot, 1906.If *D. reticulata* should ever be shown to be a separate species, then the two names would stand.

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VI. ON FIONA MARINA, FORSKÅL.

The history of the nomenclature of the species now known as *Fiona marina* is a varied one, and has not, I think, been fully set forth. It is of interest since it is one of the first three forms to be recorded from this region.

One of the first nudibranchs to be described in a manner that enabled it to be recognized subsequently was *Limax marinus*, which was reported by Forskål (17, p. 99) in 1775.

Van Hasselt, in a letter to Professor van Swinderen dated 25th May, 1823, from Tjuringe, Java, but first published in 1824 (18, p. 22, and 19, p. 238), described what he presumed to be a new species *Eolidia alba*.

Eschscholtz (15, p. 14) in 1831, furnishing the first account of the Nudibranchs from the Pacific Coast of North America, included the record of an *Eolidia pinnata*, examples of which were collected by Captain von Kotzebue at Sitka, Alaska, in 1824.

Quoy et Gaimard (20, p. 288), in 1832, described an *Æolis longicauda* from New Zealand waters. In 1857 Alder and Hancock (1, p. 291) recorded a new form which they termed *Oithona nobilis*, and claimed it not only as a new species, but also as the type of a new genus. In Forbes and Hanley's "British Mollusca" (16, p. x) we find a footnote: "Mr. Alder and Mr. Hancock inform us of their intention to substitute the generic name *Fiona* for *Oithona* (Fam. Eolididæ), the latter appellation having been previously employed by Dr. Baird for a genus of Entomostraca." This was established more permanently by these two writers in 1855 (3, pp. 52-53). In the latter paper, also, they made it not only the type of a genus but also of the Family Fionidæ, an arrangement subsequently accepted and adopted by Eliot (14, pp. 75 and 166) in 1910.

The establishment of the genus *Fiona* was also accepted by Bergh, when in 1858 (4) he described a form as *Fiona atlantica*, and again in 1859 (5) and in his subsequent papers. Generic rank is undoubtedly deserved by these forms, since, while they resemble the *Æolidida* superficially, they differ in certain important respects and are easily recognizable. The genus is to be distinguished by the presence of a gill lamella or membrane running down the side of each of the cerata; the anus is dextro-dorsal in position; the apertures of the genital ducts are separate; the dorsal margin forms a rudimentary flap; the jaws are denticulate; the radula is uniseriate, and the oral tentacles are set far back.

In 1866 (13, iii, pp. 64-80) and in 1867 Costa (13, iv, p. 28) described a species from the Mediterranean Sea under the name *Hymenæolis elegantissima*, but this is obviously a *Fiona*.

It appears probable, however, that all these names have been given to one and the same species. Bergh in 1879 (8, p. 86) gives as synonyms *L. marinus*, *F. nobilis*, *F. atlantica*, and *H. elegantissima*. Eliot, again (14, p. 166), in 1910, regards *L. marinus*, *F. nobilis*, and *F. atlantica* as identical.

Bergh also, in 1879 (8, p. 86), in 1884 (9, p. 9), and again in 1894 (11, pp. 130-131), also suggests that *Eolidia pinnata*, Esch., *Æolis longicauda*, and *E. alba* are also to be regarded as synonymous. The last of these is apparently still somewhat doubtful, for the same author says of it in 1887 (10, p. 310): "Diese, von van Hasselt durch zwei Figuren illustrierte Form, lässt sich weder durch den Text, noch durch die Figuren generich bestimmen; vielleicht konnte sie einen *Proctonotus* darstellen." The same author includes as synonyms his own *Fiona pinnata* of 1873 (6) and 1874 (7). Further, in 1879 (8, p. 86) and in 1894 (11, p. 130) he terms the species on the Pacific Coast *F. marina* var. *pacifica*. But as far as can be ascertained from these accounts, the animals are fairly typical examples of *F. marina*, and the addition of var. *pacifica* does not indicate any particular variety of form, but simply that they came from the Pacific Coast.

If the foregoing identifications are correct, as seems probable in all save that of *E. alba*, van Hass., then *Fiona marina* is one of the most widely distributed species known and, for most areas, one of the earliest recorded forms. It is known from the Indian Ocean, the Atlantic Coast of North America, the Pacific Coast of North America from Alaska and California, the Australian Seas, the New Zealand Seas, the Japanese Seas, the Madagascar Seas, the European Seas, the Eastern Atlantic and the Mediterranean Sea.

As the result of Casteel's work, its larval development is more fully known than is that of other nudibranch.

Its synonymy is, therefore, as follows:—

Family FIONIDÆ, Eliot, 1910.

Genus FIONA, Alder and Hancock, 1853 and 1855.

Species *Fiona marina*, Forskål, 1775.

Synonymy: *Limax marinus*, Forskål, 1775.

Eolidia alba, van Hasselt, 1824.

Eolidia pinnata, Eschscholtz, 1831.

Æolis longicauda, Quoy et Gaimard, 1832.

Oithona nobilis, Alder and Hancock, 1851.

Fiona nobilis, Alder and Hancock, 1853.

Fiona nobilis, Alder and Hancock, 1855.

Fiona atlantica, Bergh, 1858.

Hymenæolis elegantissima, Costa, 1866.

Fiona pinnata, Bergh, 1873 and 1874.

Fiona marina var. *pacifica*, Bergh, 1879-1894.

Fiona marina, Casteel, 1904.

Fiona marina, Eliot, 1910.

For some reason or other Bergh (11, p. 130) gives the founders of this genus and species as Hancock and Embleton, and later also Eliot (14, p. 166), while he ascribes the genus to Alder and Hancock, puts the specific name *F. nobilis* down to Hancock and Embleton. Both of these, as far as I can see, are slips, and Alder and Hancock are responsible for both the specific and generic names.

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VII. ON MELIBE (CHIORÆRA) LEONINA, GOULD.

This striking and interesting form was first described by Gould in 1852 (7, p. 310) from Puget Sound, and this account quoted by

Adams (1, p. 71) in November, 1854. Cooper in 1863 (5, p. 60) recorded a form from Santa Barbara, which he thinks is probably the *C. leonina* of Gould, and he gave a short description of it. This account, however, is so imperfect that the identity of the animal is doubtful: it cannot be referred to any other form and appears to belong to the genus, so that it probably does represent *C. leonina*.

It was mentioned again in 1888 by Fewkes from Monterey, as *Chioræa leontina* [sic] (6, p. 45). In 1904 Bergh (9) described a *Melibe pellucida* from the coast of Washington, near the mouth of the Columbia River. He also gives an incomplete description of it, but so far as he goes there seems to be no reason for separating it from the forms previously described, and so his name is to be regarded as a synonym.

Heath in "The Anatomy of an Eolid, *Chioræra dalli*" in 1917 (8, pp. 137–148) describes as a new species a form which he separates from the *C. leonina* of Gould, on the ground of the lack of a lamellated rhinophore clavus. It is recorded from Rose Inlet, Dall Island, South-eastern Alaska; from Hecate Strait, Prince of Wales Island; and from Echo Harbour and Sewell Inlet, Queen Charlotte Islands. This paper deserves some consideration, since it is the first detailed account of a member of the genus from the Pacific Coast of North America. In the first place, the term "Eolid" in the title is used very loosely, for the animal is not a member of the genus *Aeolidia*, nor of the family *Aeolididæ*, but undoubtedly falls in the family *Tethymelibidæ*. The author, strangely enough, does not appear to have paid the least attention to any other paper, save that of Gould, and yet various members of the family have been dealt with by a number of authorities on the group. At the bottom of p. 143 he refers to what he terms the "otocyst", but even from his imperfect description it is obvious that he is dealing with the eye.

The rest of the account of the structure, habits, and habitat of the animal agrees in practically all its details with the form described by Gould as *Chioræa leonina*. He appears to have been unfortunate in his examination of the alimentary canal, which he always found empty save in one case, where a few diatoms were present. It is not at all uncommon to find the gizzard full of small crustaceans (Copepoda, Amphipoda, etc.), a fact that Kjerschow-Agersborg has also pointed out (9, p. 272, and 10, p. 229).

The sole difference upon which Heath erects his species is that "Unlike *Chioræa leonina*, the dorsal tentacles are not retractile, and in preserved material are plain, muscular, foliaceous outgrowths. Gould states that the tentacles of *C. leonina* bear on their anterior margin 'an opaque, whitish papilla, presenting something of a spiral or lamellar structure'. Nothing of the kind has been found to exist in the present species".

Gould's description of the species is vague in several respects, but when he says the "cephalic tentacles foliate, retractile", he is

not referring to the "foliaceous outgrowths" as Heath appears to suggest. He is using a well-known technical description of the clavus of the rhinophore when he says it is "foliate". This is the "white papilla" with a "lamellar structure". The species bears on the cowl two foliaceous outgrowths which are extremely modified rhinophore stalks, and at the antero-median corner of each of these is a small, retractile, foliate clavus with six or seven very low leaves, which when partially extended appears superficially to be somewhat spiral in shape. When this is fully retracted the whole clavus and sheath simply forms a tiny thickening about 2-2.5 mm. by 1-1.5 mm. on the edge of the large appendage, and is very easily missed. It seems highly probable that Heath overlooked this structure, and it is interesting to note in this connexion that he actually figures a nerve (pl. xi, c4), calling it the "tentacular nerve", which, if he had followed it completely, would have been found to send its main branch to the clavus. That this organ can readily escape notice I know from my own experience, since in my description of the external characters of this species I also overlooked this tiny clavus.

It would appear, then, that *C. dalli* cannot be admitted as a valid species without confirmation, and with this view Professor F. M. MacFarland is in agreement for, at any rate, some of the reasons given above.

Kjerschow-Agersborg in 1919 (9, p. 269) and again in 1921 (10, p. 222) deals with the animal from Puget Sound as *Melibe leonina*. The present writer in the same year as the latter also furnished a description of this species from Vancouver Island (11, p. 192), using the name *Chioræra leonina*, which was employed again later (12, p. 165).

The genus *Melibe* was established by Rang in 1829 (13, pp. 129-130), and the same term was employed by Bergh in 1875 (2, pp. 362-376) and in a series of subsequent papers, particularly one in 1907, where he actually refers the *Chioræra leonina* of Gould to this genus (4, p. 96).

In my previous papers I had not access to the complete literature of Bergh, and so I placed the form back in the genus *Chioræra*. Re-examination of the question in the light of the further details adduced by Kjerschow-Agersborg, however, leads me to think that there is no valid reason why this species should not be referred to the genus *Melibe*, the name of which has priority over *Chioræra*, and with this conclusion Professor F. M. MacFarland informs me he is in entire agreement.

The family Tethymelibidæ, so far as at present recorded, is represented by one species from the area under consideration. This form is widely distributed from South-eastern Alaska down to Santa Barbara, and has probably been taken from a wider range of localities than any other Nudibranch on the coast.

It stands, therefore :—

Genus *MELIBE*, Rang, 1829.

Species *Melibe leonina*, Gould, 1852.

Synonymy : *Chioræra leonina*, Gould, 1852.

Chioræra leonina, Adams, 1852.

Chioræra leonina, Cooper, 1863.

Chiorea leontina, Fewkes, 1888.

Melibe pellucida, Bergh, 1904.

Melibe leonina, Bergh, 1908.

Chioræra dalli, Heath, 1917.

Melibe leonina, Kjerschow-Agersborg, 1919–21.

Chioræra leonina, O'Donoghue, 1921.

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NOTE ON THE GENUS VORTEX OF OKEN.

By A. S. KENNARD, F.G.S., and B. B. WOODWARD, F.L.S.

Read 7th April, 1922.

IN his "Lehrbuch der Naturgeschichte", Thl. iii, abth. 1, 1815, p. 314, Oken founded a genus under the name of *Vortex*, which is best described in the verdict passed on it by Dr. Pilsbry, *Man. Conch.*, Ser. II, vol. ix, 1895, p. 286, where he writes that it "contained depressed Helices and Zonitids of many groups, and, as it is a composite group, and the name was not used in especial connexion with *Helicodonta* until after the publications of Féruccac and Risso, it has no claim for adoption, and had better be dropped entirely".

Unfortunately, since this was written such summary method of dealing with an inconvenient genus is not allowed, and decision one way or another is insisted on. This would have been easy had not the "Museum Calonnianum", 1797, of G. Humphrey been set aside as invalid for nomenclatural purposes, seeing that a genus *Vortex* occurs in it and thus would have had priority.

Nor can resort be had to the now abandoned practice, once so delighted in by our transatlantic colleagues, of type selection by elimination. All the items of Oken's conglomeration have long ago been safely housed in other genera. It is, therefore, necessary to have recourse to the modern practice, so fashionable in the same quarter, of designating a type, so far, we believe, not done for this genus.

Accordingly we hereby designate Oken's *Vortex caracolla* as type of his genus *Vortex*. This becomes a synonym of Montfort's earlier *Caracolus oculatus* (*Conch. Syst.*, ii, 1810, p. 139) = *Helix caracolla*, Linn., and will dispose of Oken's *Vortex* as a valid name, thus preventing any mischievously inclined nomenclatorist from using it to upset some other better-known appellation.

NOTE ON TERRESTRIAL MOLLUSCA FROM A BLOWN SAND DEPOSIT ON CALDEY.

By W. J. WINTLE, F.Z.S.

Read 12th May, 1922.

ON the edge of the South Cliff of Priory Bay, Caldey, is an old accumulation of blown sand, of no definite age. About a week ago I noted a pocket in this sand, about 8 feet deep, at the bottom of which was a small accumulation of shells—the result of a wind eddy which had apparently excavated the hole.

I scraped up two or three handfuls of the sand and shells; and found the following species:—

- Polita cellaria.* A few tops.
- ,, *alliaria.* Four examples.
- Pyramidula rotundata.* Fairly common.
- Helicella virgata.* Common.
- ,, *caperata.* Very common.
- Cochlicella acuta.* Very common.
- Hygromia hispida.* Fairly common.
- Helix aspersa.* Very common.
- ,, *nemoralis.* Common.
- ,, *pisana.* Common.
- Cæciliodes acicula.* Four examples.
- Cochlicopa lubrica.* Common.
- Vallonia excentrica.* Common.
- Lauria cylindracea.* Common.
- Pupilla muscorum.* Common.
- Vertigo pygmæa.* Twelve examples.

The points of interest are the occurrence of *Cæciliodes acicula*—not previously recorded for Caldey, and only recorded as a scarce species in Pembrokeshire—and the occurrence of *Pupilla muscorum*, which had previously only occurred as a Pleistocene fossil on the island. It is curious that, while *Vallonia excentrica* is quite common, *V. pulchella* does not seem to occur.

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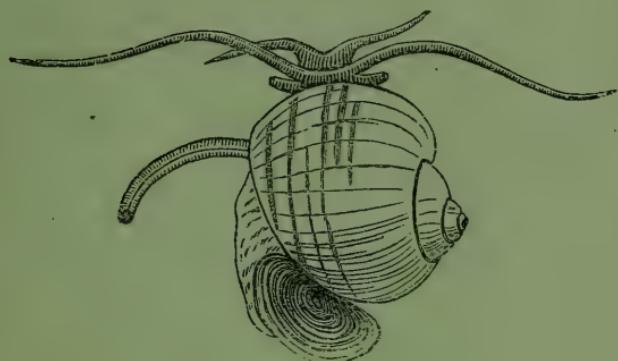
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Rec'd Apr. 6/23

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ORDINARY MEETING.

FRIDAY, 10TH NOVEMBER, 1922.

A. S. KENNARD, F.G.S., President, in the Chair.

The following communications were read :—

1. "On the Anatomical Characteristics of some British Pisidia."

By Nils Hj. Odhner (communicated by B. B. Woodward, F.L.S.).

2. Notes on the Bionomics of British *Cepaea*. By Capt. C. R. P. Diver, F.R.G.S.

The following exhibits were made :—

By Mr. Woodward : 1. *Pisidium clessini*, Surbeck, from (a) L. Torne Trask (3937V), Swedish Lapland; (b) Cwm Glas, Snowdon; (c) Loch Ness, Inverness; in illustration of Dr. Nils Hj. Odhner's paper.2. *Balea perversa*, L., with well-developed mouth, from Ethie Burn, Cromarty, and associated *Clausilia rugosa*, Drap.3. *Lauria cylindracea*, Da Costa, from Dolgelly, Merionethshire, of which one specimen exhibits an extra whorl and is analogous to the *Azeca elongata* of Taylor and the *Cochlicopa lubrica*, var. *og* of Bowell.4. *Fruticicola (Zenobiella) subrufescens*, Miller, dark variety from Leigh Woods, Bristol, lately described in the Journal of Conchology, with other specimens from Bristol collected by Miss Hele, and the more typical northern form from Scarborough, and from Ireland.5. Abnormal form of *Strophocheilus rosaceus*, King, with normal examples for comparison from the neighbourhood of Valparaiso, Chili.By Capt. Diver, Shells and Darts of *Helix (Cepaea) nemoralis*, L., and *hortensis*, Müll., in illustration of his paper.By Col. Peile, the Type Shell of *Ptychotrema fisheri*, Connolly. See Ann. & Mag. Nat. Hist., ser. ix, vol. x, 1922, p. 489.

ORDINARY MEETING.

FRIDAY, 8TH DECEMBER, 1922.

A. S. KENNARD, F.G.S., President, in the Chair.

Mr. H. J. Finlay, Dr. C. O'Donoghue, and Mr. Leslie Cox were elected to membership of the Society.

The following communications were read :—

1. List of British Nudibranchiate Mollusca. By T. Iredale and Dr. C. O'Donoghue.

2. Description of twenty-one species of Turridæ from various localities in the collection of Mr. E. R. Sykes. By Dr. J. C. Melvill, F.L.S.

The following exhibits were made :—

By Col. Peile: Five radulæ of different types obtained from Twofold Bay (Australia) species of Turridæ, including one of

Spirotropis type from an *Austrodrillia* (?) species not yet determined. This makes an addition to the record of radulæ of this type. See *antea*, p. 14.

By Mr. Tomlin, Madeiran species of *Clausilia*.

By Mr. Iredale : 1. A specimen of Rackett's handwriting signed by himself. 2. A copy of "Museum Callonianum".

By Mr. Winckworth, Fry and young of species of *Nucula* and *Lutraria* from Plymouth (by courtesy of the Marine Biological Association) exemplifying the work being carried out in mapping faunal areas of sea bottom by means of the Grab.

By Capt. Diver: Shells of *Theba cartusiana*, from near Dover.

ORDINARY MEETING.

FRIDAY, 12TH JANUARY, 1923.

A. S. KENNARD, F.G.S., President, in the Chair.

Mr. Chas. Oldham, F.L.S., and Col. Peile were appointed auditors.

Mr. J. C. Dacie and Mr. Cecil Price Jones, M.B., were elected to membership of the Society.

The following notes were read by the President :—

(a) On the capture of *Spirula* alive.

(b) On the date of publication of Charpentier's "Catalogue des Mollusques Terrestres et Fluviaires de la Suisse".

On the motion of the President, the following resolution was unanimously carried :—

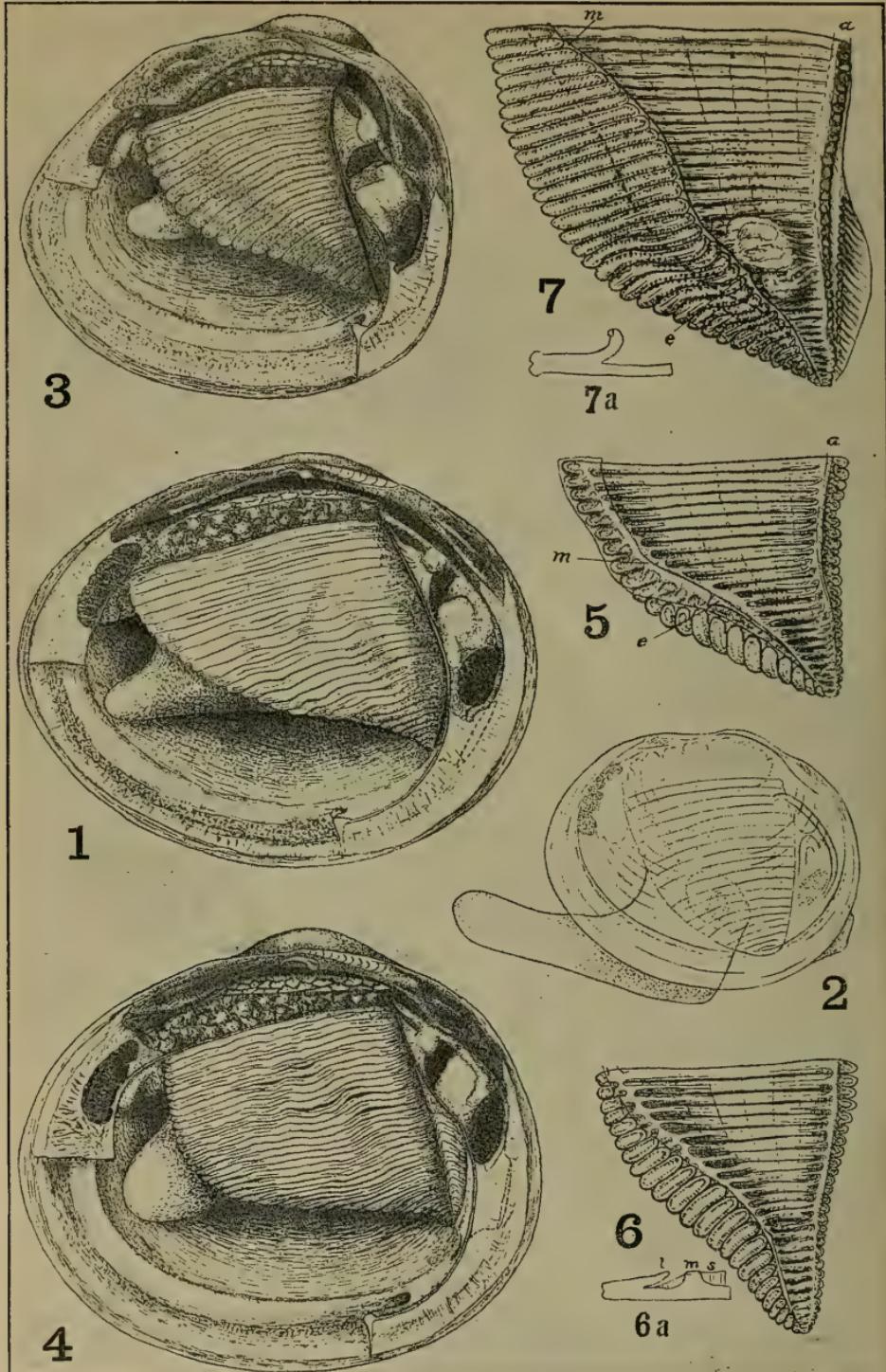
That the Malacological Society of London is very greatly indebted to Professor Dr. Jules Favre, as well as to Professor Strohl and Professor Schinz, for all the indefatigable trouble they have taken to assist in clearing up the date in question, which in many points affects molluscan nomenclature, and this Society would take the present opportunity of returning to them its most sincere thanks.

The following communications were read :—

1. Conditions of Molluscan Life on the South Dogger Bank.
By G. C. Robson, F.Z.S.

2. A Systematic List, prepared from a paper by Messrs. Henderson and Bartsch, "A classification of the American Operculate Mollusca of the Family Annulariidae": Proc. U.S. Nat. Mus., vol. lviii, 1922, pp. 48-82. Compiled by H. C. Fulton.

3. Notes on New Zealand Pelecypods. By W. R. B. Oliver, F.L.S.



ANATOMY OF SOME BRITISH PISIDIA.

ON THE ANATOMICAL CHARACTERISTICS OF SOME BRITISH
PISIDIA.

By NILS HJ. ODHNER.

(Communicated by B. B. Woodward, F.L.S.)

Read 10th November, 1922.

PLATE III.

IN a previous paper ("On some species of *Pisidium* in the Swedish State Museum," Journ. of Conch., xvi, 1921, pp. 218-23) I drew attention to the anatomy of *Pisidium*, and pointed out that this gives important points for the taxonomy in that genus hitherto analysed by the systematists chiefly on conchological grounds.

The most useful characters in question are to be found in the number and structure of the gills, in the mode of fusion of the mantle margins, and in the shape of the nephridia. In the present article I give some exemplifications and illustrations of these particulars, choosing for subject two of the British species belonging to the subgenus *Neopisidium* (with one single gill on each side and a single siphonal slit), and a third species representing *Eupisidium*. The species in question are *P. clessini*, Surbeck, *P. torquatum*, Stelfox, and *P. personatum*, Malm (cf. Odhner, loc. cit.). Some details are given of other species for comparison; but a more thorough report on those will be published at another occasion.

The British material forming the base of this investigation was kindly sent to me by Mr. Oldham; in addition, specimens from other countries have been used for completion of the details.

In the first place I will remark that the conditions described later can only be well observed under considerable magnification (about thirty to sixty times), and consequently a very sharp oblique light must be used.

PISIDIUM CLESSINI, Surbeck.

Gill.—This species (Pl. III, Figs. 1, 2) is the most simply organized of all British *Pisidia*. There is only one gill (or demibranch) on each side, representing the *inner* one in most of the Lamellibranchia, or the anterior one in *Eupisidium*. The gill (Pl. III, Fig. 5) consists of the direct lamella only; but a feeble trace of a reflected lamella may be considered to be present. This is, however, very incomplete, and restricted to the middle and lower parts of the gill. The uppermost filament is, just as in all *Pisidia*, coalesced all along the body side. The upper (about eleven) filaments have a direct course from the gill axis (*a*) towards the front, where they end without bending. Beneath this portion of the gill its filaments have reflected ends; the whole of them taken together thus forms an indistinct reflected lamella. Only the uppermost six filaments coalesce with the body surface at their ends; all the remaining ones have their ends free

from the body. A short distance behind the ends, however, the filaments are connected by an interfilamentar blood vessel (the marginal vein carrying blood from the oral sinus venosus), and this vein (*m*) is attached along the body side. From this vessel there rise small septa running backwards all along the inside of the filaments, and also towards the front end of each filament a small septum arises. The latter septa are all combined with a thin membrane, which thus covers the inside of the front part of the gill turned towards the foot. Behind the foot, in about the middle of the gill, the marginal vessel is detached from the body and joined with the corresponding one of the opposite gill (at *e*); thus, behind the foot, an interbranchial septum is formed including the blood vessel. The opposite margins of the gills (the ends of the filaments) end freely without being mutually connected. At the end of the gill the septum is attached to the mantle beneath the anal siphon, and the vein passes into the axial vessel which brings the blood into the heart.

In fertile specimens the posterior septa are highly developed by inflation and connexion into incubatory pouches. When the fry is ripe the gill is much inflated, and the reflected lamella thus becomes obsolete and looks like the immediate continuation of the convex descending one. Both gills, further, become widely separated, but hold together by means of the interbranchial septum, which thus forms the ventral wall of the single brood-pouch constituted by the two gills.

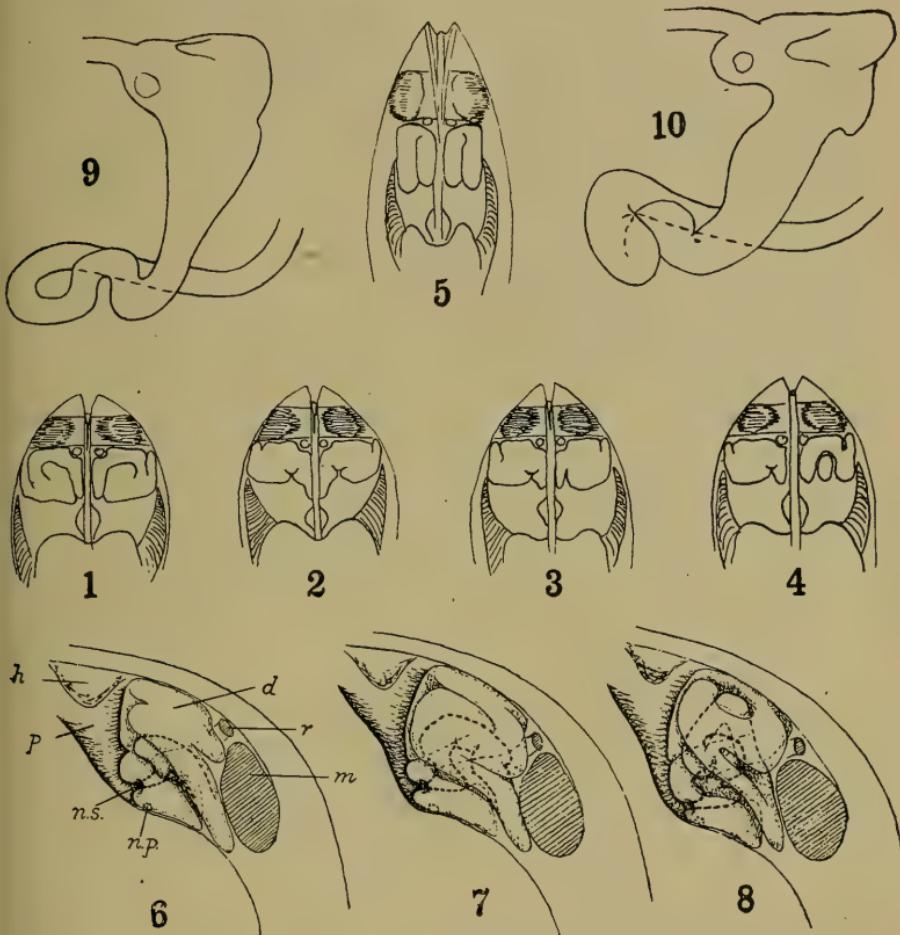
The ventral side of the gill, where the filaments bend, is wholly destitute of any marginal furrow, which in other Eulamellibranchia, as well as in all other Pisidia, marks the line of reflection of the filaments.

On the inside of the gill there are visible the interfilamentar junctions at equal distances; they are about eight in number.

The number of filaments in an adult specimen amounts to about twenty-five. In some cases a filament may be confluent with an adjacent one or may branch into two.

Mantle.—*P. clessini* shares with *P. torquatum* the peculiarity of possessing only one siphonal slit, viz. the anal one (Pl. III, Fig. 1). Here a very short siphon is formed (Pl. III, Fig. 2), the ventral portion of which is most muscular, whereas the dorsal part has lower and thinner walls. Beside this opening there exists only the long pedal slit. Behind this the mantle coalesces for a rather long space (about twice that of the siphonal opening or the height of the posterior adductor, cf. Pl. III, Fig. 1). In the mode of fusion, however, an interesting case of variation deserves to be mentioned, which I have observed in specimens from Lake of Luzern (cotypes) as well as in those from Swedish Lapland. Normally, the mantle folds which form the post-pedal suture are entirely coalesced. Occasionally, however, a fissure appears between them which may join the pedal slit so that a prolongation of it arises. In this case

the rear termination of the pedal slit proper is yet distinct ; its level margins bend quite suddenly towards each other. The fissure behind it has, on the contrary, uneven margins. This fissure certainly represents a branchial slit, the development of which has been, normally, suppressed in this species.



Figs. 1-5.—Diagrams of the nephridia in a dorsal view of *P. personatum* (1), *torquatum* (2), *clessini* (3, 4), and *amnicum* (5).

Figs. 6-8.—Sketches of the left nephridium, seen from outside, of *P. clessini* (6), *personatum* (7), and *nitidum* (8).

Figs. 9-10.—Stomach and intestine, seen from the left, of *P. clessini* (9) and *personatum* (10).

Nephridium.—As I have already mentioned in my paper of 1921, the nephridium of *P. clessini* shows a comparatively simple construction. Text-fig. 6 gives a sketch of the left nephridium seen from outside. The wall lining the pericardium (*p*), and that of the most proximal portion of the nephridial canal, are more strongly

outlined for the purpose of differentiation. The proximal or pericardial branch of the nephridium begins with a ciliated funnel (cf. Odhner, "Morphologische und phylogenetische Untersuchungen über die Nephridien der Lamellibranchien," Zeitschr. f. wiss. Zoologie, Bd. c, 1912, p. 330), describes a short curve towards the front and upwards, and then descends backwards; in front of the posterior adductor the canal is sharply reflected, and ascends forwards till it debouches into the wide dorsal lobe of the nephridium. That lobe, further, passes into the efferent portion, a wide canal directed medially and, distally, crossing the ciliated tube on its external side, forming here an urinatory sac which debouches to the exterior by means of a pore turned towards the median line of the body (Text-fig. 6, n.p.).

Seen from the upper side (Text-fig. 3), the dorsal lobe has, normally, only a slight fissure in its front margin, but this character is not always constant, since exceptionally the fissure may widen to let the tip of the pericardial coil penetrate dorsally (Text-fig. 4). The figures show that an assymmetric structure of the nephridia may occur.

A comparison with the nephridium of *Calyculina lacustris* (cf. Odhner, loc. cit., 1912, p. 330, fig. 21) will reveal the fact that *P. clessini* in its nephridial characters corresponds most closely to an early embryonic stage in the development of the former genus; it is, moreover, simpler than all the species of *Eupisidium*.

Stomach.—Also from yet a fourth organic system a point of discrimination of *P. clessini* is to be obtained, viz. the intestinal canal. In all Pisidia the intestine crosses the lower part of the stomach (or the duodenum) on its right side. This is the case in *P. clessini*, too, but the coil formed by the intestine in front of the duodenum is somewhat longer and describes a simpler course than in other species. Further, the stomach lacks a posterior coecum or pocket, whereas the lateral coecum of the left side is comparatively well developed (cf. Text-fig. 9).

PISIDIUM TORQUATUM, Stelfox.

Gill.—Just as in *P. clessini* the present species (Pl. III, Fig. 3) has a single gill on each side, which, however, differs from that of *P. clessini* in shape and structure; it has a higher triangular form, it is furnished with a more or less distinct anterior marginal furrow, and it has a reflected lamella extending all along the gill, also the upper filaments thus being reflected (Pl. III, Fig. 6). The ascending lamella is narrow, occupying only about a third of the breadth of the direct one. The margin of the reflected lamella is free from the body, but a transverse marginal vessel somewhat within its edge connects the gill with the body wall, and the attachment is continued further backwards than in *P. clessini*. Behind the foot the six to eight filaments, which form the posterior lappet of the

gill, are connected to the opposite gill by means of an interbranchial septum exactly as in *P. clessini*.

After its flexure the ascending branch of the filaments is fused to the descending one for nearly the whole of its length; only the marginal end projects freely (Pl. III, Fig. 6a).

The number of filaments in the gill is about twenty-five, and the interfilamentar junctions are about eight.

Mantle.—As to the mantle, the pedal slit is very long and the post-pedal suture correspondingly short, about half the height of the posterior adductor or the length of the anal slit. I have not observed any rudimentary branchial slit like that occasionally occurring in *P. clessini*.

Nephridium.—The nephridium (Text-fig. 2) has essentially the same shape as in *P. clessini*; only it is lodged somewhat lower on the front side of the adductor.

Stomach.—The stomach has no posterior pocket but a well-developed left coecum, and the intestine is rather short and describes a curve to the left, as in *P. personatum*, before traversing the duodenum on its right side.

Though agreeing in essential characters, the two species just mentioned differ, however, in several respects. To the anatomical differences, especially in the structure of the gill, conchological ones are added: the very feebly constructed shell of *P. clessini* contrasts greatly with the solid valves of *P. torquatum*, which are, further, equipped with the umbonal crest, a rather enigmatic phenomenon. In consideration of these facts it seems questionable whether the two species have a common origin, and it should be emphasized that the creation of a subgenus *Neopisidium* for comprising them implies only their systematic but not genetic unity. Their agreeing in simpler organization has been attained, probably, by reduction, and this process might have proceeded diphyletically. Further inquiries only can bring decision.

PISIDIUM PERSONATUM, Malm.

Gill.—I have chosen this species as a representative of the subgenus *Eupisidium* because it differs less than other species from the types described above, and thus, in some respects, serves to bridge the transition. We find here the typical two gills on each side of the body, the larger or anterior one corresponding to the single one in *P. clessini* and *torquatum*, as well as to the anterior (or inner) one in *Sphaerium* and other Eulamellibranchia. This gill (Pl. III, Fig. 7) consists of a well-developed direct lamella and a smaller reflected one, which ascends to about half the breadth of the former. The margin of the reflected lamella is attached along the side of the body for more than two-thirds of its length; then, behind the foot, the margins of opposite lamellæ are united to form an interbranchial septum.

Along the margin, beneath the line of attachment, the marginal vessel runs, transporting the venous blood from the cephalic region to the filaments. This combination of the marginal vessel with the edge of the inner lamella is a characteristic met with in all *Eupsidium* in contradistinction to *Neopisidium*, where the vessel has been disconnected from the edge and fused to the inside of the direct lamella.

Towards this margin the filaments of the reflected lamella are free from the opposite branches in the direct lamella, but in the lower two-thirds of their length the respective branches are intimately fused (Pl. III, Fig. 7a), the reflected lamella thus becoming fused with the direct one for two-thirds of its breadth. This interlamellar fusion is a simple coalescence without any development of septa between the branches, a higher development that occurs in other species, e.g. *P. casertanum* and *henslowanum*; in the latter, further, the septa alternate in height. In the present form the connexion is extended to an equal height in adjacent filaments, though decreasing in height posteriorly.

In the rear portion of the gill the filaments are elevated on their inside, thus forming the pockets usual in fertile specimens.

There are about thirty-five filaments in the foremost gill and about eight interfilamentar junctions. The foremost crest of the gill is furnished with a distinct longitudinal furrow marking the line of reflection.

Compared with the anterior gill, the posterior one is rather small in size (Pl. III, Figs. 4, 7); it forms a narrow stripe behind the gill axis and occupies its lower half only. In other species of *Pisidium* the posterior gill generally attains a greater height. This gill is homologous with the posterior (or external) one in *Sphaerium* and other Eulamellibranchia, and consists entirely of the reflected lamella, the descending one being completely obsolete and represented only by the axial portions of the filaments. An indication of a direct lamella may be found occasionally, e.g. in *P. amnicum*.

Mantle.—On examining the mantle we find the pedal slit to be extended far backwards; the length of the post-pedal suture equals the height of the posterior adductor (and the siphonal opening), and surpasses considerably the diameter of the branchial slit. Further, it is to be mentioned that the inner mantle fold is somewhat thickened but essentially of about a uniform breadth throughout its length, this being in sharp contrast to *P. subtruncatum*, in which the pedal slit is much smaller and the post-pedal suture correspondingly very elongated; the mantle fold, further, of that species is much more swollen in its foremost portion than posteriorly.

The shape of the siphon is described and figured by Phillips and Stelfox (1918).

Nephridium.—The nephridium of *P. personatum* (Text-fig. 7) forms a step towards a higher development than that of *P. clessini*.

Its pericardial tube has become somewhat more winding, though not in such a degree by far as we find it in *P. nitidum* (Text-fig. 8). Beside this, the dorsal lobe, which completely covers the pericardial coil of the tube, is more deeply incised by a curved fissure (cf. Text-fig. 1), a feature that we meet with also in *P. casertanum*. In other species of *Eupisidium* this partition of the dorsal lobe has given rise to other aspects; thus in *P. amnicum* the fissure extends straight backwards (Text-fig. 5); in *P. nitidum* (Text-fig. 8), *P. milium*, and *P. henslowanum* it is widened to an open foramen, in which the top of the pericardial tube is visible surrounded by the narrowed annuliform dorsal coil.

The final stage in this series of the complicated tubuliform nephridium is represented by *Sphaerium* and *Caliculina* (cf. Odhner, 1912).

Stomach.—In the alimentary canal we find that the present species is furnished with a more or less distinct posterior cæcum, as well as a left one. The intestine describes, in front of the duodenum, a short coil towards the left before it turns and traverses the latter on its right side (Text-fig. 10).

EXPLANATION OF PLATE III.

- FIG. 1.—*P. clessini*, Surbeck. Llyn Cwm, Clyd Nant Ffrancon, Snowdon, Wales. Coll. Ch. Oldham, 17/9/1921. $\times 40$.
- FIG. 2.—*P. clessini*, in adult specimen with fry in gills, showing foot and siphon protracted. $\times 40$.
- FIG. 3.—*P. torquatum*, Stelfox. Grand Junction Canal, Cheddington, Buckinghamshire. Coll. Ch. Oldham, 16/7/1921. $\times 45$.
- FIG. 4.—*P. personatum*, Malm. Tring, Hertfordshire. Coll. Ch. Oldham, 16/7/1921. $\times 40$.
- FIG. 5.—*P. clessini*, right gill from inside. *a*, gill axis; *e*, interbranchial septum; *m*, marginal vessel.
- FIG. 6.—*P. torquatum*, right gill from inside. *6a*, Section along a filament showing the marginal vessel (*m*), septa (*s*), and free edge of reflected lamella (*l*).
- FIG. 7.—*P. personatum*, right gills from inside. *7a*, Section along a filament showing the coalescence of its branches.

DESCRIPTIONS OF TWENTY-ONE SPECIES OF TURRIDÆ (PLEUROTOPIDÆ) FROM VARIOUS LOCALITIES IN THE COLLECTION OF MR. E. R. SYKES.

By JAMES COSMO MELVILL, M.A., D.Sc.

Read 8th December, 1922.

PLATES IV AND V.

SOME time ago I was asked by Mr. Sykes to take in hand a number of unnamed and, in some cases, critical species of Turridæ, which he, as opportunity offered, had obtained from various sources. Fortunately, in every case the locality had been registered, and as regards the majority of them they had been closely examined, so far as comparison with the vast series of the British Museum (Nat. Hist.) was concerned, by himself in company with the late Mr. Edgar Smith. The Eastern Turridæ are particularly well represented there. The occidental tropical species, mostly from Cuba, have been, at our request, very kindly looked over by Dr. W. H. Dall, and also Mr. J. B. Henderson, to both of whom we are greatly indebted. About six of those forwarded were found to have been described, some quite recently, and the remainder were passed as new to science. We are enabled, therefore, to offer at the present opportunity descriptions of twenty-one species, a large proportion of these belonging to a genus *Drillia*, now being divided into sections, as is indeed necessary, but of which I am not prepared at present to grasp the full details. Accordingly, in this paper I fall back upon the old classification as given in Tryon's Manual of Conchology, vol. vi, 1884.

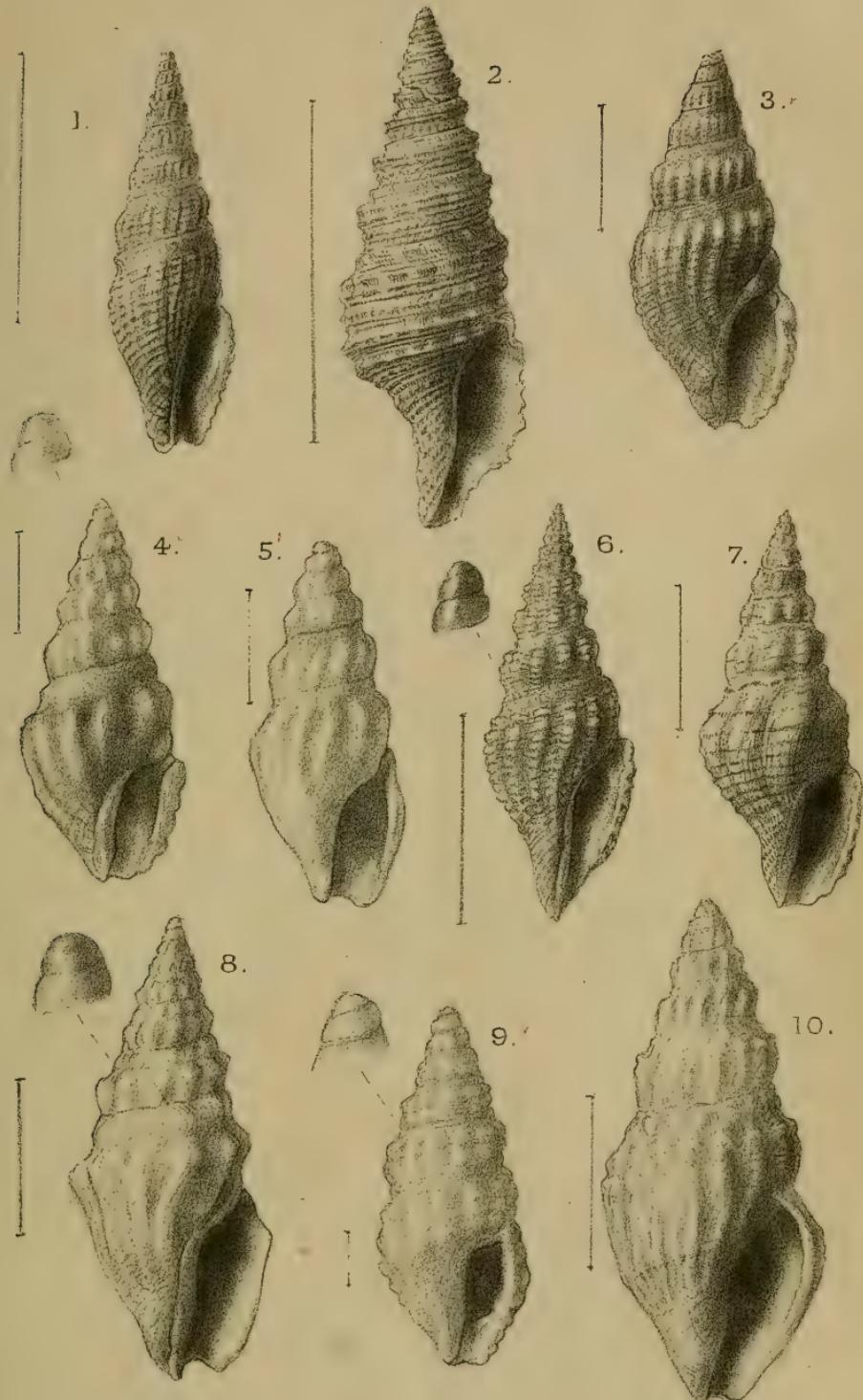
TURRIS RUTHVENIANA, n.sp. (Pl. IV, Fig. 2.)

Shell fusiform, thick; whorls, especially the upper, somewhat compressed, being ten in number, inclusive of the two apical. Colour bright chestnut brown, with squarrose, fairly regular, white tessellations on the spiral carinæ. These revolving keels appertain throughout—one, in particular, central, and subdivided by a shallow sulcus; the lesser tornate keels increase numerically in each of the lower whorls, till, on the body-whorl, they total five or six, all beautifully variegated with white and chestnut alternately, as mentioned above. Mouth ovate-oblong, canal wide, abbreviate, sinus well expressed, wide, and deep, columellar margin fairly straight.

Long. 41.5, lat. 14 mm.

Hab.—Mauritius.

A handsome species, standing somewhat alone, and conspicuous for its bright coloration and tessellated carinal ornamentation. (Named after Mr. E. Ruthven Sykes, in whose collection is the type.)



G.M. Woodward del. et lith.

Huth imp.

NEW SPECIES OF TURRIDÆ.

DRILLIA ANTHAMILLA, n.sp. (Pl. IV, Fig. 1.)

Shell narrowly fusiform, surface rather dull, blackish-fuscous, eleven whorled, of which the apical are smooth, shining, apparently carinate centrally, but the type specimen is a little worn and imperfect in this particular. The lower whorls are suturally impressed just below the sutures, at the summit of each whorl, once spirally acutely keeled, the remaining portion being rather ventricose, longitudinally obliquely multicostate, crossed by, on the four penultimate whorls, three to five spiral revolving lines, gemmulate at the several points of junction with the ribs; gemmules shining, often pale; the body-whorl possesses fourteen such liræ, with over twenty closely grained ribs. Mouth narrow, oblong, outer lip not effuse, columellar nearly straight, sinus shallow, but well expressed, canal slightly recurved.

Long. 34, diam. 9 mm.

Hab.—?

Mr. Edgar A. Smith considered this species an ally of *D. œmula*, Angas, from Australia, but the coloration is different, it is larger, with the body-whorl also longer in proportion to the length of spire. To my mind *D. maura*, Sowerby, a West American species, is akin, but the ribs seem more numerous, and the revolving lines stronger and better developed in the last-named shell. From the figure also of *D. appelii*, Weink,¹ one traces affinity, but this species is described as light-ochraceous in colour, and being indistinctly white banded. The general contour is, however, very similar. (*ἀνθάμιλλος* rivalling.)

DRILLIA CUBANA, n.sp. (Pl. IV, Fig. 3.)

Shell elegantly fusiform, dark sienna-brown, whorls 8, nuclear? imperfect in our specimens, the remainder very closely and finely longitudinally costate, say about sixteen on the body-whorl, slightly oblique, warm-brown in colour, with spiral white band just below the sutures. The surface is crossed with uniform spiral raised lines; these extend very nearly to the base of the body-whorl. Mouth narrow, outer lip rather incrassate, sinus well expressed, just below the suture, columellar margin straight, canal very short.

Long. 15, lat. 6 mm.

Hab.—Cuba.

A striking little shell both in form and coloration. The ribs are particularly numerous and fine in character, not in the least incrassate. Indeed, it superficially recalls some small *Mitra* of the subgenus *Turricula*.

Dr. Dall considers it undescribed, and mentions that it belongs to a group of closely allied forms described by Reeve, Edgar Smith, Orbigny, and others, of some of which there are no authentic

¹ *Vide* Conch. Cab., pl. xx, fig. 5.

specimens in the United States National Museum, including the species now under review. Examples of the allied *D. leucocyma*,¹ Dall, and *zebra*, Lam., accompanied this from the island of Cuba, and are in Mr. Sykes' collection. Also two of the Orbignyan species, *D. ornata* and *albomaculata*.²

I have unusual pleasure in having the opportunity of naming this species after an island which I visited many years ago—in March, 1872—where a most happy and enjoyable time was spent in what is, perhaps, the most beautiful, as it is the largest, of the West Indies.

✓ DRILLIA EUPHANES, n.sp. (Pl. IV, Fig. 4.)

Shell fusiform, rather solid, white; whorls 8, of which two are nuclear, globular, white, smooth, the remainder suturally impressed, with regular incrassate nodulous longitudinal ribs, bluntly angled at the periphery, the nodules large, shining. The ribs on the body-whorl number eight or nine. These are crossed by somewhat coarse revolving lines, which, in the specimens before us, are nearly obsolete. Mouth roundly-ovate, sinus rather wide and deep, outer lip slightly expanded, columellar margin fairly straight, canal very short.

Long. 12, lat. 5 mm. sp. maj.; long. 9, lat. 4 mm. sp. min.

Hab.—Cuba.

Dr. Dall informs me that similar shells in the United States National Museum are labelled *fucata*, Reeve,³ but these are unauthenticated, and the name is therefore very doubtful. This Antillean species is larger, say 20–21 mm. in length, but much of the same character as to its ribs and general appearance. It is, however, channelled above the periphery, and the coloration is yellowish-white, with brown maculations. *D. paria*, Reeve,⁴ may also be compared. (*εὐφάνης* of good appearance.)

✓ DRILLIA INNOCENS, n.sp. (Pl. IV, Fig. 5.)

Shell fusiform, very smooth and shining, somewhat lightly built, pure white; whorls 7–8, of which the nuclear (two) are smooth and globose, the remainder all suturally impressed, with numerous irregularly formed longitudinal incrassate ribs; the rest of the surface smooth and plain. Mouth rather wide, ovate, outer lip thin, to some extent expanded, sinus situate directly below the suture, wide, columellar margin straight, canal very abbreviate.

Long. 14, lat. 6 mm. sp. maj.; long. 9, lat. 3·5 mm. sp. min.

Hab.—Cuba.

¹ Proc. U.S. Nat. Hist. Mus., vi, 1883, 328, pl. x, fig. 8.

² Orbigny, Moll. Cuba, pl. xxiv, fig. 16, and xxiii, fig. 26; Ramon de la Sagra, Hist. Cuba, ii, 1846, 176, pl. xxiv, figs. 16, 18.

³ Proc. Zool. Soc. Lond., 1845, p. 115; Conch. Icon. Pleurotoma, pl. xx, fig. 169.

⁴ Proc. Zool. Soc. Lond., 1846, p. 5; Conch. Icon. Pleurotoma, pl. xxxvi, fig. 334.

An elegant pure white and very smooth *Drillia*, which, as Dr. W. H. Dall observes, in form belongs to the same group as his *D. thea*,¹ this being an olivaceous species, with a silky epidermis, found off the Florida and contiguous coasts in about 60–100 fathoms.

DRILLIA INSIGNITA, n.sp. (Pl. IV, Fig. 6.)

Shell fusiform, gradually attenuate, incrassate, of a rich sienna-brown in colour; whorls 12, including three nuclear, smooth, shining brown, semidiaphanous, centrally carinate, the fourth whorl with numerous somewhat undeveloped noduled riblets, the remaining eight spirally ornamented with close revolving lines, crossing the conspicuously noduled longitudinal ribs; nodules white, body-whorl obliquely twelve-ribbed, below the periphery obscurely fasciated with white; canal somewhat extended, straight columellarly, outer lip effuse, sinus well marked, narrow, but deep.

Long. 25, diam. 10 mm.

Hab.—Philippine Islands.

Allied to *D. Griffithii*² and *major*,³ both of Gray, but smaller and more compact. (Insignitus, distinguished.)

DRILLIA LATIRIFORMIS, n.sp. (Pl. IV, Fig. 7.)

Shell fusiform, with fairly broadened body-whorl, but very attenuate spire; whorls 9, of which the two nuclear are smooth, diaphanous, and globular, the remainder with strong, rounded, shining, nodulous longitudinal ribs, about eight in number on the penultimate and body-whorls. Suturally strongly raised-plicate, and spirally furnished with regular raised revolving lines, chestnut in colour, thus contrasting with the paler ochreous brown surface; these raised striae are very close and frequent on the body-whorl, especially below the periphery. Mouth oblong, outer lip somewhat thin, with sinus rather broad and deep. Columellar margin oblique, canal abbreviate.

Long. 17, lat. 6 mm.

Hab.—New Caledonia.

In the opinion of Mr. Edgar Smith, this very interesting species had not attained its maximum of growth. This may be the case; but, at all events, the outer lip, with the well-expressed sinus, is sufficiently formed for all practical purposes. The style of pattern is somewhat similar to the beautiful *Drillia euchroës*, Melv.,⁴ from the Persian Gulf, but that is smooth throughout. Both species are small mimics of *Latirus turritus*, Gmel., and others of that group.

¹ Proc. U.S. National Mus., vi, 1883, 328, pl. x, fig. 5.

² Reeve, Conch. Icon. Pleurotoma, pl. xix, fig. 157.

³ Reeve, Conch. Icon. Pleurotoma, pl. vii, fig. 59.

⁴ Proc. Malac. Soc. Lond., x, 1912, p. 250, pl. xi, fig. 11.

DRILLIA PARÆCA, n.sp. (Pl. IV, Fig. 8.)

Shell abbreviate fusiform, solid, white, the basal third of the body-whorl ochreous; whorls 9, including the smooth and globular nuclear, the remainder longitudinally many-ribbed, the ribs being stout, angled, and echinate, crossed by many faint revolving lines. The body-whorl is ten-ribbed. Mouth oblong, outer lip slightly expanded, columellar margin almost straight. Canal wide, abbreviate, sinus well expressed, wide, and fairly deep.

Long. 19, diam. 7 mm.

Hab.—?

Much stouter in build than *D. wilmeri*,¹ Smith, from the Andaman Isles, but is nearly allied, the ochreous or chestnut coloration in the lower portion of the body-whorl being very similar. This also obtains in the more recently described *D. infrafusca*² of Sowerby, a broader and coarser species still. (*παροίκος*, an ally.)

✓ DRILLIA PRIMULA, n.sp. (Pl. IV, Fig. 9.)

Shell small, gradately fusiform, compact; whorls 8, of which the uppermost two are nuclear, smooth, white, globular, the remainder plicately ridged spirally at the sutures, and, below these, angularly sloping and closely longitudinally ribbed; ribs crossed, as regards the upper whorls, by two, the body-whorl by four or five spiral incrassate revolving lines, gemmulate, white, and shining at the points of junction with the ribs, interstices oblong. Shell of pale primrose hue, very delicate in colour. Mouth small, oval, outer lip slightly angled centrally and thickened. Columellar margin almost straight, sinus very obscure, canal abbreviate.

Long. 6, lat. 2 mm.

Hab.—Cuba.

Apparently of the same alliance as *D. papillosa*,³ Garrett, from Fiji, but not so pronounced in sculpture. Dimensions identical. (Primula, a primrose, from the pale lemon colour.)

DRILLIA (CRASSISPIRA) OCHROBRUNNEA, n.sp. (Pl. IV, Fig. 10.)

Shell oblong-fusiform, solid, yellow or ochreous-brown; whorls 8–9, of which the two nuclear are smooth, globose, blunt at actual apex, the remainder suturally impressed, angled, longitudinally multicostate; costæ smooth, crossed by obscure spiral lines on the body-whorl, more particularly towards the base. Whorls ornamented with spiral rows of white beaded gemmæ just below the sutures, and again in several regularly arranged rows on the ribs, and towards the base of the body-whorl. There is,

¹ Proc. Zool. Soc. Lond., 1878, p. 805, pl. I, fig. 4.

² Proc. Zool. Soc. Lond., 1893, pp. 487 sqq. I may add that I have been able to examine the actual type of this species, *infrafusca*, which, formerly in General Tripe's collection, now belongs to Mr. Sykes.

³ Proc. Acad. Nat. Sci. Philadelphia, 1873, p. 218, pl. ii, fig. 29.

in the examples seen by us, some extent of variation in the disposition of these gemmæ, and likewise in the number of ribs. The mouth is ovate, outer lip slightly rounded in the largest specimen, straighter in the smaller, and with sinus shallow but well expressed. Columellar margin straight, canal very short, slightly recurved basally.

Long. 21, lat. 8 mm. sp. maj.; long 17, lat. 5 mm. sp. min.

Hab.—Mauritius.

This species exists, unnamed, in our National Museum. It is of the same alliance as *D. digitalis*,¹ Reeve, from the Philippine Isles and Mauritius, and *D. ochroleuca*,² Melv. & Sykes, from the Andamans (Booley collection).

CLAVATULA GABONENSIS, n.sp. (Pl. V, Fig. 11.)

Shell pyramidate, smooth throughout, eleven whorled, the two nuclear white, plain, and bulbous, the remainder concave, well exhibiting incremental lines of growth, elegantly and regularly ornamented with fluctuate brown lines, and, on the body-whorl, longitudinal flames; the periphery is conspicuously angular and bicarinate, mouth ovate, outer lip with median angle, sinus wide, canal moderate, very slightly recurved, columellar margin straight.

Long. 25, lat. 10 mm.

Hab.—Gaboon, West Africa.

To this the only allied species is *C. lelieuri*, Récluz.³ Both species agree in complete smoothness of surface, with no sign of tubercles or spines which characterize all others of the genus. But it differs from the species just named in the very conspicuous bicarinate angle at the periphery of the body-whorl, thereby rendering the shell attenuate at either extremity, while the character and disposition of the brown markings differ likewise.

PERRONA JESSICA, n.sp. (Pl. V, Fig. 12.)

Shell acuminate fusiform, shining, and very smooth; whorls 12, of which the two nuclear are transparent, white, and slightly bulbous; the remainder moderately suturally impressed, with a plicate and conspicuous revolving keel just below the suture, a plain space just below this, and then, joining on to the suture below, another carina raised and ornamented with a spiral row of small shining nodules. The body-whorl is almost straight, quite smooth, shining, and milky white until the close rows of striae commence round the base. Canal prolonged and recurved, outer lip hardly incrassate, sinus wide and well-formed, columellar margin straight, mouth oblong.

¹ Reeve, Proc. Zool. Soc. Lond., 1843, p. 186; and Conch. Icon., i. Pleurotoma, pl. xvii, fig. 138.

² Proc. Malac. Soc. Lond., vol. ii, 1897, p. 165, pl. xiii, figs. 4, 5.

³ Journ. de Conchyl., ii, 1851, p. 210, pl. v, fig. 7.

Long. 28, lat. 9 mm.

Hab.—Goree, West Africa; collection Denans.

This extremely select species was examined by the late Mr. G. B. Sowerby, who wrote that at first he considered it might be an albino variety of *P. lineata*,¹ Lam., but that it was well distinguished from that species by the "plicate angle". It certainly seems abundantly distinct from any other known *Perrona*.

SURCULA MACILENTA, n.sp. (Pl. V, Fig. 13.)

Shell fusiform, gracefully attenuate, thin, pale tan-coloured; whorls 9–10, of which the two nuclear are pale, shining, and globose; the remainder medially angled, suturally impressed, longitudinally ribbed; ribs broad, rather irregular, rounded, oblique, the whole surface crossed very delicately by close revolving sulcuse striæ. Mouth oblong, sinus (in type specimen) hardly expressed, but the shell may not have quite reached its full growth, the outer lip being thin. Columella straight, canal abbreviate, wide.

Long 17, lat. 5 mm.

Hab.—South Africa.

This appears nearly allied to *D. lanceolata*,² Reeve, and likewise to the much larger *Surcula undatiruga*,³ Biv., this being a Mediterranean species, of which *tenuis*, Gray, is a synonym.

(Macilenta, lean.)



MANGELIA INTERCEDENS, n.sp. (Pl. V, Fig. 14.)

Shell fusiform, small, delicate, thin, white with partial pale yellow suffusion; whorls 7, of which three are nuclear, globose, semi-diaphanous, white, shining, the third being microscopically longitudinally striate; the remaining whorls, all impressed suturally, are closely longitudinally ribbed; these ribs are close, shining, and smooth, obliquely flexuose, with the interstices finely spirally striate. Mouth ovate-oblong, outer lip thin, but hardly adult, columellar margin oblique, canal abbreviate.

Long. 5, lat. 2 mm.

Hab.—Cuba.

A distinct species. Dr. Dall writes concerning it: "This belongs to the group of *cerina*, Kurtz & Stimpson,⁴ from the Atlantic shores of U.S.A. Though worn, we cannot identify it by any species in our collection." It may likewise be found comparable with another West Indian species, viz. *M. dorvilleæ*, Gray.⁵

(Intercedens, a go between.)

¹ Reeve, Conch. Icon. Pleurotoma, 1843, pl. xi, figs. 96a, b.

² Proc. Zool. Soc. Lond., 1845, p. 111. Also Reeve, Conch. Icon., i. Pleurotoma, pl. xxi, fig. 182.

³ Phil. Moll. Siciliae, ii, pl. xxvi, fig. 13.

⁴ Proc. Boston Nat. Hist. Soc., iv, p. 115.

⁵ Reeve, Conch. Icon., i. Pleurotoma, pl. xxviii, fig. 249.

✓ *MANGELIA NANODES*, n.sp. (Pl. V, Fig. 15.)

Shell abbreviate fusiform, solid, yellowish white; whorls 6, two being nuclear, small, globular, the remainder ventricose, much impressed suturally, with longitudinal incrassate smooth ribs, the interstices crossed by coarse infrequent spiral lines; mouth oblong, outer lip thickened, sinus very obscure, columellar margin inclined to obliquity, canal extremely short.

Long. 5·5, lat. 3 mm.

Hab.—Cuba.

This petite *Mangilia*, in which the incrassate longitudinal ribs seem very large, proportionately speaking, is not to be found either in American or British Museums, and Dr. Dall queries it as most probably new to science. The whorls are very tumid, the spiral lines at the interstices coarse. (*νανώδης* dwarf.)

MANGELIA UMBROSA, n.sp. (Pl. V, Fig. 16.)

Shell small, narrow, fusiform, of rude sculpture, dusky-brown with rufous tinge over the body-whorl and orifice; whorls 7–8 (the nepionic being imperfect in the specimens seen), the remainder longitudinally furnished with obtusely-rounded, strong, and frequent ribs, say about fourteen on the body-whorl; all the whorls ventricose, impressed, and spirally plainly ridged suturally, and crossed by strongly developed spirals, swollen and almost becoming nodulous at the points of junction with the costæ. Mouth small, ovate, outer lip slightly expanded, sinus wide but shallow, canal very short, columellar margin oblique.

Long. 12, lat. 4 mm.

Hab.—Hirado Hegén, Japan (Hirase).

This small but roughened species was received from Mr. Y. Hirase through the medium of Messrs. Sowerby and Fulton, and studied well by the late Mr. G. B. Sowerby. We do not know a very near ally.

MANGELIA TANABENSIS, n.sp. (Pl. V, Fig. 17.)

Shell solid, white, longitudinally multicostate, ribs straight, at first, with the interstices, surrounded with deep revolving sulcate spiral lines, but soon becoming worn, and then are smooth and shining. One example is plain, without bands or coloured lines, another possesses two lines on the upper whorls, and on the body-whorl these are supplemented by a broad chestnut-brown band at the periphery, extending round the shell to the lower part of the outer lip. The mouth is ovate, outer lip white, shining, smooth, thickened, sinus small but well expressed, situate just below the suture. Canal abbreviate, columellar margin smooth.

Long. 14, lat. 4 mm. sp. maj.; long. 10, lat. 3·75 mm. sp. min.

Hab.—Tanabe Kü, Japan (Hirase, No. 1399).

A pretty, small, but solid shell, many ribbed, surrounded with sulcate revolving lines, the surface being sometimes plain and unrelieved, or lined and banded with chestnut-brown.

V LIENARDIA CHRYSOLEUCA, n.sp. (Pl. V, Fig. 18.)

Shell small, columbelliform, white, spirally banded with bright yellow, centrally on the upper whorls, and twice, at the periphery and towards the base, of the body-whorl. Whorls 6, in our specimens imperfect as regards the nuclear, the three remaining whorls angular below the impressed sutures, everywhere closely and obliquely ribbed, crossed by spiral incrassate lines, beautifully gemmate with small globular shining nodules at the points of junction, so that the whole surface is cancellate, the interstices being deep and smooth. Outer lip thickened, crenulate without, eight or nine denticled within, sinus rather narrow, but deep and conspicuous; columellar margin slightly plicate, fairly straight; canal short.

Long. 6, lat. 3·75 mm.

Hab.—Cuba.

A very pretty, bright little species, which does not appear to be known in either British or American collections; excepting one, for example, at the United States National Museum, dredged off the south coast of Cuba in 150 fathoms; dead (W. H. Dall *in litt.*). ($\chi\rho\sigma\omega\lambda\epsilon\kappa\sigma$, from the yellow-banded coloration on white ground.)

CYTHARA DUPLARIS, n.sp. (Pl. V, Fig. 19.)

Shell solid, yellowish white, longitudinally irregularly but closely ribbed, ribs incrassate; whorls 6–7, at first sloping, then conspicuously and broadly angled, the whole surface covered with fine revolving striæ, which run in pairs, alternating with very narrow intervening spaces. Mouth narrow, elongate, outer lip thickened, with fifteen small shining white denticulations at the orifice; columellar margin extended, similarly denticulate; canal very short, wide; sinus shallow and obscure.

Long. 12, lat. 4·25 mm.

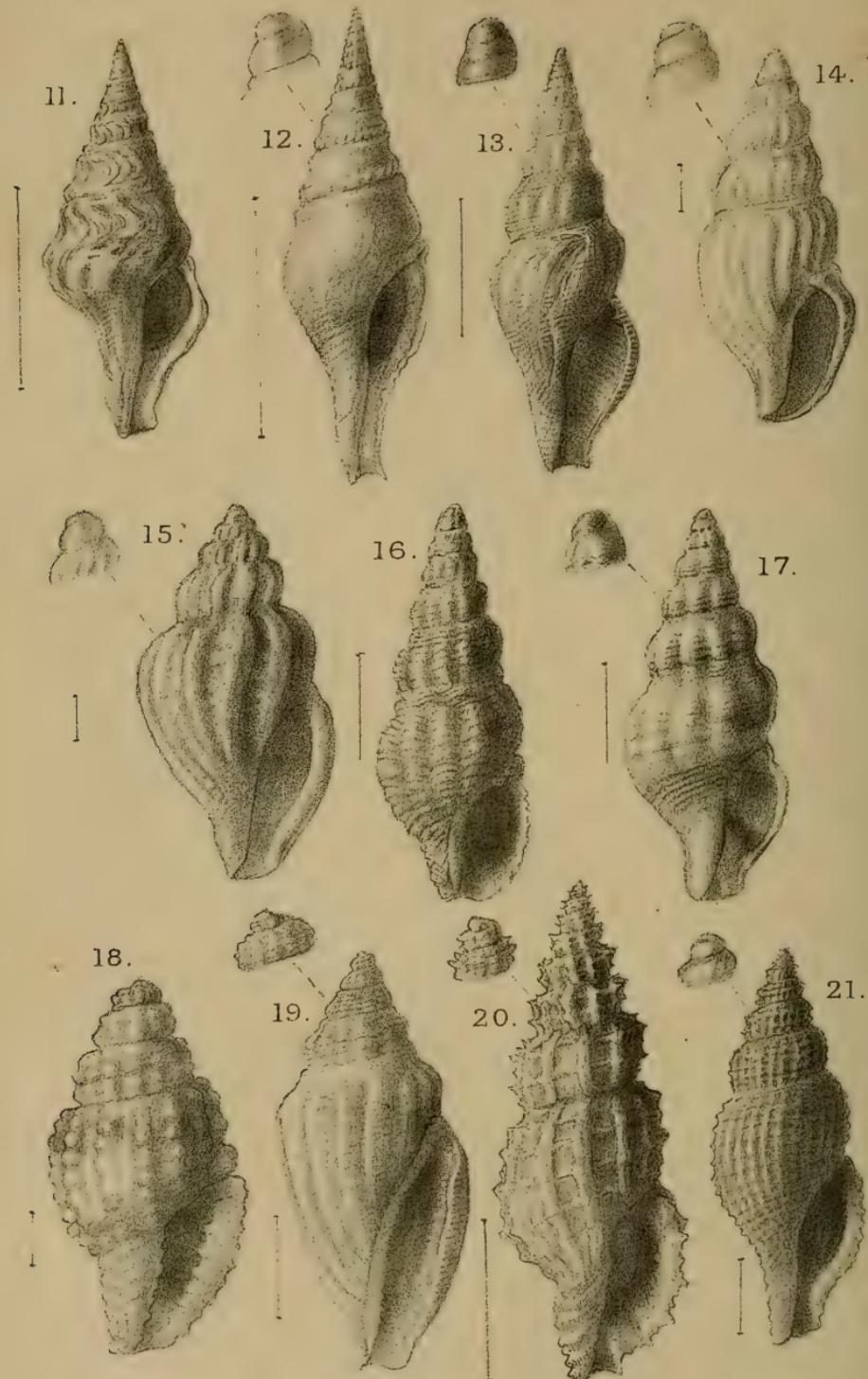
Hab.—Andaman Isles.

Though commonplace in appearance, this little *Cythara* cannot exactly be matched among the many described species. It seems nearest, perhaps, to *capillacea*, Reeve.¹ The number of ribs, irregularly set out on the body-whorl, is about sixteen; they are numerous likewise on the two next whorls.

VEPRECULA MENECHARMES, n.sp. (Pl. V, Fig. 20.)

Shell delicate, pale ochreous-brown, or (var. *albescens*) pure white, turreted; whorls 8–9, the nuclear itself globular, plain, the next beautifully but microscopically cancellate, the remainder longitudinally acutely costate, angled above, crossed by, in full-grown specimens, on the upper whorls, two, on the body-whorl four, spiral raised costæ, the interstitial spaces quadrate, smooth, acutely echinate at the points of junction. Number of ribs on the body-whorl eleven to twelve. Mouth oblong, outer lip

¹ Proc. Zool. Soc. Lond., 1846, p. 60.



incrassate, without 5-echinate, within obscurely denticulate, sinus fairly broad and conspicuous, columellar margin straight, multiplicate, canal abbreviate, slightly recurved.

Long. 21, lat. 7 mm. sp. max.; long. 14, lat. 5 mm. sp. min.

Hab.—Mauritius.

I have for many years possessed this attractive little shell, unnamed, also received further individuals in 1899 from Mr. J. H. Ponsonby Fane, and later from Mr. Hugh Fulton; this last containing the largest example, the dimensions of which are mentioned. The var. *albescens* is pure white, as just given above. (*μενέχάρης*, ready for battle, in fanciful allusion to the "militant" echinations.)

PLEUROTOMELLA BORBONICA, n.sp. (Pl. V, Fig. 21.)

Shell delicate, small, elegantly fusiform, rather narrow, and gradually attenuate upwards, white, semidiaphanous; whorls 7-8, the nepionic or nuclear being smooth, white, and globose, the third whorl elegantly but microscopically decussate, the remainder angled a little below the sutures, delicately semi-transparent, regularly cancellate, interstices quadrate, longitudinal ribs of the body-whorl slightly oblique, mouth oblong, outer lip incrassate, sinus well defined, broad but very shallow, columellar margin fairly straight, canal short and a little recurved.

Long. 8, lat. 3 mm.

Hab.—I. Réunion (or Bourbon).

A very beautiful and elegant species, perfect in form and symmetry, allied to some Persian Gulf and Arabian Sea forms, e.g. *Pl. eulimines*,¹ Melv.

EXPLANATION OF PLATES IV-V.

FIG.

PLATE IV.

1. *Drillia anthamilla*, n.sp.
2. *Turris ruthveniana*, n.sp.
3. *Drillia cubana*, n.sp.
4. " *euphanes*, n.sp.
5. " *innocens*, n.sp.
6. " *insignita*, n.sp.
7. " *latiriformis*, n.sp.
8. " *paræca*, n.sp.
9. " *primula*, n.sp.
10. " *(Crassispira) ochrobrunnea*, n.sp.

PLATE V.

11. *Clavatula gabonensis*, n.sp.
12. *Perrona jessica*, n.sp.
13. *Surcula macilenta*, n.sp.
14. *Mangelia intercedens*, n.sp.
15. " *nanodes*, n.sp.
16. " *umbrosa*, n.sp.
17. " *tanabensis*, n.sp.
18. *Lienardia chrysoleuca*, n.sp.
19. *Cythara duplaris*, n.sp.
20. *Veprecula menecharmes*, n.sp.
21. *Pleurotomella borbonica*, n.sp.

¹ Journ. Malac., xi, 1904, p. 84, pl. viii, fig. 15.

ON THE DATE OF PUBLICATION OF CHARPENTIER'S
 "CATALOGUE DES MOLLUSQUES TERRESTRES ET
 FLUVIATILES DE LA SUISSE".

By Professor Dr. JULES FAVRE.

Read 12th January, 1923.

THE following letter from Professor Dr. Jules Favre, of the Muséum d'Histoire Naturelle de Genève, throws more light on this point than has hitherto been obtainable :—

Le 18 novembre 1922.

Cher Monsieur,

Grace à l'amabilité de M. le Professeur Strohl, directeur du Concilium bibliographicum et du M. le Professeur Schinz, directeur du Jardin botanique, tous deux à Zürich, je puis vous donner quelques précisions concernant la publication de Charpentier.

Je vous transcris ce que m'écrivit M. Strohl :

" Dans les documents imprimés 'Actes de la Société helvétique' , 22ème session à Neuchâtel, il est mentionné à la date du 24 juillet 1837 qu'une commission a été chargée d'examiner les comptes relatifs à l'impression du dernier volume des mémoires de la Société.

" Or, le dernier mémoire en question à du être le premier volume de la nouvelle série (nouveaux mémoires), donc celui précisément où se trouve le travail de Charpentier. Car à la date du 25 juillet, M. Mallet fait son rapport sur les comptes en question et il est dit alors expressément (p. 6 des actes) qu'il s'agit du 1er volume des 'Nouveaux mémoires' .

" Celui-ci aurait donc paru *en tout cas AVANT* le 24 juillet 1837.

" Mais il y a des raisons de croire qu'il ait paru déjà dans les tout premiers mois de 1837 et même peut-être en 1836 déjà. Grace à l'amabilité de M. le Professeur Schinz, président de la commission des mémoires, dont je fais partie également, nous avons fait venir de Berne les procès verbaux et les livres de comptes se rapportant aux dites années. Malheureusement, ces comptes ont été faits alors très sommairement par Escher v.d. Linth ; ce n'est qu'à partir de 1840, quand Westmüller a commencé à les rédiger qu'ils devenus plus détaillés.

" Néanmoins il se trouve mentionné dans les comptes de 1837 qu'une somme de 1,000 frs. a été payée à M. Coulon fils à Neuchâtel le 17 février 1837. Or M. Coulon était président de la commission qui avait été chargée l'année précédente en juillet 1836 de la publication des 'nouveaux mémoires'. La somme mentionnée comme ayant été versée le 17 février 1837 à M. Coulon, ne peut avoir servi qu'à payer l'imprimeur, M. Petitpierre. Elle a été suivie par d'autres versements dans le courant de 1837.

" Il y a donc lieu d'admettre que la commission instituée fin juillet 1836 et dont le président M. Coulon résidait à Neuchâtel ait commencé dès 1836 à préparer la publication du vol. i des nouveaux mémoires qui aurait donc été prêt dès le début de 1837."

Ainsi donc, la question concernant Held est réglée. Reste celle de Beck. . . .

The Malacological Society of London is very greatly indebted to Professor Dr. Jules Favre, as well as to Professor Strohl and Professor Schinz, for all the indefatigable trouble they have taken to assist in clearing up the date in question, which in many points affects molluscan nomenclature, and this Society would take the present opportunity of returning to them its most sincere thanks.

NOTE ON THE CAPTURE OF *SPIRULA* ALIVE.

(Prepared by the Editor, B. B. WOODWARD, F.L.S.)

Read 12th January, 1923.

THE recent announcement of the capture of no less than ninety-five living specimens of *Spirula* in the North Atlantic by the Danish "Dana" Expedition seems to be a matter of sufficient importance to warrant calling the attention of this Society specially to the interesting fact.

Hitherto only some five examples have been met with; none alive. The present successful captures are mentioned by the leader of the expedition, Dr. J. Schmidt, in a communication to "Nature" of the 9th of December last.

The specimens were taken at depths of from 200 to 2,000 metres (110 to 1,100 fathoms), and most abundantly at from 300 to 500 metres (165 to 275 fathoms), so that *Spirula* evidently is bathypelagic, and only after death becomes mingled with the surface fauna. Individuals were frequently kept alive for a day or two in an aquarium on board the "Dana" and their habits observed.

Left to itself in the tank, the *Spirula* will remain suspended for hours at the surface, or lower down in the water, always in a vertical position, head downwards, and with arms more or less closed in. The cambered shell acts as a float, and its tendency to lift the animal to the surface is counteracted by the action of the fins and the current of water from the backwardly directed funnel. Like other cuttlefish, however, the *Spirula* often makes swift jerky movements, dashing off in any direction suddenly. These dashes are generally made backwards, the funnel for the moment being forwardly directed.

The growth of the shell increases with the growth of the animal, roughly speaking there is a chamber for each millimetre in length of the mantle.

The bead-like organ at the posterior end, which has given rise to much conjecture in the past, proves to be a light organ. It emits a pale, yellowish-green light which will shine uninterruptedly for hours together.

The occurrence of *Spirula* in the North Atlantic, according to the researches of the "Dana", is confined to an area between 10 and 35 degrees N. Lat. on the western side, and from the Canary Islands to north of the Cape Verde Island on the eastern side.

MOLLUSCAN LIFE ON THE SOUTH DOGGER BANK.

By GUY C. ROBSON.

(Published by permission of the Trustees of the British Museum.)

Read 12th January, 1923.

THESE notes are based upon observation made while on a cruise in the Fisheries Research steamer "George Bligh" (Captain W. H. Stewart) from 31st May to 7th June, 1922. The main purpose of the survey was to take bottom samples on an intensive scale over an area of 340 square miles north-east of "the South-West Patch" at the south end of the Dogger Bank. Full details of this work are to be published by Capt. F. M. Davis, of the Ministry of Agriculture and Fisheries, as well as an account of the technical methods employed.

In the area in question, and at an average depth of 12 fathoms, the bottom was found to consist almost exclusively of very fine grey sand. Occasional patches of coarse and fine gravel are found, as well as a little grey clay. One large boulder, probably ice-transported, of Scandinavian origin, was brought up. In accordance with the fine sandy bottom and the depth, there was a complete absence of macroscopic plant life. Practically the whole of the bottom over this area is covered by a layer of shell-fragments, the significance of which will be discussed later.

The bottom was sampled at stations a mile apart, and intensive work at closer intervals was undertaken. The instrument employed was a large-sized Petersen "grab", capable of covering $\frac{1}{5}$ sq. metre. Criticisms of this instrument and its gear may be found in Captain Davis' paper. For the present purpose it may be said that it appears to give a fair sample of the bottom, though the following criticisms may be put forward. In the first instance it is uncertain whether it gets up all the mollusca (e.g. large examples of *Ensis*) that burrow below the surface layer of the bottom. In the second place, if anything (a stone or shell, for example) happens to get fixed in the teeth of the closing edges, the latter are kept slightly apart, and a certain amount of the fine material is washed out of the grab.

The following is a list of the Molluscan forms obtained:—

GASTROPODA.

Living.	Empty shells.
<i>Natica alderi</i> , Forbes.	<i>Aporrhais pes-pelecani</i> (Linn.).
„ <i>catena</i> (Da C.).	<i>Epitonium communis</i> (Lamk.).
<i>Bittium reticulatum</i> (Da C.).	<i>Buccinum undatum</i> (Linn.).
<i>Propebela turricula</i> (Mont.).	<i>Bullinella cylindracea</i> (Penn.).
<i>Buccinum undatum</i> , Linn. (egg capsules).	
<i>Eolis</i> sp.	

SCAPHOPODA.

Dentalium entale, Linn.

LAMELLIBRANCHIA.

Living.	Empty shells.
<i>Gari ferroensis</i> (Chenn.).	<i>Mactra solida</i> , Linn.
<i>Mactra stultorum</i> , Linn.	<i>Cardium edule</i> , Linn., and sp.
<i>Venus gallina</i> , Linn.	<i>Astarte sulcata</i> (Da C.).
<i>Spisula subtruncata</i> (Da C.).	<i>Dosinia exoleta</i> (Linn.).
<i>Donax vittatus</i> (Da C.).	<i>Lucina borealis</i> (Linn.).
<i>Tellina fabula</i> , Gron.	<i>Lucinopsis undata</i> (Penn.).
<i>Nucula nitida</i> , Sby.	<i>Lutraria elliptica</i> (Lamk.).
<i>Ensis ensis</i> (Linn.).	<i>Cyprina islandica</i> (Linn.).
<i>Cultellus pellucidus</i> (Penn.).	<i>Tellimya ferruginosa</i> (Mont.).
	<i>Pecten opercularis</i> (Linn.).
	<i>Syndosmya prismatica</i> (Mont.).
	<i>Ensis siliqua</i> (Linn.).

It is impossible to give a complete list of the members of other groups associated with these mollusca, but the following forms were found fairly constantly in the hauls throughout the area :—

<i>Nephthys cæca</i> (Müll.).
<i>Lanice conchilega</i> , Pallas (empty tubes only).
<i>Goniada maculata</i> , Oerst.
<i>Magelona papillicornis</i> , Müll.
<i>Sigalion mathildæ</i> , Aud.
<i>Bathyporeia pelagica</i> (Bate.).
<i>Ampelisca lævigata</i> , Lilljeborg.
<i>Echinocardium cordatum</i> , Gray.

The large quartzite boulder referred to above had a special fauna of its own, which in variety and number contrasted very markedly with the poverty of the sandy bottom. Upon it were found five Hydroids (*Tubularia* sp., *Gonothyræa gracilis*, Sars, *Obelia dichotoma* (Linn.), *Calycella syringa* (Linn.), *Filellum serpens* (Hass.)), three Polychætes, *Flustra foliacea* (Linn.), *Eolis* sp., *Buccinum* (egg capsules), *Ophiothrix fragilis* (D. & K.), *Balanus* sp., and a Tunicate (*Styelopsis grossularia* (van Ben.)). This boulder was found upon a remarkably sterile patch of gravel.

The list of mollusca given above contrasts very remarkably with other lists that have been published in the past. The Dogger has usually been regarded as a malacologist's El Dorado, and in the most exhaustive list¹ published are recorded seventy-six species of Gastropoda and fifty-eight of Lamellibranchia. As against this, we have as the result of six days' intensive work on the South-west Patch no more than ten Gastropod species and twenty-one Lamellibranchia, or only 23 per cent of the total recorded by Hargreaves. The contrast becomes more marked if we consider the Gastropoda alone ; for of these only 13 per cent of Hargreaves' records were

¹ Hargreaves, Journ. of Conch., xiii, 1910, pp. 80, 99.

obtained. It must be borne in mind that Hargreaves' list is a collation based upon many collectors' results, and covering a long period. But comparison with the results of previous cruises on the Bank will make it clear that this particular area is extremely poor in Molluscan life. In 1875 Leckenby and Marshall obtained no less than sixty-four Gastropod and fifty-seven Lamellibranch species.

As to the gear used on the present trip I am satisfied that, with the two slight criticisms noted above, it obtains a fair sample of the bottom, and one probably much better than that given by dredges of an older pattern.

In addition to the relatively small number of species, we have to record that with one exception the number of individuals obtained was very small as compared with other records. *Spisula subtruncata* was found locally in vast quantities. *Venus gallina*, *Mactra stultorum*, *Tellina fabula*, and *Donax vittatus* were fairly plentiful, but were very often represented by only one or two examples of each per haul. Of the Gastropoda, *Natica alderi* was fairly numerous, but relatively to the Lamellibranchia was scanty. The others were only occasionally found. Full details, with the numerical data, of the occurrence of these forms will be given in Captain Davis' paper.

The chief facts so far arrived at are therefore: (1) the general poverty of molluscan life; (2) the abundance of one form, *Spisula subtruncata*; (3) the greater frequency of Lamellibranchia. That the general vital conditions are not inimical to invertebrate life is apparent from (a) the abundance of *S. subtruncata*, (b) large hauls of *Hydralmannia* taken at two stations, (c) the plentiful and varied population of the quartzite block referred to previously.

In discussing the relations between the mollusca of the Southwest Patch and their environment, and initiating comparisons with previous results, one is under a certain disadvantage, in that previous workers did not record the type of bottom on which the various forms were obtained. We do not know, therefore, whether the previous hauls, such as that of Leckenby and Marshall, were obtained from a bottom similar to that explored on the cruise now described.

It is not easy to account for the poverty of molluscan life in this area. We may refer the absence of Gastropoda to the sandy bottom, though the *Naticas* which are specially adapted for life in such a place can scarcely be called plentiful. On the other hand, that such a sandy bottom is not wholly a deterrent to other Gastropoda is shown by the fact that *Propobela* and *Bittium* were found alive there. I believe it is generally agreed that the Prosobranch foot is not well adapted to crawling over fine loose sand bottom. But I do not think this is wholly true, as I have found *Littorina* occasionally, and species of *Paludestrina* frequently, living on a bottom of fine suspended sand, and even mud. I therefore feel that the power of effecting progress on the bottom is not wholly the determining

factor in this case. On the other hand, none of the Lamellibranchia, except the *Spisula*, were plentiful. Four other forms referred to (p. 176) were frequently met, but normally only four or five living examples in a haul,¹ and never in the plenty that one finds elsewhere. It is on just such a bottom that one would expect to find quantities of *Ensis*, *Cardium*, *Modiolaria*, etc.

In default of objective evidence to account for this poverty of molluscan life, I am tempted to stress the absence of any organic débris that might afford food for an average molluscan population. Every haul I inspected contained only the clear fine sand and shell fragments, with the occasional particles of mud or gravel. Whether no débris settles there at all, or, if it does, whether it is swept away by a strong scour and deposited elsewhere, it is impossible to say. In any case, the mollusca that do live there must be, like the *Naticas*, carnivorous, or they must subsist entirely upon planktonic organisms or bottom protozoa and diatoms.

As previously stated, the bottom in this area is covered with a layer of shell fragments. Since there is so little hard bottom, it is most improbable that these are remains of molluscs, that have died *in situ*, abraded by tidal action. In several examples of dab and haddock trawled on the spot the stomach was found full of similar fragments, and Captain Davis and I are of the opinion that this layer is derived from molluscs swallowed whole by these fish and voided as comminuted remains in the fæces. With the exception of the patches of *Spisula*, these fragments are always vastly in excess of the living animals taken on the spot, and it remains to account for these.

The conclusion one would come to is that these fragments represent the bulk of the indigenous molluscan fauna that has been demolished by the vast shoals of dab, plaice, and haddock that are found on this ground in certain seasons of the year. If this is true, then, with the exception of the *Spisula*, it is plain that periodically the molluscan fauna is enormously impoverished by the attacks of fish. Whether this destruction is counterbalanced by abundance of molluscan life, so that after the periodic raids it is replenished by a single breeding season, or whether the molluscan fauna is in danger of partial extinction in this area, it is impossible to say.

The enormous quantities of *Spisula subtruncata* are very hard to explain. It is evidently palatable at least to the dabs, as examples were found in the stomachs of the latter. For the time being, one can only fall back on the suggestion that it is a newcomer that has found the Bank very suitable as a breeding-ground, a suggestion supported by the fact that it does not figure in Hargreaves' list as coming from the Dogger up to 1910.

¹ The maxima obtained were : *Tellina fabula*, 8 per haul ; *Mactra stultorum*, 11 per haul. [F. M. D.]

Though the attacks of fish might seem at first sight to afford a complete explanation of the relative paucity of molluscan life on this part of the Bank, I do not think that this actually is the case. In the first place the poverty in species cannot be explained thus, since many of the forms which are absent here are very abundant elsewhere. In the second place one would have expected the area surveyed by Leckenby and Marshall to have been similarly depopulated, especially since one of their visits was in August. But this was not the case. It seems to follow from the later fact that, in addition to the depredation of fish, there is another factor contributing to the relative sterility of the South-west Patch. This factor may be the absence of organic débris, as already suggested, though limiting factors of a physical, chemical, or even mechanical nature, should not be disregarded.

I have to acknowledge the courtesy of Dr. E. S. Russel, Director, and Captain F. M. Davis, Assistant Naturalist, of the Fisheries Laboratory, Lowestoft, who afforded me the opportunity of this cruise. My thanks are also due to my colleagues, Messrs. R. Kirkpatrick, W. Campbell Smith, and A. K. Totton, for identifying specimens referred to in this report.

NOTES ON NEW ZEALAND PELECYPODS.

By W. R. B. OLIVER, F.L.S.

Read 12th January, 1923.

THE appearance of Suter's work on the Mollusca of New Zealand, in 1913 made a great advance in the study of the subject by making readily available descriptions, references to literature, figures, and other information on all the species admitted by him. The work forms a new starting-point for making known the constitution and relationships of molluscan fauna of New Zealand. Iredale, in an article published in vol. xlvii of the Transactions of the New Zealand Institute, next took up the subject from the point of view of nomenclature, made a number of changes in names, and proposed various new arrangements in the generic locations of the species. In the same volume I removed thirty-two names from the records of species from the Kermadec Islands in Suter's book. Other work on the recent species of New Zealand Mollusca since the appearance of Suter's Manual consists mainly in additions to the fauna made by E. A. Smith (Report, "Terra Nova" Expedition) and Miss M. K. Mestayer (Trans. New Zealand Inst., vols. xlviii, I, li).

A critical examination of types in the Dominion Museum and other material does not entirely confirm the results of either Suter or Iredale. Suter worked with plenty of New Zealand specimens, but appears not to have troubled to compare exotic species. Iredale, on the contrary, has ample foreign material to study, but, judging by his results, did not have sufficient New Zealand specimens, so that many of Suter's mistakes are repeated in Iredale's lists. The specimens available to me are not adequate either in New Zealand or exotic species, yet I have little doubt that many of the species of Pelecypods admitted by Suter and not here dealt with, will, when proper comparisons are made, share the fate of some of those I have examined. Unfortunately, Suter did not purge the New Zealand list of all the exotic species included by Hutton, and this result is especially misleading when new names founded on foreign material are included by Suter as good New Zealand species.

1. ANOMIA WALTERI, Hector.

The typical form of this species I have found only under stones near low-tide mark at the Bay of Islands, and on rocks between tide-marks in sheltered water at Port Fitzroy, Great Barrier Island, attached to a shell of *Mytilus canaliculus*. The shell is of regular shape, broader than high, with radiating ribs and the valves thin and almost transparent at the edges. This form is well figured by Suter (Man. N.Z. Moll., pl. lvii, fig. 10). Living on exposed rocks at the Bay of Islands, however, it becomes irregular in outline, the valves are much thicker, frequently the radial ribs are obscure or

obsolete, and the outer surface is dull and eroded. Such specimens are not easily separated from those of *A. trigonopsis*.

2. ANOMIA TRIGONOPSIS, Hutton.

Anomia trigonopsis, Hutton, 1877, Trans. N.Z. Inst., vol. ix, p. 598; Suter, 1915, N.Z. Geol. Surv. Pal. Bull., No. 3, p. 48.

Anomia huttoni, Suter, 1913, Man. N.Z. Moll., p. 843; Suter, 1914, N.Z. Geol. Surv. Pal. Bull., No. 2, p. 34.

Anomia undata (not Hutton), Suter, 1913, Man. N.Z. Moll., p. 843.

That there are two, but not more than two, recent species of Anomia in New Zealand is the conclusion I have arrived at after studying the material available. The type of *A. huttoni*, and the specimen on which Suter has admitted, *A. undata*, as a recent species (Man. N.Z. Moll., p. 843), are in the Dominion Museum. There is no difference by which they can be separated. Suter's figure of *A. undata* (pl. 57, fig. 9) is not the recent specimen, but, judging by the measurements, is that of the type, a Pliocene fossil. *A. undata* is a distinct species so far only found fossil in the Pliocene. I am unable to distinguish *A. trigonopsis* of Hutton, as represented by Suter's plesiotype in the collection of the Geological Survey, from the recent shells in the Dominion Museum. This being the earliest name, I apply it to all the recent examples of Anomia from New Zealand except *A. walteri*. As a species, *A. trigonopsis* may be defined as being irregular in form, with moderately thick valves with a pinkish sheen. The left valve has irregular, more or less concentric plications, striæ, and lamellæ, but no distinct radial ribs. The relative position of the muscular scars and the shape of the disc varies with the shape of the shell and affords no diagnostic characters. The lower byssal scar, however, is not relatively large, as in *A. undata*. The range of *A. trigonopsis* is from the Miocene to recent.

3. MONIA FURCATA, Suter.

Anomia furcata, Suter, 1907, Trans. N.Z. Inst., vol. xxxix, p. 262, pl. 9, figs. 9, 10; Suter, 1913, Man. N.Z. Moll., p. 842, pl. li, figs. 6, 6a.

My attention was first drawn to the wrong classification of this species in Suter's Manual by Mr. Marwick, who suggested that by the sculpture it should be a *Monia*. We then examined the type and found the characters of that genus, namely, only two muscular scars, of which the byssal was radiately striated. The examination of further specimens confirmed this. Suter has figured three muscular scars and also described the characters of three, but only two exist. He further states (Trans. N.Z. Inst., vol. xxxix, p. 263, 1907) that of a number of left valves obtained only one showed the muscle scars distinctly. In this, apparently, he was also mistaken. The species is found commonly in Hauraki Gulf, at depths of about 25 fathoms, attached to the shells of *Pinna zelandica*. Specimens

reach a length of 28 mm., and have in the central and dorsal portion of the left valve a large green patch showing both inside and outside.

4. *MYTILUS PLANULATUS*, Lamarck.

Mytilus planulatus, Lamarck, 1819, Anim. s. Vert., vol. vi, pt. 1, p. 125.

Mytilus edulis (not Linné), Hutton, 1880, Man. N.Z. Moll., p. 167; Suter, 1913, Man. N.Z. Moll., p. 862, pl. lvi, fig. 4.

For more than forty years the common mussel of the southern portion of New Zealand has been masquerading under the name of *M. edulis* of the Arctic and north temperate regions. This is the more strange because the species to which it belongs was, on Australian specimens, recognized as distinct from the northern species by Lamarck over 100 years ago, and, judging by the synonyms, by several other authors subsequently. The type is from King George's Sound, Western Australia, and the species occurs from there eastward to New South Wales and Tasmania. In New Zealand it is the most common mussel found between tide-marks from Cook Strait southward, and it is also found at Great Barrier Island. The true *M. edulis* has an expanded lip, or hinge-plate, bearing a row of small teeth, usually four to six in number. The colour of the shell is bluish- to brownish-black, with radiating blue lines. These latter are best seen on young shells, but many old ones also show them. The New Zealand shell is much thicker and heavier, and has only two or three teeth, larger than in *M. edulis* and placed inside the apex, not on an expanded lip. The colour is bluish-black weathering to blue, and there are never any radiating bands. It is thus easily separated from *M. edulis*, but I have failed to find any character by which it can be distinguished from *M. planulatus*.

M. planulatus from Cook Strait southward forms extensive associations on rocks in the mid-tide belt. In size it appears to increase from north to south. For instance, the average length of the shell in Wellington Harbour is 65 mm., in Stewart Island shells of 75 mm. in length are common, while Suter states that specimens from the islands to the south of New Zealand are of a very large size. The largest specimens I have seen, however, came from Great Barrier Island, north of Auckland, and measured 89 mm. in length.

5. *MODIOLUS CONFUSUS* (Angas).

Perna confusa, Angas, 1871, Proc. Zool. Soc., p. 21, pl. i, fig. 21.

Modiolus fluviatilis, Hutton, 1878, Journ. de Conchyl., p. 53; Suter, 1913, Man. N.Z. Moll., p. 867, pl. clviii, fig. 6.

Modiolus confusus is an Australian species from which I am unable to distinguish *M. fluviatilis* of Hutton. In both countries the species occurs in brackish water, and is variable in the shape of the shells. Both Mr. May, of Tasmania, and Mr. Hedley, of Sydney, are in agreement with me in uniting the Australian and New Zealand forms under one name.

6. OSTREA ANGASI, Sowerby.

- Ostrea angasi*, Sowerby, 1871, Conch. Icon., vol. xviii, pl. xiii, fig. 27 ;
Suter, 1913, Man. N.Z. Moll., p. 888, pl. lvii, fig. 3.
Ostrea reniformis (not Sowerby), Hutton, Journ. de Conchyl.,
vol. xxvi, p. 56 ; Hutton, 1880, Man. N.Z. Moll., p. 175.
Ostrea tatei (part), Suter, 1913, Man. N.Z. Moll., p. 889, pl. lvii, fig. 4
(the New Zealand shell only).

The characters of this species, so far as it is distinguished from other New Zealand species of *Ostrea*, are the irregular low distant radiating ribs and coarse laminations on the left valve, and the fine brown brittle laminæ on the right or flat valve. On muddy bottoms, where the shell is free or only slightly attached, the left valve is regularly convex. When a large portion of the left valve is attached to a rock it always turns more or less sharply up along the margin of the area of attachment. This is a necessary adaptation for the animal to get the space it requires between the two valves. It seems curious that the convex valve is the one that is attached to the rock and thus made subject to special adjustment, a circumstance that might have been avoided had the flat valve been the lower one. The species reaches its largest size in water of 15 to 20 fathoms in Foveaux Strait. Between tide-marks the shells are usually smaller, and being attached to rocks have the free portion of the lower valve turned at an angle to the attached portion. Shells only 2 or 3 cm. in diameter, at Spirits Bay on rocks between tides, I refer to this species.

The rock form of this species from the southern portion of New Zealand is classed by Suter with the Eocene fossil from Australia, which he then names *O. tatei* (Man. N.Z. Moll., p. 889, 1913).

7. OSTREA CORRUGATA, Hutton.

- Ostrea corrugata*, Hutton, 1873, Cat. Tert. Moll. N.Z., p. 35 ; Suter,
1913, Man. N.Z. Moll., p. 890, pl. lvii, fig. 5.
Ostrea reniformis (not Sowerby), Suter, 1913, Man. N.Z. Moll.,
p. 892, pl. lvii, fig. 7.

There is a small oyster found on inter-tidal rocks in harbours and, in deeper waters, in Hauraki Gulf. I have examined specimens from Auckland, Wellington, Lyttelton, and Dunedin Harbours. It also occurs in Pliocene beds near Wanganui. It usually has a thin shell, with many often high, close, radiating ribs, three or four ribs to 1 cm., and is usually attached by only a small portion of the left valve. It is easily separated from *A. angasi* by these characters. The right valve often bears three broad, radiating, dark bands.

The type of Hutton's species, a Pliocene fossil, is in the Dominion Museum. The shell is more solid than recent forms and has larger, higher, and more distant ribs ; otherwise it agrees. Suter figures an oyster from Auckland Harbour under the name of *O. reniformis*,

Sowerby. Through the courtesy of Mr. Murdoch I have been able to examine this specimen, and it is referable to the present species. The use of the name *reniformis* shows how persistently names once introduced into the fauna are retained. Hutton used it for the Dunedin rock oyster (= *O. angasi*), but Sowerby's description does not agree with any New Zealand species. The locality from which it was collected is unknown, and the name is best rejected as indeterminable.

8. ARCA TRAPEZIA, Deshayes.

Arca trapezia, Deshayes, 1840, Mag. Zool., p. 21.

This species has not hitherto been recorded from New Zealand, but in 1916 I found two waterworn valves at Spirits Bay, and a few years later Mr. A. W. B. Powell discovered a valve in a much better state of preservation at Muruwai, west of Auckland. All these specimens are large, heavy shells, but I am unable to separate them, as a species, from Australian specimens of *A. trapezia*.

9. CARDIUM MACULOSUM, Wood.

Cardium maculosum, Wood, 1818, General Conchology, p. 218, pl. lii, fig. 3.

Protocardia pulchella (not Gray), Oliver, 1915, Trans. N.Z. Inst., vol. xlvii, p. 556.

I am indebted to Mr. Hedley for naming shells of this species and supplying the reference above quoted. It is found at the Kermadec Islands, whence I recorded it as *Protocardia pulchella*, which species, however, has not yet been obtained there.

10. LASÆA MINUTISSIMA (Iredale).

Iredale (Trans. N.Z. Inst., vol. xl, 1908, p. 387) described this species as a *Modiolarca*. Suter (Man. N.Z. Moll., p. 926, 1913) reduced it to *Lasæa miliaris*. Iredale next asserts that his species is a " *Modiolarca* " and a valid species, and (Trans. N.Z. Inst., vol. xlvii, 1915, p. 487) lists it as *Gaimardia minutissima*. If, before making this statement, Iredale had examined specimens, he could not have repeated his error. The species is correctly placed by Suter under *Lasæa*, but it is certainly not *L. miliaris*. It is a good species, and should be entered as above.

11. PSEUDARCOPAGIA DISCULUS, Deshayes.

With Iredale's statement that *Arcopagia* needs generic distinction I agree, but he incautiously accepts Suter's location of *Tellina disculus*, instead of examining the species for himself. It may be referred to *Pseudarcopagia*, which is a closer ally of *Tellina* than is *Arcopagia*.

12. RAETA CANALICULATA, Say.

Lutraria canaliculata, Say, 1822, Journ. Acad. Nat. Sci. Philad., vol. ii, p. 311.

Raeta perspicua, Hutton, 1873, Cat. Mar. Moll. N.Z., p. 65; Suter, 1913, Man. N.Z. Moll., p. 970, pl. lx, fig. 5.

This is a North Atlantic species, but a specimen in the Dominion Museum is the type of *R. perspicua*, Hutton. The original label bears no locality name, nor is any given with the original description. Yet Hutton afterwards (Man. N.Z. Moll., 141, 1880) attaches the locality "Bay of Islands", and forthwith the species "*R. inconspicua*" becomes safely installed in the New Zealand fauna. It should, of course, be omitted, and were this the only instance of foreign shells being introduced into the New Zealand lists by Hutton and retained by Suter it might be overlooked. But there are several others. Some may be detected, as when a known West Indian species like *Acanthoplema granulata* is included, but when foreign shells are made the types of new species, such "species" are likely to be long retained, especially by those who have not access to the types.

13. ANTIGONA ZELANDICA (Gray).

Dosina zelandica, Gray, 1835, Yate's New Zealand, p. 309; Gray, 1843, Dieffenbach's Travels in New Zealand, vol. ii, p. 249.

Venus zelandica (Gray); Hutton, 1873, Cat. Mar. Moll. N.Z., p. 70.

Venus oblonga (not Gray), Hanley, 1856, Cat. Recent Bivalve Shells, p. 359, pl. xvi, fig. 1 (possibly two species confused, but figure is that of *A. zelandica*).

Chione crebra, Hutton, 1873, Cat. Mar. Moll. N.Z., p. 70.

Cytherea crebra (Hutton), Suter, 1913, Man. N.Z. Moll., p. 984, pl. lxi, fig. 1.

A great deal of confusion exists with regard to the species included by Suter under *Cytherea*. Gray first described this common species under the name of *Dosina zelandica*. In 1843 Gray describes a second species (*D. oblonga*), and had no more names been applied to these two species all would have been well. Unfortunately, however, Hutton in 1873 described *Chione crebra*. The type of this is in the Dominion Museum, and is Gray's *A. zelandica*. Next, in 1880 (Man. N.Z. Moll., p. 147), Hutton reduces Gray's "*V. zelandica*" to the synonymy of *oblonga*, and keeps his own name *crebra* for the true *zelandica*. This course has been followed by Suter (Man. N.Z. Moll., 1913, p. 985). Iredale (1915), in restoring Gray's specific name, fails to note that Gray had correctly separated the two species, and, judging by his list on p. 494, retains *crebra* for Gray's *zelandica* and uses *zelandica* for Gray's *oblonga*.

14. ANTIGONA OBLONGA (Gray).

Dosina oblonga, Gray, 1843, Dieffenbach's Travels in N.Z., vol. ii, p. 249.

Cytherea oblonga (Gray, not Hanley), Suter, 1913, Man. N.Z. Moll., p. 985, pl. lxi, fig. 2.

Antigona zelandica (not Gray), Iredale, 1915, Trans. N.Z. Inst., vol. xlvi, p. 495.

As a species, *A. oblonga* is doubtfully distinct from *A. zelandica*. It includes the oblong forms, which are not nearly so abundant as the more ovate forms. Many specimens are difficult to assign definitely to either species. The main characters relied on by Suter for distinguishing *oblonga* and *crebra* (= *zelandica*) are the shape of the lunule and the angle made by the dorsal and anterior sides. The lunule varies in shape with the width of the shell; the more ventricose the shell the wider the lunule. The angle made by the dorsal and anterior sides is more important, as the narrower it is the more prominent are the umbones. The brown colour markings are found on both species, and are best seen in young specimens.



Notopaphia elegans (Deshayes).

15. NOTOPAPHIA, n.gen.

Venerupis elegans, Deshayes, differs from true *Venerupis* and the allied genera, *Paphia*, *Protothaca*, and *Marcia*, in the characters of the teeth and in possessing a well-defined lunule. I therefore propose it as the type of a separate genus, *Notopaphia*.

The essential characters are: The anterior cardinals are directed forwards and parallel, or nearly so, to the margin of the shell; the lunule is deeply impressed; the sculpture consists of concentric laminæ and fine radial striæ, and the inner margins of the valves are crenulated. The right side of the lunule is larger than the left; in the escutcheon the reverse is the case. Pallial sinus, triangular.

16. VENERUPIS REFLEXA, Gray.

Venerupis reflexa, Gray, 1843, Dieffenbach's Travels in N.Z., vol. ii, p. 250; Suter, 1913, Man. N.Z. Moll., p. 998, pl. lxii, fig. 7.

Venerupis siliqua, Deshayes, 1854, Proc. Zool. Soc., 1853, p. 5, pl. xviii, fig. 1; Suter, 1913, Man. N.Z. Moll., p. 999, pl. lxii, fig. 8.

V. reflexa and *V. siliqua* have been generally recognized as distinct species, but I do not think a dividing line can be found. According to Suter, the difference between them concerns the escutcheon and the lamellæ. The anastomosing of the lamellæ may at once be dismissed as of no classificatory importance, as in specimens assigned to both forms the shell is more irregular in outline and the lamellæ are similarly irregular. The escutcheon also, when present is small and variable. Finally, one other difference is observed when comparing the descriptions given by Suter. The right posterior cardinal is stated to be "small" in *reflexa*, and "strong, grooved" in *siliqua*. I have never seen it other than grooved; in fact, this is a character of the genus. I have examined specimens from many parts of New Zealand, and find it impossible to separate them into two groups. I therefore propose to unite the nominal species *reflexa* and *siliqua* under the first published name.

17. BASSINA DISJECTA (Perry).

Venus disjecta, Perry, 1811, Conchology, pl. lviii, fig. 3.

Venus lamellata, Lamarck, 1818, Anim. s. Vert., vol. v, p. 592.

Chione lamellata (Lamarck), Hutton, 1873, Cat. Mar. Moll. N.Z., p. 69.

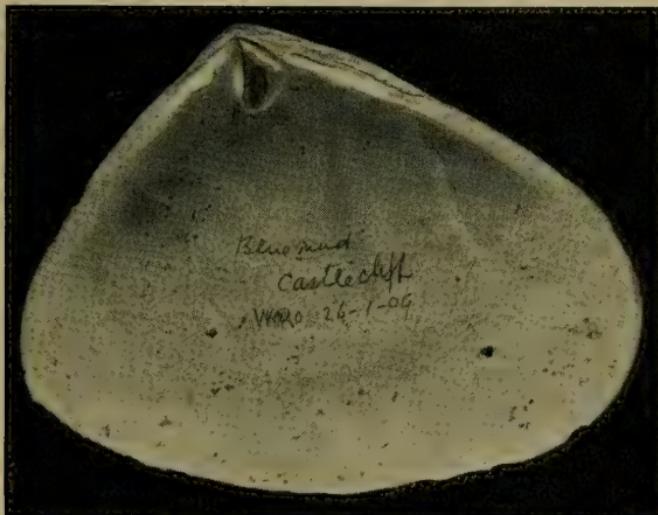
Chione disjecta (Perry), Suter, 1913, Man. N.Z. Moll., p. 989, pl. lxi, fig. 5.

This species has been admitted to the fauna of New Zealand on the evidence of two valves in the Dominion Museum. The original labels bear no locality name, nor is any given when Hutton includes the species in his Cat. Mar. Moll. of New Zealand. The species next appears in Hutton Man. N.Z. Moll., p. 147, 1880, with the locality Auckland, with Cheeseman as authority. Finally, Suter (1913) gives Cook Strait as the locality and omits Auckland. The history of this species is like that of *Raeta perspicua*, recorded above. In his Manual, Hutton appears to have set himself the task of attaching localities to the species he had previously included in his Catalogue without any. Suter not only follows him without question, but goes so far as to hunt up extra localities or change Hutton's. No good can come to science by such methods. The simple fact is that the Dominion Museum specimens have no authentic history. They, of course, I might without fear of contradiction say, certainly came from Australia, and the name should be struck off the list of New Zealand Mollusca.

18. AMPHIDESMA SUBTRIANGULATA, Wood.

This appears to be a variable species, the extreme forms of which are the thick, angled, triangular form from the north, and the flattened, more ovate, form from Banks Peninsula and other localities in the south. This last form is *quoyi*, which Iredale (Trans. N.Z. Inst., vol. xlvii, p. 492, 1915), says Suter has confused in the description of *ventricosa*. But this is not the case. Suter, probably

with a series greater than was available to Iredale, included *quoyi* in the description of *subtriangulata*. His reference of *M. lata* to its synonymy, and his labels on specimens in the Dominion Museum, prove this. That we are dealing with one variable species, and not two species, is shown by the fact that variations in those characters which are supposed to separate *quoyi* from *subtriangulata* may be observed in the same locality. For instance, in shells from the Chatham Islands the angle formed by the dorsal and posterior sides varies through several degrees, while shells from Takapuna vary in the thickness of the shell. While it is thus not practicable to separate a long series of shells from many localities into two species, yet those from the north-east coast between Spirits Bay and Tauranga are usually heavy ventricose shells with the posterior end short and, therefore, the angle made by the dorsal and posterior sides comparatively small. Shells from Kaipara and Gisborne southwards, and from the Chatham Islands, are almost invariably of the broad-angled, thin form. If it be convenient to refer to these differences *subtriangulata* and *quoyi* might be used sub-specifically, but in this case *quoyi* would not have the meaning intended by Iredale, but include besides the greater part, so far as area of distribution goes, of the species *subtriangulata*.



Amphidromia subtriangulata pliocenica, n.subsp. 187

Specimens from the Pliocene beds at Castlecliff are higher than either of the recent forms, and the angle of the dorsal and posterior sides is intermediate. It is more distinct from the two recent forms than they are from each other, and I here propose for it the sub-specific name *pliocenica*. Type in the Dominion Museum. Perhaps

it is from such an ancestor as this that the recent forms have descended. The early Pliocene *A. crassiformis* is a still deeper shell.

19. DOSINIA MAORIANA, n.sp.

Dosinia cærulea (not Reeve), Suter, 1906, Trans. N.Z. Inst., vol. xxxviii, p. 318; Suter, 1913, Man. N.Z. Moll., p. 977, pl. 60, fig. 8.

A shell rather rarely found in New Zealand is that hitherto recorded as *Dosinia cærulea*. The true *cærulea* is a Tasmanian and south-east Australian species, easily separated from the New Zealand shell by its much less prominent sculpture and less ventricose form. The New Zealand species appears to be a very distinct form, and as, so far as I am aware, it is not referable to any known species, I suggest the name *maoriana* for it. Type in the Dominion Museum.

D. cærulea is far more closely related to *D. lambata* than to *D. maoriana*.

AN INDEX TO "A CLASSIFICATION OF THE AMERICAN OPERCULATE LAND MOLLUSKS OF THE FAMILY ANNULARIIDÆ". By JOHN B. HENDERSON and PAUL BARTSCH, Proc. U.S. Nat. Mus., 1920, vol. lviii, p. 49.

Compiled by HUGH C. FULTON.

Read 12th January, 1923.

THIS new family is separated from the Cyclostomatidæ on account of "a constant and essential radula difference", the sub-families are founded on "characters presented by the operculum", the new genera "upon minor modifications of the opercular characters", and the sub-genera "almost wholly upon shell characters". "The comparatively few species, the opercula of which we have not actually seen, are excluded from consideration."

Arrangement of this index:—a synopsis is given first of the sub-families, genera, etc., in the order in which they appear in the above paper, the type species being placed in parentheses; this is followed by an alphabetical list of the species with numbers referring to the genera to which they are attached by the above authors. Many species that have formerly been erroneously attributed by Pfeiffer and other authors to Gundlach, Arango, etc., are in this paper accredited to their proper authorities.

Fam. ANNULARIIDÆ, Henderson & Bartsch, 1920.

Sub-family CHONDROPOMINÆ, H. & B., 1920.

Type Genus CHONDROPOMA.

Genus CHONDROPOMA, Pf., 1847.

1. Sub-genus CHONDROPOMA, Pf., 1847. (*semilabre*, Pf.)
2. " CHONDROPOMATUS, H. & B., 1920. (*latum*, Pf.)
3. " CHONDROPOMIUM, H. & B., 1920. (*weinlandi*, Pf.)
4. " CHONDROPOMETES, H. & B., 1920. (*vignalensis*, Pf.)
5. " CHONDROPOMARTES, H. & B., 1920. (*presasiana*, Pf.)
6. " CHONDROPOMORUS, H. & B., 1920. (*dentatum*, Say)

Genus CHONDROTHYRA, H. & B., 1920.

7. Sub-genus CHONDROTHYRA, H. & B., 1920. (*egregium*, Poey.)
8. " CHONDROTHYRIUM, H. & B., 1920. (*violaceum*, Pf.)
9. " CHONDROTHYROMA, H. & B., 1920. (*sagebieni*, Pf.)
10. " CHONDROTHYRETES, H. & B., 1920. (*shuttleworthi*, Pf.)

Sub-family RHYTIDOPOMINÆ, H. & B., 1920.

Type Genus RHYTIDOPOMA, Sykes.

10* Genus RHYTIDOTHYRA, H. & B., 1920. (*bilabiatum*, Orb.)

Genus PARACHONDRIA, Dall., 1905.

11. Sub-genus PARACHONDRISCA, H. & B., 1920. (*umbricola*, Weinl.)
12. " PARACHONDRELLA, H. & B., 1920. (*fecunda*, Ad.)
13. " PARACHONDRIA, Dall., 1905. (*fascia*, Wood.)
14. " PARACHONDROPS, H. & B., 1920. (*campbelli*, C. B. Ad.)

Genus *OPISTHOSIPHON*, Dall, 1905.

15. Sub-genus *OPISTHOSIPHON*, H. & B., 1920. (*bahamense*, Shutt.)
16. " *OPISTHOSIPHONA*, H. & B., 1920. (*moreletiana*, Petit.)
17. Genus *XENOPOMA*, Crosse, 1890. (*hystryx*, Pf.)
18. Genus *RHYTIDOPOMA*, Sykes, 1901. (*rugulosum*, Pf.)

Genus *TORELLIA*, H. & B., 1920.

19. Sub-genus *TORELLIA*, H. & B., 1920. (*torreianum*, Arango.)
20. " *TORELLISCA*, H. & B., 1920. (*simpsoni*, H. & B.)

Sub-family *ADAMSIELLINÆ*, H. & B., 1920.Type Genus *ADAMSIELLA*, Pf.Genus *ADAMSIELLA*, Pf.

21. Sub-genus *ADAMSIELLA*, Pf., 1851. (*mirabilis*, Wood.)
22. " *ADAMSEILLOPS*, H. & B., 1920.

Sub-family *ANNULARINÆ*, H. & B., 1920.Type Genus *ANNULARIA*, Schum.Genus *ANNULARIA*, Schumacher, 1817.

23. Sub-genus *ANNULARIA*, Schum., 1817. (*lincina*, Linné.)
24. " *ANNULARISCA*, H. & B., 1920. (*eburneum*, Pf.)
25. " *ANNULAROSA*, H. & B., 1920. (*fragilis*, Pf.)
26. " *ANNULARITA*, H. & B., 1920. (*majusculum*, Morelet.)
27. " *ANNULARELLA*, H. & B., 1920. (*yunquense*, Pf.)
28. " *ANNULAROPS*, H. & B., 1920. (*blaini*, Pf.)
29. " *ANNULARODES*, H. & B., 1920. (*uncinatum*, Arango.)

30. Genus *BLAESOSPIRA*, Crosse, 1890. (*echinus*, Pf.)

31. Genus *ABBOTELLA*, H. & B., 1920. (*moreletiana*, Crosse.)

Genus *TUDORA*, Gray, 1850.

32. Sub-genus *TUDORA*, Gray, 1850. (*megacheilos*, Pot. & Mich.)
33. " *TUDORELLATA*, H. & B., 1920. (*interstitialis*, Pf.)
34. " *COLOBOSTYLUS*, Crosse & Fischer, 1888. (*jayanum*, C. B. Ad.)
35. " *TUDORISCA*, H. & B. (*albus*, Sow.)
36. " *TUDOROPS*, H. & B., 1920. (*banksianum*, Sow.)

Genus *EUTUDORA*, H. & B., 1920.

37. Sub-genus *EUTUDORA*, H. & B., 1920. (*limbifera*, Pf.)
38. " *EUTUDORISCA*, H. & B., 1920. (*jimenoi*, Pf.)
39. " *EUTUDORELLA*, H. & B., 1920. (*agassizii*, Pf.)
40. " *EUTUDOROPS*, H. & B., 1920. (*torquatum*, Poey.)
41. Genus *RAMSDENIA*, Preston, 1913. (*mirifica*, Prest.)

Genus *DIPLOPOMA*, Pf., 1859.

42. Sub-genus *DIPLOPOMA*, Pf., 1859. (*architectonicum*, Pf.)
43. " *JAMAICIA*, C. B. Ad., 1850. (*anomala*, C. B. Ad.)

LIST OF SPECIES.

32. *abboti*, Hend. & Bartsch.
 6. *abnatum*, Pf.
 11. *adamsi*, Pf.
 31. *adolfi*, Pf.
 6. *adulteratum*, Pf.
 39. *agassizii*, Pf.
 33. *alatum*, Pf.
 35. *albus*, Sow.
 „ var. *fuscus*, C. B. Ad.
 3. *ambigua*, Lamk.
 13. *aminensis*, Pf.
 3. *andrewsæ*, Ancey.
 43. *anomala*, C. B. Ad.
 22. *antiguense*, Shutt.
 16. *apertus*, Torre & Hend.
 23. *arangiana*, Gundl.
 42. *architectonicum*, Pf.
 35. *ariensis*, Guppy.
 12. *armata*, C. B. Ad.
 10. *assimile*, Pf.
 13. *augustæ*, C. B. Ad.
 33. *auricomum*, Pf.
 12. *avena*, C. B. Ad.
 4. *azucarensis*, Hend. & Bart.
 15. *bahamense*, Shutt.
 36. *banksianum*, Sow.
 6. *basicarinatum*, Pf.
 23. *bebini*, Pf.
 16. *berryi*, Clapp.
 „ v. *semiapertus*, Torre
 & Hend.
 27. *bertini*, Maltz.
 „ v. *gracillima*, Maltz.
 6. *biforme*, Pf.
 10.* *bilabiatum*, Orb.
 16. *bioscai*, Torre & Hend.
 28. *blaini*, Pf.
 23. *blandi*, Weinl.
 1. *blandum*, Pf.
 1. *blauneri*, Pf.
 35. *bronni*, C. B. Ad.
 1. *brownianum*, Weinl.
 1. *bryanti*, Pf.
 41. *bufo*, Pf.
 7. *canaliculatum*, Gundl.
 6. *candeanum*, Orb.
 6. *canescens*, Pf.
 14. *campbelli*, C. B. Ad.
 13. *capillacea*, Pf.
 1. *carenasense*, Pils. & Hir.
 „ v. *guantana-*
 mensis, Torre.
 1. *caribbeum*, Clapp.
 6. *caricæ*, Pf.
 38. *catenata*, Gould.
 34. *chevalieri*, C. B. Ad.
 „ v. *virgatum*, C. B. Ad.
 „ v. *pulchrius*, C. B. Ad.
 35. *chiapensis*, Crosse.
 23. *chittyi*, C. B. Ad.
 6. *chordata*, Pf.
 13. *cinclidodes*, Pf.
 18. *clathratum*, Gould.
 10. *claudicans*, Pf.
 12. *columna*, Wood.
 18. *coronatum*, Poey.
 6. *crenulatum*, Fér.
 35. *crenulosus*, C. B. Ad.
 33. *cumulata*, Pf.
 16. *dalli*, Torre & Hend.
 7. *deceptor*, Arango.
 33. *decoloratum*, Gundl.
 23. *decussatum*, Lamk.
 19. *deficiens*, Gundl.
 6. *delatreanum*, Orb.
 6. *dentatum*, Say.
 13. *dentilobatum*, Weinl.
 16. *detectus*, Torre & Hend.
 6. *dilatatum*, Pf.
 5. *discolorans*, Wright.
 1. *dissolutum*, Poey.
 5. *dunkeri*, Arango.
 24. *eburneum*, Gundl.
 15. *echinatum*, Pf.
 10. *echinulatum*, Pf.
 30. *echinus*, Wright.
 7. *egregium*, Poey.
 13. *emilianum*, Weinl.
 36. *enode*, Pf.
 6. *erectum*, Pf.
 1. *ernesti*, Pf.
 3. *eusarcum*, Pf.
 10. *excisum*, Pf.
 16. *excurrens*, Pf.

13. *fascia*, Wood.
 ,, v. *proxima*, C. B. Ad.
 12. *fecunda*, C. B. Ad.
 ,, v. *distincta*, C. B. Ad.
 23. *fimbriatulum*, Sow.
 ,, v. *docens*, C. B. Ad.
 ,, v. *albinodatum*, C. B.
 Ad.
 10. *foveatum*, Pf.
 25. *fragile*, Pf.
 14. *fraterminor*, Pils. & Brown.
 31. *gabbi*, Crosse.
 1. *garceanum*, Torre.
 36. *garridoianum*, Pf.
 13. *gonavicola*, Hend. & Bartsch.
 21. *grayana*, Pf.
 ,, v. *aureolabre*, Simpson.
 1. *gruneri*, Pf.
 3. *gutierezi*, Pf.
 32. *habichi*, Weinl.
 7. *hamlini*, Arango.
 7. *hendersoni*, Torre.
 6. *hemioptum*, Pf.
 33. *heymemani*, Pf.
 23. *hillianum*, C. B. Ad.
 ,, v. *amandum*, C. B. Ad.
 ,, v. *aculeosum*, C. B. Ad.
 ,, v. *leporilabre*, C. B. Ad.
 1. *hjalmeroni*, Pf.
 18. *honestum*, Poey.
 13. *hydii*, Weinl.
 17. *humboldtiana*, Pf.
 34. *humphreysianum*, Pf.
 17. *hystryx*, Pf.
 1. *igneum*, Rve.
 22. *ignilabre*, C. B. Ad.
 23. *illustris*, Poey.
 19. *immersum*, Gundl.
 23. *inulta*, Poey.
 21. *intermedia*, C. B. Ad.
 35. *interruptum*, Lamk.
 33. *interstitialis*, Pf.
 21. *irrortata*, Gloyne.
 1. *irradians*, Shutt.
 21. *jarvisi*, Hend.
 34. *jayanum*, C. B. Ad.
 ,, v. *rufilabre*, C. B. Ad.
1. *jayanum* v. *nigrolabre*, C. B.
 Ad.
 14. *jeannereti*, Pf.
 23. *jiguaneensis*, Pf.
 38. *jimenoi*, Pf.
 16. *judacensis*, Torre & Hend.
 1. *juliensi*, Pf.
 1. *kisslingianum*, Weinl.
 32. *kobelti*, Maltz.
 32. *labeo*, Müll.
 23. *lachneri*, Pf.
 1. *laetum*, Poey.
 35. *lamellosum*, C. B. Ad.
 23. *largillierti*, Pf.
 4. *latilabre*, Orb.
 2. *latum*, Pf.
 23. *lima*, C. B. Ad.
 ,, v. *blandiana*, C. B. Ad.
 23. *lincina*, Linné.
 23. *lincinellum*, Lamk.
 3. *lindeniana*, Weinl.
 6. *litturatum*, Pf.
 3. *loweana*, Pf.
 22. *lugubris*, Pf.
 14. *lurida*, Pf.
 33. *mackinlayi*, Pf.
 3. *magnifica*, Pf.
 26. *majusculum*, Morelet.
 1. *marginalbum*, Pf.
 12. *maritima*, C. B. Ad.
 ,, v. *aurora*, C. B. Ad.
 33. *mayensis*, Torre & Rams.
 32. *megacheilos*, Pot. & Mich.
 23. *minium*, Gundl.
 21. *mirabilis*, Wood.
 21. *miranda*, C. B. Ad.
 41. *mirifica*, Preston.
 23. *mite*, C. B. Ad.
 1. *mæstum*, Pf.
 21. *monstrorsa*, C. B. Ad.
 23. *mordax*, C. B. Ad.
 31. *moreletiana*, Crosse.
 16. *moreletiana*, Petit.
 21. *morbunda*, C. B. Ad.
 42. *moussonianum*, C. B. Ad.
 1. *navassense*, Tryon.
 6. *neglectum*, Pf.

35. *nelsoni*, Clapp.
 31. *newcombi*, Crosse.
 6. *newcombianum*, C. B. Ad.
 6. *newtoni*, Shutt.
 14. *nigriculum*, Pf.
 3. *nobilis*, Pf.
 41. *nobilitatum*, Poey.
 18. *nodiferum*, Arango.
 18. *nodulatum*, Poey.
 1. *obesum*, Menke.
 16. *obtectus*, Torre & Hend.
 16. *obturatus*, Torre & Hend.
 22. *occidentale*, Pf.
 16. *occultus*, Torre & Hend.
 4. *ottonis*, Pf.
 1. *oxytremum*, Pf.
 3. *papyracea*, C. B. Ad.
 16. *paredonensis*, Torre & Hend.
 21. *pearmaneum*, Chitty.
 7. *percrassa*, Pf.
 1. *perlatum*, Gundl.
 23. *perplicatum*, Gundl.
 41. *perspectivum*, Pf.
 6. *petitianum*, Pf.
 1. *pfeifferianum*, Poey.
 1. *pictum*, Pf.
 23. *pisum*, C. B. Ad.
 3. *plicatulum*, Pf.
 1. *poeyanum*, Orb.
 5. *presasiana*, Pf.
 30. *pretrei*, Orb.
 16. *protractus*, Torre & Hend.
 27. *pseudalatum*, Torre.
 21. *pulchrius*, C. B. Ad.
 23. *pulchrum*, Wood.
 36. *pulverulentus*, Pf.
 13. *pupæformis*, Sow.
 16. *pupoides*, Morelet.
 33. *putre*, Pf.
 13. *quaternata*, Lk.
 42. *radiosum*, Morelet.
 33. *ramsdeni*, Pils. & Hend.
 32. *rangelinum*, Poey.
 1. *raveni*, Crosse.
 6. *rawsoni*, Pf.
 35. *rectus*, Pf.
 36. *redfieldianum*, C. B. Ad.
- redfieldianum v. *concentrica*,
 C. B. Ad.
32. *reeeveana*, Pf.
 42. *retrorsus*, C. B. Ad.
 6. *revinctum*, Poey.
 1. *revocatum*, Gundl.
 33. *roemerii*, Pf.
 32. *rollei*, Maltz.
 1. *rollei*, Weinl.
 31. *rosaliae*, Pf.
 36. *rotundatum*, Poey.
 3. *rubicundum*, Morelet.
 1. *rufilabre*, Beck.
 5. *rufopictum*, Pf.
 6. *rüsei*, Pf.
 9. *sagebieni*, Poey.
 6. *salleanum*, Pf.
 16. *salustii*, Torre & Hend.
 6. *santacruzense*, Pf.
 23. *sauliae*, Sow.
 28. *sauvallei*, Pf.
 23. *scabriuscum*, C. B. Ad.
 ,,, v. *amabile*, C. B. Ad.
 5. *scobina*, Pf.
 15. *sculptum*, Pf.
 41. *semicoronatum*, Pf.
 1. *semilabre*, Pf.
 23. *senticosum*, Smith.
 10. *sericatum*, Morelet.
 1. *serraticosta*, Weinl.
 14. *sheppardiana*, C. B. Ad.
 10. *shuttleworthi*, Pf.
 ,,, v. *gundlachi*, Arango.
 ,,, v. *incrassatum*, Wright.
 1. *simillina*, Vendreyes.
 1. *simplex*, Pf.
 20. *simpsoni*, Hend. & Bartsch.
 13. *simulans*, C. B. Ad.
 10. *sinuosum*, Wright.
 1. *solidulum*, Gundl.
 ,,, v. *tanamensis*, Torre.
 31. *solutum*, Pf.
 28. *sordidum*, Poey.
 23. *storchii*, Pf.
 16. *subobturatus*, Torre & Hend.
 6. *subreticulatus*, Maltz.
 23. *sulculosum*, Fé.

1. *swifti*, Shutt.
35. *tamsiana*, Pf.
13. *tappaniana*, C. B. Ad.
35. *tectilabris*, C. B. Ad.
10. *tenebrosum*, Morelet.
 1. *tenuilirata*, Pf.
 36. *tenuistriata*, C. B. Ad.
 31. *tentorium*, Pf.
 6. *textum*, Pf.
34. *thysanorhaphe*, Sow.
41. *tolleni*, Ramsden.
40. *torquatum*, Poey.
42. *torrei*, Ramsden.
19. *torreiana*, Arango.
 6. *tortolense*, Pf.
23. *tractum*, Gundl.
16. *trincheracensis*, Torre & Hend.
23. *trochlearis*, Pf.
36. *troscheli*, Pf.
28. *tryoni*, Arango.
11. *umbricola*, Weinl.
29. *uncinatum*, Arango.
36. *undosum*, Pf.
10. *unilabiatum*, Pf.
21. *variabilis*, C. B. Ad.
32. *versicolor*, Pf.
 4. *vignalensis*, Pf.
 5. *violaceum*, Pf.
 6. *watlingensis*, Dall.
3. *weinlandi*, Pf.
 - „ v. *superba*, Hend. & Simp.
1. *wilcoxi*, Pils. & Hend.
31. *wilhelmi*, Pf.
14. *wilkinsoni*, C. B. Ad.
18. *wrightianum*, Arango.
36. *xanthostoma*, Sow.
36. *yallahensis*, C. B. Ad.
33. *yateracensis*, Pf.
 1. *yucayum*, Presas.
27. *yunquense*, Pf.

LIST OF BRITISH NUDIBRANCHIATE MOLLUSCA.

By TOM IREDALE and CHAS. H. O'DONOGHUE, D.Sc.

Read 8th December, 1922.

SOME years ago one of us (Iredale) checked the names given in the Conchological Society's List of British Marine Mollusca, 2nd edition, published in 1902, in accordance with the International Rules governing nomenclatural usage, obtaining some curious results. It was considered inopportune to publish the corrections as a whole owing to the complex nature of some of the problems, but some notes were recorded in the Proceedings of this Society at various times, and in Vol. XIII, 1918, pp. 29–30, the cases of the Nudibranch names *Tritonia* and *Doto* were discussed. The other collaborator (O'Donoghue) has been working for some years on the Nudibranchs of North-west America, and visiting England the opportunity has been taken of revising the nomenclature and grouping of the British forms, as necessary for the stabilization of a world study of the group.

With this apology we may pass to the history of the study of these interesting molluscs.

In his tenth edition of the *Systema Naturæ*, Linné introduced a genus *Doris* for a single species of Nudibranch mollusc, which he called *Doris verrucosa*. This was based on a specimen described by Rumph and figured in Seba, and is at present indeterminable, though Mörch has suggested it may be a *Phyllidia*!

In the twelfth edition Linné added three other species, *bilamellatus*, *lævis*, and *argo*. *Doris bilamellatus* he referred to *Limax bilamellatus*, of the Fauna Suecica 2094, 1761, which is apparently a planarian, but the description here given is amplified from a nudibranch. *D. lævis* is now the type of *Cadlina*, and *D. argo* was based on Bohadsch's genus *Argus*, which Bohadsch did not specifically name, but was well described and was later generically named *Platydoris* by Bergh, on the contention that *Argus*, Bohadsch, was not available. Under the present rules *Argus* must be accepted.

O. F. Müller, in his *Zoologica Danica Prodromus* published in 1776, described in short diagnostic sentences no fewer than twelve species. Some of these were figured in the next few years in his great work, the *Zoologica Danica*, but owing to his death some were left unfigured by the editors of the continuation of the work.

Gmelin incorporated in his *Systema Naturæ*, under binomial names, many other species described by non-binomial authors, but, of course, included all in *Doris* as Müller had done, and made no addition whatever to our knowledge of the group.

Cuvier then dissected and differentiated several groups, and this marks the beginning of the segregation of the molluscs without shells, but one of the greatest natural history works was later prepared by two Englishmen, Alder and Hancock. Montagu and Fleming had

superficially described some new species, and then Johnston, Thompson, and Forbes introduced even new genera, but Alder and Hancock, making a special study of this group, found over sixty new species of strange aspect in addition to the already described forms.

Alder and Hancock were fortunate in impressing the Ray Society with the value of their discoveries, and this Society undertook the publication of the magnificent paintings and drawings in connexion with their monographic account. No more beautiful work has ever appeared, but it has not led to a great deal of interest by British students. On the Continent, however, about the same time, workers investigated and described new forms, and then Bergh, a Danish professor, made a lifelong study of the group, dissecting and minutely describing numerous novelties from all over the world for fifty years. As usual with specialists, he became a very pronounced "splitter", and the new genera proposed by him, many upon slight anatomical features, are very numerous.

Sir Charles Eliot, K.C.M.G., recently interested himself in this group, and in 1910 the Ray Society published a Supplementary Part to Alder and Hancock's Monograph, in which Eliot gave a series of notes on the species discovered since Alder and Hancock's time, with some paintings and notes left by these workers. In addition, Eliot gave a Synopsis of Families, Genera, and Species of the British Fauna. This has been used by us in connexion with the Conchological Society's List, and we now give the name we accept, the primary reference, the specific synonyms, and a reference to Alder and Hancock's Monograph, the Conchological Society's List, and Eliot's Synopsis.

In the present list the name changes are numerous, and the reasons may be here pointed out. Bergh would scarcely recognize any of the older species unless in his opinion he had complete data. Consequently, the majority were left undetermined, though comparatively easily recognizable from the characters cited. Eliot was averse to changes even when the facts were clear, and thus the literature of the Nudibranchia is littered with scores of unrecognized names. We have indicated the majority, as we find these molluscs are not difficult to determine when due attention is paid to all the characters of the groups.

The classification here adopted is mainly that proposed by Bergh. The more important generic name changes may be here summarized:

<i>Amphorina</i>	is altered to	<i>Cratena</i> .
<i>Æolidiella</i>	"	<i>Eolidina</i> .
<i>Antiopella</i>	"	<i>Janolus</i> .
<i>Candiella</i>	"	<i>Duvaucelia</i> .
<i>Doris</i>	"	<i>Doridigitata</i> .
<i>Doto</i>	"	<i>Idulia</i> .
<i>Galvina</i>	"	<i>Eubranchus</i> .

<i>Idalina</i>	is altered to	<i>Okenia</i> .
<i>Lamellidoris</i>	"	<i>Onchidorus</i> .
<i>Platydoris</i>	"	<i>Argus</i> .
<i>Pleurophyllidia</i>	"	<i>Armina</i> .
<i>Proctonotus</i>	"	<i>Zephyrina</i> .
<i>Staurodoris</i>	"	<i>Doridigitata</i> .
<i>Triopa</i>	"	<i>Euphurus</i> .
<i>Tritonia</i>	"	<i>Sphærostoma</i> .

The new names introduced in this essay are :—

Diaphoreolis, gen. nov. Type, *Eolis northumbrica*, Alder & Hancock.

Favorinus albidus, nom. nov., for *Eolis alba*, Alder & Hancock.

Embletonia pygmæa, nom. nov., for *Eolida minima*, Forbes & Goodsir.

Atalodoris, gen. nov. Type, *Doris pusilla*, Alder & Hancock.

Diaphorodoris, gen. nov. Type, *Doris luteocincta*, M. Sars.

Issena, gen. nov., for *Issa*, Bergh.

Rostanga rufescens, nom. nov., for *Doris coccinea*, Alder & Hancock.

Doridigitata sticta, nom. nov., for *Doris maculata*, Garstang.

Candellista, gen. nov. Type, *Tritonia alba*, Alder & Hancock.

NUDIBRANCHIA.

ASCOGLOSSA.

Family LIMAPONTIIDÆ.

Genus ACTEONIA, Quatrefages, 1844.

Acteonia, Quatrefages, Ann. Sci. Nat. (Paris), ser. III, vol. i, p. 142, March (published *ante April 15*), 1844.

Type by monotypy, *A. senestra*, nov.

Ictis, Alder & Hancock, Athenæum, No. 1028, p. 748, July 10, 1847.

Type by monotypy, *I. cocksii*, nov.

Cenia, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. i, p. 404, June 1, 1848.

New name for *Ictis*, A. & H., not *Ictis*, Kaup, Skizz. Entwick.-Gesch. Nat. Syst., p. 40, 1829.

Lafontia, Locard, Prodr. Malac. Franc. Moll. Marins, p. 532, 1886.

New name for *Acteonia*, Quatrefages, 1844, for the sake of purism.

ACTEONIA COCKSII (Alder & Hancock, 1847).

Ictis cocksii, A. & H., Athenæum, No. 1028, p. 748, July 10, 1847 : near Falmouth.

Acteonia corrugata, A. & H., Ann. & Mag. Nat. Hist., ser II, vol. i, p. 403, pl. xix, figs. 2 and 3, June 1, 1848 (ex Athenæum, No. 1028, p. 748, July 10, 1847, *n.n.*) : Falmouth.

Acteonia corrugata, A. & H., Conch. Soc. List, p. 17 ; Eliot, pp. 142, 179.

Cenia cocksi, A. & H., Conch. Soc. List, p. 17 ; Eliot, p. 143, pl. vii, figs. 10–11, p. 179.

Acteonia cocksi, Colgan, Irish Naturalist, vol. xxi, p. 225 *et seqq.*, 1912.

Genus LIMAPONTIA, Johnston, 1836.

Limapontia, Johnston, Mag. Nat. Hist. (Loudon), vol. ix, p. 79, Feb. 1836.

Type by monotypy, *L. nigra*, nov.

Chalidis, Quatrefages, Ann. Sci. Nat. (Paris), ser. III, vol. i, p. 155, March (published *ante April 15*), 1844.

Type by monotypy, *C. cœrulea*, nov.

Pontolimax, Creplin, Arch. für Naturg., 1848, *non comp.*

LIMAPONTIA CAPITATA (O. F. Müller, 1774).

Fasciola capitata, O. F. Müller, Verm. Hist., vol. i, pt. 2, p. 70, 1774 : Baltic Sea.

Limapontia nigra, Johnston, Mag. Nat. Hist. (Loudon), vol. ix, p. 79, Feb. 1836 : Berwick Bay.

Chalidis nigricans, A. & H., Athenæum, No. 1028, p. 748, July 10, 1847, *n.n.*

Limapontia capitata, Müller, Conch. Soc. List, p. 17.

— *nigra*, Johnston, Eliot, pp. 141, 178.

LIMAPONTIA DEPRESSA, Alder & Hancock, 1862.

Limapontia depressa, A. & H., Ann. & Mag. Nat. Hist., ser III, vol. x, p. 264, Oct. 1, 1862 : Sunderland.

— — — Conch. Soc. List, p. 17 ; Eliot, p. 142, pl. vii, figs. 6, 8, p. 178.

Family ELYSIIDÆ.

Genus ELYSIA, Risso, 1818.

Elysia, Risso, Journ. de Physique, vol. lxxxvii, p. 375, Nov. 1818.

Type by monotypy, *Notarchus timidus*, nov.

Actæon, Oken, Lehrb. Naturg., Th. iii, Zool. pt. 1, p. 307, 1815.

Type by monotypy, *Aplysia viridis*, Montagu.

Not *Acteon*, Montfort, Conch. Syst., vol. ii, pp. 314–15, 1810.

Aplysiopterus, Chiaje, Mem. Anim. s. Vertebr. Napoli, vol. iv, p. 31, "1829," 1830.

Type by monotypy, *A. neapolitanus*, nov.

Rhyzobranchus, Cantraine, Bull. Acad. R. Sci. Bruxelles, vol. ii, p. 384, Dec. 1835.

Type by monotypy, *Aplysia viridis*, Montagu.

ELYSIA VIRIDIS (Montagu, 1804).

Laplysia viridis, Montagu, Trans. Linn. Soc. (Lond.), vol. vii, p. 76, pl. vii, fig. 1, 1804 : Devon.

Notarchus timidus, Risso, Journ. de Physique, vol. lxxxvii, p. 376, Nov. 1818 : Nice.

Aplysiopterus neapolitanus, Chiaje, Mem. Anim. s. Verteb. Napoli, vol. iv, p. 31, "1829," 1830 : Naples.

Rhyzobranchus viridis, Cantraine, Bull. Acad. R. Sci. Bruxelles, vol. ii, p. 384, Dec. 1835.

Elysia viridis, var. *olivacea*, Jeffreys, Brit. Conch., vol. v, p. 32, 1869 : Lochmaddy, Hebrides.

Elysia viridis, Montagu, Conch. Soc. List, p. 17.

— — — var. *olivacea*, Jeffreys, ibid.

— — — Montagu ; Eliot, p. 140, pl. vii, figs. 1, 2, p. 178.

Family STILIGERIDÆ.

Genus ALDERIA, Allman, 1846.

Alderia, Allman, Ann. & Mag. Nat. Hist., vol. xvii, p. 4, Jan. 1846.

Type by original designation, *Stiliger modestus*, Lovén.

Alderia, Allman MS., Thompson, Rep. Brit. Assoc. 1843, p. 250, 1844, n.n. Alder & Hancock, Rep. Brit. Assoc. 1844, p. 26, 1845, n.n. Allman, Rep. Brit. Assoc. 1844, p. 65, n.n.

ALDERIA MODESTA (Lovén, 1844).

Stiliger modestus, Lovén, Öfvers. K. Vet. Akad. Förh. Stockh., vol. i, No. 3, p. 49, March 20, 1844 : Bohuslan, Norway.

Alderia amphibia, "Allman MS.", Thompson, Rep. Brit. Assoc. 1843, p. 250, 1844, n.n. : Ireland.

Alderia modesta, Lovén, A. & H., Mon., Fam. 3, pl. xli, pt. 6, 1854 ; Conch. Soc. List, p. 17 ; Eliot, p. 137, pl. vii, figs. 3-5, p. 177.

Genus STILIGER, Ehrenberg, 1828.

Stiliger, Ehrenberg, Symbolæ Physicæ, Zool. ii, pl. vii (Moll. pl. i, fig. 3), 1828, sheet i, 1831.

Type by monotypy, *S. ornatus*, nov.

Calliopæa, Orbigny, Mag. de Zool., Classe v, p. 12, pl. cviii (post Nov.), 1837.

Type by monotypy, *C. bellula*, nov.

Ercolania, Trinchese, Atti R. Univ. Genova, vol. ii, pl. v, 1877 ?

Type, here selected, *Ercolania siottii*, Trinchese.

Custiphorus, Deshayes, non comp.

STILIGER BELLULUS (Orbigny, 1837).

Calliopæa bellula, Orbigny, Mag. de Zool., Classe v, p. 12, pl. 108 (post Nov.), 1837 : Brest.

Embletonia mariae, Meyer & Möbius, Fauna der Kieler Bucht, Bd. i, p. 13, plate, 1865 : Kieler Bucht.

Stiliger bellulus, Orbigny, Conch. Soc. List, p. 17 ; Eliot, pp. 136, 177.

Genus HERMÆA, Lovén, 1844.

Hermæa, Lovén, Öfvers. K. Vet. Akad. Förh. Stockh., vol. i, No. 3, p. 50, March 20, 1844.

Type by subsequent designation, Gray, Proc. Zool. Soc. (Lond.), p. 166, 1847 : *Doris bifida*, Montagu.

Hermæina, Trinchese, Mem. Accad. Sci. Inst. Bologna, ser. III, vol. v, fasc. i, p. 73 (read March 24), 1874.

Type by monotypy, *Hermæina maculosa*, Trinchese.

Placida, Trinchese, Atti R. Univ. Genova, vol. ii, pl. xv, 1877 ?

Type here designated *Placida tardyi*, Trinchese.

HERMÆA BIFIDA (Montagu, 1815).

Doris bifida, Montagu, Trans. Linn. Soc. (Lond.), vol. xi, pt. 2, p. 198, pl. xiv, fig. 2 (3), 1815 : Devon.

Hermæa bifida, Montagu ; A. & H., Mon., Fam. 3, pl. xxxix, pt. 5, 1851 ; Conch. Soc. List, p. 17 ; Eliot, p. 176.

HERMÆA DENDRITICA (Alder & Hancock, 1843).

Calliopæa dendritica, A. & H., Ann. & Mag. Nat. Hist., vol. xii, p. 233, Oct. 1843 : Torbay.

Hermæa dendritica, A. & H., Mon., Fam. 3, pl. xl, pt. 4, 1848 ; Conch. Soc. List, p. 17 ; Eliot, p. 176.

SACOGLOSSA.

CLADOHEPATICA.

Family CALMIDÆ.

Genus CALMA, Alder & Hancock, 1855.

Calma, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 7, App. p. xxi, 1855.

Type by original designation, *Eolis glaucoidea*, A. & H.

Forestia, Trinchese, *non comp.*

CALMA GLAUCOIDES (Alder & Hancock, 1854).

Eolis glaucoidea, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv, p. 104, Aug. 1, 1854 : Isle of Herm.

— — — Mon., Fam. 3, pl. xxii, pt. 6, 1854.

Calma glaucoidea, A. & H., Conch. Soc. List, p. 18 ; Eliot, pp. 133-4, 175.

Family ÆOLIDIIDÆ.

Genus ÆOLIDIA, Cuvier, 1798.

Eolidia, Cuvier, Tabl. Élem. Hist. Nat., p. 388, published Dec. 24, 1797, "1798." Diagnosis only : Dumeril, Zool. Analytique, p. 162, "1806," Dec. 1805 ; diagnosis only : ibid., ed. Froriep, p. 163, 1806 (post Sept.), examples, *Doris fasciculata, papillosa*.

Type by subsequent designation, Gray, Proc. Zool. Soc. (Lond.), p. 166, 1847 : *Doris papillosa*, i.e. *Limax papillosus*, Linné.

Eolia, Cuvier, Leçons Anat. Comp., vol. i, 5th table at end, April 19, 1800, for "Eolies" ; alternative name only for preceding.

Eolis, Cuvier, Annales Mus. Hist. Nat. (Paris), vol. vi, p. 416, Dec. 1805.

Name on plate 61 only for "genre Eolide".

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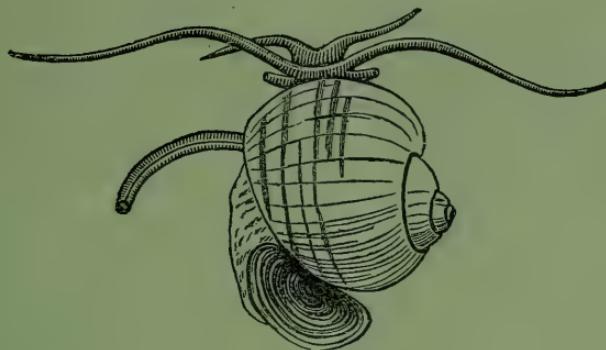
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Spain, Trinidad, B.W.I.

Eolidia, Cuvier, Règne Animal, vol. ii, p. 393, "1817," i.e. Dec. 14, 1816.

For "Les Eolides", including *Doris papillosa*, Müll., etc.

ÆOLIDIA PAPILLOSA (Linné, 1761).

Limax papillosus, Linné, Fauna Suecica, 2nd ed., p. 508, 1761: Mari Norvegico.

Doris bodöensis, Gunnerus, Skrift. Kjobenh. Selsk., x, p. 170, figs. 11-16, 1770: Bodo, Nordland.

Doris papillosa, O. F. Müller, Zool. Danica Prod., p. 229, 1776: Denmark.

Doris vermicula, Turton, British Fauna, vol. i, p. 132 (pref. Jan. 1), 1807: captured April 24, 1807; Mumble Rocks.

Eolis cuverii [sic], Lamarck, Hist. Anim. s. Vert., vol. vi, pt. 1, p. 302, July 31, 1819, for Eolide, Cuv., 1805 (*supra*).

Eolidia zetlandica, Forbes and Goodsir, Athenæum, No. 618, p. 647, Aug. 31, 1839: Shetland.

Eolis rosea, Alder & Hancock, Ann. & Mag. Nat. Hist., vol. ix, p. 34, March, 1842: Cullercoats.

Eolis obtusalis, ibid.

Æolis murrayana, Macgillivray, Hist. Mollusc Anim. Aberd., pp. 70-193 (pref. March 6), 1843: St. Fergus.

Æolis lesliana, ibid., pp. 70-194: Aberdeen.

? Æolidia herculea, Bergh, Bull. Mus. Comp. Zool. Harvard, vol. xxv, No. 10, p. 128, pl. i, figs. 8-12, Oct. 1894: near St. Barbara Islands, California, 414 fathoms.

Eolis papillosa, var *albina*, Dautzenberg & Durouchoux, Feuille des jeunes naturalistes. Paris, sér. v, An. 43, Suppl. No. 54, p. 8, 1 Oct., 1913: Saint Malo, France.

Eolis papillosa, Linné: A. & H., Mon., Fam. 3, pl. 9, pt. 6, 1854.

Æolidia papillosa, Linné: Conch. Soc. List, p. 17: Eliot, p. 175.

Genus EOLIDINA, Quatrefages, 1843.

Eolidina, Quatrefages, Ann. Sci. Nat. (Paris), sér. II, vol. xix, p. 276, May, 1843 (ex Comptes Rendus Acad. Sci. (Paris), vol. xvi, p. 31, 9 Jan., 1843, n.n.).

Type by monotypy, *E. paradoxum*, nov.

Ethalion, Risso, Hist. Nat. Europ. Mérid., vol. iv, p. 36, Nov. 1826.

Type by monotypy, *E. hystrix*, nov., ex *Eolidia histrix*, Otto, 1821. Not *Ethalion*, Le Peletier de Saint-Fargeau, Ency. Méth., vol. x (Ins.), p. 765, 1825.

Spurilla, Bergh, K. Dansk. Vidensk. Selsk. Skrift., ser. v, nat. og mat. Afdel., Bd. vii, p. 205, 1864.

Type by monotypy, *Æolidia neapolitana*, Chiaje, Verany = *Ethalion hystrix*, fide Locard.

Æolidiella, Bergh, Vid. Meddel. Nat. Forh. (Kjöben.), 1866, p. 99 note, 1867.

Type by subsequent designation by Suter, *Æ. saemmeringii*.

Berghia, Trinchesse, Rendic. Accad. Sci. Institut. Bologna, 1877, p. 151.
Type by monotypy, *Eolidia cærulescens*, Deshayes.

EOLIDINA GLAUCÀ (Alder & Hancock, 1845).

Eolis glauca, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 314,
Nov. 1845 : Torbay.

— — — Mon., Fam. 3, pl. xi, pt. 4, 1848.

Æolidella glauca, A. & H., Conch. Soc. List, p. 18 ; Eliot, p. 174.

EOLIDINA ALDERI (Cocks, 1852).

Eolis alderi, Cocks, Naturalist (Morris), vol. ii, p. 1, pl. i, fig. 1,
1852 : Falmouth.

— — — A. & H., Mon., Fam. 3, pl. x, pt. 6, 1854.

Æolidella alderi, Cocks, Conch. Soc. List, p. 18 ; Eliot, p. 174.

EOLIDINA ANGULATA (Alder & Hancock, 1844).

Eolis angulata, A. & H., Ann. & Mag. Nat. Hist., vol. xiii, p. 165,
March, 1844 (ibid., vol. xii, p. 238, Oct. 1843, n.n.) : Cullercoats.

— — — Mon., Fam. 3, pl. xxiii, pt. 2, 1846.

Cratena paradoxa, Quatrefages, Conch. Soc. List, p. 18.

Æolidiella angulata, A. & H. ; Eliot, pp. 131, 174.

EOLIDINA SANGUINEA (Norman, 1877).

Eolis sanguinea, Norman, Ann. & Mag. Nat. Hist., ser. iv, vol. xx,
p. 517, Dec. 1, 1877 : Connemara.

Æolidella sanguinea, Norman, Conch. Soc. List, p. 18 ; Eliot,
p. 174.

EOLIDINA INORNATA (Alder & Hancock, 1845).

Eolis inornata, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 315,
Nov. 1845 : Torbay.

Cuthona inornata, A. & H. ; Eliot, p. 131, pl. vi, fig. 3, p. 173.

[BERGHIA CÆRULESCENS.

Eolidia cærulescens, Deshayes, Cuvier, Règne Animal (Disciples Edition), Moll., pl. xxx bis, fig. 5, as of Laurillard ; text received British Museum 11 Oct., 1838, where name does not occur ; no locality given.

Berghia cærulescens, Guérin-Meneville, Conch. Soc. List, p. 18.
Eliot, p. 174, states that the specimen preserved under the above name at Plymouth is *Facelina coronata*. Cf. Journ. Mar. Biol. Assoc., vol. vii, p. 357, 1906.]

GENUS DIAPHOREOLIS, nov.

Type : *Eolis northumbrica*, Alder & Hancock.

DIAPHOREOLIS NORTHUMBRICA (Alder & Hancock, 1844).

Eolis northumbrica, A. & H., Ann. & Mag. Nat. Hist., vol. xiii,
p. 165, March, 1844 : Cullercoats.

— — — Mon., Fam. 3, pl. xxxi, pt. 3, 1847.

Cratena northumbrica, A. & H., Conch. Soc. List, p. 18.

Cuthona? northumbrica, A. & H.; Eliot, p. 131, pl. vi, figs. 4, 5, p. 173.

Genus CUTHONA, Alder & Hancock, 1855.

Cuthona, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 7, App. p. xxii, 1855.

Type by monotypy, *Eolis nana*, A. & H.

CUTHONA NANA (Alder & Hancock, 1842).

E(olis) nana, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 36, March, 1842: Cullercoats.

— — — Mon., Fam. 3, pl. xxv, pt. 4, 1848.

Cuthona nana, A. & H., Conch. Soc. List, p. 18; Eliot, p. 173.

CUTHONA PEACHII (Alder & Hancock, 1848).

Eolis peachii, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. i, p. 191, March 1, 1848 (ex Athenaeum, No. 1028, p. 748, July 10, 1847, n.n.): Fowey Harbour.

— — — Mon., Fam. 3, pl. x, pt. 6, 1854.

Cratena peachii, A. & H., Conch. Soc. List, p. 18.

Cuthona peachii, A. & H.; Eliot, p. 173.

CUTHONA CONCINNA (Alder & Hancock, 1843).

Eolis concinna, A. & H., Ann. & Mag. Nat. Hist., vol. xii, p. 234, Oct. 1843: Whitley, Northumberland.

— — — Mon., Fam. 3, pl. xxiv, pt. 1, 1845.

Cratena concinna, A. & H., Conch. Soc. List, p. 18.

Cuthona concinna, A. & H.; Eliot, p. 173.

CUTHONA AMENA (Alder & Hancock, 1845).

Eolis amœna, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 316, Nov. 1845: Torbay.

— — — Mon., Fam. 3, pl. xxx, pt. 2, 1846.

Cratena amœna, A. & H., Conch. Soc. List, p. 18.

Cuthona amœna, A. & H.; Eliot, p. 173.

CUTHONA PUSTULATA (Alder & Hancock, 1854).

Eolis pustulata, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv, p. 104, Aug. 1, 1854: Cullercoats.

— — — Mon., Fam. 3, pl. xlvi, Suppl., pt. 7, 1855.

Cratena pustulata, A. & H., Conch. Soc. List, p. 18.

Cuthona pustulata, A. & H.; Eliot, p. 173.

CUTHONA COUCHII (Cocks, 1852).

Eolis couchii, Cocks, Naturalist (Morris), vol. ii, pt. 1, pl. i, fig. 2, 1852: Falmouth.

— — — A. & H.; Mon., pt. 7, App. p. x, 1855.

Cratena couchii, Cocks, Conch. Soc. List, p. 18.

Genus CRATENA, Bergh, 1864.

Cratena, Bergh, K. Dansk. Vidensk. Selsk. Skrift., ser. v, Bd. vii, pp. 198 to 213, 1864.

New name for *Montagua*, Fleming.

Type *Doris cærulea*, Montagu.

Not *Cratena*, as used by Bergh in later years.

Montagua, Fleming, Suppl. to 4th–6th ed. Encycl. Brit., vol. v, p. 575, May, 1822; Phil. Zool., vol. ii, p. 470, June, 1822.

Type by subsequent designation, Gray, Proc. Zool. Soc. (Lond.), 1847, p. 166: *Doris cærulea*, Montagu.

Not *Montagua*, Leach, Edinb. Encycl. (Brewster), vol. vii, p. 436, 1814.

Amphorina, auctt., not of Quatrefages, 1844, which = *Eubranchus*, q.v.

CRATENA CÆRULEA (Montagu, 1804).

Doris cærulea, Montagu, Trans. Linn. Soc. (Lond.), vol. vii, p. 78, pl. vii, figs. 4–5, 1804: Devon.

Eolidia bassii, Verany, Descr. Genova, vol. i, pt. 2, pp. 97–107, 1846: Genoa.

Amphorina cærulea, Montagu, Conch. Soc. List, p. 18; Eliot, p. 129, pl. vi, figs. 6–8, p. 172.

CRATENA MOLIOS (Herdman, 1881).

Eolis molios, Herdman, Proc. Roy. Phys. Soc. Edinb., vol. vi, p. 28, pl. i, figs. 1–3, 1881: 10 fathoms off Port Lewis.

Amphorina molios, Herdman, Conch. Soc. List, p. 18; Eliot, p. 172.

CRATENA AURANTIA (Alder & Hancock, 1842).

E(olis) aurantia, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 34, March, 1842: Whitley, Northumberland.

A(eolis) bellula, Lovén, Öfvers. K. Vet.-Akad. Förh. (Stockh.), vol. iii, No. 5, p. 140, May 13, 1846: Boh.

Eolis aurantiaca, A. & H.; Mon., Fam. 3, pl. xxvii, pt. 5, 1851.

Cuthona aurantia, A. & H., Conch. Soc. List, p. 18.

Amphorina aurantiaca, A. & H.; Eliot, p. 173.

CRATENA FOLIATA (Forbes & Goodsir, 1839).

Eolida foliata, Forbes & Goodsir, Athenæum, No. 618, p. 647; Aug. 31, 1839: Shetland.

E(olis) olivacea, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 35, March, 1842: Whitley, Northumberland.

Eolis olivacea, A. & H.; Mon., Fam. 3, pl. xxvi, pt. 1, 1845.

Cratena olivacea, A. & H., Conch. Soc. List, p. 18.

Amphorina olivacea, A. & H.; Eliot, p. 173.

CRATENA VIRIDIS (Forbes, 1840).

Montagua viridis, Forbes, Ann. Nat. Hist., vol. v, p. 106, pl. ii, fig. 18, April, 1840: Ballaugh, Isle of Man.

Eolis arenicola, A. & H., Mon. Nudib. Moll. (Ray Soc.), Fam. 3, pl. xxxi, fig. 1, pt. 3, 1847: Menai Straits.

Eolis viridis, ibid., Fam. 3, pl. xxxii, pt. 6, 1854.

Cratena viridis, Forbes, and var. *arenicola*, A. & H., Conch. Soc. List, p. 18.

Amphorina viridis, Forbes; Eliot, p. 173.

CRATENA GLOTENSIS (Alder & Hancock, 1846).

E(olis) glotensis, A. & H., Ann. & Mag. Nat. Hist., vol. xviii, p. 293, Nov. 1846: Lamlash Bay.

— — — Mon., Fam. 3, pl. xxix, pt. 6, 1854.

Cratena viridis, var. *glottensis*, A. & H., Conch. Soc. List, p. 18.

Amphorina glottensis, A. & H.; Eliot, p. 173.

CRATENA STIPATA (Alder & Hancock, 1843).

Eolis stipata, A. & H., Ann. & Mag. Nat. Hist., vol. xii, p. 233, Oct. 1843: Torbay.

— — — Mon., Fam. 3, pl. xxii, pt. 6, 1854.

Cratena stipata, A. & H., Conch. Soc. List, p. 18.

Cuthona stipata, A. & H.; Eliot, p. 173.

Genus FAVORINUS, Gray, 1850.

Favorinus, Gray, Figs. Mollusc. Anim., vol. iv, p. 109, 1850.

Type by monotypy, *Eolis alba*, A. & H. = *Favorinus albidus*, nov.

FAVORINUS ALBIDUS, nom. nov.

Eolis alba, A. & H., Ann. & Mag. Nat. Hist., vol. xiii, p. 164, March, 1844: near Dublin.

Not *Eolidia alba*, Van Hasselt, Alg. Konst. & Letter-Bode, p. 23, Jan. 1824.

Eolis alba, A. & H.; Mon., Fam. 3, pl. xxi, pt. 1, 1845.

Favorinus albus, A. & H., Conch. Soc. List, p. 18; Eliot, p. 172.

FAVORINUS CARNEUS (Alder & Hancock, 1854).

Eolis carnea, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv, p. 104, Aug. 1, 1854: Torquay.

Favorinus carneus, A. & H., Conch. Soc. List, p. 18; Eliot, p. 172.

Genus FACELINA, Alder & Hancock, 1855.

Facelina, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 7, App. p. xxii, 1855.

Type by monotypy, *Eolida coronata*, Forbes & Goodsir = *Doris longicornis*, Montagu.

Acanthopsole, Trinchesse, Mem. Accad. Sci. Inst. Bologna, ser. III, vol. v, fasc. i, p. 76 (read March 24), 1874.

Type by original designation, *Eolis rubrovittata*, Costa.

FACELINA CURTA (Alder & Hancock, 1843).

Eolis curta, A. & H., Ann. & Mag. Nat. Hist., vol. xii, p. 234, Oct. 1843: Whitley, Northumberland.

Eolis tenuibranchialis, ibid., vol. xvi, p. 315, Nov. 1845 : Torbay.
Eolis drummondi, ibid., Mon. Nudib. Moll. (Ray Soc.), Fam. 3, pl. xiii, pt. 4, 1848 ; ex Thompson, Rept. Brit. Assoc. 1843, p. 250, 1844, name for *Eolis rufibranchialis*, Thompson, Ann. Nat. Hist., vol. v, p. 89, April, 1840, not described : Co. Down.
Facelina drummondi, Thompson, Conch. Soc. List, p. 18 ; Eliot, p. 171.

[Trinchesse states (Atti R. Accad. Lincei, ser III, Mem. delle Classe sci. fisich. mat. e nat., vol. xi, p. 7, "1881," 1882) that *Æolis gigas*, Costa, *Eolis panizzæ*, Verany, and *E. janii*, Verany, are synonyms of this species.]

FACELINA LONGICORNIS (Montagu, 1808).

Doris longicornis, Montagu, Trans. Linn. Soc. (Lond.), vol. ix, p. 107, pl. vii, fig. 1, 1808 : Devon.

Tritonia plumosa, Fleming, Edinb. Encycl. (Brewster), vol. xiv, p. 619, Nov. 1820 : Zetland.

Eolida coronata, Forbes & Goodsir, Athenæum, No. 618, p. 647, Aug. 31, 1839 : Shetland.

Eolis hurleyi, Garstang, Journ. Marine Biol. Assoc., n.s., vol. i, p. 195, Oct. (ante 23), 1889 : Plymouth.

— ibid., p. 442, 1892.

Eolis coronata, Forbes, A. & H., Mon., Fam. 3, pl. xii, pt. 2, 1846.

Facelina coronata, Forbes & Goodsir, Conch. Soc. List, p. 18 ; Eliot, p. 172.

FACELINA PUNCTATA (Alder & Hancock, 1845).

Eolis punctata, Alder & Hancock, Ann. & Mag. Nat. Hist., vol. xvi, p. 315, Nov. 1845 : Torbay.

— Mon., Fam. 3, pl. xv, pt. 2, 1846.

Facelina punctata, A. & H., Conch. Soc. List, p. 18 ; Eliot, p. 172.

FACELINA ELEGANS (Alder & Hancock, 1845).

Eolis elegans, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 316, Nov. 1845 : Torbay.

— Mon., Fam. 3, pl. xvii, pt. 5, 1851.

Facelina elegans, A. & H., Conch. Soc. List, p. 18.

Genus EMBLETONIA, Alder & Hancock, 1851.

Embletonia, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 5, genus 14, 1851.

New name for *Pterochilus*, A. & H., 1844.

Type by monotypy, *Pterochilus pulcher*, A. & H.

Pterochilus, A. & H., Ann. & Mag. Nat. Hist., vol. xiv, p. 329, Nov. 1844.

Type by monotypy, *P. pulcher*, nov.

Not *Pterochilus*, Klug, Weber & Mohr, Beitr. Nat., i, p. 143, 1805.

Diplocera, Verany, Journ. de Conchyl., vol. iv, p. 385, 1853,
ex Bouchard-Chantereaux MS.

Type by monotypy, *D. veranyi*, B-C (? unpublished).

EMBLETONIA PULCHRA (Alder & Hancock, 1844).

Pterochilus pulcher, A. & H., Ann. & Mag. Nat. Hist., vol. xiv, p. 329,
Nov. 1844 : Rothesay Bay.

Embletonia pulchra, A. & H., Mon., Fam. 3, pl. xxxviii, pt. 5, 1851 ;
Conch. Soc. List, p. 18 ; Eliot, p. 171.

EMBLETONIA PALLIDA, Alder & Hancock, 1854.

Embletonia pallida, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv,
p. 105, Aug. 1, 1854 : Birkenhead.

Embletonia hyalina, "A. & H.", Sanford, Somerset Archæol. & Nat.
Hist. Soc. Proc., vol. x, p. 152, fig. 1, 1861 : St. Audries,
Somerset.

Embletonia pallida, A. & H. Conch. Soc. List, p. 18 ; Eliot, p. 128,
pl. vi, figs. 1, 2, p. 171.

EMBLETONIA GRAYI, Kent, 1869.

Embletonia grayi, Kent, Proc. Zool. Soc. (Lond.), 1869, p. 109,
pl. viii, June 1 : Victoria Docks.

Embletonia pallida, var. *grayi*, Kent, Conch. Soc. List, p. 18.

EMBLETONIA PYGMÆA, nom. nov.

Eolida minima, Forbes & Goodsir, Athenæum, No. 618, p. 647,
Aug. 31, 1839 : Shetland.

Not *Eolis minima*, Lamarck, Hist. Anim. s. Verteb., vol. vi,
pt. 1, p. 302, 1819.

Embletonia minuta, Forbes & Hanley, Hist. Brit. Moll., pts. xli and
xlii, vol. iii, p. 607, pl. BBB, fig. 5, Sept. 1, 1851 ; error only as
Eolida minuta cited as original reference.

Not *Eolis minuta*, A. & H., Ann. & Mag. Nat. Hist., vol. ix,
p. 36, March, 1842.

Embletonia minima, Forbes & Goodsir, Conch. Soc. List, p. 18.
— *minuta*, F. & G. ; Eliot, p. 171.

Genus TERGIPES, Cuvier, 1805.

Tergipes, Cuvier, Ann. Mus. Hist. Nat. (Paris), vol. vi, p. 433, Dec.
1805.

Type by tautonymy, *Limax tergipes*, Forskål = *Doris lacinulata*, Gmelin.

Psiloceros, Menke, Zeit. Malak., vol. i, p. 149, (end Oct.) 1844.

Type by monotypy, *P. claviger*, nov.

TERGIPES DESPECTUS (Johnston, 1835).

Eolidia despecta, Johnston, Mag. Nat. Hist. (Loudon), vol. viii,
p. 378, fig. 35e, July, 1835 : Berwick Bay.

Eolis despecta, Johnston ; A. & H., Mon., Fam. 3, pl. xxxvi, pt. 1,
1845.

Tergipes despectus, Johnston ; Conch. Soc. List, p. 18 ; Eliot, p. 170.

Family FLABELLINIDÆ.

Genus EUBRANCHUS, Forbes, 1838.

Eubranchus, Forbes, Malac. Monensis, p. 5, (pref. Feb. 28), 1838.
Type by monotypy, *E. tricolor*, nov.

Amphorina, Quatrefages, Ann. Sci. Nat. Paris, ser. III, vol. i, p. 145,
March (ante April 15), 1844.

Type by monotypy, *A. alberti*, nov. = *Eolis farrani*, A. & H.,
i.e. *E. tricolor*, Forbes.

Galvina, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 7, App.
p. xxii, 1855.

Type here designated *Eubranchus tricolor*, Forbes.

EUBRANCHUS TRICOLOR, Forbes, 1838.

Eubranchus tricolor, Forbes, Malac. Monensis, p. 5 (pref. Feb. 28),
1838 : Isle of Man.

Amphorina alberti, Quatrefages, Ann. Sci. Nat. Paris, ser. III, vol. i,
p. 145, March (ante April 15), 1844 : Brittany.

Eolis farrani, A. & H., Ann. & Mag. Nat. Hist., vol. xiii, p. 164,
March, 1844 : near Dublin.

Eolis violacea, ibid., p. 166 : Cullercoats.

Eolis amethystina, ibid., vol. xvi, p. 316, Nov. 1845 : Cullercoats.

Eolis adelaide, Thompson, ibid., ser. III, vol. v, p. 49, Jan. 1, 1860 :
Weymouth Bay.

Eolis andreapolis, M'Intosh, Proc. Roy. Soc. Edinb., 1864-5, p. 392,
(after May), 1865 : St. Andrew's.

Eolis robertianæ, ibid., p. 393 : ibid.

Eolis purpurea, Alder in Jeffreys Brit. Conch., vol. v, p. 54, 1869 :
error only.

Eolis tricolor, Forbes, A. & H., Mon., Fam. 3, pl. xxxiv, pt. 1, 1845.
— *farrani*, A. & H., ibid., pl. xxxv.

Galvina tricolor, Forbes, Conch. Soc. List, p. 18 ; Eliot, p. 169.

EUBRANCHUS EXIGUUS (Alder & Hancock, 1848).

Eolis exigua, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. i, p. 192,
March 1, 1848 (ex Athenaeum, No. 1028, p. 748, July 10, 1847,
n.n.) : Fowey.

— — — Mon., Fam. 3, pl. xxxvii, pt. 5, 1851.
Galvina exigua, A. & H., Conch. Soc. List, p. 18 ; Eliot, p. 169.

EUBRANCHUS PALLIDUS (Alder & Hancock, 1842).

Eolis pallida, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 35, March,
1842 : Cullercoats.

Eolis minuta, ibid., p. 36 : Whitley, Northumberland.

Eolis picta, ibid., Mon. Nudib. Moll. (Ray Soc.), Fam. 3, pl. xxxiii,
pt. 3, 1847 ; new name for *E. pallida*, A. & H. only.

Galvina picta, A. & H., Conch. Soc. List, p. 18 ; Eliot, p. 169.

EUBRANCHUS CINGULATUS (Alder & Hancock, 1847).

Eolis cingulata, A. & H., Mon. Nudib. Moll. (Ray Soc.), Fam. 3, pl. xxviii, pt. 3, 1847; new name for *Eolis hystrix*, A. & H. *E(olis) hystrix*, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 35, March, 1842: Cullercoats.

Not *Eolidia histrix*, Otto, Conspp. anim. quor. marit. non edit., pt. 1, p. 8, 1821.

Galvina cingulata, A. & H., Conch. Soc. List, p. 18; Eliot, p. 170.

EUBRANCHUS VITTATUS (Alder & Hancock, 1842).

E(olis) vittata, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 35, March, 1842: Cullercoats.

— — — Mon., Fam. 3, pl. xxix, pt. 6, 1854.

Galvina cingulata, var. *vittata*, A. & H., Conch. Soc. List, p. 18.

— *vittata*, A. & H.; Eliot, p. 169.

Genus CUMANOTUS, Odhner, 1907.

Cumanotus, Odhner, K. Svensk. Vet. Akad. Handl. (Stockh.), n.s., vol. xli, No. 4, pp. 26-9, Feb. 1, 1907.

Type by monotypy, *C. laticeps*, nov. = *Coryphella beaumonti*, Eliot, 1906.

CUMANOTUS BEAUMONTI (Eliot, 1906).

Coryphella beaumonti, Eliot, Journ. Marine Biol. Assoc. U.K., n.s., vol. vii, p. 361, June, 1906: Plymouth.

Cumanotus laticeps, Odhner, K. Svensk. Vet. Akad. Handl. (Stockh.), n.s., vol. xli, No. 4, pp. 26-9, Feb. 1, 1907.

Cumanotus beaumonti, Eliot, p. 125, pl. viii, figs. 1-5, p. 169.

Genus CORYPHELLA, Gray, 1850.

Coryphella, Gray, Figs. Mollusc. Anim., vol. iv, p. 109, 1850.

Type by subsequent designation, A. & H., Mon., pt. 5, App. p. xxii, 1855: *Eolis rufibranchialis*, Johnston.

CORYPHELLA RUFIBRANCHIALIS (Johnston, 1832).

Eolis rufibranchialis, Johnston, Mag. Nat. Hist. (Loudon), vol. v, p. 428, fig. 85, June, 1832: Berwick Bay.

Eolidia embletoni, ibid., vol. viii, p. 378, fig. 36, July, 1835: Berwick Bay.

Eolis rufibranchialis, Johnston, A. & H., Mon., Fam. 3, pl. xiv, pt. 4, 1848.

Coryphella rufibranchialis, Johnston, Conch. Soc. List, p. 18; Eliot, p. 168.

CORYPHELLA PELLUCIDA (Alder & Hancock, 1843).

Eolis pellucida, A. & H., Ann. & Mag. Nat. Hist., vol. xii, p. 234, Oct. 1843: Cullercoats.

— — — Mon., Fam. 3, pl. xix, pt. 3, 1847.

Coryphella pellucida, A. & H., Eliot, p. 168.

CORYPHELLA GRACILIS (Alder & Hancock, 1844).

Eolis gracilis, A. & H., Ann. & Mag. Nat. Hist., vol. xiii, p. 166, March, 1844 : Cullercoats.

Eolis smaragdina, ibid., Mon. Nudib. Moll. (Ray Soc.), Fam. 3, pl. xvii, pt. 5, 1851 : Whitley, Northumberland.

Eolis gracilis, ibid., Fam. 3, pl. xviii, pt. 6, 1854.

Coryphella gracilis, A. & H.; Eliot, p. 168.

CORYPHELLA PEDATA (Montagu, 1815).

Doris pedata, Montagu, Trans. Linn. Soc. (Lond.), vol. xi, p. 197, pl. xiv, fig. 1 (2), 1815 : Devon.

Eolis landsbergii, A. & H., Ann. & Mag. Nat. Hist., vol. xviii, p. 294, Nov. 1846 : Saltcoats, Ayr.

Eolis landsburgii, A. & H., Mon., Fam. 3, pl. xx, pt. 4, 1848.

Coryphella landsburgi, A. & H., Conch. Soc. List, p. 18 ; Eliot, p. 168 (*landsburghii*).

CORYPHELLA SALMONACEA (Couthouy, 1838).

Eolis (Cavolina, Brug) salmonacea, Couthouy, Boston Journ. Nat. Hist., vol. ii, pt. 1, p. 68, pl. i, fig. 2, Feb. 1838 : Mouth of Charles River, Massachusetts, U.S.A.

Æolis papilligera, "Beck, 1847," Mörch, Grönland (Rink) (Prodr. Fauna Moll. Grönl., p. 6), 1857 (in synonymy).

Coryphella salmonacea, Couthouy ; Eliot, pp. 128, 168.

[Mörcb (Grönland (Rink) Prodr. Fauna Moll. Grönl., p. 6, 1857) cites "*Æolis papilligera*, Bk. 1847" as a synonym of this species, which he identified with *Doris papillosa*, Fab., and *Æolis bodoensis*, Möll. not Gun.]

CORYPHELLA LINEATA (Lovén, 1846).

Æolis lineata, Lovén, Öfvers. K. Vet. Akad. Förh. (Stockh.), vol. iii, p. 140, May 13, 1846 : Boh.

Eolidia demartinii, Verany, Descr. Genova, vol. i, pt. 2, pp. 97 to 105, 1846 : Genoa.

Eolis lineata, A. & H., Ann. & Mag. Nat. Hist., vol. xviii, p. 294, Nov. 1846 : Saltcoats, Ayr.

Æolis argenteolineata, Achille Costa, Ann. Mus. Zool. Univ. Napoli, An. iii, 1863, p. 66, pl. i, fig. 3 (pref. Dec. 15, 1866), "1866" : Bay of Naples.

Eolis lineata, Lovén, A. & H., Mon., Fam. 3, pl. xvi, pt. 5, 1851.

Coryphella lineata, Lovén, Conch. Soc. List, p. 18 ; Eliot, p. 168.

Family IDULIIDÆ.

Genus IDULIA, Leach, 1852.

Idulia, Leach, Synops. Moll. Gt. Britain, p. 25, Dec. 1852.

Type by monotypy, *Doris maculata*, Montagu.

Doto, Oken, Lehrb. Naturg., Th. iii, Zool., pt. 1, pp. x, 278, 1815.

Type by subsequent designation, Gray, Proc. Zool. Soc. (Lond.), 1847, p. 165 : *Doris maculata*.

Not *Doto*, Oken, Gottingen Gelehrte Anz., 1807, pt. 2, p. 1168.
Dotona, Iredale, Proc. Malac. Soc. (Lond.), vol. xiii, p. 30, Aug. 1918.

Type by original designation, *Melibaea fragilis*, Forbes.

[Note.—*Dotona* was proposed for *Doto* preoccupied, as *Idulia* had been commonly regarded as simply a misspelling of *Idalia*, but reference to Leach's proof-sheets, printed in 1819, shows *Idulia* to have been invented years before *Idalia*, so *Idulia* must be used.]

IDULIA CORONATA (Gmelin, 1791).

Doris coronata, Gmelin, Linn. Syst. Nat., ed. 13, vol. i, pt. 6, p. 3105, May 14, 1791, based solely on Bommé, Act Vliss, i, p. 394, pl. iii, figs. 1–3, and 3, p. 288 : Ins. Walcheren, Seelandia.

Doris maculata, Montagu, Trans. Linn. Soc. (Lond.), vol. vii, p. 80, pl. vii, figs. 8 and 9, 1804 : Devon.

Scyllæa punctata, Bouchard-Chantereaux, Mem. Soc. Agric. Boulogne, 1834, p. 135 (Cat. Moll. Marin. Côtes de Boulonnais, Reprint, p. 39), 1835 : Boulogne.

Melibaea ornata, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 34, March, 1842 : Cullercoats.

Doto coronata, Gmelin, A. & H., Mon., Fam. 3, pl. vi, pt. 2, 1846 ; Conch. Soc. List, p. 18 ; Eliot, p. 166.

IDULIA FRAGILIS (Forbes, 1838).

Melibaea fragilis, Forbes, Malac. Monensis, p. 4 (pref. Feb. 28), 1838 : Isle of Man.

Doto fragilis, Forbes, A. & H., Mon., Fam. 3, pl. v, pt. 5, 1851 ; Conch. Soc. List, p. 18 ; Eliot, p. 167.

IDULIA PINNATIFIDA (Montagu, 1804).

Doris pinnatifida, Montagu, Trans. Linn. Soc. (Lond.), vol. vii, p. 78, pl. vii, figs. 2, 3, 1804 : Devon.

Doto pinnatifida, var. *nigra*, Eliot, p. 124, 1910 : Plymouth.

— — — var. *papillifera*, ibid., p. 125 : ibid.

Doto pinnatifida, Montagu, A. & H., Mon., Fam. 3, pl. xlvi, Suppl., pl. vii, 1855 ; Conch. Soc. List, p. 18 ; Eliot, pp. 124 and 167.

IDULIA CUSPIDATA (Alder & Hancock, 1862).

Doto cuspidata, A. & H., Ann. & Mag. Nat. Hist., ser. III, vol. x, p. 264, Oct. 1, 1862 : Shetland.

— — — A. & H., Conch. Soc. List, p. 18 ; Eliot, p. 123, pl. v, figs. 1–3, p. 167.

IDULIA CINEREA (Trinchese, 1881).

Doto cinerea, Trinchese, Atti R. Accad. Lincei, ser. III, Mem. della Class. sci. fis. mat. e nat., vol. xi, p. 92, pl. lv, fig. 1, 1881 : Genoa.

Doto cinerea, Trinchese, Eliot, pp. 124, 167.

Family FIONIDÆ.

Genus FIONA, Forbes & Hanley, 1851.

Fiona, Forbes & Hanley, Hist. Brit. Moll., pts. xli and xlii, vol. iii (Contents, p. x, note), Sept. 1, 1851.

New name for *Oithona*, Forbes & Hanley, ex A. & H. MS.

Type by monotypy, *O. nobilis*, Forbes & Hanley, ibid.

Oithona, ibid., vol. iii, p. 589, ibid.

Oithona, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. viii, p. 290, Oct. 1, 1851.

Type by monotypy, *O. nobilis*, nov.

Not *Oithona*, Baird, Zoologist, 1843, p. 59.

Hymenæolis, Achille Costa, Ann. Mus. Zool. Napoli, An. iii, "1863," pref. Dec. 15, 1866, pp. 64-80; An. iv, "1864," pref. Dec. 1867, p. 28.

Type by monotypy, *H. elegantissima*, p. 29, pl. i, figs. 1-3.

FIONA PINNATA, Eschscholtz, 1831.

Eolidia pinnata, Eschscholtz, Zoolog. Atlas, Heft 4, p. 14, pl. xix, fig. 1, 1831: Sitka, North-West America.

Fiona marina, auctt., ex *Limax marinus*, Forskål.

Doris fasciculata, Gmelin, Linn. Syst. Nat., ed. 13, vol. i, pt. 6, p. 3104, May 14, 1791; based solely on *Limax marinus*, Forskål, Fn. Arab., p. 99, n. 3, anim. t. 26, fig. 5.

Not *Doris fasciculata*, O. F. Müller, Zool. Dan. Prodr., p. 229, 1776.

? *Eolidia alba*, Hasselt, Alg. Konst. & Letter-Bode, 1824 (2), p. 23, Jan. 1824 (Bull. des Sci. Nat., vol. iii, p. 239, 1824): Java.

Æolis longicauda, Quoy & Gaimard, Voy. Astrol., Zool., vol. ii, p. 183, 1832.

Oithona nobilis, Forbes & Hanley, Hist. Brit. Moll., pts. lxi and lxii, vol. iii, p. 589, Sept. 1, 1851, ex "Alder & Hancock MS.": Falmouth.

Oithona nobilis, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. viii, p. 291, Oct. 1, 1851: Falmouth.

"*Fiona nobilis*, Hancock & Embleton," auctt.

Fiona atlantica, Bergh, Vidensk. Meddel. Nat. Foren. Kjoben., 1857, p. 273.

Hymenæolis elegantissima, Achille Costa, Ann. Mus. Zool. Napoli, An. iii, "1863," pref. Dec. 15, 1866, pp. 64-80; An. iv, "1864," pref. Dec. 1867, p. 29, pl. i, figs. 1-3: Naples.

Fiona marina, var. *pacifica*, Bergh, Proc. Acad. Nat. Sci. Philad., 1879, p. 85.

Fiona nobilis, A. & H., Mon., Fam. 3, pl. xxxviiiA, pt. 7, 1855.

— *marina*, Forskål, Conch. Soc. List, p. 18; Eliot, p. 166.

[Strictly speaking, Forskål was not a binomialist; his papers edited and published after his death show this clearly when the vertebrates are studied, but not so clearly in the invertebrates.]

Limax marinus, Forskål, Descr. Anim., p. 99, 1775, is antedated by *Limax marinus*, Gunnerus, Skrift. Kjöb. Selsk., vol. x, p. 170, 1770.]

Family ZEPHYRINIDÆ.

Genus JANOLUS, Bergh, 1884.

Janolus, Bergh, Rept. Sci. Results Challenger, Zool., vol. x, p. 18, 1884.

Type by monotypy, *J. australis*, nov.

Janus, Verany, Rev. Zool. Soc. Cuv., p. 302, Aug., 1844, Diagnosis only; Mág, Zool., Moll., pl. cxxxvi, 1845.

Type by monotypy, *J. spinolæ*, nov.

Not *Janus*, Stephens, Ill. Brit. Entom. (Mandib. vii), p. 108, 1835.

Antiopa, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. i, p. 190, March 1, 1848.

Type by monotypy, *A. splendida*, nov.

Not *Antiopa*, Meigen, Nouv. Class. Mouches, p. 32, 1800.

Antiopella, Hoyle, Journ. of Conch., vol. x, p. 214, July 1, 1902.

New name for *Antiopa*, A. & H.

JANOLUS CRISTATUS (Chiaje, 1841).

Eolis cristata, Chiaje, Descr. Anim. Invert. Sicil. cit., pl. lxxxviii, 1841: Sicily.

Janus spinolæ, Verany, Mag. Zool., Moll., pl. cxxxvi, 1845: Port de Genes.

Antiopa splendida, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. i, p. 190, March, 1848 (ex Athenæum *Proctonotus* ? *splendidus*, No. 1028, p. 748, July 10, 1847, n.n.): Torbay.

Antiopa cristata, Chiaje, A. & H., Mon., Fam. 3, pl. xliv, pt. 6, 1854.

Antiopella cristata, Chiaje, Conch. Soc. List, p. 18; Eliot, p. 165.

JANOLUS HYALINUS (Alder & Hancock, 1854).

Antiopa hyalina, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv, p. 105, Aug. 1, 1854: Mouth of Dee.

— — — Mon., Fam. 3, pl. xliv, pt. 6, 1854.

Antiopella hyalina, A. & H., Conch. Soc. List, p. 18.

Janolus hyalinus, A. & H.; Eliot, p. 122, pl. v, figs. 4-7, p. 165.

JANOLUS FLAGELLATUS, Eliot, 1906.

Janolus flagellatus, Eliot, Journ. Marine Biol. Assoc. U.K., n.s., vol. vii, p. 374, June, 1906: near Plymouth.

— — — Eliot, p. 165.

Genus ZEPHYRINA, Quatrefages, 1844.

Zephyrina, Quatrefages, Ann. Sci. Nat. Paris, sér. III, vol. i, p. 130, March (ante April 15), 1844.

Type by monotypy, *Z. pilosa*, nov.

Venilia, A. & H., Ann. & Mag. Nat. Hist., vol. xiii, p. 161, March 1, 1844.

Type by monotypy, *V. mucronifera*, nov.

Not *Venilia*, Godart, Nat. Hist. Lepid. France, vol. vii, pt. 2, p. 110, 1829.

Proctonotus, A. & H., Ann. & Mag. Nat. Hist., vol. xiii, p. 407, May 1, 1844.

New name for *Venilia*, A. & H.

ZEPHYRINA MUCRONIFERA (Alder & Hancock, 1844).

Venilia mucronifera, A. & H., Ann. & Mag. Nat. Hist., vol. xiii, p. 163, March 1, 1844: near Dublin.

Zephyrina pilosa, Quatrefages, Ann. Sci. Nat. Paris, sér. III, vol. i, p. 130, March (ante April 15), 1844: Brittany.

Proctonotus mucroniferus, A. & H., Mon., Fam. 3, pl. xlvi, pt. 2, 1846; Conch. Soc. List, p. 18; Eliot, p. 165.

Family HEROIDÆ.

Genus HERO, Alder & Hancock, 1855.

Hero, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 7, App. p. xx, 1855 (ex Lovén MS.).

Type by monotypy, *Cloelia formosa*, Lovén.

[*Cloelia*, Lovén, K. Vet. Acad. Handl. Stockh., 1839, p. 235, 1841.

Type by subsequent designation, Gray, Proc. Zool. Soc. (Lond.), 1847, p. 166: *Doris fimbriata*, Müller.

Not *Cloelia* of Fitzinger, 1833.

Note.—Although generally regarded as a synonym of *Hero*, which was introduced because *Cloelia* was preoccupied, but fortunately without prejudice and with another type, Odhner states that *Doris fimbriata*, Vahl, i.e. Rathke, Zool. Danica (Müller), 3rd ed., vol. iv, p. 22, pl. 138, fig. 2, 1806: Norway, is equal to *Tritonia hombergi*, Cuvier, 1802, a member of another family.]

HERO FORMOSA (Lovén, 1841).

Cloelia formosa, Lovén, K. Vet. Acad. Handl. Stockh., 1839, p. 235, fig. 7, 1841: Boh.

Hero formosa, Lovén, Conch. Soc. List, p. 18; Eliot, p. 120, pl. iv, figs. 1–4, p. 164, var. *arborescens*, Eliot, p. 121.

Family SCYLLÆIDÆ.

Genus SCYLLÆA, Linné, 1758.

Scyllæa, Linné, Syst. Nat., ed. 10, p. 656, Jan. 1, 1758.

Type by monotypy, *S. pelagica*, Linné, ibid.

Pleuropus, Rafinesque, Analyse Nature, p. 141, 1815.

SCYLLÆA PELAGICA, Linné, 1758.

Scyllæa pelagica, Linné, Syst. Nat., ed. 10, p. 656, Jan. 1, 1758: Ocean.

Scyllæa pelagica, Linné; A. & H., Mon., Fam. 2, pl. v, pt. 4, 1848; Conch. Soc. List, p. 18; Eliot, p. 163.

[Note.—The synonymy of this world-wide species is very complicated and will be worked out later.]

Family LOMANOTIDÆ.

Genus LOMANOTUS, Verany, 1844–6.

Lomanotus, Verany, Rev. Zool. Soc. Cuv., 1844, p. 303, Aug.: diagnosis only.

— — Dscr. Genova, vol. i, pt. 2, pp. 97–102, pl. ii, fig. 6, 1846.

Type by monotypy, *L. genei*, nov.

Eumenis, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 311, Nov. 1845.

Type by monotypy, *E. marmorata*, nov.

Not *Eumenis*, Hübner, Verz. bekannt. Schmett., p. 58, 1818.

LOMANOTUS GENEI, Verany, 1846.

Lomanotus genei, Verany, Descr. Genova, vol. i, pt. 1, pp. 97–102, pl. ii, fig. 6, 1846: Genoa.

Lomanotus portlandicus, Thompson, Ann. & Mag. Nat. Hist., ser. III, vol. v, p. 50, Jan. 1, 1860: Weymouth Bay.

? *Lomonotus hancocki*, Norman, Ann. & Mag. Nat. Hist., ser. IV, vol. xx, p. 518, Dec. 1, 1877: Torbay.

Lomanotus eisigii, Trinchese, Rendic. Accad. Sci. Fis. Mat. Napoli, An. xxii, fasc. 3, March, 1883, pp. 92–94, April: Naples.

Lomanotus varians, Garstang, Journ. Marine Biol. Assoc. U.K., n.s., vol. i, p. 185, Oct. (ante 23rd), 1889: Plymouth.

Lomanotus genei, Verany, Conch. Soc. List, p. 18; Eliot, pp. 112–15, pl. iii, figs. 1–8, p. 162.

LOMANOTUS MARMORATUS (Alder & Hancock, 1845).

Eumenis marmorata, A. & H., Ann. & Mag. Nat. Hist., vol. xiii, p. 311, Nov. 1845: Torbay.

Lomanotus (Eumenis) marmorata, A. & H., Mon., Fam. 3, pl. ia, pt. 3, 1847.

— *marmoratus*, A. & H.; Eliot, pp. 116, 163.

LOMANOTUS FLAVIDUS (Alder & Hancock, 1846).

Eumenis flava, A. & H., Ann. & Mag. Nat. Hist., vol. xiii, p. 293, Nov. 1846: Lamlash Bay.

Lomanotus flavidus, A. & H., Mon., Fam. 3, pl. xli, pt. 6, 1854; Eliot, p. 163.

Genus HANCOCKIA, Gosse, 1877.

Hancockia, Gosse, Ann. & Mag. Nat. Hist., ser. IV, vol. xx, p. 316, Oct. 1, 1877.

Type by monotypy, *H. eudactylota*, nov.

Govia, Trinchese, Rendic. Accad. Sci. fis. e mat. Napoli, An. xxiv, fasc. 6, p. 175, June, 1885, July.

Type here designated *Govia rubra*, Trinchese.

HANCOCKIA EUDACTYLOTA, Gosse, 1877.

Hancockia eudactylota, Gosse, Ann. & Mag. Nat. Hist., ser. IV, vol. XX, p. 316, pl. xi, Oct. 1, 1877: Torquay.

Govia rubra, Trinchese, Rendic. Accad. Sci. fis. e mat. Napoli, An. xxiv, fasc. 6, p. 175, June, 1885, July: Naples.

Hancockia eudactylota, Gosse, Conch. Soc. List, p. 18; Eliot, pp. 118, 163; Eliot, Proc. Zool. Soc. (Lond.), p. 770, pl. XXXV, 1912.

Family DENDRONOTIDÆ.

Genus DENDRONOTUS, Alder & Hancock, 1845.

Dendronotus, A. & H., Athenæum, No. 922, p. 644, June 28, 1845.

Type by original designation, *Tritonia arborescens*, Müller = *Amphitrite frondosa*, Ascanius.

Amphitrite, Ascanius, K. Norske Vidensk. Selsk. Skrifter, Deel 5, p. 155, pl. v, fig. 2, 1774 (not of Müller, 1771).

Type by monotypy, *Amphitrite frondosa*, Ascanius.

Amphitritidea [Kröyer], Amtl. Bericht. (24) Deutsch. Naturf., 1847, pp. 114, 217: n.n.

— “Beck,” Mörch, Grönland (Rink) (Prodr. Fauna Moll. Grönl., p. 6) 1857: in synonymy.

DENDRONOTUS FRONDOSUS (Ascanius, 1774).

Amphitrite frondosa, Ascanius, K. Norske Vidensk. Selsk. Skrifter, Deel 5, p. 155, pl. v, fig. 2, 1774: Norway.

Doris arborescens, O. F. Müller, Zool. Dan Prod., p. 229 (pref. March 31), 1776: based on Act. Havn, p. 14, pl. v, fig. 5.

Doris cervina, Gmelin, Linn. Syst. Nat., ed. 13, vol. i, pt. 6, p. 3105 (May 14), 1791: based only on Bomme Act Vliss., 3, p. 290, n. 2, fig. 1.

Tritonia reynoldsi, Couthouy, Boston Journ. Nat. Hist., vol. ii, No. 1, p. 74, pl. ii, figs. 1-4, Feb. 1838: Massachusetts Bay.

T(riton)ia pulchella, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 33, March, 1842: Cullercoats.

Amphitritidea fabricii, “Bk. 1847,” Mörch, Grönland (Rink) (Prodr. Fauna Moll. Grönl., p. 6), 1857: in synonymy.

Dendronotus arborescens, Müller, A. & H., Mon., Fam. 3, pl. iii, pt. 1, 1845.

— *frondosus*, Ascanius, Conch. Soc. List, p. 18; Eliot, p. 161.

DENDRONOTUS LACTEUS (Thompson, 1840).

Tritonia lactea, Thompson, Ann. Nat. Hist., vol. v, p. 88, pl. ii, fig. 3, April, 1840: Strangford Lough, Ireland.

Dendronotus lacteus, Thompson; Eliot, pp. 112, 161; cf. Becker, Moll. von Jun Meyen, p. 14, 1886.

Family ARMINIDÆ.

Genus ARMINA, Rafinesque, 1814.

Armina, Rafinesque Schmaltz, Précis découv. trav. Somiol, p. 30, (pref. June 3), 1814.

Type here designated, *A. tigrina*, Raf.

Pleurophyllidia, " Meckel in Hammer Dis. Obs. Anat. Comp., 1816": Deutsch. Arch. f. Physiol., vol. viii, p. 197, 1823.

Diphyllidia, " Cuvier," Otto, Conspec. Anim., pt. I, p. 8, May 11, 1821: ex Cuvier vernacular.

ARMINA LOVENI (Bergh, 1861).

Pleurophyllidia loveni, Bergh, Vidensk. Meddel. natur. Foren. Kjöben, 1860, p. 328, 1861.

— — Conch. Soc. List, p. 18; Eliot, p. 111, pl. viii, figs. 8-10, p. 160.

HOLOHEPATICA.

Super-family PHANEROBRANCHIATÆ.

Family OKENIIDÆ.

Genus IDALIELLA, Bergh, 1881.

Idaliella, Bergh, Arch. f. Naturg. (Wiegmann.), Jahrg. xlvii, pt. 1, p. 145, 1881.

Type *Idalia aspersa*, A. & H.

IDALIELLA ASPERSA (Alder & Hancock, 1845).

Idalia aspersa, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 1, Fam. 1, pl. xxvi (reviewed Oct. 1), 1845: Cullercoats.

Idalina (Idaliella) aspersa, A. & H., Conch. Soc. List, p. 19.

Idalia (Idaliella) aspersa, A. & H.; Eliot, p. 159.

IDALIELLA INAEQUALIS (Forbes & Hanley, 1851).

I(dalia) inaequalis, Forbes & Hanley, Hist. Brit. Moll. (pts. xli, xlvi), vol. iii, p. 579, pl. xv, fig. 4, Sept. 1, 1851: Zetland.

Idalina (Idaliella) inaequalis, Forbes, Conch. Soc. List, p. 19.

Idalia (Idaliella) inaequalis, Forbes, Eliot, p. 159.

IDALIELLA PULCHELLA (Alder & Hancock, 1854).

Idalia pulchella, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv, p. 103, Aug. 1, 1854: St. Ives, Cornwall.

Idalina (Idaliella) pulchella, A. & H., Conch. Soc. List, p. 19.

Idalia (Idaliella) pulchella, A. & H.; Eliot, p. 159.

Genus OKENIA, Menke, 1830.

Okenia, Menke, Synops. method. Mollusc., ed. 2, p. 10, pref. April, 1830: ex Leuckart MS., as synonym of *Idalia*, Leuckart.

Okenia, Bronn, Ergeb. meiner naturh. öcon. Reise, vol. i, 1826: n.n.

Idalia, Leuckart, Breves Animal. quor. Descr., p. 15, 1828.

Type by monotypy, *I. elegans*, nov.

Not *Idalia*, Hübner, Verz. bekannt. Schmett., p. 149, 1820.

Idalina, Norman, Ann. & Mag. Nat. Hist., ser. vi, vol. vi, p. 74,
July 1, 1890.

New name for *Idalia*, Leuckart.

OKENIA QUADRICORNIS (Montagu, 1815).

Doris quadricornis, Montagu, Trans. Linn. Soc. (Lond.), vol. xi,
p. 17, pl. ix, fig. 4, 1815 : Devon.

Idalia elegans, Leuckart, Breves Animal. quor. Descr., p. 15, 1828 :
Mediterranean Sea.

Doris laciniosa, Philippi, Enum. Moll. Sicil., vol. ii, p. 77, pl. xix,
fig. 5 (pref. Aug. 31, 1843), 1844 : Sicily.

Idalia elegans, Leuckart ; A. & H., Mon., Fam. 1, pl. xxvii, pt. 7,
1855 ; Eliot, p. 158.

Idalina elegans, Leuckart, Conch. Soc. List, p. 19.

OKENIA LEACHII (Alder & Hancock, 1854).

I(dalia) leachii, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv,
p. 103, Aug. 1, 1854.

New name for *I. elegans*, Cat. Moll. Northumberland.

— — — Mon., Fam. 1, pl. xxvii, pt. 7, 1855 ; Eliot, p. 159.

Idalina leachii, A. & H., Conch. Soc. List, p. 19.

Genus ANCULA, Lovén, 1846.

Ancula, Lovén, Öfvers. k. Vet. Akad. Förh. (Stockh.), 1846, p. 137,
May 13.

Type by monotypy, *Polycera cristata*, Alder.

Miranda, A. & H., Mon. Nudib. Moll. (Ray Soc.), Fam. 3, pl. xxv,
name on plate, pt. 3, 1847, as a synonym.

ANCULA CRISTATA (Alder, 1841).

P(olycera) cristata, Alder, Ann. & Mag. Nat. Hist., vol. vi, p. 340,
pl. ix, figs. 10–11, Jan. 1841 : Cullercoats.

Ancula cristata, Alder ; A. & H., Mon., Fam. 1, pl. xxv, pt. 3, 1847 ;
Conch. Soc. List, p. 19 ; Eliot, p. 158.

Genus GONIODORIS, Forbes & Goodsir, 1839.

Goniodoris, Forbes & Goodsir, Athenæum, No. 618, p. 647, Aug. 31,
1839.

Type by subsequent designation, Gray, Proc. Zool. Soc.
(Lond.), 1847, p. 164 : *Doris nodosa*, Montagu.

GONIODORIS NODOSA (Montagu, 1808).

Doris nodosa, Montagu, Trans. Linn. Soc. (Lond.), vol. ix, p. 107,
pl. vii, fig. 2, 1808 : Devon.

D(oris) barvicensis, Johnston, Ann. Nat. Hist., vol. i, p. 55, pl. ii,
figs. 11–13, March, 1838 : Scotland.

Doris elongata, Thompson, Ann. Nat. Hist., vol. v, p. 88, pl. ii,
fig. 7, April, 1840 : Isle of Lambay, Dublin.

Goniodoris emarginata, Forbes, ibid., p. 105, pl. ii, fig. 12 : Ballaugh,
Isle of Man.

Goniodoris nodosa, Montagu, A. & H., Mon., Fam. 1, pl. xviii, pt. 2, 1846; Conch. Soc. List, p. 19; Eliot, p. 157.

GONIODORIS CASTANEA, Alder & Hancock, 1845.

Goniodoris castanea, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 341, Nov. 1845: Salcombe.

— — var. *pallida*, Dautzenberg & Durouchoux, Feuille jeunes naturalistes Paris, ser. v, An. 43, Suppl., No. 514, p. 8, Oct. 1, 1913: Saint Malo, France.

— — Mon., Fam. 1, pl. xix, pt. 3, 1847; Conch. Soc. List, p. 19; Eliot, p. 157.

Family ONCHIDORIDÆ.

Genus ONCHIDORUS, Blainville, 1816.

Onchidorus, Blainville, Bull. Sci. Soc. Philom. Paris, (April No.), 1816, p. 96, July, 1816; Dict. Sci. Nat. (Levrault), vol. xxxii, p. 280, Nov. 13, 1824 (*Onchidoris*).

Type by monotypy, *O. leachii*, nov. = *Doris fusca*, Müller. *Lamellidoris*, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 7, app. p. xvii, 1855.

Type by subsequent designation, or virtual tautonymy, *Doris bilamellata*, "A. & H."

Proctaporia, Mörch, Grönland (Rink) (Prodr. Fauna Moll. Grönl., p. 6), 1857.

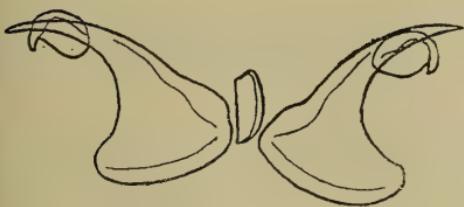
Type by monotypy, *Doris fusca*, Fabr., Fauna Groenlandica, p. 344 (pref. May 17, 1779), 1780 = ? *Doris fusca*, Müller.

Villiersia, Orbigny, Mag. Zool., Classe v, p. 15, pl. cix, (after Nov.) 1837.

Type by monotypy, *V. scutigera*, nov.: Rochelle.

Oicodespina, Gistel, Naturg. Thierr. f. Schulen, p. xi (pref. Easter, 1847), 1848.

New name for " *Villiersia*, Orbigny, in Guérin, Magas., vol. vii."



[Note.—*Onchidoris* was used by Gray, who had access to the type, since Blainville described his genus from a specimen from the British Museum. Apparently Blainville named the same speci-

men three times, and this is not strange when we know the history of his rejected and mislaid MSS., both in the British Islands and France. However, Leach figured the typical specimen in his Moll. Brit. Synops., which was not published until after his death in 1852. Since there was no means of correction, p. 20 *Doris elfortiana*, pl. vii, fig. 1, is cited with the wrong reference, but there is no difficulty

in the quotation. The specimen is still preserved in the British Museum (Nat. Hist.), and was recognized by Leach's figure, the bottle being labelled "*Onchidoris leachii*, *Doris elfortiana*, *Doris affinis*, Thomson, the *Lamellidoris bilamellata*, auctt.", the last handwriting different, and probably Abraham's. The radula was dissected out by O'Donoghue, and is here figured and absolutely proves the certainty of the name.]

ONCHIDORUS FUSCA (O. F. Müller, 1776).

- Doris fusca*, O. F. Müller, Zool. Dan. Prodr., p. 229, (pref. March 31), 1776 (description reads: "ovalis, lamella scabra, punctata. *D. bilamellata*, Linn."): Denmark.
Doris bilamellatus, Linné, Syst. Nat., ed. 12, p. 1083, 1767 partim, not *Limax bilamellatus*, Linné, Fauna Suecica, ed. 2, p. 508, 1761.
Doris elfortiania, Blainville, Bull. Sci. Soc. Philom. Paris, (April No.), 1816, p. 95, July, 1816: Scotland ex Leach in B.M.
Onchidorus leachii, ibid., p. 97: Location unknown, ibid.
Doris leachii, ibid., Dict. Sci. Nat. (Levrault), vol. xiii, p. 450, July 24, 1819: Scotland ex Leach in B.M.
Doris affinis (not of Gmelin, p. 3106), Thompson, Ann. Nat. Hist., vol. v, p. 85, April, 1840: Greencastle, Ireland.
Doris vulgaris, Leach, Synops. Moll. Gt. Britain, p. 19, Dec. 1852; name for *D. verrucosa*, Pennant, i.e. *D. fusca*, Müller.
Doris bilamellata, L., A. & H., Mon., Fam. 1, pl. xi, pt. 6, 1854.
Lamellidoris bilamellata, Linné, Conch. Soc. List, p. 19; Eliot, p. 156, var. *pacifica*, Bergh.

ONCHIDORUS MURICATA (O. F. Müller, 1776).

- Doris muricata*, O. F. Müller, Zool. Dan. Prodr., p. 229, (pref. March 31), 1776: Denmark.
Lamellidoris muricata, Müller, Conch. Soc. List, p. 19; Eliot, p. 156.

ONCHIDORUS DIAPHANA (Alder & Hancock, 1845).

- Doris diaphana*, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 313, Nov. 1845: Torbay.
— — — Mon., Fam. 1, pl. x, pt. 2, 1846.
Lamellidoris diaphana, A. & H., Conch. Soc. List, p. 19; Eliot, p. 156.

ONCHIDORUS ASPERA (Alder & Hancock, 1842).

- Doris aspera*, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 32, March, 1842: Tynemouth.
— — — Mon., Fam. 1, pl. xix, pt. 6, 1854.
Lamellidoris aspera, A. & H., Conch. Soc. List, p. 19; Eliot, p. 156.

ONCHIDORUS SPARSA (Alder & Hancock, 1846).

Doris sparsa, A. & H., Ann. & Mag. Nat. Hist., vol. xviii, p. 293, Nov. 1846 : Cullercoats.

— — — Mon., Fam. 1, pl. xiv, pt. 4, 1848.

Lamellidoris sparsa, A. & H., Conch. Soc. List, p. 19 ; Eliot, p. 156.

ONCHIDORUS DEPRESSA (Alder & Hancock, 1842).

Doris depressa, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 32, March, 1842 : Whitley, Northumberland.

— — — Mon., Fam. 1, pl. xii, pt. 5, 1851.

Lamellidoris depressa, A. & H., Conch. Soc. List, p. 19 ; Eliot, p. 156.

ONCHIDORUS INCONSPICUA (Alder & Hancock, 1851).

Doris inconspicua, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 5, Fam. 1, pl. xii, 1851 : from deep-water fishing boats, Northumberland.

Lamellidoris inconspicua, A. & H., Conch. Soc. List, p. 19 ; Eliot, p. 156.

ONCHIDORUS OBLONGA (Alder & Hancock, 1845).

Doris oblonga, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 314, Nov. 1845 : Torbay.

— — — Mon., Fam. 1, pl. xvi, pt. 5, 1851.

Lamellidoris oblonga, A. & H., Conch. Soc. List, p. 19 ; Eliot, p. 156.

ONCHIDORUS ULIDIANA (Thompson, 1845).

Doris ulidiana, Thompson, Ann. & Mag. Nat. Hist., vol. xv, p. 312, May, 1845 : Belfast.

Doris ulidiæ, Thompson, Rept. Brit. Assoc. 1843, p. 250, 1844, n.n.

Lamellidoris ulideana, Thompson, Conch. Soc. List, p. 19 ; Eliot, p. 108, pl. ii, figs. 6-7, p. 156.

[Note.—Mörch (Grönland (Rink) Prodr. Fauna Moll. Grönl., p. 6, 1857) cites "*Doris liturata*, Bk. Moll." as a synonym of *D. muricata* (Müll.), Sars.]

Genus ATALODORIS, nov.

Type *Doris pusilla*, A. & H.

ATALODORIS PUSILLA (A. & H., 1845).

Doris pusilla, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 313, Nov. 1845 : Torbay.

— — — Mon., Fam. 1, pl. xiii, pt. 2, 1846.

Lamellidoris pusilla, A. & H., Conch. Soc. List, p. 19 ; Eliot missing, errore only, cf. Eliot, Journ. Marine Biol. Assoc. U.K., n.s., vol. vii, p. 343, 1906.

Genus DIAPHORODORIS, nov.

Type *Doris luteocincta*, M. Sars, as identified in *Doris beaumonti*, Farran.

DIAPHORODORIS LUTEOCINCTA (M. Sars, 1870).

Doris luteocincta, M. Sars, Nyt. Mag. f. Naturvid. Christ., vol. xvii, p. 191, 1870 : Christiana Sound.

Doris beaumonti, Farran, Rept. Sea and Inland Fisheries, Ireland, pt. 2, Scient. Invest., Append. No. 8, p. 126, pl. xviii, 1903.

Lamellidoris luteocincta, M. Sars ; Eliot, p. 109, pl. ii, figs. 8-9, p. 156.

Genus ADALARIA, Bergh, 1878.

Adalaria, Bergh, Reisen Archipel der Philippinen (Semper), Malac. Untersuch., Bd. i, Heft xiv, p. xxxiii, 1878 (Cat. Doridis).

(Archiv. f. Naturg. (Wiegmann.), Jahrg. xlv, pt. 1, p. 348, 1879.)

Type by monotypy, *Doris proxima*, A. & H.

ADALARIA PROXIMA (Alder & Hancock, 1854).

Doris proxima, A. & H., Ann. & Mag. Nat. Hist., ser II, vol. xiv, p. 103, Aug. 1, 1854 : Birkenhead.

— — — Mon., Fam. 1, pl. ix, pt. 6, 1854.

Adalaria proxima, A. & H., Conch. Soc. List, p. 19 ; Eliot, p. 155.

ADALARIA LOVENI (Alder & Hancock, 1862).

Doris loveni, A. & H., Ann. & Mag. Nat. Hist., ser III, vol. x, p. 262, Oct. 1, 1862 : Bantry Bay.

Adalaria loveni, A. & H., Conch. Soc. List, p. 19 ; Eliot, p. 108, pl. i, figs. 1-2, p. 155.

Genus ACANTHODORIS, Gray, 1850.

Acanthodoris, Gray, Figs. Mollusc. Anim., vol. iv, p. 103, (pref. Feb. 12), 1850.

Type by monotypy, *Doris pilosa*, Müller, i.e. Abildgaard.

ACANTHODORIS SUBQUADRATA (Alder & Hancock, 1845).

Doris subquadrata, A. & H., Ann. & Mag. Nat. Hist., vol. xvi, p. 313, Nov. 1845 : Torbay.

Doris quadrangulata, ibid.

Doris subquadrata, A. & H., Mon., Fam. 1, pl. xvi, pt. 5, 1851.

— *quadrangulata*, ibid., figs. 1-3.

Acanthodoris subquadrata, A. & H., Conch. Soc. List, p. 19 ; Eliot, p. 155.

ACANTHODORIS PILOSA (Abildgaard, 1789).

Doris pilosa, Abildgaard, Zool. Danica (Müller), ed. 3, vol. iii, p. 7, pl. lxxxv, figs. 5-8, 1789 : Denmark.

Doris stellata, Gmelin, Linn. Syst. Nat., ed. 13, vol. i, pt. 6, p. 3107, (May 14), 1791 ; based solely on Bomme, Act Vliss, 3, p. 298, n. 5, fig. 4.

Doris nigricans, Fleming, Edinb. Encyc. (Brewster), vol. xiv, p. 618, Nov. 1820 : Zetland (Brit. Anim., p. 283, 1828).

Doris flemingii, Forbes, Malac. Monensis, p. 3, pl. i, figs. 2-3, (pref. Feb. 28), 1838 : Isle of Man.

Doris sublævis, Thompson, Ann. Nat. Hist., vol. v, p. 87, pl. ii, fig. 1, April, 1840 : Belfast.

Doris similis, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 32, March, 1842 : Cullercoats.

Doris rocinela, Leach, Synops. Moll. Gt. Britain, p. 19, Dec. 1852 : near Sandgate and Dover, Kent.

Doris pilosa, Müller, A. & H., Mon., Fam. 1, pl. xv, pt. 5, 1851.

Acanthodoris pilosa, Müller, Conch. Soc. List, p. 19 ; Eliot, p. 155.

Family EUPHURIDÆ.

Genus PALIO, Gray, 1857.

Palio, Gray, Guide Syst. Distr. Moll. Brit. Mus., Pt. i, p. 213, 1857.

Type by monotypy, *Polycera ocellata*, A. & H.

PALIO LESSONII (Orbigny, 1837).

Polycera lessonii, Orbigny, Mag. Zool., Classe v, p. 5, pl. cv (post Nov.), 1837 : Rochelle.

(Polycera) citrina, Alder, Ann. & Mag. Nat. Hist., vol. vi, p. 340, pl. ix, figs. 7-9, Jan. 1841 : Cullercoats.

Polycera modesta, Lovén, Öfvers. K. Vetensk.-Akad. Förh. (Stockh.), vol. iii, No. 5, p. 138, May 13, 1846 : Boh.

Polycera lessonii, Orbigny, A. & H., Mon., Fam. 1, pl. xxiv, pt. 4, 1848.

Palio lessoni, Orbigny, Conch. Soc. List, p. 19.

Polycera (Palio) lessoni, Orbigny, Eliot, p. 154.

PALIO NOTHUS (Johnston, 1838).

T(riopa) nothus, Johnston, Ann. Nat. Hist., vol. i, p. 124, pl. ii, figs. 14-16, April, 1838 : Prestonpans Bay.

Polycera ocellata, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 33, March, 1842 : Cullercoats.

— — — Mon., Fam. 1, pl. xxiii, pt. 2, 1846.

Palio lessoni, var. *ocellata*, A. & H., Conch. Soc. List, p. 19.

Polycera (Palio) ocellata, A. & H. ; Eliot, p. 154.

Genus POLYCERA, Cuvier, 1816.

Polycera, Cuvier, Règne Animal, vol. ii, p. 389, "1817," i.e. Dec. 1816.

Type by subsequent designation, Gray, Proc. Zool. Soc. (Lond.), 1847, p. 165 : *Doris quadrilineata*, Müller.

Themisto, Oken, Lehrb. Naturg., Th. iii, Zool. pt. 1, pp. x, 278, 1815. Type *Doris quadrilineata*, Müller.

Not *Themisto*, Oken, Goetting. gelehrte Anz., 1807, p. 1168.

Cufæa, Leach, Synops. Moll. Gt. Britain, p. 21, Dec. 1852.

Type by monotypy, *Doris flava*, Montagu.

POLYCERA QUADRILINEATA (O. F. Müller, 1776).

Doris quadrilineata, O. F. Müller, Zool. Dan. Prodr., p. 229 (pref. March 31), 1776 : Denmark.

Doris cornuta, Rathke, Zool. Dan. (Müller), ed. 3, vol. iv, p. 29, pl. 145, figs. 1-3, 1806 (ex Abildgaard MS.) : Heligoland.

Doris flava, Montagu, Trans. Linn. Soc. (Lond.), vol. vii, p. 79, pl. vii, fig. 6, 1804 : Devon.

Policere lineatus, Risso, Hist. Nat. Europ. Mérid., vol. iv, p. 30, Nov. 1826 : Nice.

Polycera ornata, Orbigny, Mag. Zool., Classe v, p. 9, pl. cvii (post Nov.), 1837 : Brittany Coast.

Polycera typica, Thompson, Ann. Nat. Hist., vol. v, p. 92, pl. ii, fig. 5, April, 1840 : Strangford Lough, Ireland.

Polycera quadrilineata, var. *nonlineata*, ibid., fig. 6, ibid.

Polycera quadrilineata, var. *nigrolineata*, Dautzenberg & Durouchoux, Feuille jeunes naturalistes Paris, sér. v, An. 43, Suppl., No. 514, p. 8, Oct. 1, 1913 : Saint Malo, France.

Polycera quadrilineata, Müller ; A. & H., Mon., Fam. 1, pl. xxii, pt. 5, 1851 ; Conch. Soc. List, p. 19 ; Eliot, p. 154.

Genus THECACERA, Fleming, 1828.

Thecacera, Fleming, Hist. Brit. Anim., p. 283, March, 1828.

Type by original designation, *Doris pennigera*, Montagu.

THECACERA PENNIGERA (Montagu, 1815).

Doris pennigera, Montagu, Trans. Linn. Soc. (Lond.), vol. xi, p. 17, pl. iv, fig. 5, 1815 : Milton, Devon.

Thecacera pennigera, Montagu, A. & H., Mon., Fam. 1, pl. xxi a, pt. 7, 1855 ; Conch. Soc. List, p. 19 ; Eliot, p. 153.

THECACERA VIRESSENS, Forbes & Hanley, 1851.

Thecacera virescens, Forbes & Hanley, Hist. Brit. Moll. (pts. xli, xlvi), vol. iii, p. 576, Sept. 1, 1851 : Falmouth (ex A. & H. MS.).

— — — A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. viii, p. 290, Oct. 1, 1851 : Falmouth.

— — — A. & H., Conch. Soc. List, p. 19 ; Eliot, p. 153.

THECACERA CAPITATA, Alder & Hancock, 1854.

Thecacera capitata, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv, p. 103, Aug. 1, 1854 : St. Ives, Cornwall.

— — — Conch. Soc. List, p. 19 ; Eliot, p. 153.

Genus CRIMORA, Alder & Hancock, 1862.

Crimora, A. & H., Ann. & Mag. Nat. Hist., ser. III, vol. x, p. 263, Oct. 1, 1862.

Type by monotypy, *C. papillata*, nov.

CRIMORA PAPILLATA, Alder & Hancock, 1862.

Crimora papillata, A. & H., Ann. & Mag. Nat. Hist., ser. III, vol. x, p. 263, Oct. 1, 1862: Guernsey.

— — Conch. Soc. List, p. 19; Eliot, p. 107, pl. ii, figs. 1-5, p. 153.

[Genus ISSENA, nom. nov.

ISSA LACERA, Abildgaard. *Issa* was introduced by Bergh (Verh. k. k. zool.-bot. Gesell. Wien, vol. xxx, p. 645, 1880) to replace *Colga*, Bergh, Proc. Acad. Nat. Sci. Philad., p. 112, 1880, but unfortunately *Issa* had been proposed anteriorly by Walker, Journ. Linn. Soc. (Zool.), vol. ix, p. 198, 1867. We therefore propose *Issena*, nom. nov.

Doris lacera, "Abildgaard," Rathke, Zool. Danica (Müller), 3rd ed., vol. iv, p. 23, pl. cxxxviii, figs. 3-4, 1806: Norway, is, moreover, anticipated by *Doris lacera*, Cuvier, Ann. Mus. Hist. Nat. Paris, vol. iv, p. 453, pl. i, figs. 1-3, Aug. 1804, given to a different species collected by Péron.

Bergh, Bull. Mus. Comp. Zool., vol. xxv, No. 10, p. 189, pl. ix, figs. 3-11, Oct. 1894, proposed *Issa lacera*, var. *pacifica*: north-west of Unimak Island, Alaska, 43 fathoms, and the varietal name will now become the specific, *Issena pacifica*.]

Genus EUPHURUS, Rafinesque, 1815.

Euphurus, Rafinesque, Analyse de la Nature, p. 142, 1815.

New name for "*Tritonia*, Lam."

Type by monotypy, *Doris clavigera*, Müller.

Tritonia, Lamarck, Syst. Anim. s. Vertebr., p. 65, Jan. 1801.

Type by monotypy, *Doris clavigera*, Müller.

Not *Tritonia*, Meigen, Nouv. Class. Mouches, p. 33, 1800.

Triopa, Johnston, Ann. Nat. Hist., vol. i, p. 123, April, 1838.

Type by original designation, *Doris clavigera*, Müller.

EUPHURUS CLAVIGER (O. F. Müller, 1776).

Doris clavigera, O. F. Müller, Zool. Dan. Prodr., p. 229, (pref. March 31), 1776: Denmark.

Tergipes pulcher, Johnston, Mag. Nat. Hist. (Loudon), vol. viii, p. 490, fig. 59 in text, Oct. 1835: Berwick Bay.

Euplocomus plumosus, Thompson, Ann. Nat. Hist., vol. v, p. 90, pl. ii, fig. 4, April, 1840: Strangford Lough.

Triopa clavigera, Müller, A. & H., Mon., Fam. 1, pl. xx, pt. 4, 1848; Conch. Soc. List, p. 19; Eliot, p. 152.

Family ÆGIRETIDÆ.

Genus ÆGIRES, Lovén, 1844.

Ægires, Lovén, Öfvers. k. Vet. Akad. Förh. (Stockh.), vol. i, p. 49, March 20, 1844.

Type by monotypy, *Polycera punctilucens*, Orbigny.

ÆGIRES PUNCTILUCENS (Orbigny, 1837).

- Polycera punctilucens*, Orbigny, Mag. Zool., Classe v, p. 7, pl. cvi, (*post Nov.*), 1837 : Brest.
- Doris maura*, Forbes, Ann. Nat. Hist., vol. v, p. 103, pl. ii, fig. 17, April, 1840 : Campbelltown, Argyllshire.
- Ægirus punctilucens*, Orbigny, A. & H., Mon., Fam. 1, pl. xxi, pt. 4, 1848.
- Ægires punctilucens* (d'Orbigny). Conch. Soc. List, p. 19 ; Eliot, p. 151.

Super-family *CRYPTOBRANCHIATÆ*.

Family DORIDIGITATIDÆ.

Genus CADLINA, Bergh, 1879.

- Cadlina*, Bergh, Proc. Acad. Nat. Sci. Philad., 1879, p. 114.
Type by original designation, *Doris repanda*, A. & H. =
Doris laevis, Linné.
- Acanthochila*, Mörch, Vidensk. Meddel. naturh. Foren. Kjoben, 1868, p. 202.
Type by monotypy, *Doris laevis*, Linn. (= *D. repanda*, A. & H.).
Not *Acanthocheila*, Stål, 1860, Hemiptera.

CADLINA LÆVIS (Linné, 1767).

- Doris laevis*, Linné, Syst. Nat., ed. 12, p. 1083, 1767 : Oceano Norvegico.
- Doris obvelata*, O. F. Müller, Zool. Dan. Prodr., p. 229, (pref. March 31), 1776 : Denmark.
- Doris marginata*, Montagu, Trans. Linn. Soc. (Lond.), vol. vii, p. 79, pl. vii, fig. 7, 1804 : Devon.
- Doris repanda*, A. & H., Ann. & Mag. Nat. Hist., vol. ix, p. 32, March, 1842 : Cullercoats.
— — — Mon., Fam. 1, pl. vi, pt. 3, 1847.
- Cadlina obvelata*, Müller, Conch. Soc. List, p. 19.
— *repanda*, A. & H., Eliot, p. 150.

Genus ALDISA, Bergh, 1878.

- Aldisa*, Bergh, Reisen Archipel der Philippinen (Semper), Malac. Untersuch., Bd. i, Heft xiv, p. xxxviii, (Cat. Doridis) 1878 (Archiv. fur Naturg. (Wiegmanns.), xlvi Jahr., pt. 1, p. 348, 1879).
Type by monotypy, *Doris zetlandica*, A. & H.

ALDISA ZETLANDICA (Alder & Hancock, 1854).

- Doris zetlandica*, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv, p. 102, Aug. 1, 1854 : Shetland.
- Aldisa zetlandica*, A. & H., Conch. Soc. List, p. 19 ; Eliot, p. 105, pl. i, figs. 3-4, p. 150.

Genus *ROSTANGA*, Bergh.

Rostanga, Bergh, Arch. f. Naturg. (Wiegm.), Jahrg. xlv, pt. 1, p. 353, 1879.

Type by monotypy, *Doris coccinea*, "Forbes," A. & H.

Rhabdochila, Fischer, Man. Conch., fasc. vi, p. 521, Dec. 20, 1883.

Type here designated "*D. coccinea*, Forbes", cited by Fischer as example of *Rostanga*, Bergh, i.e. of A. & H.

ROSTANGA RUFESCENS, nom. nov.

Doris coccinea, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 4, Fam. 1, pl. vii, 1848 (? Forbes): Cornish Coast.

[*Doris coccinea*, Forbes, Rept. Brit. Assoc. 1843, p. 133, (Aug.) 1844: Aegean Sea; *n.n.*

Doris coccinea, ibid., p. 193; new name for *D. argo* of many British authors; *D. argo*, Forbes = *Doris flammea*, A. & H.]

Rostanga coccinea, A. & H., Conch. Soc. List, p. 19; Eliot, p. 149.

Genus *JORUNNA*, Bergh, 1876.

Jorunna, Bergh, Reisen Archipel der Philippinen (Semper), Malac. Untersuch., Bd. i, Heft x, p. 413, note, 1876.

Type by monotypy, *Doris johnstoni*, A. & H. *

JORUNNA TOMENTOSA (Cuvier, 1804).

Doris tomentosa, Cuvier, Ann. Mus. Hist. Nat. Paris, vol. vi, p. 470, Aug. 1804: La Rochelle.

Doris johnstoni, A. & H., Mon. Nudib. Moll. (Ray Soc.), pt. 1, Fam. 1, pl. v, (reviewed Oct. 1), 1845: (new name for *Doris obvelata*, Johnston, not Müller).

Jorunna johnstoni, A. & H., Conch. Soc. List, p. 19; Eliot, p. 149. Note.—This synonymy was pointed out by Fischer (Journ. de Conchyl., vol. xvii, p. 6, 1869) and confirmed by Cuénot (Trav. Lab. Soc. Sci. Arcachon Stat. Biol., Univ. de Bord., vol. vii, p. 17, 1903, 1904, received B.M. Oct. 5).

Genus *GEITODORIS*, Bergh, 1891.

Geitodoris, Bergh, Zool. Jahrb., Syst., vol. vi, p. 130, 1891.

Type by monotypy, *Doris complanata*, Verrill.

GEITODORIS PLANATA (Alder & Hancock, 1846).

Doris planata, A. & H., Ann. & Mag. Nat. Hist., vol. xviii, p. 292, Nov. 1846: Lamlash Bay.

— — — Mon., Fam. 1, pl. viii, pt. 3, 1847.

Geitodoris planata, A. & H.; Eliot, p. 104, p. 148; cf. Eliot, Proc. Malac. Soc. (Lond.), vol. vi, p. 180, 1904.

Genus *APORODORIS*, Ihoring, 1886.

Aporodoris, Ihoring, Jahrb. Malak. Gesell., vol. xiii, Heft 3, p. 238, (received B.M. Nov. 18), 1886.

Type by original designation, *Doris millegrana*, A. & H.

APORODORIS MILLEGRANA (Alder & Hancock, 1854).

Doris millegrana, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv, p. 102, Aug. 1, 1854: Torbay.

Thordisa ? dubia, Bergh, Bull. Mus. Comp. Zool. (Harvard), vol. xxv, No. 10, p. 178, pl. vi, figs. 6-9, Oct. 1894: near Rio Janeiro, "West Atlantic."

Aldisa millegrana, A. & H., Conch. Soc. List, p. 19.

Aporodoris millegrana, A. & H.; Eliot, pp. 106, 149.

Genus ARCHIDORIS, Bergh, 1878.

Archidoris, Bergh, Reisen Archipel der Philippinen (Semper), Malac. Untersuch., Bd. i, Heft xiv, p. 616, 1878.

Type by original designation, *Doris tuberculata*, A. & H.

Anoplodoris, Fischer, Man. Conch., fasc. vi, p. 521, Dec. 20, 1883.

Type here designated "*D. tuberculata*, Linné" cited by Fischer as example of *Archidoris*, Bergh, i.e. of A. & H. *supra*.

ARCHIDORIS BRITANNICA (Johnston, 1838).

Doris britannica or *D. montagui* [sic], Johnston, Ann. Nat. Hist., vol. i, p. 52, March, 1838, ex Brit. Mus. (Scotch specimens figured on pl. iii, figs. 1-3).

Doris mera, A. & H., Ann. & Mag. Nat. Hist., vol. xiv, p. 330, Nov. 1844: Cullercoats.

Doris tuberculata, auctt., but not *Doris tuberculata*, Cuvier, Ann. Mus. Hist. Nat. Paris, vol. iv, p. 469, pl. ii, fig. 4, Aug. 1804: Ile de Ré.

Doris tuberculata, Cuvier; A. & H., Mon., Fam. 1, pl. iii, pt. 6, 1854.

Archidoris tuberculata, Cuvier, Conch. Soc. List, p. 19.

Doris (Archidoris) tuberculata, Cuvier; Eliot, p. 148.

ARCHIDORIS FLAMMEA (Alder & Hancock, 1844).

Doris flammea, A. & H., Ann. & Mag. Nat. Hist., vol. xiv, p. 330, Nov. 1844: Rothesay Bay.

— — — Mon., Fam. 1, pl. iv, pt. 1, 1845.

Archidoris flammea, A. & H., Conch. Soc. List, p. 19.

Doris (Archidoris) flammea, A. & H.; Eliot, p. 148.

ARCHIDORIS STELLIFERA, Vayssi  re, 1904.

Archidoris stellifera, Vayssi  re, Journ. de Conchyl., vol. lii, p. 123, pl. iv, (ante July), 1904, ex Ihering MS.: Marseille.

Doris testudinaria, A. & H., Ann. & Mag. Nat. Hist., ser. III, vol. x, p. 261, 1862.

Platydoris testudinaria, Risso, Conch. Soc. List, p. 19.

Doris (Archidoris) testudinaria, A. & H.; Eliot, p. 99, pl. i, figs. 5-8, p. 148.

Not *Doris testudinaria*, Risso, Journ. de Physique, vol. lxxxvii, p. 370, Nov. 1818, which according to Bergh is *Doris argo*, Linn  , 1767, type of *Platydoris*, Bergh, and *Argus*, Bohadsch, 1761.

Genus DORIDIGITATA, Orbigny, 1839.

Doridigitata, Orbigny, Hist. Nat. Île Canaries (Webb et Berthelot), vol. ii, pt. 2, Moll., p. 39, 1839.

Type by monotypy, *D. bertheloti*, nov.

Doris of some authorities, not *Doris*, Linné, Syst. Nat., ed. 10, p. 653, 1758.

Staurodoris, Bergh, Reisen Archipel der Philippinen (Semper), Malac. Untersuch., Bd. i, Heft xiii, p. 578, 1878.

Type *Doris verrucosa*, Bergh, ex Cuvier.

DORIDIGITATA DERELICTA (Fischer, 1867).

Doris derelicta, Fischer, Journ. de Conchyl., vol. xv, p. 7, Jan. 1867 : new name for *D. verrucosa*, auctt. : Arcachon, France.

Doris seposita, ibid., p. 8 : ibid.

? *Doris eubalia*, ibid., p. 10 : ibid.

Doris biscayensis, ibid., vol. xx, p. 6, Jan. 1, 1872 : ibid.

Doris verrucosa, auctt., but not *Doris verrucosa*, Linné, Syst. Nat., ed. 10, p. 653, 1758 : Amborne.

Staurodoris verrucosa, var. *mollis*, Eliot, Journ. Marine Biol. Assoc., n.s., vol. vii, p. 338, 1906.

Doris (Staurodoris) verrucosa, Eliot, pp. 96, 97 ; var. *mollis*, p. 97.

DORIDIGITATA STICTA, nom. nov.

Doris maculata, Garstang, Journ. Marine Biol. Assoc. U.K., n.s., vol. iv, p. 167, Feb. 1896 : Plymouth.

Not *Doris maculata*, Montagu, Trans. Linn. Soc. (Lond.), vol. vii, p. 80, pl. vii, fig. 9, 1804 : Devon.

Lamellidoris maculata, Garstang, Conch. Soc. List, p. 19.

Doris (Staurodoris) maculata, Garstang, Eliot, p. 98, pl. viii, figs. 6, 7, p. 147.

Super-family ZONABRANCHIATÆ, nov.

Family DUVAUCELIIDÆ.

Genus SPHÆROSTOMA, Macgillivray, 1843.

Sphaerostoma, Macgillivray, Hist. Moll. Anim. Aberd., p. 335, (pref. March 6), 1843.

Type by monotypy, *S. jamesoni*, nov. = *Tritonia hombergi*, Cuvier.

Tritonia, Cuvier, Ann. Mus. Hist. Nat. (Paris), vol. i, p. 483, pls. xxxi and xxxii, April, 1803.

Type by monotypy, *T. hombergi*, nov.

Not *Tritonia*, Cuvier, Tabl. Élem. Hist. Nat., p. 387, "1798" (Dec. 24, 1797) ; diagnosis only : ibid., Leçons Anat. Comparée, vol. i, table v, April 19, 1800, name only : Lamarck, Syst. Anim. s. Vert., p. 65, Jan. 1801 ; sole example, *Doris clavigera*, Müller.

Necromantes, Gistel, Naturg. Thierr. f. Schulen, p. xi, (pref. Easter, 1847), 1848.

New name for *Tritonia*, Cuvier (1803).

Liriope, Gistel, ibid., p. 171.

Type by monotypy, *Tritonia (hombergi)*, Cuvier.

SPHÆROSTOMA HOMBERGII (Cuvier, 1803).

Tritonia hombergii, Cuvier, Ann. Mus. Hist. Nat. Paris, vol. i, p. 483, pls. xxxi and xxxii, April, 1803 : Havre.

Doris fimbriata, Rathke, Zool. Danica (Müller), ed. 3, vol. iv, p. 22, pl. cxxxviii, fig. 2, 1806 (ex Vahl MS.) (*fide* Odhner) : Norway.

Sphærostoma jamesoni, Macgillivray, Hist. Moll. Anim. Aberd., p. 335, (pref. March 6), 1843 : Aberdeen.

Tritonia atrofusca, ibid., p. 346 : ibid.

Tritonia hombergi, Cuvier ; A. & H., Mon., Fam. 2, pls. i, ii, pt. 7, 1855 ; Conch. Soc. List, p. 18 ; Eliot, p. 146.

Genus DUVAUCELIA, Risso, 1826.

Duvaucelia, Risso, Hist. Nat. Europ. Mérid., vol. iv, p. 38, Nov. 1826, ex Leach MS.

Type by monotypy, *D. gracilis*, nov.

Candiella, Gray, Figs. Mollusc. Anim., vol. iv, p. 106, (pref. Feb. 12), 1850.

Type by monotypy, *Tritonia plebeia*, Johnston.

DUVAUCELIA PLEBEIA (Johnston, 1828).

Tritonia plebeia, Johnston, Edinb. New Phil. Journ. Sci. Arts, vol. v, p. 77, June, 1828 : Sea near Berwick.

Tritonia pulchra, ibid., p. 78 : ibid.

Tritonia plebeia, Johnston, A. & H., Mon., Fam. 2, pl. iii, pt. 3, 1847.

Tritonia (Candiella) plebeia, Johnston, Conch. Soc. List, p. 18 ; Eliot, p. 146.

DUVAUCELIA LINEATA (Alder & Hancock, 1848).

Tritonia lineata, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. i, p. 191, March 1, 1848 (ex Athenæum, No. 1028, p. 748, July 10, 1847, n.n.) : Scarborough, England.

— — — Mon., Fam. 2, pl. xiv, pt. 5, 1851.

Tritonia (Candiella) lineata, A. & H., Conch. Soc. List, p. 18 ; Eliot, p. 146.

Genus CANDELLISTA, nov.

Type *Tritonia alba*, A. & H.

CANDELLISTA ALBA (Alder & Hancock, 1854).

Tritonia alba, A. & H., Ann. & Mag. Nat. Hist., ser. II, vol. xiv, p. 104, Aug. 1, 1854 : Cullercoats.

— — — Mon., pt. 7, App. p. vi, 1855.

Tritonia (Candiella) alba, A. & H., Conch. Soc. List, p. 18; Eliot, p. 93, pl. i, fig. 10, p. 146.

Achille Costa in the Ann. Mus. Zool. Napoli, An. iii, "1863" (pref. Dec. 15, 1866), described *Æolis gigas*, p. 65, pl. i, fig. 2; *A. argenteolineata*, p. 66, pl. i, fig. 3; *A. digitata*, p. 68, pl. i, fig. 6; *A. robrovittata*, p. 70, pl. ii, fig. 2; *Flabellina inornata*, p. 72, pl. ii, fig. 6; *Favorinus versicolor*, p. 73, pl. ii, figs. 4, 5; *Embletonia viridis*, p. 75, pl. iii, figs. 1, 2; *E. nigrovittata*, p. 75, pl. iii, fig. 3; *Tenellia*, gen. nov., p. 76, type (mono.) *T. mediterranea*, p. 76, pl. iii, fig. 7; *Hermæa lutescens*, p. 79, pl. iii, fig. 5; *Hermæa orbicularis*, p. 79, pl. iii, fig. 6, p. 80; *Hymenæolis* (named on p. 64) (mono.) *elegantissima*.

In the next volume, An. iv, "1864" (pref. Dec. 1867), Achille Costa continued *Hymenæolis*, nov. gen., p. 28, type (mono.) *H. elegantissima*, p. 29, pl. i, figs. 1-3; *Alderia comosa*, p. 32, pl. ii, fig. 3; *Flabellina verrucicornis*, p. 35, pl. ii, fig. 4; *Embletonia funerea*, p. 36, pl. ii, fig. 5; and *Hermæa brevicornis*, p. 37, pl. ii, fig. 6.

In a book entitled *Descr. Genova*, vol. i, pt. ii, 1846, Verany describes a large number of new species with short diagnoses, more fully describing and figuring a few in the succeeding pages. These are: *Doris nardii*, pp. 96, 100; *D. calcara*, p. 96; *D. pasinii*, p. 96; *D. orsinii*, p. 96; *D. sismondæ*, pp. 96, 101; *D. rissæ*, p. 96; *D. villæ*, p. 97; *D. piraini*, p. 97; *D. schembrii*, p. 97; *D. porri*, pp. 97, 102; *D. krohnii*, p. 97; *D. paretii*, pp. 97, 102, pl. ii, figs. 4, 5; *Lomanotus genei*, pp. 97, 102, pl. ii, fig. 6; *Tritonia costæ*, pp. 97, 103, pl. ii, figs. 7, 8; *Calliopea souleyetii*, p. 97; *Janus spinolæ*, pp. 97, 104, pl. ii, fig. 9; *Æolidia panizzæ*, p. 97; *E. flabellina*, pp. 97, 105; *E. affasciata*, "Lam.", p. 97; *E. janii*, p. 97; *E. demartinii*, p. 97; *E. rusconii*, p. 97; *E. cavolinii*, p. 97; *E. deflippii*, pp. 97, 106; *E. bellardii*, p. 97; *E. durazzii*, p. 97; *E. balsamii*, pp. 97, 107; *E. gandolfii*, p. 97; *E. whately*, p. 97; *E. bassii*, p. 97; *E. casarettii*, p. 97; and *E. tergipedina*, pp. 97, 108.

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MALACOLOGICAL SOCIETY OF LONDON.

ACCOUNTS FOR YEAR ENDED 31ST DECEMBER, 1922.

INCOME AND EXPENDITURE ACCOUNT.

Dr.	£ s. d.	Cr.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
To Balance, 1st January, 1922	44 19 0	By Cost of Proceedings:					
,, Annual Subscriptions for 1922	88 4 6	Vol. XIV, Pts. 5 and 6.					
,, Arrears	3 12 0	Printing and					
		Postage .	77 19 9				
		Illustrations and					
		Blocks .	3 12 10				
				81 12 7			
		Vol. XV, Pt. 1.					
		Printing and					
		Postage .	50 19 6				
		Illustrations and					
		Blocks .	5 7 9				
				56 7 3			
		Vol. XV, Pts. 2 and 3.					
		Estimated cost	75 0 0				
				212 19 10			
		Less Provision made in					
		Account for 1921 .	. 77 19 9				
				135 0 1			
		Linnean Society:—					
		Expenses of Room .	. 5 0 0				
		Gratuities to Attendant .	. 2 0 0				
				7 0 0			
		" Printing and Stationery .	. . .			
		" Postages .	. . .			
		" Balance, being Excess of Income over	. . .				
		Expenditure .	. . .			
				72 16 5			

LIFE MEMBERSHIP FUND.

	£ s. d.	£ s. d.	£ s. d.
To Amount of Fund, 1st January, 1922	170 13 0	By Transfer to Income and Expenditure Account	8 19 0
," Dividends on Investments	8 19 0	,, Amount of Fund, 31st December, 1922	170 13 0
	<hr/>	<hr/>	<hr/>
	£179 12 0		

BALANCE SHEET.

Liabilities.	£ s. d.	Assets.
Annual Subscriptions paid in advance	12 2 4	Investments—
Provision for cost of <i>Proceedings</i> , Vol. XV,	75 0 0	£50 Metropolitan 2½% Consolidated Stock, valued at
Pts. 2 and 3	170 13 0	. . . . . 25 0 0
Life Membership Fund	72 16 5	£154 0s. 6d. 5% War Loan, at cost : 135 4 0
Balance of Income and Expenditure Account	<hr/>	Cash at Bankers 170 7 9
	<hr/>	<hr/>
	£330 11 9	£330 11 9

Assets in addition to those shown in the Balance Sheet are (a) Stock of unsold publications ; (b) Annual Subscriptions in arrear.

Audited and found correct, 6th February, 1923.

CHAS. OLDFHAM } Auditors.
A. J. PEILE }

R. BULLEN NEWTON, Hon. Treasurer.

ANNUAL GENERAL MEETING.

FRIDAY, 9TH FEBRUARY, 1923.

A. S. KENNARD, F.G.S., President, in the Chair.

Capt. Diver and Mr. Fulton were appointed scrutineers.

The following report was read :—

"The Council have pleasure in presenting their Thirtieth Annual Report and in recording that the work of the Society is still well maintained. The usual monthly meetings have been held, and the communications continue to be of a high standard.

"The membership roll remains about the same, though it is to be desired that a greater proportion of younger candidates for membership could be obtained so that the number of members may be maintained and the Society's work carried on in years to come.

"The Council regret to announce that since their last report news came to hand of the death at the end of 1921 of Dr. Jousseaume, whose loss the Society deplores.

"During the year one single and one double number of the *Proceedings*, forming Vol. XV, Parts 1 to 3, were issued in April and December respectively.

"They comprised 152 pages of text, with two plates, and frontispiece (portrait of the Rev. Dr. A. H. Cooke, President 1913–15), and six sets of figures. Drawings or photographs for the illustrations were furnished by Dr. A. E. Boycott, Major M. Connolly, the Rev. Dr. A. H. Cooke, Col. A. J. Peile, and R. Winckworth.

"Once again the cordial thanks of the Society are due to the Council of the Linnean Society for their continued kindness in permitting the meetings of the past year to be held in their apartments."

The Treasurer presented the statement of income and expenditure for the year ended 31st December, 1922.

On the motion of the President, seconded by Mr. Oldham, the foregoing report and statement of accounts were adopted.

The following were elected Officers and Council for the year 1923 :—

President.—A. S. Kennard, F.G.S.

Vice-Presidents.—Dr. A. E. Boycott, F.R.S.; Chas. Oldham, F.L.S.; G. K. Gude, F.Z.S.; Lieut.-Col. A. J. Peile.

Treasurer.—R. Bullen Newton, I.S.O., F.G.S.

Editor.—B. B. Woodward, F.L.S.

Secretary.—A. E. Salisbury.

Six other Members of the Council.—H. O. N. Shaw, F.Z.S.; T. Iredale; Dr. E. W. Bowell; Hugh Watson; J. R. Le B. Tomlin, F.E.S.; W. J. Wintle, F.Z.S.

A vote of thanks to retiring Officers, Members of the Council, the Auditors, and Scrutineers terminated the proceedings.

ORDINARY MEETING.

FRIDAY, 9TH FEBRUARY, 1923.

A. S. KENNARD, F.G.S., President, in the Chair.

The President announced the death of Col. Wilmer.

Mr. Arthur G. Wrigley and Mr. J. Marwick were elected to membership of the Society.

The President then delivered his Address on "The Holocene non-marine Mollusca of England".

On the motion of Mr. R. Bullen Newton, seconded by Mr. Tomlin, a vote of thanks to the President for his address was passed, with the request that he would allow the same to be printed *in extenso* in the *Proceedings* of the Society.

ORDINARY MEETING.

FRIDAY, 9TH MARCH, 1923.

Lieut.-Col. A. J. PEILE, Vice-President, in the Chair.

Mr. James Zetec was elected to membership of the Society.

Mr. Bullen Newton read an obituary notice of the late Col. Wilmer.
The following communications were read :—1. "Note on *Littorina rudis*, Maton, var. *altilcola*, Dacie." By J. C. Dacie.2. "Note on the Genus *Stenochiton* (order Polyplacophora) and the discovery and recognition of the type of Blainville's *Chiton longicymba* in *Stenochiton juloides*, Ad. and Ang." By Edwin Ashby, F.L.S.

The following exhibits were made :—

By Mr. Tomlin : Foreign specimens of *Euparypha pisana*; and *Arion subfuscus*, a new record for east Sussex.

By Mr. Salisbury : A curious miniature set of specimens illustrating the Linnean Genera.

By Col. Peile : A curious form of *Helix aspersa*.By Mr. Dacie : Examples of *Littorina* illustrating his paper.

SPECIAL GENERAL MEETING.

FRIDAY, 13TH APRIL, 1923.

The following resolution was proposed and duly passed :—

That Rule XI be altered to read as follows :—

"That the management of the Society be vested in a President, six Vice-Presidents, a Treasurer, a Secretary, an Editor, and nine other members, who shall constitute a Council to be elected annually at the Annual General Meeting by Ballot, and that the two senior Vice-Presidents and three other members of the Council shall retire annually and shall not be eligible for re-election to their respective offices until the next Annual General Meeting."

ORDINARY MEETING.

FRIDAY, 13TH APRIL, 1923.

A. S. KENNARD, F.G.S., President, in the Chair.

The President alluded to the loss Malacological science had sustained by the recent death of F. W. Harmer, F.G.S., whose work in connexion with the Crag Mollusca was well known to all.

Dr. H. E. Quick was elected to membership of the Society.

The following communications were read :—

1. "On the external characters of *Sigaretus*." By G. C. Robson, F.Z.S.

2. "On the anatomy of *Helix (Otala) companyii*, Aler." By the late Charles Ashford ; read by the President.

The following exhibits were made :—

By Mr. Kennard : A series of rare tracts dealing with Mollusca.

By Mr. Leslie Cox : Species of *Taia* received from Dr. Annandale for the British Museum Collection.

By Mr. Tomlin : A number of rare species dredged in deep water off the Cape of Good Hope, many of them new, including *Turritella ferruginea*, Rve., *T. declivis*, Ad. and Rve., *T. excavata*, Sow., a new *Latiaxis*, two new *Columbarium*, a *Eudolium*, a new *Glyptenthira*, etc.

By Mr. B. B. Woodward : The copy of a rare pamphlet, "Énumération des Plantes rares ou remarquables ainsi que des Mollusques terrestres et d'eau douce de l'île de Corse. Extrait de l'édition française de 'Southward Ho !' ou Notes sur l'île de Corse, par Thomasina Campbell." Ajaccio, 1872. This addition to the French translation of "Southward Ho !" occupies pp. 291-320 of that edition, but the reprint of pp. 30 exhibited cannot so far be traced in any bibliography. The introductions to the two sections are signed "R. J. S." and "R. I. S." respectively, and manifestly stand for the well-known naturalist Robert James Shuttleworth.

By Col. Peile : *Pæcilonzonites cupula*, Gulick, typical and a new variety differing in the colour markings ; *P. circumfirmatus*, var. *discrepans*, Pfr., and a new form allied thereto and flatter than any hitherto recorded.

OBITUARY.

COL. L. WORTHINGTON-WILMER, 1838-1923.

IT is with deep regret that we have to record the death of Lieut.-Col. Lewis Worthington-Wilmer, one of the original members of our Society, which took place at his residence in the Isle of Wight on the 8th January of this year, in his 85th year.

He was born at Naples on 25th September, 1838, receiving his education at Cheltenham College and afterwards obtaining a commission in the 90th Light Infantry, now the Cameronians, at the early age of 17. In due course he proceeded to India, and fought with distinction in some of the noted engagements of that time, being present throughout the Mutiny campaign of 1857-8, including the Relief of Lucknow under Sir Colin Campbell, and the later operations at Oude directed by Sir James Outram.

During his long period of retirement from the Army he was actively engaged, almost to the last, in many and varied pursuits, taking a considerable interest in Conservative propaganda, the Primrose League, and the League of Mercy, whilst in the late war he did much recruiting work, besides serving on the military tribunal. He will, however, be long remembered by his scientific friends as an excellent all-round field naturalist, being more ardently devoted perhaps to the study of conchology than to the other groups of animal life.

During his travels to various parts of the world he amassed a considerable collection of both recent and fossil shells, and was ever most generous in presenting some of his best material to both British and American museums. Notwithstanding such withdrawals, his son, Major G. R. Worthington-Wilmer, informs the writer that the collection of recent shells at the present time numbers something like 40,000 specimens. When on military duty in the Andaman Islands he dredged many marine shells, which he gave to the British Museum, these being described and figured by the late E. A. Smith in 1878, one of the new forms receiving the name of *Pleurotoma wilmeri*. He had a considerable acquaintance with the geology of the West Indies, gained from a study of the Tertiary faunas of that region, making most interesting collections on his different visits, especially from the Panama country and Jamaica, his fossils being presented to the Geological Department of the British Museum. Coming nearer home, it should be mentioned that he obtained a sound knowledge of the geology of the Isle of Wight, being chiefly interested in the Lower Cretaceous (Aptian) rocks developed at Sandown Bay, where on and off for some years he collected many molluscan and other remains which were, also, given to the National Collection.

A specimen representing a large cephalopod, *Crioceras bowerbanki*,

which unfortunately is not at the British Museum, was referred to by our deceased friend in a published note (Proc. Mal. Soc. for 1917); it was discovered in beds of similar age (Aptian) at Walpen Chine, south-west of the Isle of Wight, and was of interest as fixing the locality of J. de C. Sowerby's type of *C. bowerbanki*.

It was only in the very early history of the Society, when the late Col. Wilmer was resident in London, that he occasionally attended its meetings; although it is of interest to state that he was elected a member of the Council for the years 1897-9.

The writer of this notice had the privilege of a long acquaintance with the deceased, who during his visits to London seldom missed calling at the Geological Department of the British Museum, where he would consult specimens and books and ask advice on prospective collecting expeditions. He was a delightful companion in the field, the writer preserving many pleasant memories of a visit to his residence at Ryde, when daily excursions were made to the rocks of Sandown Bay in quest of Aptian fossils.

R. BULLEN NEWTON.

PRESIDENTIAL ADDRESS.

THE HOLOCENE NON-MARINE MOLLUSCA OF ENGLAND.

By A. S. KENNARD, F.G.S.

Delivered 9th February, 1923.

MALACOLOGY, like other sciences, contains within its borders many branches of research. There is the literary side, partly the result of the laws of nomenclature, necessitating a knowledge of books and all that pertains thereto. This, though sometimes derided by superficial critics, does enable one to become acquainted with the literature of the subject, an extremely important factor in all scientific work. Judging by some recent work there is, alas, too often a tendency to consider that all previous work can be safely ignored, a misconception attended by disastrous results. Anatomy, Ecology, Embryology, Genetics, Palaeontology, and Systematics all form part of that science which we are banded together to promote, whilst the importance of the mollusca as food, the value of their "gouty" products as gems, and the fact that some species are the intermediate hosts of deadly internal parasites, of Man and domesticated animals, enable us to add Economics as well. For myself the borderland between palaeontology and zoology has always been a very attractive sphere, and to-night I would crave the indulgence of the Members and endeavour to place before them the results of recent work on the Holocene Non-marine Mollusca of England. For various reasons into which there is no need to enter, this branch of study is a comparatively recent one, and even the use of the word Holocene with us only dates from 1897 (*Essex Naturalist*, x, July, 1897, p. 92 and table; and *Quart. Journ. Geol. Soc.*, vol. liii, p. 434).¹

With regard to the history of the subject, the earliest reference I can trace is the account of a deposit and its contained mollusca at Mears Ashby in Northamptonshire by the Rev. J. Morton (*Phil.*

¹ Mr. C. Davies Sherborn, however, in January, 1916, drew the attention of Mr. B. B. Woodward and myself to the following quotation, the existence of which had been quite unknown to us : " À ce point de vue, les êtres organisés qui ont remplacé ceux du pliocène et les terrains dans lesquels nous en recueillons les dépouilles, ont été plus justement nommés *Pleistocènes*, ceux aux quels ils ont succédé portant les noms de *Pliocènes*, *Miocènes* et *Eocènes*. On pourrait aussi appeler *Holocènes*, ceux de l'époque historique, ou dont le dépôt n'est pas antérieur à la présence de l'homme ; mais, ainsi que nous l'avons dit, il ne paraît pas que l'on doive les séparer des terrains diluviens eux-mêmes ou des premiers dépôts pleistocènes, puisque ceux-ci renferment certaines espèces de *Mammifères* qui ont évidemment continué à vivre jusqu'ici. Sous ce rapport, les terrains pleistocènes méritent également le nom de terrains holocènes." (Paul Gervais, " Sur la répartition des *Mammifères* fossiles entre les différents étages tertiaires," etc. : *Mém. Acad. Sci. Montpellier, Sect. des Sci.*, Tom. i [pt. iv, 1850], p. 413.)

Trans., vol. xxv, No. 305, 1706, pp. 2210-14). The investigation was carried out in the true scientific manner by means of a special excavation ; the identifications of the shells can be easily checked by the references to Lister, whilst the postulating of a deluge as an explanation of the observed facts is not unknown even to-day.

Later workers have not always maintained the high standard which was thus set, and the illuminating phrase, "a number of snail shells occurred at this level," has been considered quite sufficient to satisfy all the reasonable demands of the student.

A very long period of quiescence then ensued, and it was not until early Victorian times that any additions to our knowledge were made, principally by John Brown, of Stanway, Lyell, Mantell, and S. P. Woodward. Their work, however, was of a sporadic nature, and no real systematic work was accomplished until 1890, when the foundations were laid by B. B. Woodward by the publication of a paper dealing partly with the Holocene mollusca of the London district (*Proc. Geol. Assoc.*, vol. xi, pp. 331-88). The great feature in this paper is the careful checking of previous records, a procedure entailing great labour, but the results amply justified the work, the drudgery of which can only be estimated by those who have worked on similar lines. It is far easier, and more imposing to the uninitiated, to publish long lists of undigested records, many of them dating from the early days of science, the names of the species and the deposits occurring again and again under their various synonyms, but the real value is *nil*.

Inspired by Mr. B. B. Woodward's work, a number of papers have been published by many writers dealing with numerous deposits in many parts of England, whilst archæologists and geologists have begun to realize the importance of these formerly despised objects in helping to solve their problems. Though much still remains to be done, yet sufficient facts have been accumulated to enable us to see that there is a coherent story, though, alas, too often the details are blurred and obscure.

In a civilized area like England human activities have had an enormous effect on the state of the country, and those of us who, like myself, have no personal acquaintance with a virgin country necessarily find it difficult to visualize an England untouched by the hand of man, yet such it was within, geologically speaking, recent times. These human activities have had great influence on the fauna, especially that branch with which we are more interested, an influence sometimes beneficial and sometimes imimical.

The uniting of drainage areas by the canalization of rivers and the construction of canals has enabled the freshwater species to pass barriers which were formerly insurmountable, and has greatly increased the number of suitable habitats for the deeper water forms such as *Dreissensia polymorpha* (Pall.). The making of innumerable ponds and of lakes and reservoirs has also been favourable to many

species, whilst the abnormal conditions often prevailing in these habitats has been reflected in their molluscan inhabitants, and consequently in the list of varietal names. Marshes and fens have been drained, thus reducing the areas suitable for the damp-loving species, whilst the conversion of woodland into pasture and tilth has been of great advantage to some forms and injurious, if not destructive, to others.

Charlton Wood, the original habitat of *Clausilia rolphii*, Gray, was thus destroyed, and as a consequence Dr. Leach noted "no specimens have been taken for several years" (*Synopsis Moll. Gt. Britain*, 1852, p. 86). The construction of numerous stone walls in many parts of the country has provided welcome oases for such species as *Pyramidula rupestris* (Drap.) and *Lauria cylindracea* (Da Cost.). Horticulture, too, has played a considerable part in the dissemination of many of the slugs, as well as such forms as *Helicella draparnaldi* (Beck) and *Opeas pumilum* (Pfr.). The growth of motor traffic and the consequent tarring of the roads has had a very adverse effect on the molluscan fauna of the bordering hedges, ditches, and ponds. The molluscan inhabitants of many ponds in West Kent have thus been quite exterminated. Though hedges are often of modern origin, and thus not a "natural" habitat in the botanical sense, yet in many parts of England, especially in the east and south-east, they are often strips of old woodland left when the land was originally cleared, and have been havens of refuge for the fauna. Building operations, too, have destroyed many recorded localities, and it is useless now to look for *Clausilia biplicata* (Mont.) in Hyde Park, Chelsea meadows, or Fulham meadows; *Fruticicola (Zenobiella) subrufescens* (Mill.)¹ at Blackheath; *Succinea oblonga*, Drap., and *Pisidium supinum*, A. Schm., in Battersea meadows; whilst H. C. Huggins informs me that the original habitat of *Jacosta (Xeroclivia) elegans* (Gmel.)¹ at Lydden is now buried by the tip from a neighbouring colliery.

It is thus obvious that it is quite impossible by the most careful collecting to ascertain the true molluscan fauna of any given district, or to say whether a species is a casual, a colonist, a denizen, or a native. To solve these problems one must turn to the Holocene deposits, always remembering the imperfections of the geological record, and the relatively small attention that has been paid to these beds. Some species, too, such as *Zonitoides excavatus* (Ald.) and *Margaritifera margaritifera* (Linn.), from their pronounced calcifuge habits, are not likely to be preserved in a fossil state, whilst the constitution of the shell of *Fruticicola (Zenobiella) subrufescens* (Mill.) will account for its absence from all deposits.

¹ In view of the fact that the species constituting these two genera are now frequently referred to under the subgeneric or sectional names direct, the latter have been introduced throughout this address.

It is difficult to classify Holocene deposits, but they may be divided into seven groups, viz. :—

1. River deposits.
2. Lacustrine deposits.
3. Swamp deposits.
4. Buried land surfaces.
5. Rain-washes.
6. Cavern deposits.
7. Ancient graves.

Of these, all but the two last may be considered as sealed deposits, though the possibility of disturbance by burrowing animals must always be remembered. River deposits need special consideration for two reasons. They often represent the sweepings of a large area, and the shells may have travelled a considerable distance, whilst there is also the probability that they may contain shells derived from earlier beds. The alluvial beds of the Thames and Lea, the results of the slow intermittent sinking of the land, often contain not only true river deposits but also old land surfaces and swamp deposits, as was plainly seen in the New Albert Docks.

Lacustrine and swamp deposits need no elaboration, the contained mollusca having lived practically where they were entombed. Swamp deposits are frequent in Essex and the Midlands, Copford being perhaps the best known. In this group, too, may be classed the various tufaceous deposits, such as Blaskeenwell, in Dorsetshire, and Totland Bay, Isle of Wight.

Old land surfaces are principally found in sand dunes, but many archaeological sites such as Grimes Graves, Norfolk, and Cissbury, Sussex, may well be included. In these also the possible margin of error is extremely small, and the evidence derived from their fossils may be relied upon. Rain-washes are very common on the slopes of the chalk-hills, and probably owe their formation to the destruction of the woodland on the ground above them, thus exposing the soil and the already disintegrated subsoil to the action of rain. Their accumulation was thus very rapid, and practically ceased as soon as the vegetation covered the slopes again. Where there is evidence that the slopes have not been disturbed, these rain-washes are absent. Though not relevant to our subject, it may be mentioned that the rain-wash at Oftord is situate below the so-called Pilgrims Way, which has been claimed to be a pre-Roman road. Now, when the deposit was accumulated, there must have been an unbroken slope of bare chalk soil, and the road cannot have existed. Since the rain-wash can be definitely dated on archaeological evidence as of Roman age, it follows that this part of the road is not as old as enthusiasts would wish us to believe. As a rule, mollusca are common in these deposits, and they furnish interesting evidence as to former conditions.

Cavern deposits are particularly liable to disturbance by

burrowing animals, and great care must be used in dealing with the contained mollusca. Caves, too, are often frequented by birds of prey, and the crops of their victims, killed perhaps miles away, would contain undigested shells and thus add to the confusion. This is the only explanation of the presence of *Sabinea ulvae* (Penn.) in Chudleigh Cave, and of the same species and *Zonitoides excavatus* (Ald.) at Nanna's Cave, Caldey.

Ancient graves are of great importance as furnishing archaeological evidence as to age, but in many instances the smaller burrowing mammals have provided easy means of ingress for hibernating mollusca, whilst the systematic rifling of grave mounds from Roman times to the present has too often completely destroyed all reliable evidence.

Having thus briefly described the characteristics of the varying deposits from which the Holocene mollusca have been obtained, we will now examine the evidence which has been accumulated.

On comparing this with the admirable census recently published as a memorial to the late W. D. Roebuck (*Journ. of Conch.*, vol. xvi, 1921, pp. 165-211), many differences will be noted. A few species are unknown in a fossil state, three fossil forms have not been detected living, some species have greatly extended their range, whilst the area of distribution of others has apparently diminished. In endeavouring to arrive at proper conclusions it is better to ignore the slugs, for the determination of species from their scanty remains, so easily overlooked except by the trained observer, is always very difficult, and in the case of the Arionidæ quite impossible, whilst obvious accidental introductions must be similarly treated.

Excluding these, there are only twenty-eight living species which are unknown from the Pleistocene, and of these nine have never been found fossil at all. These are :—

Jacosta (Xerophila) neglecta (Drap.).

„ *(Xeroclivia) elegans* (Gmel.).

Fruticicola (Zenobiella) subrufescens (Mill.).

„ *(Capillifera) oedea* (Loc.).

Euparypha pisana (Müll.).

Margaritifera margaritifer (Linn.).

Pseudanodontia rothomagensis, Loc.

Pisidium tenuistriatum, Stelf.

„ *steenbuchii* (Möll.).

As already noted, the shell of *Fruticicola (Zenobiella) subrufescens* (Mill.) contains so little lime that it is extremely unlikely to be preserved after death, and this species is the only widely distributed form unknown in a fossil state. From its habits it is improbable also that *Margaritifera margaritifer* (Linn.) would occur in a fossil state, but the periostracum of this species has been detected in the Holocene beds of the Clyde, the shell having completely

vanished (*Trans. Geol. Soc. Glasgow*, 1866, vol. ii, p. 109, and vol. xvi, 1915, p. 108). In Wales, too, an imperfect valve of this species was found in the Perthi Chwaren Cave, near Llandegla, Denbighshire, a sepulchral cave of Neolithic age, and its presence there is clearly due to Neolithic man (J. W. Jackson, *Lanc. Nat.*, 1913, p. 321). This specimen had originally been recorded as *Mya truncata*, Linn. (*Journ. Ethnol. Soc. Lond.*, 1871, p. 443). The remaining seven species are all extremely local forms. Whether they are really native species with a formerly wider distribution, or recent introductions, it is impossible to say, for we are dealing with negative evidence, which is too often a broken reed. In this group, I think, *Eulota fruticum* (Müll.) should also be included, for though it is found in the Pleistocene, yet its restricted modern distribution and its absence from all Holocene beds leads one to infer that it may be only a modern re-introduction. The following species are known from the Holocene, but not from earlier beds:—

- Helicella draparnaldi* (Beck).
Jacosta (Candidula) gigaxii (Pfr.).
Theba cantiana (Mont.).
 " *cartusiana* (Müll.).
Helix pomatia, Linn.
Clausilia biplicata (Mont.).
 " *dubia*, Drap.
 " *rolphii*, Gray.
Limnea auricularia (Linn.) (typical form).
Planorbis stroemii, West.
Paludestrina jenkinsi (Smith).
Vivipara vivipara (Linn.).
Assiminia grayana, Leach.
Theodoxus fluviatilis (Linn.).
Dreissensia polymorpha (Pall.).
Pseudanodonta elongata (Holl.).
Pisidium hibernicum, Westld.

Helicella rogersi (B. B. Woodw.) probably belongs to this assemblage, for the two Pleistocene records, Ightham Fissure, Kent, and Langwith Cave, Derbyshire, are both cavern deposits, and in each case there had been disturbance. It is, of course, possible that it may yet be found in a sealed bed, but the course I have suggested appears to be the correct one. Thus the vast majority of our living species have been resident here for a much longer period than was formerly considered to be the case, and it may be noted that nearly all the presumed post-Pleistocene immigrants are confined in the British Isles to England.

Three species have apparently become extinct during the Holocene period.

Goniodiscus ruderatus (Stud.) is known from the Holocene of Copford, Essex, and Wheatley, Nottinghamshire. It is also known

from the Forest Bed (Cromerian) of West Runton, Norfolk, as well as from a number of Pleistocene deposits, being fairly common at Woodston, Northamptonshire, and Clacton, Essex. It is possible that it may yet be found living, but I think that the story of its occurrence at Grange-over-Sands, Lancashire, probably arises from an error in locality.

Fruticicola (Ponentina) montivaga (Westld.) was found in the deposits at Harlyn Bay, Cornwall, by the Rev. R. Ashington Bullen, the only record for the species in England, and it had apparently been able to maintain itself there for some considerable time. But the possibility that it may be only an extreme form of *Fruticicola (Ponentina) subvirescens* (Bellamy) must be remembered.

Unio auricularius (Spengl.) has been dredged in some quantity from the gravels of the Thames at Barn Elms and Mortlake. The gravels from which these shells have been obtained have recently been claimed to be of Pleistocene age.

G. F. Lawrence, through whose hands passed all the specimens that have been obtained, informed me that polished stone axes also occur in these gravels, but no metal objects, thus proving conclusively that the associated shells are early Holocene and not Pleistocene, a conclusion strongly supported by the other mollusca found with the *Unios* (*Proc. Malac. Soc. Lond.*, Vol. X, 1913, p. 332).

There are eight species of which it can be definitely said that their area of distribution at the present day is much greater than was formerly the case. They are:—

- Helicella draparnaldi* (Beck).
- Jacosta (Cernuella) virgata* (Da Cost.).
- „ *(Candidula) caperata* (Mont.).
- „ „ *gigaxii* (Pfr.).
- Theba cantiana* (Mont.).
- Fruticicola (Capillifera) striolata* (C. Pfr.).
- Helix aspersa* Müll.
- Paludestrina jenkinsi* (Smith).

Known only from the Holocene of Newquay, Cornwall, and Anstice Cove, near Torquay, Devonshire, *Helicella draparnaldi* (Beck) has now a very wide range, but an examination of the records reveals the fact that many of these are based on occurrences in gardens or even greenhouses, scarcely natural habitats. It is only in the west of England that it occurs away from human habitations, and there alone can it be considered a true native. As already suggested, horticulture has probably been the chief agent in the modern distribution of this form, and it is not improbable that examples of this species were introduced into many parts of England by this means during mediaeval times from the Continent. It is often associated with monastic ruins. This dual origin may account for the slight differences that have been noted in both the animal and the test between the eastern and western forms of this species.

The case of *Jacosta (Cernuella) virgata* (Da Cost.) is an extremely interesting one. At the present day it is very common throughout the whole of England, and one would naturally infer that it is a true native, but the geological evidence tells a very different story. Common in the early Holocene beds of Cornwall and Devon, elsewhere it is practically absent from all Holocene deposits, the exceptions being Cleeve Hill, Gloucestershire, of Late Celtic age, and St. Catherine's Down, Isle of Wight, a deposit that sadly wants re-investigation. The Chalk districts of Kent and Surrey are particularly favourable to this species, yet it is absent from every rain-wash, whether pre-Roman, Roman, or later. It is true that the growth of tilth has been beneficial to the species, but there must have been very large areas of cornland in Roman times, yet this species is always absent from Roman deposits. The only conclusion is that over the greater part of England *Jacosta (Cernuella) virgata* (Da Cost.) must be considered a very modern immigrant, certainly within the last three or four hundred years.

Jacosta (Candidula) caperata (Mont.) has an exactly similar geological history, occurring as a fossil only in Cornwall and Devonshire. Elsewhere it is absent, except a doubtful record from St. Catherine's Down. One can only conclude that the duration of residence of this species also is a very limited one. I am quite at a loss to account for the rapid dissemination of these two species, and we know too little of their life histories to speculate with any degree of certainty.

Jacosta (Candidula) gigaxii (Pfr.), unlike the preceding forms, is not a western species. It has occurred in several deposits in Kent, Surrey, and Sussex, and one of these, Northfleet, is certainly pre-Roman. It is, however, decidedly rare as a fossil, and it is only since Roman times that it has been able to extend its range to any great degree. It may possibly be an introduction into England by human agency in late Celtic times, for it is quite absent from all early Holocene deposits.

Theba cantiana (Mont.), though so abundant at the present day, owing to its absence from all pre-Roman and Roman beds, must be considered a modern introduction, and one is tempted to suggest that it arrived here in Norman times. It occurred in the Ightham fissure in close proximity to the bones and bell of a ferret, a good example of the doubtful value of unsupported cavern evidence.

Helix aspersa, Müll., is extremely common in all Roman deposits, and examples were found in London in the crevices of the Roman Wall. Its size prevents its being overlooked by the archæologist, and hence its recorded occurrences with Roman objects are numerous, whilst this association has on more than one occasion been the cause of its being labelled "Roman snail", with the added information for the benefit of the public that the scientific name was "*Helix pomatia*"! It occurs in the early Holocene of Cornwall and Devon,

and in a Bronze age tumulus in Somerset, but being unknown from any pre-Roman deposit over the greater part of England, it has proved a useful zone fossil. Since this species does not burrow to hibernate, human habitations and their surroundings furnish excellent hibernacula, and the large population and high civilization which existed in England in Roman times will account for its wide distribution during that period, while the recent extension of its range may well be attributed to the same causes.

Fruticicola (Capillifera) striolata (C. Pfr.) is known from several early Holocene deposits in the South of England, so that it is undoubtedly a true native, but its modern distribution differs greatly from the fossil records, and its area of distribution was probably greatly increased during Roman and more modern times. A. W. Stelfox has suggested that it is quite a modern introduction into Ireland (*Proc. Malac. Soc. Lond.*, vol. x, 1913, pp. 290-1), a view strongly supported by the geological evidence (*Proc. Geol. Assoc.*, vol. xxviii, 1917, p. 167). It has a marked partiality for the neighbourhood of human habitations, especially gardens.

Paludestrina jenkinsi (Smith) is a puzzling form. It is known fossil from Barking (Essex), Blythburgh (Suffolk), and Clevedon (Somerset). The two former deposits are mediaeval, and there is no evidence as to the age of Clevedon, but it is clear that the theory that it was introduced into this country during the last century must be discarded. One thing, however, is certain, and that is that it has enormously increased its range during the last fifty years. Now that this species is known from Denmark and Germany, it will be interesting to see if it will be able to extend its range in those countries in so rapid a manner. There are a number of species which are apparently more abundant at the present day than formerly. These include *Helicella rogersi* (B. B. W.), *H. alliaria* (Mill.), *Pyramidula rupestris* (Drap.), *Helix hortensis*, Müll., *Ena obscura* (Müll.), *Lauria cylindracea* (Da Cost.), *Abida secale* (Drap.), *Balea perversa* (Linn.), *Limnaea glabra* (Müll.), *Dreissensia polymorpha* (Pall.), and *Sphaerium lacustre* (Drap.). All these forms are decidedly rare as fossils, though the records show that there has been no great, if any, extension of range. *Helicella rogersi* (B. B. W.) is absent from all the Kentish rain-washes, yet at the present day it is very common on the chalk hills. Its occurrence in an early Holocene bed at Walton Heath, Surrey, as well as other records, show that it is a native.

Helicella alliaria (Müll.) is decidedly rare as a fossil, though the records prove that it was widely spread. It has a curious partiality for pigsties, scarcely a natural habitat.

Why *Helix hortensis*, Müll., should be so rare as a fossil is a problem I cannot answer and in only one Holocene deposit was it common, the early Neolithic flint mines of Grimes Graves, Weeting, Norfolk. It does not occur in many of the Kentish rain-washes, though living

abundantly in the neighbourhood. *Ena obscura*, Müll., too, is another form far more abundant than formerly.

Lauria cylindracea (Da Cost.) has a marked partiality for old stone walls covered with ivy, and I have never yet seen an old churchyard wall of this description that did not yield this species.

The fragility of the shell of *Balea perversa* (Linn.) may account in some degree for its rarity as a fossil, and the lack of suitable habitats may be the cause of the former scarcity of *Sphaerium lacustre* (Drap.). Though known from the Pleistocene, this last species is absent in the Holocene from all pre-Roman beds.

Dreissensia polymorpha (Pall.) has been claimed as an introduction during the early part of last century, but its occurrence as a fossil in a Roman deposit at Whitefriars, London (*Proc. Geol. Assoc.*, vol. xi, 1890, p. 342), as well as at Clifton Hampden, Oxfordshire, completely negatives this view, and it must be considered a true native, a view which was always advocated by Gwyn Jeffreys. To nearly all these species human agencies have been beneficial by increasing their suitable habitats.

Those species whose area of distribution has apparently diminished are :—

Theba cartusiana (Müll.).

Ena montana (Drap.).

Acanthinula lamellata (Jeff.).

Lauria anglica (Fér.).

Vertigo substriata (Jeff.).

„ *mouliniana* (Dup.).

„ *alpestris*, Ald.

„ *pusilla*, Müll.

„ *angustior*, Jeff.

“ *Truncatellina minutissima* (Hart.”)

Planorbis stroemii, Westld.

Acicula lineata (Drap.).

Theba cartusiana (Müll.) in Kent is unknown living west of Canterbury, yet it occurs in all the pre-Roman and Roman rain-washes at the foot of the chalk hills from Otford to Snodland, as well as at Northfleet and Greenhithe, clearly proving that this species was formerly a widely spread and common form in West Kent, whilst linking up this area with its present distribution, it has been found fossil at Hollingbourne. Though unknown living in Essex, it occurs fossil at Harwich and Felstead, whilst it has also occurred in a deposit at Butley, Suffolk, thus proving that the isolated colonies in Norfolk and Suffolk are not accidental introductions, but are the last survivors of a formerly common species.

Acanthinula lamellata, Jeff., is quite a common form in some of the Essex deposits as well as at Wheatley, Nottinghamshire, and from neither of these counties is it known living.

Similarly *Ena montana* (Drap.), known fossil from Reigate, Surrey,

and Blashenwell, Dorset, has not yet been detected living in either county.

Lauria anglica (Fér.) is now known fossil from Totland Bay (Isle of Wight), Copford, Shalford, and Felstead (Essex), Harlton (Cambridgeshire), Ledbury (Herefordshire), and Askern (Yorkshire), and of these comital divisions it is to-day apparently absent from the first three.

Vertigo substriata (Jeff.), too, has been found in deposits at Ledbury (Herefordshire), Wilstone (Hertfordshire), Mottisfont (Hampshire), and Totland Bay (Isle of Wight), and is unrecorded living from any of these counties.

Vertigo mouliniana (Dupuy) is as yet unknown in a recent state from Gloucestershire, South Essex, and Kent, though occurring fossil at Westbury on Severn, Walthamstow, Chingford, and Deal, whilst the two fossil records for *Vertigo alpestris*, Ald., Wheatley (Nottinghamshire), and Chignal St. James (Essex), clearly show that this species was once far more widely spread than at present.

Vertigo pusilla, Müll., has now been detected fossil at Totland Bay (Isle of Wight), Blashenwell (Dorset), Ightham and Crossness (Kent), Tilbury (Essex), Reigate (Surrey), and Southampton and Mottisfont (Hampshire), six divisions which still remain blank in the recent census.

The former abundance of *Vertigo angustior*, Jeff., has often been commented upon, for to-day it is one of our rarest shells. It is an abundant species in the early Holocene beds of Copford, Felstead, and Chignal St. James, Essex, and has occurred in a bed of similar age at Harlton, Cambridgeshire, and in neither county has it yet been found living.

"*Truncatellina minutissima* (Hart.)" and I use this name for the aggregate species since the value of the suggested segregates has yet to be tested, is only known fossil from Northfleet, Greenhithe, and Cuxton (Kent), near Staines (Berkshire), Westbury (Gloucestershire), and Grimes Graves (Norfolk), and the recent census has no record from any of these counties.

Planorbis stroemii, Westld., is only known living from one locality in Oxfordshire, yet in the Holocene beds of the Lea and the Thames it is a common species, being known from Berkshire, Buckinghamshire, Essex, Middlesex, Oxfordshire, and Surrey. So far it has not been found in the extensive Holocene beds of the Kennett. This shell was found living in a bed of *Chara*, and there is nearly always abundant *Chara* débris in the beds in which it is found. Possibly the cause of the almost total extinction of this species has been the destruction of its natural habitats by the canalization of the rivers and better drainage of the surface waters.

Acicula lineata (Drap.) is another species common in the early Holocene beds of Essex, and it must have been an abundant species there in former times, a condition of things very different from that

experienced by recent collectors. Its occurrence in rain-washes at Cuxton and Greenhithe, Kent, and in the Neolithic flint mines at Grimes Graves, Weeting, Norfolk, clearly show that this species was able to live at one time on what is now dry chalkland.

Besides these species there are several other forms whose area of distribution has slightly diminished. *Helicodonta obvoluta* (Müll.), from its occurrence in the Neolithic flint mines at Cissbury (*Archæologia*, vol. xlvi, 1880, p. 339), had formerly a more easterly distribution in Sussex.

Helix pomatia, Linn., occurred at Northfleet, Kent, in association with Roman remains, and in a pre-Roman rain-wash. It is quite absent from the district at the present time, but probably intensive cultivation will account for this. So far nothing has been found enabling us to link up the two areas of distribution in Kent.

The only Holocene record for *Succinea oblonga*, Drap., is at Harlton, Cambridgeshire, a county in which it has not yet been detected living, whilst *Clausilia rolphii*, Gray, though unknown living in North Essex, occurs fossil at Copford and Felstead.

It will be noted that nearly all the species whose area of distribution has diminished are damp-loving forms, and it may be urged that this is the result of human agencies in draining the swamps and marshes, and thus decreasing the natural habitats. The deposits yielding these species, however, are not confined to the low-lying grounds, but occur on the slopes of the chalk hills well above the springs, and where the influence of man cannot be traced. Thus at Cuxton, Kent, *Helicella radiatula* (Ald.), *Arianta arbustorum* (Linn.), *Lauria cylindracea* (Da Cost.), *Vertigo substriata*, Jeff., and *Acicula lineata* (Drap.) occur in a Neolithic deposit, but do not occur on these same dry slopes at the present time. Moreover in the same deposit the form of *Fruticicola (Capillifera) hispida* (Linn.), differs markedly from the chalk-hill form, the var. *nana*, Jeff., which is now living there. At Totland Bay (Isle of Wight), Blashenwell (Dorset), at Caerwys (Flintshire), and Leckwith (Glamorganshire) this damp-loving fauna is found in tufa which has long ceased to form, and in the case of Blashenwell the tufa is certainly Neolithic (C. Reid, *Proc. Dorset Nat. Hist. and Antiq. Field Club*, vol. xvii, 1896, pp. 67-75). Wherever it is possible to date these deposits by archæological evidence the result is always the same, that they are early Holocene, when human activities were negligible, and the conclusion is inevitable that at one period, at least, formerly the rainfall of England must have been much greater than it is to-day.

Besides the presence or absence of certain species, there is another important series of facts the full significance of which cannot yet be ascertained, and that is the varying development of the individual. It is easy enough to conceal our ignorance by using such phrases as "suitable conditions" or "congenial environment", but the fact remains that we know next to nothing of the multiple

factors which combine to produce these conditions, and for my purpose it is essential to ascertain what these factors are and their relative importance. The methods and times of reproduction of the mollusca, the history of their early stages, their powers of resistance to extremes of temperature and aridity, their food under natural conditions and not in a state of captivity, their enemies whether external or parasitic, how little do we really know about all these things. One welcomes, therefore, all such contributions as that by Dr. A. E. Boycott recently published in our proceedings (*Proc. Malac. Soc.*, Vol. XIV, 1921, pp. 163-72) and the numerous observations compiled by J. W. Taylor in his "Monograph".

I had hoped that some careful observer with more leisure than falls to my lot would have published ere this his observations on the results amongst the mollusca of the semi-arid conditions prevailing in England in 1921.

So far as my limited experience goes with the land mollusca, it was only the slugs that suffered. There was a very welcome decrease in their numbers, especially in the case of *Agriolimax agrestis* (Linn.), arising, I think, from the destruction of the young. Xerophiles were as abundant as ever, and other forms showed no diminution when the autumn rains allowed them to resume activity. Very different was it with the plants and insects, which suffered greatly, and a well-known entomologist informed me that he was afraid that many isolated colonies of the rarer insects had been extirpated.

With the freshwater mollusca, however, the dessication of the ponds and ditches only slightly reduced their numbers. The small volume of water in the Thames enabled the brackish tidal water to flow far above the usual limit, a fact which was realized too late at Kew Gardens. But for the locks and the strict limitation of the flow, the tidal waters would have reached still higher, and the destruction of the flora and fauna, extensive as it was, would have been much greater. But for human interference the Upper Thames would have been reduced to a series of pools connected by small streams, with the inevitable effects on the unfortunate mollusca. But this would have been only an episode, normal conditions would soon have returned, and there would probably have been no trace in the geological record. The deposits we are considering are certainly not the products of such episodes, but represent stable conditions over a considerable period of time.

Ecologists, too, may be asked to give more details in their interesting papers. The relative abundance of species in an artificial habitat is interesting as showing the presence or absence of enemies such as ducks and fowls, but the development of the individuals is usually ignored. This is of paramount importance. It must be remembered that Ecology was founded by botanists, and in plants there is a keen competition between the species. This is not so with the mollusca, and facts that are important to the botanist are trivial to the malacologist.

Yet in spite of this lack of knowledge I shall venture to put forward tentative views based on the mean development of the individual.

Here I must pay a tribute to the work of J. R. Bourguignat, who was the pioneer in this line of research. Opinions may differ as to the wisdom of the "New School" in departing from the original conception of a species, yet the idea of the founder was by so doing to furnish the nomenclatorial details to enable us to ascertain what were the circumstances and climate when such deposits as I am now discussing were accumulated. For this purpose he considered that the varying forms arising from environment should be ranked as species and described and figured as such. Whether the conclusions arrived at in his "Mollusques terrestres et fluviatiles des environs de Paris à l'époque quaternaire", "Histoire des monuments mégalithique de Roknia", and "Histoire de la colline de Sansan" are absolutely correct or not time alone can tell, but there can be no doubt that many will stand the test. I trust I may be permitted to lay a wreath of appreciation on his grave, more especially as in his case "the crown of the innovator was a crown of thorns". In studying his work and the adverse criticisms passed on it, one is impressed by the fact that there are two viewpoints in nomenclature, that of the systematist and that of the palaeontologist, and each of these is based on their needs. The former has no interest in the variation of forms, and has grudgingly admitted even the existence of sub-species. He has no need to name syntonic forms, and the more comprehensive the species the easier the work of placing it in its correct relative position. But the palaeontologist has other aims. He wishes to reconstruct the past, and how can he do this if a specific name, say *Fruticicola (Capillifera) hispida* (Linn.), indicates an allied group of forms living from Southern Europe to the Arctic Circle that flourishes in damp situations, and is equally common on a dry hillside and in intermediate situations, each distinct habitat possessing its own form. In such a case the systematist only needs and uses one name, but to the palaeontologist this name conveys little or nothing.

Bourguignat was at heart a palaeontologist; he realized their needs, and he endeavoured to the best of his ability, and it was certainly of no mean order, to provide a scheme of nomenclature that would satisfy their requirements. It failed principally through the excesses of his followers, who possessed neither his knowledge nor his "flaire". The older system is based on the immutability of species, a view which received its deathblow many years ago from the "Origin of Species". I think that had Bourguignat thrown over the fetish of binomialism and adopted the trinominal system he would have had a much larger following, and this course will eventually be found to be the means of reconciling the two divergent views.

In considering the question of the development of the mollusca

it is essential to have large series of specimens, for giants and dwarfs are not uncommon, and the contrasted series must be from the same geological formation. It would be misleading to compare fossil shells that had lived on the Chalk and recent shells collected on the Gault. Exigencies of space prevent me from giving the numerous measurements, and after all the results are the important matter, and these show that in many deposits, some of which can be dated archaeologically, the average size of the mollusca is decidedly larger than the mean of those now living in the immediate neighbourhood. The cause of this is in my opinion changed meteorological conditions.

If we compare the non-marine mollusca of South Devonshire and Kent, differences in the size will be noted. The former possesses what is known as an insular type of climate, but little frost and absence of extreme heat in summer, whereas Kent approaches to the continental type with hotter summers and colder winters.

Xerophiles such as *Jacosta (Cernuella) virgata* (Da Cost.), *J. (Xerophila) itala* (Linn.), and *J. (Candidula) caperata* (Mont.) are far more abundant and larger in Kent than in South Devon, whilst *Helix aspersa*, Müll., attains a larger size in the former county.

Devon examples of *Helix nemoralis*, Linn., are perhaps brighter coloured, a character of no value to the palaeontologist, but are certainly smaller than Kentish specimens. The chief difference, however, is the comparative abundance of heavy shells in South Devon compared with their extreme rarity in Kent. This no doubt arises from the mild winters being favourable to longevity, a fact which has long been known to Harley Street specialists. Kentish examples of *Arianta arbustorum* (Linn.) and *Fruticicola (Capillifera) striolata* (C. Pfr.) are decidedly larger than those from Devon, and this remark applies to many of the land and freshwater forms. When we compare English examples with foreign similar differences are noted. With *Helix aspersa*, Müll., the largest examples are from Algiers and Greece, whilst shells from Beyrouth, Italy, Spain, and Majorca are not far behind. Shells from Crete, Tasmania, Melbourne, and Mauritius are about an English average, whilst those from Cape Town and the Canaries are slightly smaller. These are larger than examples from Portugal and Costa Rica, whilst the smallest are from St. Helena, the Seychelles, and Lord Howes Island. From these facts one may infer that a "continental" climate is more favourable to this species than an "insular".

The largest examples of *Helix nemoralis*, Linn., are found in Lombardy, the Pyrenees, Portugal, Switzerland, and in Ireland in Co. Clare and the Aran Islands, West Galway; whilst French and German examples are certainly larger than English.

Now these facts do not agree with the data for *Helix aspersa*, Linn., for the Irish examples of *H. nemoralis* are an apparent exception, but the Irish localities are exceptionally arid, being

practically dry stretches of limestone with innumerable crevices into which the animals retreat during hot weather, and here again we can come to the same conclusion as with *Helix aspersa*, Müll. The largest examples of *Arianta arbustorum* (Linn.) are from Central Europe, whilst the large size attained by *Succinea putris* (Linn.), *Limnaea stagnalis* (Linn.), *L. palustris* (Müll.), and *Planorbis corneus* (Linn.) in Austria has often been noticed. The examples of *Cochlicella acuta* (Müll.) from Sussex are much larger than those from the West of England, whilst German examples of *Helix pomatia*, Linn., are decidedly larger than English.

It would thus appear that the "continental" type of climate is far more beneficial to the development of the mollusca than the "insular", and it is not presuming too much to conclude that the evidence derived from the Holocene mollusca points distinctly to at least one period of this character.

We have seen that the Molluscan fauna of England has varied greatly in Holocene times, and I have endeavoured to show that this variation has arisen from changes of climate. From archæological and stratigraphical evidence a sequence in these changes can be deduced, and it is now necessary to compare this with the results obtained from other lines of research.

Perhaps the clearest exposition of the Holocene period is that given by Professor F. J. Lewis, based on the results of his work on the great masses of Scotland, an investigation undertaken to ascertain what changes of climate had occurred (*Trans. Roy. Soc. Edinburgh*, vol. xli, 1905, p. 679; vol. xlvi, 1906, p. 335; vol. xlvi, 1907, p. 33; and vol. xlvii, 1911, p. 793).

According to this author the present conditions may be considered as dry, and the sequence in descending order is:—

1. Sphagnum: humid.
2. Upper Forest Growth.
3. Sphagnum: humid.
4. Subarctic plants (colder).
5. Sphagnum: humid.
6. Lower Forest Growth.
7. Subarctic plants.
8. Arctic plants.
9. Moraine.

This differs markedly from the succession recently suggested by C. E. P. Brooks (*The Evolution of Climate*, London, 1922, pp. 126–58). This author only recognizes three principal periods:—

1. The "Classical" Rainfall, maximum, 1800 B.C.–A.D. 500.
2. The Forest period (dry), 3000 B.C.–1800 B.C.
3. The post-glacial optimum, a warm period.

There are a number of minor changes postulated, principally from literary evidence, which in these matters is always doubtful.

Our facts, however, strongly support the views of Professor Lewis, whilst the occurrence of two forest growths separated by

a long interval is a common feature in many alluvial deposits, especially in the lower Thames valley, so for my purpose I shall only consider the first sequence. It is open to question whether stages 7, 8, and 9 should be included in the Holocene. In these matters it is always difficult to draw the division line. Stage 9 is certainly Pleistocene, and since the two succeeding stages are really part of the preceding glacial period, I prefer to classify them with it.

Stage 6. The lowest forest growth is well known and has been recognized in many places in Northern Europe and in Ireland (*Proc. Geol. Assoc.*, vol. xxviii, 1917, pp. 144, 157). The well-known deposit at Dogs Bay, West Galway, yielding the large and heavy examples of *Helix nemoralis*, Linn., is of this age. This form has been named var. *pura* by Westertund (*Verhandl. Zool.-Bot. Gesell. Wien*, vol. xlvi, 1892, p. 34). The derivative examples of this species found in the Neolithic flint mines at Grimes Graves, Norfolk, also belong to this stage (*Report of the Excavations at Grimes Graves*, 1915, pp. 220-3). To this period I would also assign the lacustrine deposit at Perranzabuloe, Cornwall (*Proc. Malac. Soc. Lond.*, vol. viii, 1909, pp. 247-50) and the remarkable chara deposit at Haweswater, Silverdale, Lancashire (*Journ. of Conch.*, vol. xi, 1905, pp. 147-51; and *Lanc. and Chesh. Nat.*, 1914, pp. 135-40 and 197-201), as well as many of the chara marls of the Fen Country (*Fenland Past and Present*, p. 572). It may be noted that in this country it was the late Dr. R. Munro, the able archaeologist, who first pointed out the true age of the marl deposits from the molluscan evidence, for he said, "The suggestion that the period of maximum development of the freshwater testacea which produced the shell marl deposits of Scotland correspond chronologically with that of the forest growths is not therefore unreasonable" (*Prehistoric Scotland*, 1899, p. 26). As already noted, lack of knowledge prevents me from deducing accurately all the climatic conditions, but I can assume that the summers were much warmer than the average of to-day, probably resembling that of 1921, but with a greater rainfall in the remaining seasons than in that year.

Stage 5. The succeeding humid period is well represented in England, and it may be called "the maximum development of the damp-loving species". Copford, Felstead, Chignal St. James, and Shalford (Essex), Blashenwell (Dorset), Totland Bay (Isle of Wight), Allen's Farm, Ightham, and the Neolithic grave at Cuxton (Kent), the Cornish Towan deposits, Harlton (Cambridgeshire), Wilstone (Hertfordshire), Grimes Graves (Norfolk), Wheatley (Nottinghamshire), and many other Midland deposits may all be assigned to this stage. There is no evidence so far as we are concerned of the supposed colder phase No. 4, and it is probable that it may represent the maximum of humidity (see *Proc. Geol. Assoc. Lond.*, vol. xxxiii, 1922, p. 142), and thus the stages 3, 4, and 5 would represent one phase in climatic change.

C. E. P. Brooks has suggested that this stage practically coincides

with the introduction of Bronze into England, but the evidence is against this. Grimes Graves (Norfolk), Blashenwell (Dorset), as already noted, and the Neolithic grave at Cuxton, Kent (*Proc. Malac. Soc. Lond.*, vol. viii, 1909, pp. 375-6) are all Neolithic, and certainly not late Neolithic. The mollusca (as yet undescribed) obtained from the recent extension of the new Albert Docks are of this age, for they occurred between the two forest growths, and here again the only archaeological objects noted were flint flakes and implements. As to the climate one can only say with safety that it was much damper than the present.

Stage 2. The Upper Forest Growth. This is a return to a "continental type" of climate, but not so pronounced as in Stage 6. On archaeological evidence this can be shown to be of Bronze Age about 1500 b.c., and the recent exploration of a Bronze Age tumulus at Micheldever, Hampshire, has yielded strong confirmatory evidence from the mollusca, for they are all well developed.

Of the succeeding damp stage No. 1 we have no evidence. It was certainly not so extreme as the preceding damp stage, and it may be that it was confined to Scotland. There is, however, slight evidence that during the Roman occupation of this country the climate was slightly warmer than at present, for in Roman deposits the mollusca are nearly always slightly larger than those now living near the sites.

We thus see that there is a marked agreement between the conclusions derived from the mollusca and those deduced from the peat mosses, and we can, I think, conclude that the scheme of Professor Lewis is in the main correct.

It is interesting to note that there are but few abnormalities in the Holocene mollusca, although an enormous amount of material has passed through my hands. Only one sinistral shell has been found, an example of *Arianta arbustorum* (Linn.), at Uxbridge, Middlesex, whilst a few scalariform Limnææ and Planorbæ have occurred in the Lea Valley deposits. The Limnææ at Perranzabuloe, Cornwall, were, however, nearly all abnormal, and this was certainly the result of the conditions in which they lived. I would suggest that in this case the lake was subject to slight incursions of the sea.

I have endeavoured to show that the formerly ignored or despised and maltreated Holocene mollusca are of great importance in several lines of research, and that they can be used as evidence in solving many problems, and I would take this opportunity of thanking those numerous friends by whose kind assistance this has been possible. In pioneer work of this character, based, as I have already noted, on imperfect knowledge, temporary mistakes are bound to occur, to be rectified as our learning increases. I have had to make bricks with but little straw. Whether they will be lasting or not the future will tell, but this is certain—that the work has not only given me interest and pleasure, but has produced friendships which will last to the end of the chapter.

THE HOLOCENE SEQUENCE.

<i>Professor F. J. Lewis (1911).</i>	<i>C. E. P. Brooks (1922).</i>	<i>Divisions based on Molluscan evidence.</i>	<i>Localities.</i>	<i>Human Industries.</i>
Present day (dry).		Present day (dry).	Watford, Wall, Darenth, Borstal.	
Sphagnum (humid). 1800 B.C.-A.D. 500.		Slight Continental climate.	Oxford, London Wall, Ightham, Bermonsey, Bath, North- fleet, Ruckland.	Roman period.
Upper Forest Growth.		Continental climate.	Cleeve Hill, Northfleet.	Late Celtic.
Sphagnum (humid).		Forest Growth. 3000 B.C.-1800 B.C.	Micheldever, Wick. Insular climate, heavy rainfall.	Bronze Age.
Sub-Arctic plants (colder).			Copford, Felstead, Shalford, Chignall St. James, Boxwell, Blashenwell, Totland Bay, Allens Farm, Ightham, Cuxton, Cornish Towns (part), Harlton, Wilstone, Grimes Graves, Cissbury, Wheatley, New Albert Docks, Ipswich, Westbury, Clapham, Ledbury.	Neolithic.
Sphagnum (humid).		Post-glacial optimum.	Continental climate.	Perranzabuloe, Haweswater, Chara marls, Newquay (<i>Nemoralis</i> zone), Barn Elms.
Lower Forest Growth.				Early Neolithic.

NOTES ON THE GENUS *STENOCHITON* AND THE DISCOVERY
AND RECOGNITION OF THE TYPE OF BLAINVILLE'S
CHITON LONGICYMBA IN *STENOCHITON JULOIDES*, ADAMS
AND ANGAS.

By EDWIN ASHBY, F.L.S.

Read 9th March, 1923.

THIS remarkable genus of Polyplacophora, while evidently rightly placed under the Ischnochitonidae, in habits and characters its members are evidently widely removed from any other known form.

Instead of harbouring or living on stones, shells, or blocks of timber, the members of this genus have as their host and probably their food supply, various species of that order of marine flowering plants known as Sea Grasses.

The genus *Stenochiton* was formed by Adams and Angas in 1864, for the reception of the South Australian shell described by them under the name *S. juloides* (Proc. Zool. Soc., 1864, p. 193). As shown later, the same shell had been described by De Blainville in 1825, under the name of *Chiton longicymba*, from a specimen collected by Péron and Lesueur, at King Island in 1803.

The next species, *S. pilosbryanus*, was described by Bednall in 1897 (Proc. Malac. Soc., vol. ii, pt. 4) as having been found "on sea-weed? *Zostera*". This being the first intimation of the possibility of its habitat being other than rocks, etc. In 1900 the writer described a third species under the name of *S. pallens*, Ashby. In May, 1918, he read a paper before the Royal Society of S. Australia showing that Bednall's description did not apply to any particular species, but that the figures and description were a sort of conglomerate made up from parts of two or more species. In the same paper he described two more forms under the names of *posidonialis*, Ashby, and *cymodocealis*, Ashby, and finally in a paper read before the same Society in July, 1919, he described a further species as *pilosbryanus*, Bednall.

It will be seen that we have five known species all described from South Australia.

Habitat.—The writer in his paper (Trans. Roy. Soc. of S. Austr., vol. xlvi, 1918) was able to show that all the members of this genus live, not as had been previously supposed on "Pinna shells, old boots, glass bottles", or on rocks, but on the growing stems and leaves of flowering plants known as "Sea Grasses", being found during the day time hidden away in the brown sheaths of old *Posidonia* leaves, usually buried several inches deep in coarse shell grit and sand. They probably come out at night time and feed on the leaves of growing *Posidonia*, only returning as day approaches to the protection of the sheaths near the roots of the plant. One needs a digging tool to get the plant up by the roots, and then in sheltered localities the *Stenochiton* is found to be quite common.

The characters differentiating these shells from any other known forms are undoubtedly developed as a result of their peculiar environment.

The publication of the writer's monograph on this genus in 1918 has led to the discovery of several of these forms in large numbers, and he was himself able in 1920, on the occasion of a brief visit to Western Australia, to extend their known range westward for about 3,000 miles of coast line. He can truthfully say that since understanding the habits of these *Stenochitons* he has been able to find the species known as *S. cymodocealis*, Ashby, in every locality he has visited in South and West Australia where the sea-grass *Cymodocea* occurs.

As representatives of sea-grasses are found in suitable localities throughout the world, it will be quite safe to assume that representatives of this genus or some kindred form should be found in all these localities when properly searched for.

STENOCHTON LONGICYMBIA, Blainville, 1825.

(= *S. juloides*, Ad. and Ang., Proc. Zool. Soc., 1864, p. 193; loc. cit., 1865, p. 58, pl. xi, f. 15. Angas, Proc. Zool. Soc., 1865, p. 188, = *S. juloides*, Ad. and Ang., of Pilsbry (Man. Con., vol. xiv, p. 55), non *Ischnochiton longicymbia*, Quoy et Gaimard, auct. = *S. juloides*, Ad. and Ang., of Ashby (Trans. Roy. Soc. of S. Austr., xlvi, 1918, and Journ. and Proc. Roy. Soc. of W. Austr., vol. vi, pt. 2, 1919–20), Auct.)

Messrs. Iredale and May in their paper "Misnamed Tasmanian Chitons" (Proc. Malac. Soc., vol. xii, Nov., 1916, p. 105), state with regard to Rochebrune's *Schizochiton nymphæ* (Bull. Soc. Philom. Paris, Sér. vii, tom. viii, 1884, p. 36), from King Island, collected by Péron and Lesueur, that from Dr. Thiele's description and figure: "There is certainty that Rochebrune renamed the Blainvillean species, and that *Chiton longicymbia*, Blainville, is a *Stenochiton*. Thiele does not definitely make this a synonym of *Stenochiton juloides*, Ad. and Ang., and until King Island specimens are again collected, we prefer to allow *Stenochiton longicymbia* (Blainville) as a separate species."

During the first week of August last (1922) I had, through the courtesy of Dr. Lamy, an opportunity of examining the collections of Polyplacophora in the Muséum d'Histoire Naturelle in Paris.

Rochebrune's type of his *Schizochiton nymphæ* was on a card, and I am delighted to be able to confirm Messrs. Iredale and May's surmise that it is the lost type of Blainville's *Chiton longicymbia*, and that it is a *Stenochiton*. I have not the slightest hesitation in stating that it is quite a typical shell of the species that was described by Adams and Angas under the name of *Stenochiton juloides* in 1864.

The type is mounted on a card, measures 32 by 6 mm., girdle absent. It is a typical specimen of the shell known as *S. juloides*,

Ad. and Ang., long, narrow, smooth, well-defined raised lateral areas, brown flecked with white, a common coloration with this species.

Dr. Lamy kindly made the following literal translation of Blainville's description of his *C. longicymba* for me: "Body very elongate, very narrow, limb with very small, farinaceous scales, shell very long, formed of eight large valves, increasing from the anterior to the posterior, convex and perfectly smooth, the intermediates with broad lateral areas distinguished by one angular prominence; colour greenish-brown, variegated or streaked with small white spots which are wider upon the dorsal line." This description absolutely accords with the specimen upon the card and in no sense will agree with any other of the specimens collected by Péron and Lesueur that are in the collections in Paris.

Dr. Lamy found a manuscript description in the handwriting of Rochebrune, headed "*Lepidopleurus longicymba*, Blainville, *Chiton longicymba*, Blainville (Dict. Sci. Nat., vol. xxxvi, p. 542). Dufresne admiram". In which he states that the type was then in the Paris Museum and giving the measurement, long. 0.99, lat. 0.12. Probably allowance had been made for the width of the girdle, which is now absent. Rochebrune seems later to have decided to redescribe this shell under the name of *Schizochiton nymphæ*, and in the letterpress gives the measurements as 32 by 11 mm. The length is correct, but the width is absolutely wrong, being twice its present actual width.

The question may very naturally be asked, how was it that only eight years after Blainville's publication of his description of *Chiton longicymba*, Blainville still being connected with the Paris Museum, could Quoy and Gaimard publish in 1833, in the *Voyage de l'Astrolabe*, a description of a strikingly different shell from New Zealand, now known as *Ischnochiton maorianus*, Iredale, under the name of *Chiton longicymba*, Blainville?

By no stretch of imagination can the New Zealand shell found by Quoy and Gaimard be made to resemble Blainville's shell.

I saw in the Paris Museum Quoy and Gaimard's type from which their description and figures were made, and it is certainly conspecific with the shell named by Iredale *I. maorianus*. On another card are two specimens of the same New Zealand shell, one of them the black variety with white dorsal stripe; this is marked in the handwriting of Quoy, or Gaimard, "var. *lineolatus*, Blainville," very naturally confusing it with the variety of that species that was later on named by Pilsbry var. *haddoni*.

I have shown in earlier papers that Blainville's *lineolatus* is the shell that we have generally known as *Ischnochiton crispus*, Reeve, a species that very closely approaches to the New Zealand shell discovered by Quoy and Gaimard, and they would then have been fully justified in considering them con-specific, the chief difference being in the girdle scales.

Through some mishap the unique type of *C. longicymba*, Bl., must have been mislaid, and Quoy and Gaimard must have been shown Blainville's *Chiton lineolatus* as being *longicymba*. Had they carefully reread Blainville's original description they would at once have recognized the error.

I have often been asked how it was possible for Quoy and Gaimard to have made such a mistake? I think the evidence adduced above is conclusive, a reference to their description demonstrates at once that it was Blainville's *C. lineolatus* that they thought was conspecific with their New Zealand shell, and they marked one of their varieties as a variety of that shell; probably the true *longicymba* had come off its card and a shell of the other species had been wrongfully placed upon it.

Blainville and Rochebrun both affirm that the type of *Chiton longicymba* was collected by Péron and Lesueur at Île King. It was probably a specimen washed up on the beach; I have seen similar ones come ashore in South Australia. Of course, until it is rediscovered in King Island, the locality must be a little uncertain, for I myself saw in the Museum in Paris specimens of *Chiton hirtosus*, Péron, = *Liocephura georgiana*, Q. and G., and *Acanthopleura gemmata*, Blain., both under the name of *Chiton hirtosus*, Péron, and both stated in Péron's handwriting as having come from "Île King", whereas they had most certainly been collected later on in Western Australia.

STENOCHTON PALLENS, Ashby, 1900.

(Trans. Roy. Soc. of S. Austr., vol. xxiv, 1900, p. 86, Ashby; loc. cit., vol. xlii, 1918, pp. 75, 76, pl. xiv, fig. 14a, b) = *S. juloides*, Ad. and Ang., of Sykes (Proc. Malac. Soc., vol. ii, pt. 2, July, 1896, p. 86), Gatliff and Gabriel (Proc. Roy. Soc. of Vict., vol. xxx, pt. 1), Ashby (Proc. Roy. Soc. of Vict., xxxiii, N. Ser., 1921).

The few known specimens of this very distinct *Stenochiton* have all with one exception been dredged by Sir Joseph Verco in South Australia; the exception is in the Bracebridge Wilson Collection, dredged in Victoria, and wrongfully referred to the previous species by Sykes.

The general coloration is cream, and while we cannot affirm for certain that they live on "Sea-Grasses", there is ample justification for our assuming that they do so.

A protective coloration is common to all the other known members of this genus, and we may assume that this species lives on old or dying leaves of "Sea-Grasses", or that it belongs to such depths that the usual green colour of these plants is much modified.

The great breadth in proportion to the longitudinal length of the anterior valve easily distinguishes this species from its congeners.

STENOCHITON CYMODOCEALIS, Ashby, 1918.

(Trans. Roy. Soc. of S. Austr., vol. xlii, 1918, pp. 70-2, pls. xii and xiv, figs. 1, 4, 5, 11, and 12, *a-e*, Ashby), (Journ. and Proc. Roy. Soc. of W. Austr., vol. vi, pt. 2, 1919-20, Ashby).

This strange little, highly polished *Stenochiton* lives on the cylindrical stems and not on the flat leaves of *Cymodocea*. For this reason it is impossible to flatten out the girdle after death, but by placing the living specimens in a glass tube of sea water some of them will affix themselves to the glass, and if then the water is poured off and the *Chitons* rapidly dried they will dry flat. If allowed to die in the water, which they do quickly, they will relax, fall from the glass, and contract. This little species is often decorated with blotches of pink and white, thereby imitating the colour of the calcareous growths more or less present on the stems of *Cymodocea*.

To find this *Chiton* the plants of *Cymodocea* want pulling up as low down as possible, the specimens usually being found only a few inches above the sand. As before stated, since one was aware of the habits of this species one has found it present in every place where *Cymodocea* has been met with, in South Australia, and, in November, 1920, as far north as Geraldton in Western Australia.

Dr. W. G. Torr and myself for twenty years had worked over stones buried in beds of *Cymodocea* without discovering this species, whereas one had only to spend a few minutes in examining the stems of the sea-grass through which we were wading to have found a number of specimens.

STENOCHITON POSIDONIALIS, Ashby, 1918.

(Trans. Roy. Soc. of S. Austr., vol. xlii, 1918, pp. 72-4, pls. xiii and xiv, figs. 2, 6, and 13, *a-d*, Ashby), (Journ. and Proc. Roy. Soc. of W. Austr., vol. vi, pt. 2, 1919-20, Ashby).

In this species both the anterior and posterior valves are very long, and the former is distinctly concave and the latter slightly so. In colour and markings it is extremely variable; the general colour is green or greenish-brown, but I have taken specimens that are bright orange, others with a dark-brown dorsal line, and again magpie-marked, blotched with dark brown with a pale ground colour.

In some localities they rarely exceed 10 mm. in length, whereas in others they are more than double, and often of a very brownish colour. This species also occurs freely in Western Australia, where the magpie or blotched variety is more numerous than in this State.

It lives usually just above the sand, on the ribbon-like leaves of *Posidonia*; it is necessary to pull up the host plant from very low down or the *Chiton* may be left behind.

STENOCHTON (ZOSTERICOLA) PILSBRYANUS, Bednall.

(= *S. pilsbryanus*, Bednall, of Ashby, Trans. Roy. Soc. of S. Austr., vol. xliii, 1919, pp. 66-9, pl. xi, figs. 2a-c.)

The sub-genus *Zostericola*, Ashby, was made for the reception of this short and broad *Stenochiton*, whereas all the previously known forms are very much elongated and proportionally narrow. In common with all the other members of this genus, its shell is smooth, highly polished, and practically without sculpture, and it lives on *Zostera* and *Posidonia*. Up to the present only two specimens have been recorded:—the adult type collected by the late Professor Ralph Tate and described by the writer, and a juvenile specimen was taken and described by the writer (*loc. cit.*, p. 69).

The convex character of the anterior valve and the proportionally greater width of the shell separates this species from its congeners.

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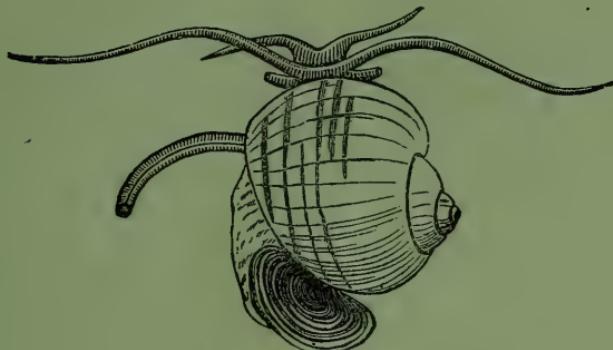
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STENOCHITON (ZOSTERICOLA) PILSBRYANUS, Bednall.

(=*S. pilsbryanus*, Bednall, of Ashby, Trans. Roy. Soc. of S. Austr., vol. xliii, 1919, pp. 66-9, pl. xi, figs. 2a-c.)

The sub-genus *Zostericola*, Ashby, was made for the reception of this short and broad *Stenochiton*, whereas all the previously known forms are very much elongated and proportionally narrow. In common with all the other members of this genus, its shell is smooth, highly polished, and practically without sculpture, and it lives on *Zostera* and *Posidonia*. Up to the present only two specimens have been recorded:—the adult type collected by the late Professor Ralph Tate and described by the writer, and a juvenile specimen was taken and described by the writer (*loc. cit.*, p. 69).

The convex character of the anterior valve and the proportionally greater width of the shell separates this species from its congeners.

ORDINARY MEETING.

FRIDAY, 11TH MAY, 1923.

A. S. KENNARD, F.G.S., President, in the Chair.

The following communications were read :—

1. On the British species of *Truncatellina*. By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S.
2. (a) Masculine deficiencies in the British Vertigininæ.
- (b) The presence of a Subcerebral Commissure in the Orthurethra. By Hugh Watson, M.A.
3. On *Turris (Surcula) macella*, nom. nov., for *T. macilenta*, Melv., nom. præocc. By J. C. Melvill, D.Sc., F.L.S.

The following exhibits were made :—

By Dr. Boycott: A coloured drawing of *Vitrina major* by Mr. Davy Dean.

By Mr. Winckworth: A series of interesting specimens of *Cardium edule*, L.

By Col. Peile: Unios from Lake Albert.

By Mr. A. S. Kennard and Mr. B. B. Woodward: Specimens illustrating their paper.

ORDINARY MEETING.

FRIDAY, 8TH JUNE, 1923.

A. S. KENNARD, F.G.S., President, in the Chair.

Dr. Dudley Stamp was elected to membership of the Society.

The following communications were read :—

1. Note on the Systematic Arrangement of the Clausiliidæ. By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S.
2. The Anatomy and General Affinities of *Ochthephila turricula*, Lowe. By Hugh Watson, M.A.
3. Some Synonyms of the Veneridæ. By J. R. le B. Tomlin, F.E.S.

The following exhibits were made :—

By Mr. A. S. Kennard and Mr. B. B. Woodward: Specimens illustrating their paper.

By Col. Peile: Specimen of *Pæciliozonites cupula*, Gulich, from the type locality.

By Mr. Winckworth, on behalf of Mr. G. Bateson: Specimen of *Synapta inhærens* with *Montacuta donacina* attached thereto.

Concerning this Mr. Bateson wrote :—

On the 3rd of April, 1923, the Easter Class at the Plymouth Marine Biological Station, visited the Salcombe Estuary and collected a number of *Leptosynapta (Synapta) inhærens*. After returning to the laboratory, Miss J. Barrington (Newnham College) found a small Lamellibranch

adhering to the surface of a *Synapta*. The mollusc was attached by its foot, which was broadened at the end, providing a circular area of contact with the skin of the Holothurian. When stimulated, it did not lose its hold, but the foot was drawn in and a little bit of the *Synapta* was pinched between the valves of the shell. The mollusc was finally pulled away with some difficulty, but there was no visible injury to the skin of the host at the point of attachment.

The mollusc was forwarded to Mr. Winckworth, who very kindly identified it as *Montacuta donacina*, S. V. Wood.

It was at first thought that the *Montacuta* had attached itself to the Holothurian while being carried up to the laboratory in a bottle; but since the original observation, Dr. J. H. Orton (Marine Biol. Assoc. Plymouth) has found other specimens in the same position.

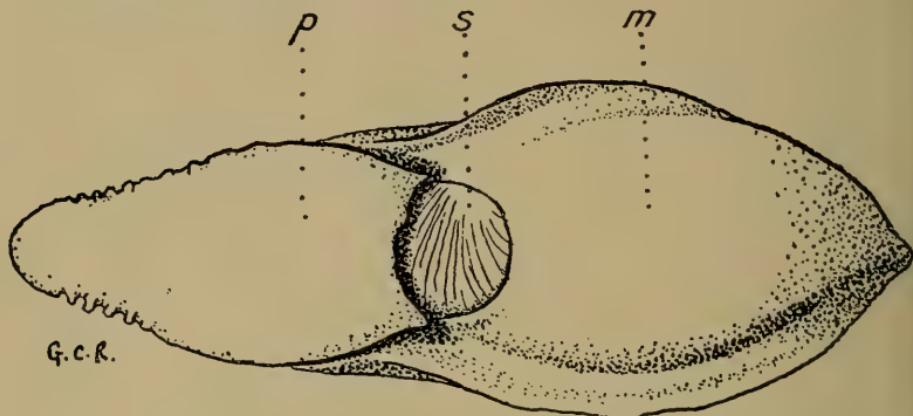
ON THE EXTERNAL CHARACTERS OF *SINUM PLANULATUM*
(Récl.).

By G. C. ROBSON, F.Z.S.

(Published by permission of the Trustees of the British Museum.)

Read 13th April, 1923.

In the autumn of last year I received from Dr. J. D. F. Gilchrist a complete specimen of *Sinum planulatum* (Récl.), obtained during the Marine Biological Survey made by the Union Government of South Africa in 1921. It was caught in 59 fathoms in Lat. 32° 11' S., Long. 18° 9' E., and had been well preserved in formalin, so that the colour was still fairly vivid. As the description of the external parts of representatives of this interesting genus is still deficient the following notes may be of service.



Sinum planulatum (Récl.), slightly enlarged. *p*, propodium; *s*, shell; *m*, metapodium.

The modification of the foot in the Naticidæ is a well-known phenomenon, and has been repeatedly figured in textbooks. A general account of *Sinum planulatum* has been given by Bergh¹; but no detailed description of the external parts has been as yet published in the case of this species, which probably shows the maximum development of the propodium and metapodium seen in this family.

The specimen is somewhat bent on itself and cannot easily be flattened out. It measures about 87 mm. in length; a figure which is twice as large as that given for Bergh's specimen. The only other complete example in the British Museum measures 85 mm. To this total length the propodium and metapodium each contribute the same, viz. about 40 mm. The whole animal is long, narrow, and flat, and only a small portion of the shell is seen projecting between the

¹ *Trans. S. African Phil. Soc.*, xvii, 1908, p. 108.

posterior expansion of the propodium and the anterior portion of the metapodium. The colour is a delicate brownish-pink uniformly distributed on the upper and lower surface. At its widest the propodium measures 25 mm. in width, the foot projecting slightly beyond it. The groove separating propodium and foot-sole begins some 10 mm. from the anterior end on the right-hand side, but is much nearer to the anterior extremity on the other, an asymmetrical arrangement which may be devoid of significance. The footsole and propodium are ovoid in plan, with the posterior end emarginate over the shell, in which area it covers the head and shell for a distance of about 6 mm. The posterior pedal area is wider than the anterior. The metapodium is not actually separated by a groove from the sole, but the propodial groove is continued backwards as a ledge about 4-5 mm. wide on each side, that on the left reaching the posterior extremity, that on the right ceasing about 10 mm. from the extremity. The anterior edge of the metapodium is hollowed out, and between this and the similarly emarginate posterior edge of the propodium some 12 mm. of the surface of the shell are revealed. The metapodium covers about 10 mm. of shell and the apex of the latter lies about 2 mm. inside the metapodial border. The metapodial area (inclusive of the sole) measures 34 mm. in width. The posterior extremity is pointed. In its general appearance the animal is thus elongate and leaf-shaped. The maximum height is 14 mm. or only one-sixth of the total length. The whole of the external surface is undifferentiated, and very little difference in the epithelium of the plantar and dorsal surfaces of the foot is observable.

When the shell is removed and the propodium cut back so as to allow an inspection of the head it is seen that the propodium is banked up against the head with an overhanging end. The head is supplied with a flat, thin, semicircular cephalic shield from which two slender tentacles originate. Contrary to Bergh's statement, a small, rather degenerate, operculum measuring about 5·5 mm. was found in this specimen.

There is a marked resemblance in function between the propodium in *Sinum* and other Naticoids and the cephalic shield of certain Bullomorpha. It would be of great interest to ascertain whether the innervation of the two structures which are of different origin, one being pedal, the other cephalic, is likewise different in origin, as one would *a priori* assume, or whether, subserving the same function, they are innervated from the same centres.

The remarkable development of the foot in this genus will be best illustrated by the statement that the viscera, shell, mantle, and head only occupy one-seventh of the total bulk of the animal, the remaining six-sevenths being represented by the enormous muscular expansion of the foot.

MASCULINE DEFICIENCIES IN THE BRITISH VERTIGININÆ.

By HUGH WATSON, M.A.

Read 11th May, 1923.

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INTRODUCTION.

THE researches of Dr. A. E. Boycott and others have revealed the remarkable fact that snails belonging to the genera *Acanthinula* and *Vallonia* very commonly have no male organs, although the individuals are fully developed in other respects and have spermatozoa as well as ova in the hermaphrodite gland.¹ Moreover, when describing the reproductive organs of *Vallonia* three years ago, I briefly mentioned that the same phenomenon occurs in at least one species of *Vertigo*, namely, *V. mouliniana* (Dupuy). Since then Dr. Boycott has prepared serial sections of several other small snails, chiefly belonging to the Vertigininæ, and has kindly sent them to me for examination. A preliminary study of these very interesting slides has yielded the following results.

BRIEF DESCRIPTIONS OF THE GENITAL ORGANS OF THE SPECIMENS EXAMINED.

Vertigo mouliniana (Dupuy).

Two specimens collected by Dr. Boycott at Braunton, North Devon, in August, 1919.—In both individuals the male organs are entirely absent, except perhaps for a vestige of the first part of the vas deferens adjacent to the oviduct. The hermaphrodite gland consists of a single cluster of follicles containing both ova and spermatozoa. The hermaphrodite duct is darkly pigmented, as is often the case in the Pupillidæ, and is somewhat swollen near its

¹ Boycott, *Journ. of Conch.*, vol. xv, 1917, p. 175; *Proc. Malac. Soc.*, vol. xii, 1917, p. 221. Steenberg, *Vidensk. Medd. fra Dansk Naturhist. Foren.*, vol. lxix, 1917, p. 6. Watson, *Proc. Malac. Soc.*, vol. xiv, 1920, p. 17.

anterior end, the swollen part functioning as a vesicula seminalis. There is a large albumen gland, as in all the specimens described in this paper. The prostate gland is small, consisting of a very few, short tubules, situated at the inner side of the hinder end of the spermoviduct where it joins the albumen gland. The broad glandular genital duct, which passes forwards from the albumen gland, is divisible into a posterior and an anterior portion, which differ in their histological structure. The posterior part is the larger, and may be termed the spermoviduct; the anterior part may be called the glandular oviduct, and is specially characterized in this species by the fact that its gland-cells contain a granular secretion which stains blue with haematoxylin. The last division passes forwards into the non-glandular free oviduct, which unites with the narrow receptacular duct, and is continued to the genital opening as a long vagina of simple structure. The receptaculum seminis, or spermatheca, is situated close to the hinder end of the spermoviduct towards its outer side, not far from the base of the albumen gland; the receptacular duct is therefore very long.

One specimen collected by Dr. Boycott at Cothill, Berkshire, in November, 1921, and nine additional specimens found in the same locality in June, 1923.¹—Five of the latter specimens are without male organs, and closely resemble the examples from Braunton in the structure of their genital ducts. In the remaining individuals from Cothill rather complex male organs are present. The penis is very long, and is somewhat swollen at its hinder extremity; its walls contain a considerable amount of glandular tissue. Into the posterior end of the penis there opens a long epiphallus, which, however, is much narrower than the penis itself and does not contain gland-cells. The slender vas deferens is very long, running forwards near the oviduct and vagina almost to the genital atrium, and then bending round and passing far back to merge into the hinder end of the epiphallus. The narrow penial retractor is inserted at the junction of the epiphallus and vas deferens. The genital atrium is rather short, and the hermaphrodite and female organs agree closely with those of the specimens without male organs.

Vertigo antivertigo (Drap.).

Two specimens collected by Dr. Boycott at Braunton, North Devon, in August, 1919.—Male organs are present in both individuals. The vas deferens is very long, running forwards beside the oviduct and vagina, and then bending round and passing back a considerable distance beyond the hinder end of the penis. It then bends round again and passes forwards to enter the penis at its extremity, this last part of the vas deferens being slightly broader than the rest, and forming an incipient epiphallus. The penis itself is long, and is

¹ Only three of these nine specimens were cut into sections; the rest I dissected in the ordinary manner.

largely lined by glandular cells containing a granular secretion. The flagellum, which Lehmann describes and figures as arising from the base of the penis in this species,¹ seems to be absent.

The genital atrium and the free oviduct are not quite so short as they are in most species of *Vertigo*. The glandular part of the oviduct is larger than in *V. mouliniana*, and the gland-cells lining it do not contain a deeply staining secretion as in that species, but are less unlike those lining the spermoviduct behind it. The part of the darkly pigmented hermaphrodite duct that serves as a vesicula seminalis is more swollen than in the last species. The hermaphrodite gland, prostate gland, spermoviduct, and vagina are similar to those of *V. mouliniana*; and so are the receptaculum seminis and its duct, the receptacular duct being very much longer than that shown in Lehmann's figure.

Vertigo substriata (Jeffreys).

Five specimens collected by Mr. Charles Oldham at Dolgelly, Merionethshire, in October, 1922.—The penis is entirely absent in all the specimens. A rather long vas deferens is present near the oviduct, but it appears to end blindly. This species resembles the last in its hermaphrodite gland, spermoviduct, and glandular oviduct; but the non-glandular free oviduct is very short, and the swelling of the hermaphrodite duct that serves as a vesicula seminalis seems to be much smaller.

Vertigo pygmaea (Drap.).

Five specimens collected by Dr. Boycott at Branscombe, South Devon, in August, 1922.—Male organs are present in all the specimens. As in *V. antivertigo*, the vas deferens is remarkably long, with the last part of it slightly broader than the rest, forming an incipient epiphallus. The penis is very long, and its walls contain numerous gland-cells. No appendix or flagellum was found. Lehmann's figure of the male organs of this species² seems to be more accurate than that of Moquin-Tandon,³ the transition from the penis to the epiphallus or vas deferens being abrupt rather than gradual in all the species of *Vertigo* that I have been able to examine.

The genital atrium is very short; the free oviduct is also short, and the glandular part of the oviduct is slightly smaller than in the last two species. The swelling of the hermaphrodite duct that forms the vesicula seminalis is large. The hermaphrodite gland, prostate, spermoviduct, and vagina resemble those of *V. mouliniana* and *antivertigo*; and, as in these species, the receptaculum seminis is situated on the outer side of the posterior end of the spermoviduct, and therefore has a very long duct, far longer than is shown in the figures of Moquin-Tandon and Lehmann.

¹ *Die lebenden Schnecken u. Muscheln der Umgegend Stettins u. Pommern*, 1873, p. 150, pl. xiv, fig. 52.

² Op. cit., pl. xiv, fig. 53.

³ *Hist. Nat. Moll. France, Atlas*, 1856, pl. xxviii, fig. 42.

Vertigo alpestris, Alder.

Ten specimens collected by Mr. Charles Oldham at Dolgelly, Merionethshire, in September, 1921.—In eight of these specimens no penis can be seen, but as some of this material is not in good condition it is only possible to say with certainty that the penis is entirely absent in the case of four individuals. The first part of the vas deferens is present beside the oviduct, but it ends blindly, sometimes in a slight swelling, at about the level of the anterior end of the receptacular duct or a little below it.

The hermaphrodite duct is darkly pigmented, and is somewhat swollen near its anterior end to serve as a vesicula seminalis. The hermaphrodite gland, the small prostate, and the spermoviduct are similar to those of the preceding forms. The glandular oviduct is rather large, the non-glandular free oviduct is very short, and the vagina is rather long. The receptaculum seminis lies beside the posterior end of the spermoviduct near the albumen gland, and has a very long duct.

In the remaining two specimens of this batch male organs are present. The penis is very long, and is lined by glandular cells containing a granular secretion. The vas deferens enters the penis at its extremity; it is very long and slender, and the last part of it does not appear to be broader than the rest. The genital atrium is very short. The remaining genital organs of these two specimens are similar to those found in the examples without a penis.

One specimen collected in the same locality in October, 1922, is without a penis, and closely resembles the similar specimens collected on the previous occasion, except that the vas deferens is somewhat longer, reaching to the neighbourhood of the genital opening, where it ends blindly in a slight swelling.

The evidence of the genital ducts does not support Boycott's suggestion that this species might prove to be viviparous.¹ On the contrary, it seems very unlikely that any of the species dealt with in this paper are viviparous forms, judging from their structure.

Vertigo pusilla, Müll.

Ten specimens collected by Mr. Charles Oldham at Dolgelly, Merionethshire, in June, 1922, and seven more found in the same locality in October, 1922.—The whole of these seventeen specimens are destitute of a penis; but they possess a vas deferens, which is usually of some length, though it does not lead anywhere. The hermaphrodite gland and its duct, the prostate gland, the spermoviduct, the glandular oviduct, and the free oviduct and vagina are all of the same type as in the last species; but it is noticeable that the secretion in the posterior end of the spermoviduct stains more deeply with haematoxylin than that in the anterior part

¹ Proc. Malac. Soc., vol. xiv, 1921, p. 172.

of the same duct, the contrast being somewhat striking, although the structure of the two parts is similar. The receptaculum seminis appears to occupy a similar position in this species to that which it does in the preceding forms.

It will be noticed that the above description does not agree with Lehmann's figure 54, which shows a penis; but there is some doubt as to whether this figure really represents the reproductive organs of *Vertigo pusilla*, which are not described in the text¹; it seems possible that it may portray the genital organs of *V. angustior*, which Lehmann does describe.

Truncatellina britannica, Pilsbry.²

Fifteen specimens collected by Dr. Boycott at Branscombe, South Devon, in August and September, 1922.—Twelve of these snails are without male organs, except that in at least some individuals there may be a vestige of the part of the vas deferens near the oviduct. The hermaphrodite gland, unlike that of the preceding species, is divided into two separate portions. The outer side of both parts is coated with a thick layer of pigment. The hermaphrodite duct is also darkly pigmented, and is only very slightly swollen towards its anterior end. No prostate gland could be found. The broad glandular duct passing forwards from the albumen gland consists of three successive portions, instead of only two, as in the preceding species. These three portions differ widely in their histological structure. The first or posterior portion has a thick compact epithelium of oblong secretory cells, like those commonly found in the wall of the spermiduct. In the second or middle portion we find large rounded glandular cells, with clear contents. In the third or anterior portion there are smaller ciliated gland-cells, the secretion of which stains a bluish colour with hæmatoxylin. The receptaculum seminis lies against the outer side of the junction of the second and third of these portions; its duct is therefore much shorter than in the species already described. The non-glandular free oviduct is short, and it and the vagina in front of it are of the same simple type found in the preceding forms.

The three other specimens found with the twelve just described are similar, except that they possess male organs. The vas deferens is of moderate length, and leads into the posterior end of a rather small penis without any apparent glandular tissue. No penial appendix was found, such as is described and figured by Lehmann in two other members of this genus.³ It is possible, however, that

¹ Op. cit., pp. 153, 319.

² This form may be a subspecies of *Truncatellina rivierana* (Benson) = *T. strobeli* (Gredler), as Pilsbry supposed (*Man. Conch.*, ser. II, vol. xxvi, 1921, p. 77). The name was originally spelt "brittanica", but I am informed that this was a printer's error.

³ Op. cit., pp. 140, 148, pl. xiii, fig. 47; pl. xiv, fig. 51.

Lehmann's observations on these very minute species may not be altogether accurate.

Columella edentula (Drap.).

(= *Sphyradium edentulum* (Drap.) of many authors.)

Four specimens collected by Dr. Boycott at Cothill, Berkshire, in November, 1921, and two additional examples found in the same locality in June, 1923.¹—All the specimens have male organs, which consist of a comparatively small penis, without any apparent glandular tissue, and a vas deferens of moderate length, which enters the penis at its extremity. The male organs thus agree with Hanna's description of American specimens,² rather than with the account of Lehmann, who describes and figures two penial appendices in this species.³

The hermaphrodite gland appears to form a single cluster of follicles. The hermaphrodite duct is darkly pigmented, and is swollen near the albumen gland to serve as vesicula seminalis. An extremely small prostate gland seems to be present on the inner side of the posterior end of the spermoviduct, that is to say, in the usual position of the prostate in the Pupillidæ. The spermoviduct and the glandular oviduct in front of it are both rather large, and of the same general character as in *Vertigo antivertigo* and *V. substriata*; but where they join there is a part having a slightly different histological structure, which may possibly correspond to the more distinct middle portion of the glandular genital duct of the last species. The non-glandular part of the oviduct is short; the vagina is longer, but the genital atrium is very short. The receptaculum seminis is situated near the junction of the spermoviduct and the glandular oviduct, i.e. about half-way up the glandular part of the genital duct, and is nearer the inner than the outer side. The receptacular duct is therefore of moderate length.

These specimens differ from Hanna's description in that the hermaphrodite duct is slightly convoluted towards its anterior end, the glandular wall of the spermoviduct is folded internally, and the genital atrium, though very short, is not entirely absent. These apparent differences, however, may be chiefly due to differences in the methods of observation; they need not be held to prove that the form examined by Hanna is specifically distinct from that found in England, especially as Sterki has stated that "the American form is absolutely identical with the palæartic".⁴

THE PRESENCE AND ABSENCE OF MALE ORGANS IN THESE SPECIMENS.

The following table summarizes the facts respecting the presence and absence of male organs in the specimens described above:—

¹ These two specimens were not cut into sections like the others, but I examined their male organs by ordinary dissection.

² Proc. U.S. Nat. Mus., vol. xli, 1912, p. 375.

³ Op. cit., p. 143, pl. xiv, fig. 49.

⁴ Nautilus, vol. x, 1896, p. 76.

		Number of individuals	
		With penis	Without penis
<i>V. mouliniana</i> , Braunton	.	0	2
" Cothill	.	5	5
<i>V. antivertigo</i> , Braunton	.	2	0
<i>V. substriata</i> , Dolgelly	.	0	5
<i>V. pygmaea</i> , Branscombe	.	5	0
<i>V. alpestris</i> , Dolgelly	.	2	5 (at least)
<i>V. pusilla</i> , Dolgelly	.	0	17
<i>T. britannica</i> , Branscombe	.	3	12
<i>C. edentula</i> , Cothill	.	6	0
<hr/>		<hr/>	
Totals	.	23	46

It will be noticed that in three of these species all the specimens examined possess a penis ; in two species none of them do ; while in three species some of the individuals have a penis but the majority are without this organ. No intermediate specimens occurred in which the penis was only partly developed ; it seems to be always either present or entirely absent. In those animals which lack a penis the other organs are fully developed, and spermatozoa are present in the hermaphrodite gland and duct. Moreover, in at least some of these species, as in the case of *Acanthinula aculeata* and *Vallonia costata*, specimens with and without a penis may be found together at the same time and in the same locality.

These facts show that the frequent absence of the male organs in this family of snails can scarcely be due to the immaturity or senility of many of the specimens, or to any influence of the environment ; it would seem more probably to be a mutation caused by some hereditary factor.¹ But as this mutation is so common among these snails, it is probable that the absence of a penis does not seriously interfere with the animal's reproductive powers in the case of these minute species. Possibly the spermatozoa pass straight down the oviduct and vagina, which are no broader than the vas deferens and epiphallus of a large snail ; and in copulation the very short distance that they have to travel may render a special intromittent organ unnecessary. On the other hand, it is quite possible that self-fertilization, which evidently occurs occasionally in some of the larger snails and slugs, may be the normal method of reproduction in these genera. The chances of successful copulation would not only be reduced by the limited locomotory powers of such small snails, as

¹ The ten species in which this phenomenon is now known to occur belong to four different genera ; nevertheless, they are all orthurethrous forms not distantly related to one another. Collinge has described single abnormal specimens of *Arion intermedius* Normand and *Helix aspersa* Müll. with no male organs ; but these are extremely rare abnormalities, and in them the receptaculum seminis is said to be absent, as well as the male ducts (*Journ. of Anat. and Physiol.*, vol. xxvii, 1893, pp. 237, 238).

Boycott has pointed out,¹ but also by the fact that, while spermatozoa are present in considerable numbers in the hermaphrodite gland in these forms, irrespective of whether the animal has a penis or not, they do not occur in the enormous quantities that one commonly finds in the genital glands of other snails. This is probably due to the small size of the gland, which does not leave room for a very large number, most of the space being occupied by the ova. In this connexion it is interesting to note that, of the species examined, the two in which the swelling of the hermaphrodite duct that serves as a vesicula seminalis is largest, namely, *V. antivertigo* and *V. pygmæa*, are the only species of *Vertigo* in which all the specimens examined possess a penis.

Dr. Boycott has also pointed out that it would be specially advantageous to very small snails to dispense with any superfluous organs, in order to leave greater room for the more essential structures.² The complex organs possessed by a snail are in most cases built up of a very large number of cells, and the size of the individual cells cannot be reduced indefinitely³; therefore a stage must be reached when some of the organs can scarcely become any smaller. Accordingly, in a minute snail the organs are likely to become unduly crowded, and it will then be an advantage to dispense with any that are unnecessary in order to leave room for the efficient working of those that are more essential. If the male organs can be dispensed with, more room will be left for the adjacent buccal mass and central nervous system, very complex and necessary structures.⁴ And there will also be more room for the passage of the eggs down the female ducts; for the eggs cannot be reduced below a certain size if they are to contain a sufficient store of food material to carry the young snail through the whole of its development, until it is hatched in a form in which it is able to feed itself.

To this argument it might perhaps be objected that some of the species with male organs, *Vertigo pygmæa* for example, are even smaller than some of those that are frequently without a penis.

¹ *Proc. Malac. Soc.*, vol. xii, 1917, p. 225. It may be observed that the three species in which no specimens without male organs have yet been found are those that are the most widely distributed throughout the British Isles. On the other hand, some of the species that seem to be usually without male organs are sometimes found in considerable numbers in the small areas in which they occur; and in such instances it may be doubted whether the chances of two individuals meeting each other are less than in the case of a few of the larger, but less gregarious, forms belonging to other groups which are not known ever to lack a penis. Moreover, the species of *Vallonia*, which seldom possess male organs, are by no means rare snails.

² *Journ. of Conch.*, vol. xv, 1917, p. 177.

³ See D'Arcy Wentworth Thompson, *On Growth and Form*, 1917, pp. 34-8, on the factors that limit reduction in the size of cells.

⁴ It is even conceivable that the pressure of these organs at an early and critical stage in the development of the genital ducts might possibly be a direct cause of the suppression of the male organs.

This objection, however, fails to take into consideration the fact that in these relatively larger forms, such as *Acanthinula aculeata*, the male organs, when present, are specially complicated and therefore presumably occupy more space.

THE EVIDENCE OF THE GENITAL ORGANS IN CONNEXION WITH THE CLASSIFICATION OF THE BRITISH VERTIGININÆ.

A detailed study of the entire anatomy of a larger number of specimens will be necessary before we can form an adequate judgment of the mutual affinities of these small species. Nevertheless, it is worth noticing that if the species dealt with in this paper were to be classified according to their genital organs alone, the result would be somewhat as follows :—

(1) Penis (when present) long, containing glandular tissue ; vas deferens very long ; receptacular duct also very long.—*Vertigo moulinsiana* (Dupuy), *V. antivertigo* (Drap.), *V. pygmaea* (Drap.), *V. alpestris*, Alder, and almost certainly *V. substriata* (Jeffr.) and *V. pusilla*, Müll., although in the last two species the form of the penis, if that organ ever occurs, is not yet known.

(2) Penis (when present) rather small, without glandular tissue ; vas deferens not exceptionally long ; receptacular duct of moderate length.

(a) Glandular part of genital duct composed of three portions differing widely in structure ; hermaphrodite gland divided into two parts.—*Truncatellina britannica*, Pilsbry.

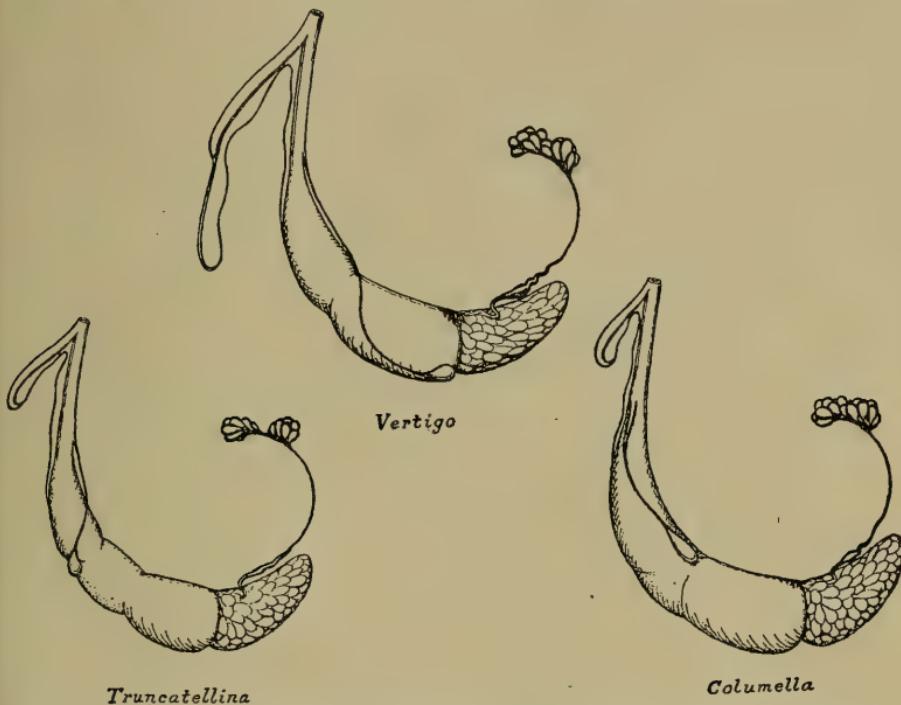
(b) Glandular part of genital duct composed of two main portions differing slightly in structure ; hermaphrodite gland not divided into two parts.—*Columella edentula* (Drap.).

It will be seen that this classification agrees remarkably well with one founded solely on the characters of the shell. If, however, the radula were also to be taken into consideration, *V. moulinsiana* would probably have to be placed slightly apart from the other British species of *Vertigo*, for the radula of this species is peculiar in that the lateral and marginal teeth are all approximately **M**-shaped, and scarcely differ from one another.¹

The reproductive system of *Truncatellina britannica* differs in several respects from that found in the other species examined, as may be seen from the description given above (on p. 274). It is thus evident that this species is rightly placed in a distinct genus. Its radula may be described as intermediate in character between the type found in *Vertigo pygmaea* and its allies, and that found in the genus *Columella* ; but it more nearly resembles the former type than the latter. In this minute species there are not more than eleven teeth on each side of the central in each transverse row.

¹ See Tomlin and Bowell, *Journ. of Conch.*, vol. xii, 1909, pp. 215, 298, pl. v.

The reproductive organs of *Columella edentula* in some respects resemble those of the last species, while in other features they are more like those of the genus *Vertigo*, though they differ from both in the position of the receptaculum seminis. There can be no doubt, however, that Hanna was right when he stated that this snail is far more nearly related to *Vertigo* than to *Punctum*,¹ a very different genus, with a sigmoidal excretory system and deep peripodial grooves. Even in its jaw it seems to me that *Columella edentula* more closely resembles *Vertigo* than *Punctum*, although the character of this organ has formed one of the chief grounds for regarding this animal as related to the latter genus. The multiple jaw of *Punctum*



Diagrammatic figures illustrating some of the differences in the reproductive organs which appear to separate the type found in most of the British species of *Vertigo* that possess male organs from the types occurring in *Truncatellina* (when male organs are present) and in *Columella*.

and *Laoma* is a very distinctive organ of peculiar structure, whereas the jaw of *Columella edentula* seems only to differ from that of *Vertigo* in that the oblong plates of which it is composed are less closely united with one another. For in *C. edentula* the plates of the jaw do not seem to be entirely disconnected, and in the genus *Vertigo* the jaw often has the appearance of being built up of a number of plates which are joined to one another but have not become entirely fused together. The type of teeth found in the radula of *Columella*

¹ Proc. U.S. Nat. Mus., vol. xli, 1912, p. 371.

might easily have been derived from that occurring in *Truncatellina*; and the resemblance of the radula of this genus to the type found in *Punctum* should probably be regarded as due to convergence. The cusps of the teeth in two English specimens of *Columella edentula* were not observed to have the blackish colour that Dall states he found in some American examples.¹

SUMMARY.

A study of Dr. Boycott's preparations shows that the penis is very commonly entirely absent in *Vertigo pusilla*, Müll., *V. substriata* (Jeffr.), *V. alpestris*, Alder, *V. mouliniana* (Dupuy), and *Truncatellina britannica*, Pilsbry, although it has been found in a few specimens of the last three species, as well as in *Vertigo pygmaea* (Drap.), *V. antivertigo* (Drap.), and *Columella edentula* (Drap.). The specimens without a penis are fully developed in other respects, with spermatozoa as well as ova in the hermaphrodite gland; the part of the vas deferens near the oviduct is usually present, but it ends blindly.

A classification of the British Vertigininæ based on the genital organs agrees well with that founded on the shell, although the radula of *V. mouliniana* suggests that this species stands slightly apart from the other members of the genus *Vertigo*. The reproductive organs of *Truncatellina* differ in some respects from those of *Vertigo*, and the male organs (when present) resemble those of the genus *Columella*. No evidence has been found in support of Lehmann's statements that flagella occur in various species belonging to these three genera; on the other hand, Hanna's views about the simplicity of the male organs of *Columella edentula*, and the affinities of this animal with *Vertigo* rather than *Punctum*, are confirmed.

THE PRESENCE OF A SUB-CEREBRAL COMMISSURE IN THE ORTHURETHRA.

By HUGH WATSON, M.A.

Read 11th May, 1923.

THE cerebral nerve-ganglia might be termed the brainiest part of a mollusk, and the commissures that unite these two ganglia are structures of considerable importance. For if the chief nerve-centres on the right and left sides were not directly connected with each other, it is difficult to perceive how an animal could efficiently regulate its actions to achieve definite ends. To be double-minded is to be unstable in all one's ways.

It is well known that in the most primitive order of Gastropods, the Aspidobranchia, the cerebral ganglia are directly connected by two commissures, one passing above the buccal mass and the other

¹ *Proc. U.S. Nat. Mus.*, vol. xli, 1912, p. 372.

below it. The anterior end of the alimentary canal is thus surrounded by a cerebral nerve-ring, which in some of the more archaic genera recalls that found in the Amphineura. But the lower commissure is usually narrower than the upper one, and it tends to disappear in the higher Streptoneura ; in fact, in the Pectinibranchia it is only known to occur in a very few of the most primitive members of the group.

In the Opisthobranchia it has been found that the cerebral ganglia are united by both upper and lower commissures, not only in primitive forms like *Actæon*, as shown by Bouvier, but also in numerous other genera belonging both to the Teetibranchia and to the Nudibranchia, as shown by Vayssièvre, Pelseneer, and others. But while the upper commissure, known simply as the cerebral commissure, is short and broad, the lower commissure, which is termed the sub-cerebral commissure, is long and very slender.¹

Turning now to the Pulmonata, we find that, while the stout cerebral commissure is one of the most conspicuous parts of the nervous system, very few writers have been able to discover a sub-cerebral commissure, and some appear to doubt whether this lower commissure is ever present in the Stylocephalophora (excluding the Ditremata). Fifty years ago, however, de Lacaze-Duthiers described what is probably the sub-cerebral commissure in *Limnaea*,² and later Amaudrut stated that it was present in *Achatina panthera* (Fér.), *Bulimus funkii* (Nyst.), *Nanina cambodjiensis* (Reeve), and *Helix aspersa*, Müll., four members of the Stylocephalophora, which, it will be noticed, not only come from four different continents, but belong to four different families.³ In 1893 Plate showed that a sub-cerebral commissure occurs in the Onchidiidæ,⁴ a fact subsequently confirmed by von Wissel and Stantschinsky ; but it was not until 1917 that Kunze⁵ and Bang⁶ were able to announce the discovery of this slender commissure in *Helix pomatia*, Lin., notwithstanding the amount of work that had already been done on the anatomy of this well-known species. I have myself been able not only to confirm the existence of a sub-cerebral commissure in *Helix aspersa* and in the Onchidiidæ, but also to report its presence in more than one species of *Apera*,⁷ in *Natalina quekettiana* (M. & P.),⁸ in *Helicarion*

¹ See, for example, Vayssièvre, *Mollusques de la France*, vol. i, 1913, pl. xvi, where is figured the central nervous system of four representative Opisthobranchia.

² *Arch. de Zool. Expér. et Génér.*, vol. i, 1872, p. 453, pl. xvii, figs. 3, 4 ; pl. xviii, fig. 8.

³ *Bull. Soc. Philom. de Paris*, ser. vii, vol. x, 1885, p. 107 ; *Ann. Nat. Sci. Zool.*, ser. viii, vol. vii, 1898, p. 127.

⁴ *Zool. Jahrb. (Anat. u. Ontog.)*, vol. vii, p. 150, pl. xii, fig. 85.

⁵ *Zool. Anz.*, vol. xlvi, p. 234.

⁶ *Ibid.*, p. 284, and fig. 1 (p. 282).

⁷ *Ann. Natal Mus.*, vol. iii, 1915, p. 137, fig. 2 (p. 152), pl. xv, figs. 73, 74.

⁸ *Ibid.*, p. 138.

(*Gymnarion*) *gomesianus* (Morelet),¹ and in *H.* (*Granularion*) *cryptophallus*, Watson.²

It is thus evident that a sub-cerebral commissure has now been found in at least six families of the Stylocephalopora alone, namely, the Zonitidæ, the Helicidæ, the Acavidæ (subfamily Strophocheilinæ), the Achatinidæ, the Rhytididæ, and the Aperidæ. But it will be observed that all these families belong to the Sigmurethra. So far as I am aware, a sub-cerebral commissure has never been stated to occur in any member of the Orthurethra. This is remarkable, not only because of the large number of genera that belong to this division of the Stylocephalopora, but also because the Orthurethra is supposed to be a rather more primitive group than the Sigmurethra, mainly on account of its excretory organs being more like the type found in the Basommatophora. It might, therefore, be inferred either that the Orthurethra is not really more primitive than the Sigmurethra, or that the sub-cerebral commissure found in the higher Pulmonates should not perhaps be regarded as a primitive structure, but might possibly have arisen by the anastomosis of a pair of cerebral nerves.

In view of these facts, it seems well to make known that I have lately discovered that a sub-cerebral commissure is present in at least three different genera belonging to the Orthurethra. I have found it in full-grown specimens of *Ena obscura* (Müll.), from the Gog Magog Hills near Cambridge, in an immature example of *Rachis punctata* (Anton), from Bombay, kindly sent to me by Col. Peile, and in a full-grown specimen of *Chondrina similis* (Brug.), from Alassio on the Italian Riviera, for which I am indebted to Major Connolly. That all these species are correctly assigned to the Orthurethra I have proved by an examination of their excretory organs.

In these species the sub-cerebral commissure does not exceed .005 mm. in diameter, apart from the surrounding connective tissue; this is scarcely one-tenth of the diameter of the cerebral commissure, which, however, is not nearly so long. As in other Pulmonates, it arises from the outer and lower side of each cerebral ganglion, a short distance in front of the origin of the cerebro-pedal connective, and close to the origin of the cerebro-buccal connective. It passes round the oesophagus anterior to the cerebro-pedal and cerebro-pleural connectives, and in *Ena obscura* and *Chondrina similis*—and possibly also in *Rachis punctata*—it is attached for the greater part of its length to the front of the two lateral cephalic arteries. In the centre, where these arteries arise from the anterior aorta, the commissure passes straight across, underneath the lower end of the odontophoral or buccal artery, but in front of the origin of the pedal

¹ Proc. Malac. Soc., vol. xiv, 1920, p. 94.

² Ibid., p. 99.

artery, a vessel which passes downwards between the sub-cerebral commissure and the broad and short anterior pedal commissure. To some of the arteries with which it is in contact the sub-cerebral commissure seems to give off one or two pairs of very slender nerves.

The sub-cerebral commissure is quite as well developed in these three species as in any of the sigmurethrous snails in which I have observed it, and it is probable that it will be found also in other orthurethrous forms. Indeed, I believe that I have seen it in *Pleurodiscus flavidus* (Rossm.) [= *Patulastra balmei* (P. & M.)] and in *Acanthinula aculeata* (Müll.), although I have not been successful in following it throughout its entire length in these species, and should not yet like to state definitely that it is present. It is very likely, however, that this slender commissure will be found to occur generally throughout the Orthurethra. Thus the evidence now before us would seem to point to the conclusion that in the Pulmonata there are normally five commissures passing beneath the alimentary canal, namely, the buccal commissure, the sub-cerebral commissure, the two pedal commissures, and the visceral commissure; but of these the narrow sub-cerebral is, of course, the only ventral commissure that unites the cerebral ganglia directly, without the intervention of any other ganglia.

SUMMARY.

A slender sub-cerebral commissure is now known to unite the cerebral ganglia beneath the alimentary canal not only in half-a-dozen families of sigmurethrous snails, but also in at least three orthurethrous genera, namely, *Ena*, *Rachis*, and *Chondrina*. It is probable that it is present also in other genera of the Orthurethra, and that there may normally be five ventral commissures in the Pulmonata.

THE ANATOMY AND GENERAL AFFINITIES OF OCHTHEPHILA (= GEOMITRA) TURRICULA (LOWE).

By HUGH WATSON, M.A.

Read 8th June, 1923.

PLATE VI.

(1) ANATOMICAL DESCRIPTION.

THE following account of the anatomy of *Ochthephila* (*Hystricella*) *turricula* (Lowe)¹—otherwise known as *Geomittra turricula*²—is

¹ *Trans. Cambridge Philos. Soc.*, vol. iv, 1831, p. 58, pl. vi, fig. 21.

² In 1895 Pilsbry discarded the name *Ochthephila* Beck, 1837, in favour of *Geomittra* Swainson, 1840, because he thought that the former generic name was too like *Ochthiphila*, a name which Fallén had given to a genus of flies in 1823 (see *Man. Conch.*, ser. II, vol. ix, pp. 238, 239, 243). But Pilsbry wrote before the establishment of the International Rules for Zoological Nomenclature; and it is clear from the recommendations of Article 36 of this

based on the examination of some specimens kindly given to me by Mr. A. S. Kennard, to whom I am much indebted for the opportunity of examining this interesting snail. The specimens were collected by Professor T. D. A. Cockerell on the Island of Cima, a small rocky islet off the south-east coast of Porto Santo, about 35 miles north-east of Madeira. The species appears to be confined to this little island, where it occurs in considerable numbers ; but numerous other members of the same genus are found throughout the Madeira Islands, although very little has been published about their anatomy.

The Shell of the specimens examined measures about 9 mm. in height by 6·5 mm. in its greatest diameter. Its form will be seen from Pl. VI, Fig. 1. The whorls are covered with minute oval granules, the major diameter of each individual granule being parallel to the lines of growth on the first two whorls, but horizontal on the remaining whorls. The shell is of a brown colour, the apex and the uninterrupted peristome being pale. Above the periphery the whorls are crossed by ill-defined lighter and darker oblique streaks. On the base of some of the specimens a broad, dark brown band encircles a lighter central area, which is perforated by the very narrow umbilicus.

The Head bears the usual two pairs of tentacles, with the eyes at the ends of the upper pair, and the usual labial palps. The genital opening is situated on the right side of the head, below and a little behind the base of the upper right tentacle, from which it is separated by about ·8 mm. A network of grooves divides the skin of the head and neck into numerous small polygonal rugæ. Vertical facial grooves are absent ; the oblique lateral grooves on the sides of the neck are somewhat irregular and poorly developed ; but the two dorsal grooves are better defined, and are rather close together. A pair of very broad, dark grey bands extends forwards from below the mantle-edge as far as the upper tentacles ; the bands nearly meet dorsally, but leave an unpigmented area beneath them on each side above the edges of the foot. The front of the head is light grey. Where the pigment is present it is chiefly concentrated on the tops of the rugæ, the grooves being paler.

The Foot is bluntly pointed at the hinder end, which is slightly flattened, there being no keel, nor median posterior groove, nor caudal mucous pore. A narrow peripodial groove runs along the edge of the foot, but there is no defined foot-fringe. The sole is unpigmented and is obscurely tripartite, the narrow lateral areas meeting at the posterior extremity, but tapering to a point at the

International Code that a name which only differs from another generic name "in a slight variation in spelling" is "not to be rejected on this account", even if it is believed to be of the same derivation. Therefore I follow Professor Cockerell in using the name *Ochtheaphila* Beck, instead of the later name *Geomitra* Swainson, for this genus of snails (*Journ. of Conch.*, vol. xvi, 1922, p. 310).

front end, where the large median area comes to occupy the whole breadth of the sole. The upper surface of the hinder end of the foot is darkly pigmented, the colour in some cases extending right across it, while in other specimens it takes the form of a pair of broad lateral bands passing obliquely downwards from below the mantle.

The Pedal Gland, which opens above the front edge of the foot, extends far back, embedded in the pedal muscles, though the top of its anterior part is exposed to the body-cavity. It consists of very numerous large gland-cells, of which the secretion stains blue with haematoxylin, surrounding a central longitudinal duct. The gland measures a little over .5 mm. in diameter, while the diameter of the duct is about .14 mm., except close to the opening, where it becomes much broader. Along the floor of the duct there is a pair of wide longitudinal ridges, with a median groove between them, towards which the gland-cells converge. On the outer side of each of these ridges, in the angle between it and the side of the duct, there is a much smaller longitudinal ridge, formed by a thickening of the epithelium lining the duct, this outer pair of ridges consisting of tall narrow columnar cells instead of cubical epithelial cells. The roof of the duct shows some small longitudinal folds.

Numerous small unicellular glands are present in the foot-sole.

The Mantle-Edge is of a pale colour, excepting the upper part near the respiratory opening, where it is often more or less tinged with grey. It bears right and left body-lobes, as shown in Fig. 2 on Plate VI. The right lobe is divided by a deep slit into an elongated portion, which lies near the penultimate whorl, and a small, somewhat quadrate portion lying below the respiratory opening. Two widely separated left body-lobes are present: a little one situated at the base of the aperture, and a larger one situated on the left side of the respiratory opening, and having a small extension which arches over the opening in the manner shown in the drawing.

The Mantle-Cavity is long, and stretches round a complete whorl. Its roof is thin and translucent, but part of it shows minute specks of brown pigment. This pigment is chiefly concentrated to form a brown patch near the mantle-edge behind the respiratory opening; but in some specimens it extends below the periphery to form a short band parallel to and just behind the mantle-edge; while it may also extend backwards for a much greater distance as a faintly pigmented zone between the rectum and the pulmonary vein. The remainder of the skin lining the shell is unpigmented.

The Vascular System.—The main pulmonary vein is large and conspicuous. It receives some small branches towards its anterior end, but these are not at all prominent and can only be seen under a strong lens. Where the pulmonary vein passes beneath the anterior part of the kidney, sections show that it receives a series of minute vessels from the inner surface of that organ. Then, as it passes into the pericardium, it receives three slightly larger branches, one from

the inner and one from the outer surface of the kidney, and one from below the pericardium.

The heart is shown in Fig. 10 on Plate VI. The auricle has an extremely thin wall formed of a pavement epithelium of flattened cells with discoidal nuclei, within which is an open network of muscle-fibres. The walls of the ventricle have a very similar structure, except that the muscle-fibres are far more numerous and the outer ones form a practically continuous layer next to the limiting epithelium. The auriculo-ventricular valve is formed by a pair of small muscular membranes, which project into the cavity of the ventricle where the auricle opens into it and leave only a narrow slit between them.

The aorta divides into anterior and posterior branches soon after leaving the hinder end of the ventricle. The anterior aorta is large; it lies close to the inner side of the spermoviduct for the greater part of its length, but bends away from it in front, passing to the ventral nerve ganglia, where it divides in the usual manner into the odontophoral artery, the pedal artery, etc. The pedal artery can be traced backwards in the foot even beyond the posterior extremity of the pedal gland; it is situated immediately above the duct of the pedal gland for most of its length.

The Excretory System.—The pericardium communicates with the exterior by means of the reno-pericardial duct, the kidney, the ureter, and the mantle-cavity. The reno-pericardial duct projects into the kidney from the inner and upper side of the pericardium about opposite to the middle of the ventricle. (Its position is shown in Fig. 10 on Plate VI.) It consists of a narrow duct, 33 mm. in length, lined by a strongly ciliated epithelium.

The kidney attains a length of about 5 mm., being rather more than twice as long as the pericardium. Its hinder end extends upwards to the rectum, as shown in Fig. 10. Internally its walls form a spongy network of thin folds covered with excretory cells.

The ureter arises from the extreme front end of the kidney. It then runs backwards along the upper edge of the kidney to the posterior extremity of the mantle-cavity, where it curves round and passes forwards beside the rectum for about 5 mm. and then opens. The secondary ureter is thus exceedingly short, as will be seen from the figure. In front of the opening, however, the groove which passes forwards to the mantle-edge beneath the rectum is lined with a cubical epithelium, similar to that of the ureter itself.

The Central Nervous System is shown in Fig. 4 on Plate VI. The buccal mass is capable of being withdrawn through the nerve-ring, the cerebral ganglia and commissure being situated immediately above the jaw in the specimens examined. The cerebral ganglia are united by a commissure measuring about 25 mm. in length. The projecting anterior portion of each ganglion bears a small lateral lobe on its outer side. The buccal ganglia are situated behind the

opening of the oesophagus, and are joined to the cerebral ganglia by long connectives. Like the latter ganglia, they do not appear to present any unusual features.

The ventral ganglia are joined to the cerebral ganglia by cerebro-pedal and cerebral-pleural connectives of moderate length, and form a compact group which is more nearly symmetrical in appearance than is usually the case. The ventral group consists of a pair of rounded pedal ganglia in front, and close behind them what at first sight seems to be a single pair of pleuro-visceral ganglia. This appearance is due to the right parietal ganglion being completely fused with the right pleural ganglion, and the left parietal completely fused with the abdominal ganglion on one side and almost completely with the left pleural ganglion on the other.

The otocysts are situated on the ventral surface of the pedal ganglia, near their posterior ends. Each otocyst contains a number of oval otoconia, with deeply staining centres. The otoconia vary considerably in size, but many of them attain a maximum diameter of '01 mm.

The distribution of the various nerves does not seem to exhibit any marked difference from that usually found in the *Helicidæ*; but time has not permitted the detailed examination of the smaller nerves and arteries of this species, structures which could be better studied in some larger member of the genus.

The Digestive System.—The jaw measures about .75 mm. in breadth; it is of a rather light brown colour, and is crossed by twelve to fourteen broad vertical ribs, as shown in Fig. 7 on Plate VI.

The radula is rather narrow, measuring about 1.9 mm. \times .6 mm. when flattened out. The transverse rows of teeth are nearly straight, though they trend slightly forwards in the region of the outer marginal teeth, and to a less extent also in the region of the inner lateral teeth. The central teeth are tricuspid, having a small ectocone on each side of the mesocone. The lateral teeth are bicuspid, there being a short ectocone in addition to the much larger mesocone, which, however, is shorter than the basal plate. The endocone is represented by a small flange on the inner side of the mesocone, to which it is wholly united. In the transitional teeth the distal end of the endocone becomes separated from the mesocone, and the ectocone is not so short. In the marginal teeth the endocone is more prominent, and is only united with the mesocone for about half its length; while the ectocone is usually divided into two small cusps, or even into three in one or two of the teeth. The marginal teeth are much shorter than the others, especially near the edges of the radula; but the forms of the teeth will be seen from Fig. 8 on Plate VI. The following are the radular formulæ of two specimens examined : $(14+9+1+10+14)\times 116$; $(14+10+1+11+14)\times 110$.

The extremity of the radula-sac projects as a small papilla beyond

the hinder end of the buccal mass. The odontophoral support is composed of radial fibres possessing elongated nuclei, with polygonal cells interspersed between them.

The œsophagus arises from the middle of the upper surface of the buccal mass, and is rather broad, especially in the region of the salivary glands. These glands are irregular in form, and are united with each other above the œsophagus, except towards their anterior ends. Their ducts, which are not quite so long as usual, open into the cavity of the buccal mass on each side slightly below the opening of the œsophagus. Passing backwards, the œsophagus leads into the long stomach which extends round a single whorl. The intestine arises from the hinder end of the stomach, and runs forwards almost to the posterior end of the pericardium, where it bends upwards and backwards, describing the usual S-shaped curve before passing forwards as the rectum to the anus. The course of the alimentary canal is shown in Fig. 9 on Plate VI.

The liver is divided as usual into two separate portions. The posterior one occupies the upper whorls beyond the stomach; the opening of its hepatic duct is shown in the figure. The anterior division lies in the region of the intestine, the loops of which tend to subdivide it into three lobes, one occupying the lower loop, another the upper loop, while the third is chiefly situated behind the upper loop, but has a narrow prolongation which extends forwards above it.

The Retractor Muscles.—Excepting towards their anterior ends the main retrector muscles are closely coiled in a spiral manner around the columella of the shell. When the muscles are spread out, as shown in Fig. 3 on Plate VI, it is seen that the columellar muscle divides close to its origin into an upper and a lower portion. The latter is the broad retrector of the hinder part of the foot. The upper portion soon divides again into a right and a left branch, and a little further forwards the left branch again divides into an upper and a lower muscle. The upper muscle is the powerful buccal retrector, which becomes subdivided into several strands close to its insertion in the buccal mass. This muscle appears to be innervated by a pair of very slender nerves arising from the cerebral ganglia. The lower left muscle unites with a strand arising from the right branch, and passes forwards, eventually dividing into the upper and lower left tentacular retractors and a couple of muscles to the left side of the anterior end of the foot. The right branch, after giving off the muscle that unites with the left branch, also passes forwards, and divides into the retractors of the upper and lower right tentacles and of the right side of the anterior end of the foot. These retractors all lie on the left of both the male and female genital ducts. The muscular strand that passes from the right to the left cephalic retrector in front of the origin of the buccal retrector, is not an abnormality, as

it occurs in all of the three specimens in which these muscles were examined ; moreover, it is also found in other Helcid genera, such as *Helicella*.

The penial retractor arises from the diaphragm, or floor of the mantle-cavity, towards its anterior end, and is attached to the epiphallus about .5 mm. behind the penis.

The Reproductive Organs are shown in Fig. 5 on Plate VI. The hermaphrodite gland or ovotestis is deeply embedded in the posterior division of the liver, and, being unpigmented, its exact form is difficult to make out. The hermaphrodite duct is very slender for at least half of its length, but a little in front of the middle it is slightly swollen and convoluted, though less so than in many other snails. It bends abruptly backwards on entering the albumen gland, and forms a very rudimentary vesicula seminalis. The albumen gland is large and elongated, its hinder part being concave on the inner side where it lies against the stomach. The spermoviduct or common duct is divisible, as usual, into the female side, with glandular, semi-translucent, transversely folded walls, and the male side, covered by the long and rather narrow, opaque-white prostate gland.

The free oviduct is rather narrow and not very long. The receptaculum seminis or spermatheca is an oval sac which lies close to the female side of the spermoviduct not far from the middle of its length. It sometimes contains an irregular hard brown mass. The receptacular duct is of moderate length, and is without any diverticulum. The free oviduct and the receptacular duct open together into a broad vagina. From the posterior end of the lower surface of the vagina three small finger-shaped processes arise close together. These processes measure about .1 mm. in diameter, and vary in length ; the longest, however, does not exceed 1 mm. in length, while the shortest of the three is usually less than half the length of the others. They are hollow, and are lined by a rather thick epithelium of tall and narrow columnar cells, with elongated basal nuclei. Outside of this epithelium there is a layer of circular muscle-fibres, but no glandular tissue seems to be present, although there can be no doubt that these processes are homologous with the so-called mucous glands found in so many of the Helicidæ. In front of them, on the outer side of the vagina towards its posterior end, there is a conspicuous hemispherical swelling, which is doubtless a degenerate dart-sac. It contains no dart, and the structure of its walls is not unlike that of the posterior part of the vagina itself, being lined by an epithelium of narrow columnar cells, with unusually long and narrow nuclei.

The vas deferens, after separating from the spermoviduct, runs forwards beside the female duct nearly to the genital atrium, and then bends round and passes backwards for about 3.5 mm. Lastly it bends forwards again, and enters the epiphallus, enlarging as it does so. The epiphallus is about 2 mm. in length by .35 mm. in

diameter, being very thick and muscular. Behind its union with the vas deferens it is continued as an equally thick and muscular flagellum, about 1 mm. long, with a broadly rounded extremity. The epiphallus and the unusually broad flagellum have a similar histological structure. They are lined by a columnar epithelium, which is folded so as to form minute papillæ; next to this there is generally a little connective tissue, but most of the wall consists of a thick outer layer of mixed longitudinal and circular muscle-fibres. The penial retractor muscle, as already mentioned, is attached to the epiphallus towards its anterior end. The penis is nearly 2 mm. long, and is considerably broader than the epiphallus, with a much larger cavity, although its walls are somewhat flattened. It is smooth internally, with a short broad penis-papilla projecting into its hinder end and having the small opening of the epiphallus at its apex, as shown in Fig. 6 on Plate VI. The penis, as well as the other genital ducts, lies on the right side of the retractor of the right upper tentacle. The genital atrium is rather small, but a few scattered gland-cells are contained in its wall.

(2) THE AFFINITIES OF *OCHTHEPHILA*.

In 1895 Pilsbry placed the genus *Ochtheephila* or *Geomitra* next to *Helicella* among the Siphonadeniate Helicidæ, although he did so with some doubt, and said: "it would obviously be quite idle to discuss the origin or genesis of this genus until its anatomy is made known."¹ Recently Cockerell dissected a specimen of *O. pulvinata* (Lowe) from Porto Santo, and found that it had no dart-sac or mucous glands; he therefore suggested that the genus belonged to the Epiphallogona, and that "*Ochtheephila* represents a survival of a type of Helicidæ which is now mainly developed in the Oriental and Australian regions".² He added, however, that he had found in *O. pulvinata* a slender cylindrical organ closely resembling, on a small scale, the supposed degenerate dart-sac of *Theba cantiana*, and wrote: "If this structure is really a degenerate dart-sac, then *Ochtheephila* may be a member of the Belogona which, through degeneration, simulates the Epiphallogona."

It will be seen from my description and figures of the anatomy of *Ochtheephila turricula* (Lowe) that Cockerell's second suggestion is undoubtedly the correct one, for this species possesses both a dart-sac and mucous glands, though in a very degenerate condition. Further, it appears that Pilsbry could not have done better than place this genus next to *Helicella*, with which it seems to have close affinities.

Ochtheephila turricula closely resembles *Helicella* and *Theba* (which Pilsbry regarded as a subgenus of *Helicella*) in the external features of the animal, in the form of the kidney, in the central nervous system, in the retractor muscles, in the position of the penis on the

¹ *Man. Conch.*, ser. II, vol. ix, p. 238.

² *Journ. of Conch.*, vol. xvi, 1922, p. 311.

right of the right ocular retractor, in the well-developed epiphallus and short flagellum, in the position of the degenerate mucous glands, and in the unbranched receptacular duct of moderate length. Moreover, the degeneration of the dart apparatus occurs also in these genera, especially in *Theba*, culminating in the entire absence of these organs in *Ashfordia granulata* (Alder). The jaw of *Ochtheephila turricula* is intermediate in type between that found in *Theba*, in which there are usually a rather larger number of ribs, and that found in *Helicella*, in which the number of ribs is generally smaller.¹ The radula is also of the same type, although in the larger or more specialized species of these genera the endocone often becomes completely united with the mesocone in the marginal, as well as in the lateral teeth. Even in the shell some species of *Ochtheephila*, such as *O. michaudii* (Dh.), closely resemble *Helicella*, although this cannot be said of the species here described. Almost the only anatomical character that seems to separate *O. turricula* from *Helicella* and the other European Helicids is the very broad and obtuse form of the flagellum, and it remains to be seen whether this feature is a constant character of the genus ; Cockerell states that in *O. consors* (Lowe) "the stout flagellum ends in a nipple-like papilla",² but he gives no figure of it.

Thus it would seem that the affinities of the genus *Ochtheephila* are with *Helicella* and *Theba*, genera which are usually regarded as rather closely allied to each other. Hesse, however, considers that *Theba* is related to *Hygromia* rather than to *Helicella*, notwithstanding the different position of the right ocular retractor, chiefly because *Theba* more nearly resembles *Hygromia* in the coloration of the shell and mantle.³ But this character does not seem to be of much importance, being largely dependent on the environment. We find, moreover, that in some species of both *Hygromia* and *Theba* the shell is semi-opaque with brown bands, and it is not unlikely that in the common ancestor of all the genera the shell was not more conspicuously striped than in these species. If this be the case, it would

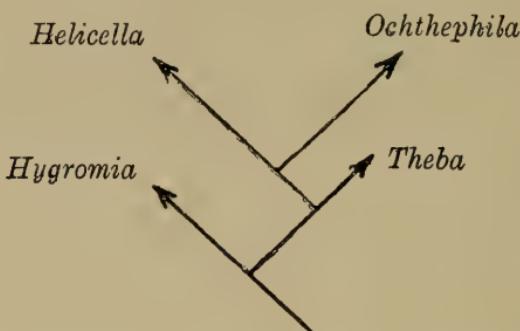
¹ According to Pilsbry (op. cit., p. 238) and Cockerell (*Proc. Malac. Soc.*, vol. xiv, 1921, p. 195) in *Ochtheephila (Hystricella) bicarinata* (Sow.) and *O. (Discula) polymorpha* var. *discina* (Lowe) the jaw has but ten ribs, while in *O. (Plebecula) lurida* (Lowe) it has only eight, being thus of the type found in *Helicella*. On the other hand, Pilsbry states that the jaw of *O. (Caseolus) abjecta* (Lowe) has no ribs at all.

² *Journ. of Conch.*, vol. xvi, 1922, p. 311.

³ *Archiv für Molluskenkunde*, vol. liii, 1921, p. 56. Hesse also mentions a possible difference between *Theba* and *Helicella* in the pallial lobes near the respiratory opening ; but an examination of these lobes shows that they are very similar in *Hygromia*, *Theba*, *Helicella*, and *Ochtheephila*.

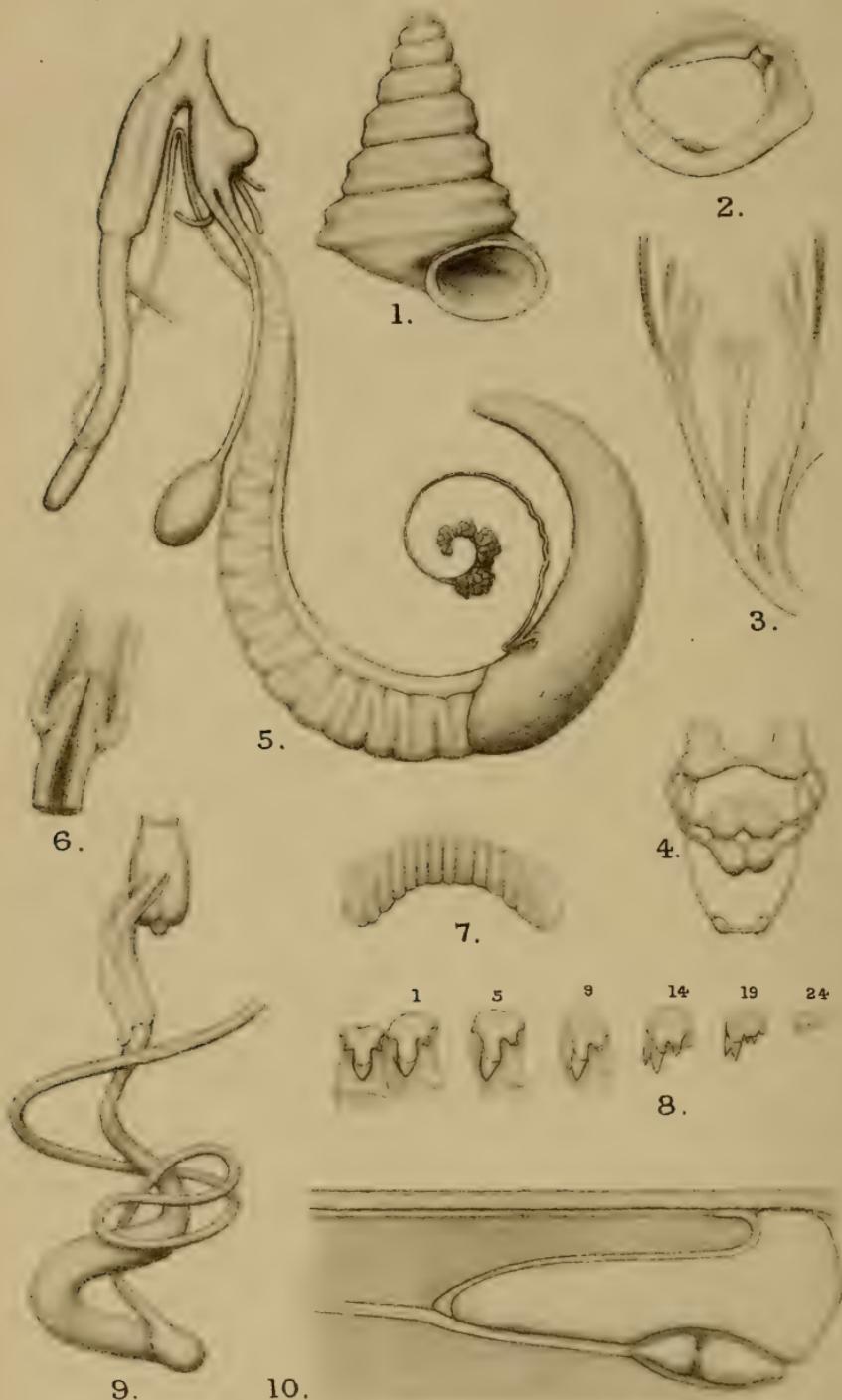
It should be explained that in the present paper the names *Hygromia* and *Helicella* are employed, in the way in which they are used by Pilsbry and others, for the genera of which *H. cinctella*, Drap. and *H. itala*, Lin. are the respective types ; for I have given reasons elsewhere (*Journ. of Conch.*, vol. xvi, 1922, pp. 277, 279) for believing that this usage is in accordance with the International Rules of Zoological Nomenclature, notwithstanding recent suggestions to the contrary.

be simplest to suppose that the change in the position of the ocular retractor took place first, before *Theba* branched off from the ancestors of *Helicella* and *Ochtheephila*, and that the greater opacity of the shell found in most species of the latter genera, and the consequent reduction in the pigmentation of the mantle, were features which arose later, owing to the preference of these snails for less shady situations. Nevertheless, Hesse is probably right in regarding *Hygromia* and *Theba* as closely related, for all these genera seem to be nearly allied to one another. Possibly their mutual relations may be somewhat as follows :—



The microscopical sculpture of the shell of *Ochtheephila turricula* and allied species closely resembles that of the type species of *Helicigona*, but the anatomy of the two genera shows that this resemblance is not due to any close relationship between them. Indeed, it is doubtful whether the reproductive organs of any European genus belonging to the Helicidae are more unlike those of *Ochtheephila* than are these organs in *Helicigona*. The larger Siphonadeniate Helicids—i.e. *Helix*, *Helicigona*, etc.—seem to belong to a slightly different and somewhat more primitive group than the genera dealt with above. In them the kidney appears to be of a slightly different shape, with the mantle-cavity extending further back above it, both the pleural ganglia are still quite separate from the parietal ganglia, the long receptacular duct usually bears a diverticulum, and the dart-sac and mucous glands have not yet become more or less degenerate. But it is possible that the smaller Helicids have not been directly derived from any of the larger genera now existing; it is even conceivable that they may have been independently evolved from the Euadenia; for the step is not a great one, and some of the Euadenia, such as the African genus *Halolimnohelix*, seem to resemble *Hygromia* and its allies in some respects more closely than the latter genera resemble the larger European Helicids. Probably a comparative study of the central nervous system in these various forms would throw some light on their probable relationships, but unfortunately nothing has yet been published about the nervous system of *Halolimnohelix* and many other genera.

It is generally agreed that the Molluscan fauna of the Madeira



OCHTHEPHILA TURRICULA (LOWE).

group is closely allied to that of the Western Palæarctic Region ; but it has sometimes been thought that when their anatomy came to be examined it would be found that the peculiar groups of snails found on these Atlantic islands might prove to be relatively primitive forms that had survived there owing to their isolation, and that these groups might be more nearly related to one another than to the genera which are now dominant on the continent of Europe. This view is not supported by our present knowledge of the anatomy of these snails. *Ochtheephila turricula* is rather primitive in its ureter and in its radula, but not more so than many common European Helicids ; and it is by no means primitive in its nervous system and reproductive organs. On the whole, therefore, *Ochtheephila* does not seem to be any more primitive than the majority of European genera. And if we compare the anatomy of *Ochtheephila* with what is known about the internal organs of the other groups found in Madeira, we find far greater differences than those that separate it from *Helicella*. Judging from the accounts of Pilsbry¹ and Cockerell,² *Leptaxis* differs from *Ochtheephila*, in that the right ocular retractor passes between the penis and the vagina, there is a slender flagellum, a large dart-sac containing a dart, and two clusters of mucous glands, and the receptaculum seminis and jaw are both somewhat peculiar. Cockerell's description and figures of the anatomy of *Helix (Idiomela) subplicata* (Sow.)³ show that, while this group differs from *Leptaxis* in certain features, it is still more unlike *Ochtheephila*, the jaw, radula, and reproductive organs being all of the type characteristic of the genus *Helix*. Thus it is probable that the different groups of snails found on the Madeira Islands are more nearly related to different genera living on the continent of Europe than to one another ; and that at the date when the ancestors of the snails now living in the Madeira group became isolated the different types of anatomy found in the Western Palæarctic Helicids had already been evolved.

EXPLANATION OF PLATE VI.

Ochtheephila turricula (Lowe) ; Cima I., Porto Santo.

FIG.

- 1.—Shell. × 4.
- 2.—Mantle-edge, showing body-lobes. × 9.
- 3.—Retractor muscles. × about 7·5.
- 4.—Central nervous system. × 15.
- 5.—Reproductive organs. × 11.
- 6.—Longitudinal section of the junction of the epiphallus and penis, showing the penis-papilla. × 15.
- 7.—Jaw. × 35.
- 8.—Representative teeth from the radula. × 450.
- 9.—Alimentary canal and salivary glands, the liver having been removed. × 7.
- 10.—Heart, kidney, and ureter, seen from the outer side. × 9.

¹ *Man. Conch.*, ser. II, vol. ix, 1895, p. 292, frontispiece, figs. 8, 9, pl. lxvii, figs. 19, 20.

² *Proc. Malac. Soc.*, vol. xiv, 1921, p. 194, figs. 2, 3 (p. 193).

³ *Ibid.*, p. 192, figs. 1, 1a (p. 193).

ON THE BRITISH SPECIES OF *TRUNCATELLINA*.

By A. S. KENNARD, F.G.S., and B. B. WOODWARD, F.L.S.

Read 11th May, 1923.

DOUBT having been expressed in some quarters as to the validity of Dr. Pilsbry's conclusion (*Man. Conch.*, ser. II, vol. xxvi, pp. 65 and 77) that two species of *Truncatellina* are present in Britain, and neither of them identifiable with the inadequately described *Pupa minutissima* of Hartmann, it became necessary for us in furtherance of our special study of the Post-Pliocene Non-Marine Mollusca to investigate the matter and, in the event of there being two species, to ascertain what microscopic characters there might be which would enable anyone to identify incomplete examples such as only too frequently are the sole available material when dealing with fossil occurrences.

For valuable help in our investigations by loan of specimens we have to thank Dr. A. E. Boycott, J. E. Cooper, A. Hartley, J. W. Jackson (Manchester Museum), J. R. B. Masefield, C. Oldham, A. E. Salisbury, C. D. Sherborn, J. R. le B. Tomlin, and W. J. Wintle.

Our researches have been, we consider, entirely successful, and the following tabular statement will show that there are two species distinguishable from each other by well-marked and fundamental characters, viz. *T. cylindrica*, Féruccac, and *T. britannica*, Pilsbry.

BRITANNICA.

<i>Shell.</i>	Minute dome-topped cylinder. The outline of the cylindrical portion showing practically parallel sides.	CYLINDRICA.
<i>Whorls.</i>	Long. 1·6 to 1·85 ; lat. 0·8 to (exceptionally) 0·9 mm. $5\frac{1}{2}$ (exceptionally 6). Nepionic shell smooth, $1\frac{1}{4}$ whorls, sharply defined from the succeeding whorls.	The same, but the outline of the cylindrical portion is very slightly arcuate, like the shaft of a well-formed column. Long. 1·8 to 2 ; lat. 0·9 mm.
<i>Aperture.</i>	Last three whorls flattened convex, with well-defined sutures. Strongly ribbed : the riblets 2 to 0·1 mm., crossing the whorl at a high angle.	$5\frac{3}{4}$ to 6. Nepionic shell smooth, $1\frac{1}{2}$ to 2 whorls, not always sharply defined from the succeeding whorls. Last three whorls convex, with even more strongly marked sutures. Less strongly ribbed : the riblets 3 to 0·1 mm., crossing the whorl obliquely at a somewhat lower angle. Ovate, tending slightly towards triangular.
	Ovate, tending towards square-rose. Peristome whitish, somewhat thickened and expanded, especially in very old individuals.	Peristome very similar, but the margin of the outer lip is inclined towards the columella as it descends

	BRITANNICA.	CYLINDRICA.
<i>Oral armature.</i>	Margin of the outer lip in line with the outline of the cylindrical portion of the shell. Characteristically three denticles.	and is not in a line with the outline of the cylindrical portion of the shell. None.
	Columellar lamella strong, deep-seated, constantly present in mature specimens, and visible in oblique view.	
	Parietal lamella, one short, obscure tubercle, visible in oblique view, but not always present.	
	Palatal fold an immersed, rounded or oblong tubercle, visible in front view, but not always present.	

The denticles, or rather tubercles, that when developed form a prominent feature in adult *T. britannica*, seemingly only develop late in life. The columellar tubercle, which is the most conspicuous as a rule, appears to form first, when the shell has come to full growth. The palatal tubercle develops next, and later the parietal (though we have seen a specimen with parietal but no palatal tubercle) completing the typical three in the old age of the snail.

Thus in a considerable series, some forty or more, collected in April or May at Portland by Mr. J. E. Cooper, whilst the columellar tubercle was present in the full-grown examples, only five of the number showed the palatal one, and none the parietal.

On the other hand, out of thirteen collected at Portland by Mr. A. E. Salisbury in August, seven showed the palatal tubercle, none the parietal. Of two batches, totalling twenty-seven, from the same locality (time of collecting not ascertained) in Mr. Tomlin's collection, leaving out of account three immature and one decomposing specimen, all showed the columellar tubercle, ten the palatal, and three the parietal.

In the Swanage specimens collected by Mr. Tomlin in May and June of two succeeding years, the columellar tubercle is placed much further back than in those from Portland and cannot be detected by a simple pocket lens; their presence is, however, easily established under the microscope. Out of thirty-seven examples (including those already presented to us) six were immature, all the rest showed the columellar tubercle, while only four exhibited the palatal and but two the parietal.

Of three large specimens from Lyme Regis, shown us by Mr. Hartley, only one, the smallest, showed the columellar denticle, placed very far back, and none of them the other denticles.

Individuals exhibiting all three denticles would, therefore, seem to be scarce.

The above facts may have given rise to the belief we have heard expressed that intermediate forms linking the two species existed. We have found none such, and where the shell is immature consider the size of the neionic shell and the number of ripples to 0·1 mm. can be relied upon for purposes of discrimination.

Whether or no the toothed form be, as Pilsbry considers, a variety or subspecies of the *Pupa strobeli* of Gredler (= *P. rivierana*, Benson) or a distinct species we have not as yet had the opportunity of determining. Since, however, as Pilsbry points out, in *T. strobeli* the striæ are more spaced, the last whorl flattened laterally toward the base, and the palatal fold and parietal lamella are longer and stronger, we consider it best to speak of the British shell as *T. britannica* and so avoid possible subsequent confusion in the matter of tracing distribution. This name cannot he held to clash with the *Pupa britannica* (= *Azeca goodalli*) of Kenyon (*Mag. Nat. Hist. Lond.*, i, 1829, p. 426).

By way of conclusion it may not be without interest to add the following notes concerning the past history of British *Truncatellinæ*. The first discovery of members of this genus in the British Islands appears to have been made in 1813 by Dr. Chalmers, of Kirkcaldy, who found them at Balmerino (misspelled by Gray and Brown as Balmenna), Fifeshire, and sent them to Dr. Fleming. The latter in 1828 (*Brit. Anim.*, p. 269) recorded them as a form of *Pupa obtusa*, Drap. Forbes, however, having seen cotypes, stated that they were referable to the species which Gray placed as *Vertigo cylindrica*, Fér. (Gray's ed. of *Turton's Manual*, 1840, p. 201). A single example was next taken by Jeffreys on Durdham Downs, near Bristol, and placed in his new genus *Alaea* under Féussac's trivial name (*Trans. Linn. Soc.*, xvi, 1830, p. 359). Rhind in 1836 (*Excur. illust. Geol. and Nat. Hist. envir. Edinb.*, 2nd ed., p. 141) recorded *Pupa cylindrica* from Salisbury Crags, and this T. Scott (Scott. Nat., 1891, p. 52) gave very good reasons for believing referred to *Truncatellina*, while he himself possesses specimens from that locality. Gray in 1840 (*loc. cit.*) had already cited *Pupa minutissima*, Hartmann, as a synonym, and this specific name adopted by Forbes and Hanley (*Brit. Moll.*, iv, p. 104, 1852) with generic changes has been generally employed for what has hitherto been considered the single British species. Lowe in 1852 (*Ann. & Mag. Nat. Hist.*, ser. II, vol. ix, p. 275) established *Truncatellina* as a section of *Pupa* for *P. linearis*, Lowe, but subsequently in 1855 (*Proc. Zool. Soc. Lond.*, 1854–55, p. 207) named *P. minutissima*, Hartmann, as the type; a second designation which, of course, cannot stand. The *Truncatellina* cited by Scudder in his *Nomenclator Zoologicus* as of Orbigny proves to be a misprint for *Truncatulina*, the well-known genus of Foraminifera, and does not therefore invalidate Lowe's name.

DISTRIBUTION

*as far as at present known to us.**TRUNCATELLINA BRITANNICA.*

RECENT.

DEVON :—

Branscombe, A. E. B.

DORSET :—

Lyme Regis, A. H.

Portland, J. E. C., A. E. S., J. R. le B. T., Manch. Mus.,
W. J. W.

Swanage, J. E. C., J. R. le B. T.

HANTS :—

Isle of Wight, A. S. K.

YORKS :—

Went Vale, R. M. Christy.

HOLOCENE.

KENT :—

Cuxton, A. S. K.

NORFOLK :—

Grimes Graves, A. S. K.

PLEISTOCENE.

CAMBRIDGE :—

Barnwell, A. S. K.

Barrington, A. S. K.

KENT :—

Ightham Fissure, Brit. Mus. G. 24814.

TRUNCATELLINA CYLINDRICA.

RECENT.

HANTS :—

? Ventnor, J. R. B. M. (one badly preserved specimen).

LINCOLNSHIRE :—

Skegness, Manch. Mus., J. R. B. M.

YORKS :—

York, W. J. W.

EDINBURGH :—

Arthur's Seat, J. E. C.

HOLOCENE.

CHESHIRE :—

Meols, Manch. Mus.

KENT :—

Greenhithe, A. S. K.

Ightham Fissure, Brit. Mus. G. 24814.

FIFESHIRE :—

Elie, A. S. K.

PLEISTOCENE.

LONDON :—

Admiralty Section, Westminster, A. S. K.

CAMBRIDGE :—

Barrington, A. S. K., and Brit. Mus. G. 5267.

ESSEX :—

Clacton, A. S. K.

NOTE ON THE NOMENCLATURE AND SYSTEMATIC ARRANGEMENT OF THE CLAUSILIIDÆ.

By A. S. KENNARD, F.G.S., and B. B. WOODWARD, F.L.S.

Read 8th June, 1923.

WHEN reviewing the British representatives of Clausiliidæ from the nomenclatorial point of view, we were surprised to find how lax as regards their nomenclature all the best-known authorities have been. Boettger, Vest, Möllendorff, and now Wagner, all when put to the test prove unreliable guides. Even the type of the genus has been lost sight of, and needless to say this, now that the genus is split up, affects the question in regard to the nomenclature of the resulting genera.

As a matter of fact, Children, in 1823, was the first to select a type, but his choice of *Cl. torticollis*, Oliv., the first of the species cited by Lamarck in his *Hist. Anim. s. Vert.*, is inadmissible because it was not one of the species comprised in the genus when founded by Draparnaud in 1805. Turton in 1831 (*Manual*, p. 6), who comes next, gave as type the *Turbo bidens* of Montagu, which is synonymous with the *Cl. rugosa* of Draparnaud, and Turton's selection must, therefore, be accepted.

When Gray in 1847 (*Proc. Zool. Soc.*, 1847, p. 177) also took "*Turbo bidens*" for the type of *Clausilia*, Drap., he evidently meant Montagu's species and not Linné's, unless since he gave his *Marpessa* as a synonym he was confusing at the time Müller's *Helix bidens* = *Cl. bidens*, Drap. = *Turbo laminatus*, Montagu, a proceeding which would have been quite characteristic. It is curious that though in both his editions of Turton's Manual Gray adopted *Marpessa* as the subgenus for *Cl. bidens* = *laminata* he never alluded to his 1821 paper.

It may not be out of place here to recapitulate the history of the misattribution to Pulteney, 1799, of the name *nigricans*. The unanimity with which successive compilers of synonymy copy each from his predecessor without ever referring to the original work is remarkable and productive of many quite unnecessary errors. As we pointed out a short time since (*Proc. Malac. Soc.*, xiv, Sept. 1820, p. 85) Ström's *Turbo bidentatus* (*Det Trondh. Selsk. Skrift.*, iii, 1765,

p. 436, pl. vi, fig. 17) being an indeterminable species, his name, which has been applied to our British shell, must be abandoned.¹ Pulteney's "Catalogues", which were to have formed part of vol. iii of Hutchins' *History of Dorset*, were never really published: the whole stock was burnt in a fire at the printers in 1808 (Rackett MS.). Pulteney, however, who died in 1801, had circulated some copies under a separate title page in 1799 "for the use of the compiler and his friends", and so the work became cited in literature. *No plates accompanied this issue*, and the name *Turbo nigricans* does not appear in its pages. On p. 46, however, there is a record of *Turbo bidens*; this, as Maton and Rackett show (*Trans. Linn. Soc.*, viii, 1807, pp. 178–9), was the well-known continental species of that name and not a British shell, as abundantly proved by their figure (op. cit., pl. v, fig. 3) taken from a specimen in Pulteney's collection, at that time in the possession of the Linnean Society.

Montagu, meantime, in 1803 (*Test. Brit.*, p. 357) had adopted the same name as Pulteney, whom he quotes, but figured (pl. xi, fig. 7) the familiar British shell. He mentions at the same time (p. 358) that the species he meant had been called by Dr. Solander, in the Portland Cabinet, *Turbo nigricans*. After the publication of Maton and Rackett's memoir he admitted the error (*Test. Brit. Suppt.*, p. 130) and adopted the trivial name of *nigricans*.

Maton and Rackett in their work cited above (p. 180) adopted Solander's name of *nigricans* for this species, and since this was the first published use of that name it must be attributed to them and date from 1807, as pointed out by Jeffreys (*Ann. & Mag. Nat. Hist.*, ser. v, vol. ii, 1878, p. 381). In their synonymy they quote "Pulteney in Hutch. Dorset, p. 46, t. 19, fig. 10", and this is the reference that has misled so many who have not consulted the original work. The "p. 46" must have been a *lapsus calami*, for, as we have seen, the name does not occur there, only *Turbo bidens* as correctly cited by Maton and Rackett themselves (p. 178); whilst the plate reference, as throughout their memoir, is to the second edition of Pulteney's "Catalogues", which Rackett had then in hand, but which was not issued until 1813, and there the description of the shell appears on p. 51.

Our shell proved subsequently to be identical with Draparnaud's *Pupa rugosa* of 1801, afterwards *Clausilia rugosa* of 1805; hence Draparnaud's name has priority and the correct synonymy, omitting earlier authors who had not fully discriminated it, will be:—

¹ The name appears to have been adopted in British lists because in the late Dr. O. Boettger's "Syst. Verzeichn. d. lebenden Arten d. Landschnecken-Gattung *Clausilia*" (17. & 18. Ber. Offenbach. Ver. Naturk., p. 71) it occurs in the synonymy of *Cl. rugosa* marked with an asterisk, implying that types had been seen by the author. In reply, however, to one of us [A. S. K.] some years ago Dr. Boettger wrote that the asterisk in question was a printer's error, and that he had never seen types of that species.

1801. *Pupa rugosa*, Draparnaud, Tabl. Moll. France, p. 63.
 1803. *Turbo bidens*, Linn., Montagu, Test. Brit., p. 357, pl. xi,
 fig. 7. [Non Linné.]
 1805. *Clausilia rugosa*, Draparnaud, Hist. Moll. France, p. 73,
 pl. iv, figs. 19, 20.
 1807. *Turbo nigricans*, Maton and Rackett, Trans. Linn. Soc.,
 viii, p. 180.
 1808. *Turbo nigricans*, Montagu, Test. Brit. Suppt., p. 131.
 1813. *Turbo nigricans*, Rackett in Pulteney, Cat. Dorset, 2nd ed.,
 p. 51, pl. xix, fig. 10.
 etc. etc. etc. etc.

Our continental confrères, whose notions of what constitutes a species differs considerably from ours, recognize a form under the name “*Cl. nigricans*, Pult.”, which to our mind is nearer to the *Cl. rugosa* of Draparnaud, as figured and described by him, than the scarce, more coarsely sculptured form to which they attach the latter name. Draparnaud, as well known, in addition to the type gave two varieties, “ β minor, fusca, minus striata . . . a moins de tours à la spire,” and “ γ minor, pallide fusca”. In the “Tableau” he attributes 12 to 13 whorls to the type form and 9 to 10 to each of the varieties. Féruccac, who probably knew Draparnaud’s species better than those who came after him, in April, 1820 (*Journ. Phys.*, xc, p. 301), when treating of British shells, distinctly referred to *nigricans* as a synonym of *rugosa*. Again in January, 1821 (*Tabl. syst. Limaçons*, p. 67), he did the same. Pfeiffer it was, in 1848, who first distinguished two species under these names (*Mon. Helic. Viv.*, ii, pp. 475–6), but did so by making *dubia*, Drap., a synonym of “*nigricans*, Pult.” It was Bourguignat in 1877 who introduced (*Ann. Sci. Nat.*, sér. vi, Zool., tom. vi, art. 2, pp. 33–4) the current view among continental conchologists. He does not appear to have consulted Draparnaud’s collection and he ignored Féruccac’s opinion, but since Draparnaud had cited as habitat “Sur les murs”, concluded the species must exist in the neighbourhood of that naturalist’s native city, Montpellier. There, after search, he found a form, which he admitted was “peu commun”, and, therefore, one would have thought would have been the less likely to be selected by Draparnaud as typical; nevertheless he proceeded to describe this as the type form of Draparnaud’s *rugosa*. He next identified the var. β with *nigricans*, passing by the var. γ , and under *Cl. parvula* (op. cit., p. 49) makes no allusion to its possible identity with either the var. β or γ of Draparnaud’s *rugosa*. Locard, Bourguignat’s disciple, followed closely on the same lines both in his “*Prodromus*” (*Ann. Soc. Agric. Lyon*, sér. v, tom. iv, 1882, p. 426) and in his *Coquilles terrestres de France*, 1894 (pp. 282, 284). In the latter he referred a strongly striate form, which is apparently only an extreme variety, to *rugosa*, noting it as “peu commun”, while the ordinary form he dubbed *nigricans* and admitted to be common. The following

year when he discussed the contents of Draparnaud's cabinet (*Ipsa Draparnaudi Conchilia*, 1895, p. 93) Locard was only able to find therein one of the three forms, which he identified with the typical one, and said that Bourguignat's description of it was very good. Although the forms β and γ were not present he had no hesitation in referring them to *nigricans* and *parvula* respectively.

Having been kindly favoured by Comm. Caziot with specimens of *rugosa* and *nigricans* as understood on the continent, and by Mr. W. J. Wintle with a large quantity, collected at Caldey, of *rugosa* as we understand it, we have come to the conclusion that Féruccac was correct and that the *nigricans* of Maton and Rackett is identical with the *rugosa* of Draparnaud, of which the *rugosa* of our continental confrères and even the *crenulata* of Risso are extreme varieties (this was also the opinion of Dr. Boettger, 17. & 18. *Ber. Offenbach. Ver. Naturk.*, 1878, p. 71), while Draparnaud's var. β was in all probability identical with *parvula* of Studer, the var. γ being indeterminate.

Cl. rugosa, Drap., being the type reduces the *Plicaphora* of Hartmann (1844) = *Pyrostoma* of Vest (1867) to a synonym for *Clausilia*, s.s.; while, on the other hand, it restores *Marpessa* of Gray (1821) to generic rank.

Hartmann's names, which are perfectly valid, have been strangely set aside by the authorities. In addition to *Plicaphora* (*Erd- & Süssw. Gasterop.*, p. 216, 1844) monotype *Cl. plicatula*, Drap., we find on the same page, *Laciniaria* monotype *Cl. plicata*, Drap., that has precedence of H. and A. Adams' *Alinda* (*Genera Moll.*, ii, p. 182, 1855) and must replace it.

Dr. A. Wagner, basing his conclusions not only on the shell, but more particularly on the radula and genitalia (the clausium and its accompanying apparatus proving unreliable), proposed an entirely new classification in 1913 (Rossmässler's *Icon.*, N.F., xxi). This after the publication of a paper by Frankenberg in 1916 (*Zool. Anz.*, xlvi, pp. 221–36) he considerably modified in 1920–1 (*Nachrbl. Deutsch. Malak. Gesell.*, and its continuation, *Archiv f. Molluskenkunde*, li, lii), and not improbably will have to still further alter with increasing knowledge. Still, his scheme will doubtless be in the main adopted by malacologists, although, to take one instance, his proposal to degrade *Balea* to a subgenus of *Alinda* (i.e. *Laciniaria*), however correct on anatomical grounds alone, is not likely to prove acceptable to systematists, quite apart from the fact that *Balea* being the older name would in that case have to stand for the genus. Nor will systematists be willing to adopt all his new names, which, as common with most anatomists, he has often introduced regardless of the prior claims of predecessors. Fortunately he has not designated types so that we are hence enabled by supplying his omission to redress where necessary the wrong done.

Neoserbica, Wagner (*Nachrbl.*, li, p. 135), established to include

Macedonica, Boettger, monotype *Cl. macedonica*, Rossm. + *Serbica*, Boettger, monotype *Cl. transiens*, Mlldff. + two odd species from other groups. We here designate *Cl. macedonica* as type of *Neoserbica*, which will, with *Serbica*, then fall into synonymy under *Macedonica*.

Leucostigma, Wagner (ibid., p. 145), type by tautonomy *Cl. leucostigma* (Zieg.) Rossm. Boettger, by error, made this species the type of *Papillifera*, Vest, overlooking the fact that Vest's own type was *Cl. papillaris*, Müll. = *bidentata*, Linn.

Aprosphyma, Wagner (Arch., lii, p. 9), comprises several subgenera, of which *Aprosphyma*, s.s., includes in part the *Stereophædusa* of Boettger, but not its type + *Megalophædusa*, Boettger, in part, but including its type, *Cl. yokohamensis*, Crosse. We, therefore, designate this last as type of *Aprosphyma*, which thus becomes a synonym of *Megalophædusa*.

Macrenoica, Wagner (ibid., p. 10), another subgenus of *Aprosphyma*, includes two species out of Boettger's *Euphædusa* + *Cl. javanica*, the type of Boettger's *Pseudonenia* + one species of his *Acrophædusa* + *Cylindrophædusa*, Boettger, monotype *Cl. cylindrata*, Gray. We, therefore, designate *Cl. javanica* as type of *Macrenoica*, which thus, with *Cylindrophædusa*, becomes a synonym of *Pseudonenia*.

Polyptychephora, Wagner (ibid., p. 10), a subgenus of *Aprosphyma*, includes one species of *Formosana*, Boettger, and one of *Oospira*, Boettger, with many species of later dates by other authors. We designate *Cl. elisabethae*, Mlldff., as the type.

Synprosphyma, Wagner (ibid., p. 12). We designate *Cl. rufa*, Bav. & Dautz., as the type.

Neostyrica, Wagner (ibid., p. 107), for two species included by Boettger in "Pirostoma". We designate *Cl. styriaca*, A. Schm., as the type.

Pleioptychia, A. S. Wagner [? n. gen.] (ibid., p. 149), includes Boettger's *Scrobifera*, monotype *Cl. foveicollis* (Parr.) Pfr. + *Cl. bicristata* and *Cl. rothi* of Boettger's *Hellenica*, all three being included in Boettger's Sect. *Oligoptychia*. *Cl. bicristata* had, however, already been selected by Martens in Albers "Heliceen", 1860, as type of *Idyla*, H. & A. Adams. Vest in 1867 named *Cl. pagana* as type of *Idyla* and was followed by Boettger in 1877. Consequently the *Idyla* of Vest and of Boettger is not that of the Adams. We designate *Cl. bicristata* (Friv.), Rossm., as type of *Pleioptychia*, which thus falls into synonym under *Idyla*, H. & A. Ad.

Polinskia, Wagner (ibid., p. 151), genotype *Cl. litotes*, Parr. in A. Schm., had been included by Boettger in *Polyptychia*.

We append a purely tentative synopsis of the family on Wagner's lines with the necessary modifications in nomenclature so far as we are able to follow them out, and would invite assistance in rendering it more complete and correct.

So far as the British species are concerned, the following would appear to be the best arrangement:—

Family CLAUSILIIDÆ.

Gen. *BALEA*.

B. perversa (Linn.).

Gen. *LACINIARIA*.

L. bispinata (Mont.).

Gen. *CLAUSILIA*.

C. rugosa, Drap.

C. dubia, Drap.

†*C. parvula* (Studer) Férv.

†*C. pumila* (Zieggl.) C. Pfr.

†*C. ventricosa*, Drap.

C. rolphii, Leach.

Gen. *MARPESIA*.

M. laminata (Mont.).

(Those marked with a † being extinct in Britain.)

TENTATIVE SYNOPSIS OF THE CLAUSILIIDÆ, BASED ON WAGNER'S CLASSIFICATION.

* is prefixed to the names of species which are here for the first time designated as types.

† is prefixed to genera, etc., whose members are only known in the fossil state.

§ is prefixed to names not included in the Zoological Record.

** Boettger's subdivisions (*a*, *b*, *c*, etc.) have for convenience sake been left under their original genera, although the true position of many of them is at present uncertain.

Family CLAUSILIIDÆ.

Subfam. *METACLASILIIINÆ* (*Metabaleinæ* of Wagner).

Gen. *REINIA*, Kobelt. Monotype: *C. variegata*, A. Ad.

LAMINIFERA, Boettger. Type: *C. rhombostoma*, Bttg.

a. Pyrenaica, Boettger. Monotype: *C. pauli*, Mabille.
(Syn. *Tortula*, Westerlund, 1878.)

b. †Laminifera, s.s.

GRACILIARIA, Bielz. Type: *C. concilians*, A. Schm. (Vest, 1867).

FUSULUS, Fitzinger. Type: *C. varians* (Zieggl.) C. Pfr. (Vest, 1867).

§*POLINSKIA*, Wagner. Genotype: *C. litotes* (Parr.) A. Schm.

ACROTOMA, Boettger. Type: *C. komarowi*, Bttg. (West-erld., 1902).
(Syn. *Thalestris*, Lindholm. Type: *C. sobrievskii*, Rozen.)

IDYLA, H. & A. Adams (*non* Vest, *nec* Boettger). Type: *C. bicristata* (Friv.) Rossm. (Mts. in Albers, 1860).

(Syn. *Scrobifera*, Boettger. Monotype: *C. foveicollis* (Parr.) Pfr.

§*Pleioptychia*, A. S. Wagner [? gen. nov.]. Type:

**C. bicristata* (Friv.) Rossm.)

Gen. OLIGOPTYCHIA, Boettger. Type: *C. laevicollis* (Parr.) Charp.

(Syn. *Crucita*, Westerlund, 1878.)

a. *Oligoptychia*, s.s. [= *Armenica*, Boettger].

b. *Scrobifera*, Boettger [now a synonym of *Idyla*, H. & A. Adams].

c. *Hellenica*, Boettger. Type: *C. pikermiana*, Roth.

Subfam. CLAUSILIINÆ (*Baleinæ* of Wagner).

Gen. NEOSTYRIACÀ, Wagner. Type: *C. styriaca*, A. Schm.

BALEA (Prideaux MS.) Gray. Type: *Turbo perversus*, Linn.

LACINIARIA, Hartmann. Monotype: *C. plicata*, Drap.

(Syn. *Alinda*, H. & A. Adams. Type: *C. biplicata* Mont. (Mts. 1860).)

Idyla, Vest (and Boettger, non Adams). Type: *C. pagana* (Zieggl.) Rossm.

a. *Idyla*, s.s.

b. *Bitorquata*, Boettger. Type: *C. bitorquata* (Friv.) Rossm.

c. *Bulgarica*, Boettger. Type: *C. varnensis*, Pfr.

Strigilecula, n.n., for *Strigiliaria*, Vest [non Rafinesque, 1815 (Pelecyp.)]. Type: *C. vetusta* (Zieggl.) Rossm.).

Subg. VESTIA, Hesse, for *Uncinaria*, Vest, non Froel (Vermes). Type: *C. elata* (Zieggl.) Rossm.

(Syn. *Pseudalinda*, Boettger. Type: *C. montana*, Stz.)

LACINIARIA, s.s.

a. *Laciniaria*, s.s. [= *Alinda* of Boettger].

b. *Index*, Boettger. Monotype: *C. index*, Mousson.

EUXINA, Boettger. Type: *C. hetæra* (Friv.) Pfr. (Westerld., 1902).

(Syn. *Mentissoidea*, Boettger. Type: **C. fusorium*, Mousson.

§Wagneria, Hesse. Genotype: *C. thracica*, Hesse.)

a. *Polyptychia*, Boettger. Type: *C. duboisi*, Charp.

b. *Galeata*, Boettger. Type: *C. schwerzenbachi* (Parr.) Charp.

c. *Strumosa*, Boettger. Type: *C. strumosa* (Friv.) Pfr.

d. *Mucronaria*, Boettger. Monotype: *C. acuminata*, Mousson.

e. *Euxina*, s.s. [= *Hetæra* of Boettger].

f. *Acroeuxina*, Boettger. Monotype: *C. huebneri*, Rossm.

g. *Megaleuxina*, Boettger. Monotype: *C. sandbergeri*, Mousson.

h. Caucasica, Boettger. Type: *C. somchetica*, Pfr.

i. Mæsta, nom. nov. for *Laciniaria*, Boettger (1877, non Hartmann, 1844). Type: *C. mæsta*, Fér.

Subg. *MENTISSA*, H. & A. Adams. Type: *C. canalifera*, Rossm. (Marts., 1860).

EUXINASTRA, Boettger. Genotype: *C. hamata*, Bttg.

? *MICROPONTICA*, Boettger. Monotype: *C. closta*, Bttg.

? *OLYMPICOLA*, Hesse. Monotype: *C. olympica* (Friv.) Pfr.

(Syn. *Olympia*, Vest, non Risso, 1826 (Crust.).)

Gen. *CLAUSILIA*, Draparnaud. Type: *Turbo bidens*, Mont. = *C. rugosa*, Drap. (Turton, 1831).

(Syn. *Plicaphora*, Hartmann. Monotype: *C. plicatula*, Drap.

Pyrostoma, Vest. Type: *C. plicatula*, Drap.

Erjavicia, Brusina. Type: *C. bergeri*, Mayer.)

Subg. *CLAUSILLA*, s.s.

KUZMICIA, Brusina. Type: *C. dubia*, Drap.

Subfam. *MARPESSINÆ* (*Clausiliinæ* of Wagner).

Gen. *SERRULINA*, Mousson. Type: *C. serrulata*, Midd. (Kobelt, 1904).

a. *Serrulina*, s.s.

b. *Filosa*, Boettger. Monotype: *C. filosa*, Mouss.

§ *SYNPROMPHYMA*, Wagner. Type: **C. rufis*, Bav. & Dautz.

MEGALOPHÆDUSA, Boettger. Type: *C. yokohamensis*, Crosse.

(Syn. *Stereophædusa*, Boettger [pars].

Aprosphyma, Wagner. Type: **C. yokohamensis*, Crosse.)

Subg. § *POLYPTYCHEPHORA*, Wagner. Type: **C. elisabethæ*, Mlldff.

PSEUDONENIA, Boettger. Type: *C. javana*, Pfr.

(Syn. *Cylindrophædusa*, Boettger. Type: *C. cylindrica*, Gray.

Macrenoica, Wagner. Type: **C. javana*, Pfr.)

MEGALOPHÆDUSA, s.s.

Gen. *PHÆDUSA*, H. & A. Adams. Type: *C. corticina*, Busch. (Mts., 1860).

a. *Euphædusa*, Boettger. Type: *C. shangaiensis*, Pfr.

b. *Pseudonenia* [now a subg. of *Megalophædusa*].

c. *Stereophædusa*, Boettger. Type: *C. valida*, Pfr.

d. *Megalophædusa* [now a separate genus].

e. *Formosana*, Boettger. Type: *C. swinhœi*, Pfr.

f. *Oospira*, Blanford. Type: *C. philippiana*, Pfr.

g. *Acrophædusa*, Boettger. Type: *C. cornea*, Phil.

h. *Cylindrophædusa*, Boettger [now a syn. of *Pseudonenia*, Bttg.].

i. *Hemiphædusa*, Boettger. Type: *C. pluvialis*, Bens.

Gen. DILATARIA, Vest. Type: *C. succineata* (Zieggl.) Rossm.
 a. *Banatica*, Boettger. Monotype: *C. tenuilabris*,
 Rossm.

c. *Dilataria*, s.s.

d. *Charpentieria*, Stabile. Type: *C. diodon*, Stud.

MARPESSA, Gray. Type: *C. laminata*, Mont. (Gray,
 1840).

a. *Serbica* [now a syn. of *Macedonica*].

b. *Marpessa*, s.s.

(Syn. *Clausiliastra*, Pfr. Type: *C. laminata*, Mont.)

Subfam. ALOPIINÆ.

Gen. PAPILLIFERA, Hartmann. Type: *C. papillaris* (Müll.) =
bidens, L.

a. *Lampedusa*, Boettger [now a subgenus of *Delima*].

b. *Isabellaria* [now a subgenus].

c. *Venusta*, Boettger [now a syn. of *Isabellaria*].

d. *Graeca*, Boettger. Monotype: *C. graeca*, Pfr.

e. *Papillifera*, s.s.

Subg. §LEUCOSTIGMA, Wagner. Type: **C. leucostigma* (Zieggl.)
 Rossm.

ISABELLARIA, Vest. Type: *C. isabellina*, Pfr.

(Syn. *Venusta*, Boettger. Type: *C. venusta*, A. Schm.)

PAPILLIFERA, s.s.

Gen. TRILOBA, Vest. Type: *C. sandrii*, Küster.

a. *Triloba*, s.s.

b. *Macedonica* [now a separate genus].

MACEDONICA, Boettger. Monotype: *C. macedonica*,
 Rossm.

(Syn. *Serbica*, Boettger. Monotype: *C. transiens*,
 Mlldff.

§NEOSERBICA, Wagner. Type: **C. macedonica*,
 Rossm.)

DELIMA, Hartmann. Type: *C. lœvissima* (Zieggl.) Rossm.
 (Mts., 1860).

a. *Gibbula*, Boettger. Type: *C. gibbula* (Zieggl.) Rossm.

b. *Stigmatica*, Boettger. Type: *C. stigmatica* (Zieggl.)
 Rossm.

c. *Piceata*, Boettger. Monotype: *C. piceata* (Zieggl.)
 Rossm.

d. *Itala*, Boettger. Type: *C. itala*, Mart.

e. *Tirolica*, Boettger. Type: *C. stentzi*, Rossm.

f. *Dalmatica*, Boettger. Type: *C. conspurcata*, Jan.

g. *Binodata*, Boettger. Type: *C. binodata* (Zieggl.)
 Rossm.

h. *Lævissima*, Boettger. Type: *C. lœvissima* (Zieggl.)
 Rossm.

§*Albanica*, Boettger. Type: †*C. semilabiata* (Kutsch) Waldff.

i. *Montenegrina*, Boettger. Type: *C. cattaroensis* (Ziegl.) Rossm.

k. *Substricta*, Boettger. Type: *C. substricta* (Parr.) A. Schm.

l. *Robusta*, Boettger. Type: *C. robusta*, K.

m. *Semirugata*, Boettger. Type: *C. semirugata* (Ziegl.) Rossm.

Subg. *DELIMA*, s.s.

CARINIGERA, Möllendorff. Type: *C. eximia*, Mlldff. (Westerld. 1902).

SICILIARIA, Vest. Type: *C. grohmanniana*, Partsch.

a. *Siciliaria*, s.s.

b. *Trinacria*, Boettger. Type: *C. crassicostata*, Ben.

LAMPEDUSA, Boettger. Monotype: *C. lampedusæ*, Calc.

(Syn. §*Mauretanica*, Boettger. Type: *C. tristrami*, Pfr.)

Gen. §*GARNIERIA*, Gredler. Genotype: *C. fuchsi*, Gredler.

MEDORA, H. & A. Ad. Type: *C. macarana* (Ziegl.) Rossm. (Mts., 1860).

Subg. *CRISTATARIA*, Vest. Type: *C. colbeauiana* (Parr.) Pfr.

ALBINARIA, Vest. Type: *C. carulea*, Fér.

AGATHYLLA, H. & A. Ad. Type: *C. exarata* (Ziegl.) Rossm. (Mts., 1860).

MEDORA, s.s.

Gen. *ALOPIA*, H. & A. Adams. Type: *C. livida*, Menke (Mts., 1860).

Subg. *HERILLA*, H. & A. Ad. Type: *C. dacica* (Friv.) Pfr. (Mts., 1860).

a. *Balcanica*, n.n., for *Turcica*, Boëttger (*non* H. & A. Adams, 1854). Monotype: *C. frivaldszkiiana*, Rossm.

b. *Herilla*, s.s.

ALOPIA, s.s.

a. *Attica*, Boettger. Monotype: *C. guicciardii*, Heldr.

b. *Alopia*, s.s.

Gen. *PROTOHERILLA*, Wagner. Type: **C. balæiformis*, Boëttger.

INSERTÆ SEDIS.

Gen. *PSEUDALINDA*, Boëttger. Type: *C. montana*, Stentz (Mts., Zool. Rec., 1878).

a. *Pseudalinda*, s.s.

- b. *Mira*, Boettger. Monotype: *C. mirabilis* (Parr.)
A. Schm.
- Gen. *NENIA*, H. & A. Adams. Type: *C. tridens*, Schweigger
(Mts., 1860).
- MACROPTYCHIA**, Boettger. Type: **C. senaariensis*, Pfr.
(Kobelt's selection of *C. schweinfurthi*, Mts., is
invalid since it was not one of the original
species).
- BOETTGERIA** (Heynemann MS.), Boettger. Type: **C.
crispa*, Lowe.
- HETEROPTYCHIA**, Westerlund. Type: *C. helvola*, Küst.
- DIADOMA**, Westerlund. Type: *C. torticollis*, Oliv.
- †**EUTRIPTYCHIA**, Boettger = *Triptychia*, Sandberger (*non*
Triptycha, Müller, 1859). Type: *C. antiqua*,
Schübl. (Bttg., 1877).
- a. *Terveria*, nov. Type: **C. terveri*, Mich.
- b. *Eutriptychia*, s.s.
- c. *Plioptychia*, Boettger. Monotype: *C. vulgata*,
Rossman.
- †**EUALOPIA**, Boettger. Type: **C. plionecton*, Bttg.
- †**CONSTRICTA**, Boettger. Type: **C. kochi*, Bttg.
- †**EMARGINARIA**, Boettger. Monotype: *C. schaefferiana*,
Bttg.
- †**CANALICIA**, Boettger. Type: *C. articulata*, Sbg.
- †**PSEUDIDYLA**, Boettger. Type: **C. moersingensis*, Sbg.
- †**DISJUNCTARIA**, Boettger. Monotype: *C. oligogyra*,
Bttg.

In the foregoing Synopsis the following new names have been proposed:—

- Strigilecula*, n.n. for *Strigiliaria*, Vest, p. 304.
Mæsta, „ *Laciniaria*, Bttg., p. 305.
Balcanica, „ *Turcica*, Bttg., p. 307.
Terveria for sect. a of †*Eutriptychia*, Bttg., p. 308.
-

ON *TURRIS (SURCULA) MACELLA*, NOM. NOV. FOR
T. MACILENTA, MELV., NOM. PRÆOCC.

By Dr. J. COSMO MELVILL, F.L.S.

Read 11th May, 1923.

I AM obliged to Mr. Arthur Wrigley for pointing out that the name *macilenta* lately bestowed by me (*antea*, p. 168) upon a small attenuate recent species, had already been given to a Tertiary fossil species, as long ago as 1766,¹ by Dr. Solander, this originally being described by him as a *Murex*, and ninety years after, in 1856, placed by Mr. F. E. Edwards² in its proper position as a member of the Lamarckian genus *Pleurotoma*, 1799, now superseded by *Turris*, Bolten, 1798.

I have collected this species at Barton myself, and am sorry not to have recollectcd the name. As Mr. Wrigley well points out, its other near allies, *dentata*, Lam., *michelini*, Desh., *textiliosa*, Desh., have been assigned by Cossmann,³ to *Surcula*, and this makes it all the more necessary for the change of name.

I therefore propose the diminutive *macella*, more appropriate in every way to the new recent species, being a small shell in comparison with the fossil form.

I would further point out that in the same paper (*antea*, p. 169) "Hegén" (l. 27) should be "Hizén", and (l. 4 from bottom) "kü" should read "kii".

¹ *Murex macilentus*, Sol., in Brander, *Fossilia Hantoniensia*, 1766, p. 20, pl. ii, fig. 33.

² Edwards, *Mon. Pal. Soc.*, 1856, p. 224, pl. xxvi, figs. 13a-b. Also *vide* *Systematic List of F. E. Edwards' Coll. in Brit. Mus.*, 1891, by R. Bullen Newton, p. 109.

³ Cossmann, *Icon. Comp. Eoc. Paris*, Tom. ii, pls. 50, 51.

SOME SYNONYMS IN THE VENERIDÆ.

By J. R. LE B. TOMLIN, F.E.S.

Read 8th June, 1923.

THE following synonymy has been established in the course of examining the Veneridæ in the collections of the British Museum. Some of the conclusions arrived at have already been surmised by Dall, Römer, and others, but apparently in very few cases have the type specimens of Broderip, Sowerby, Reeve, and Deshayes been studied.

In the following list the first name in each case falls in synonymy and is equated to what I regard as the correct name for the species.

Cytherea nubila, Reeve, Conch. Icon., xiv, pl. vii, fig. 28, Jan. 1864 = *Tivela ventricosa* (Gray).

Cytherea ventricosa, Sowerby, Thes., ii, 613, pl. cxxvii, fig. 6, 1851 = *Tivela ventricosa* (Gray).

Cytherea undulata, Sowerby, l.c., 618, pl. cxxvii, fig. 12, 1851 = *Tivela planulata* (Brod. & Sow.).

Cytherea virginea, A. Adams and Reeve, Zool. " Samarang ", Moll., 78, pl. xxiv, fig. 10, 1848 = *Tivela stultorum* (Mawe). How this Californian shell got into the " Samarang " collections is a mystery.

Cytherea piperita, Sowerby, l.c., 626, pl. cxxxvi, fig. 175, 1851 = *Macrocallista florida* (Lam.).

Meretrix grata, Deshayes, Cat. Conch. Brit. Mus., 40, 1853 = *Macrocallista lilacina* (Lam.).

Dione ustulata, Reeve, Conch. Icon., xiv, pl. xi, fig. 49, Oct. 1863 = *Pitaria citrina* (Lam.).

Chione badia, Gray, Analyst, viii, 306, 1838 = *Hysteroconcha unicolor* (Sow.).

Cytherea tortuosa, Broderip | Proc. Zool. Soc. Lond., 1835, 45, 1st
— *affinis*, Broderip | June, 1835 = *Hysteroconcha concentrica* (Sow.).

Dosinia consobrina, Deshayes, l.c., 10, 1853 = *D. hepatica* (Lam.).

Dosinia circinaria, Deshayes, l.c., 9, 1853 = *D. crocea*, Desh.

Dosinia affinis, Deshayes, l.c., 7, 1853 = *D. concentrica*, Born.

Artemis nitens, Reeve, Conch. Icon., vi, pl. iii, fig. 12, Feb. 1850 = *D. concentrica*, Born.

Dosinia coryne, A. Adams, Proc. Zool. Soc. Lond., 1855, 223, 2nd Feb. 1856 = *D. cœrulea* (Rve.).

Dosinia cydippe, A. Adams, l.c., 224, 2nd Feb. 1856 = *D. cœrulea* (Rve.).

Dosinia diana, A. Ad. and Angas, Proc. Zool. Soc. Lond., 1863, 424, April, 1864 = *D. cœrulea* (Rve.).

Dosinia eunice, A. Adams, Proc. Zool. Soc. Lond., 1855, 224, 2nd Feb. 1856 = *D. pubescens* (Ph.).

- Dosinia amethystina*, Römer, Proc. Zool. Soc. Lond., 1860, p. 118, June, 1860 = *D. lucinalis* (Lam.).
- Dosinia erythraea*, Römer, l.c., p. 117, June, 1860 = *D. radiata* (Rve.).
- Dosinia nobilis*, Deshayes, l.c., 7, 1853 = *D. incisa* (Rve.).
- Artemis kirata*, Sowerby, Thes., ii, 675, pl. clxiv, fig. 85, 1852 = *Dosinia histrio* (Gmel.).
- Artemis striatissima*, Sowerby, l.c., 673, pl. clxiii, fig. 71, pl. clxiv, fig. 84, 1852 = *Dosinia lucinalis* (Lam.).
- Dosinia ovalis*, Römer, Proc. Zool. Soc. Lond., 1860, p. 119, June, 1860 = *D. pubescens* (Ph.).
- Circe fulgorata*, Reeve, Conch. Icon., xiv, pl. ii, fig. 5, Oct. 1863 = *C. scripta* (L.).
- Circe sugillata*, Reeve, l.c., pl. iii, fig. 11, Oct. 1863 = *C. scripta* (L.).
- Circe trigona*, Reeve, l.c., fig. 12, Oct. 1863 = *C. scripta* (L.).
- Circe albida*, Deshayes, l.c., 84, 1853 = *C. scripta* (L.).
- Circe oblonga*, Deshayes, l.c., 86, 1853 = *C. scripta* (L.).
- Circe lenticularis*, Deshayes, l.c., 85, 1853 = *C. plicatina*, Lam.
- Cytherea quoyi*, Hanley, Cat. Rec. Shells, pl. xv, fig. 25 (footnote), 1844 = *Circe rivularis* (Born).
- Circe orbica*, Reeve, l.c., fig. 8, Oct. 1863 = *C. tumefacta*, Sow.
- Circe fumata*, Reeve, l.c., pl. viii, fig. 35, Oct. 1863 = *Gafrarium callipyga* (Born).
- Circe crachrodi* [sic], Gray, Analyst, viii, 307, 1838 = *Gafrarium callipyga* (Born).
- Circe pulchra*, Deshayes, l.c., 93, 1853 = *Gafrarium callipyga* (Born).
- Cytherea elliptica*, Sowerby, l.c., 645, pl. cxxxv, figs. 173, 174, 1851 = *Gafrarium callipyga* (Born).
- Cytherea subelliptica*, Sowerby, l.c., 644, pl. cxxxv, fig. 169, 1851 = *Gafrarium arabicum* (Lam.).
- Cytherea plebeia*, Hanley, Proc. Zool. Soc. Lond., 1844, 109 = *Gafrarium sulcatum* (Gray).
- Circe artemis*, Deshayes, l.c., 86, 1853 = *Gafrarium sulcatum* (Gray).
- Venus crispata*, Deshayes, l.c., 107, 1853 = *V. fischeri*, Récluz.
- Venus eburnea*, Reeve, Conch. Icon., xiv, pl. xiv, fig. 50, June, 1863 = *Ventricola oblonga* (Gray).
- Venus jukesii*, Deshayes } l.c., 100, 1853 = *Clausina toreuma* (Gould).
- Venus sculpta*, Deshayes } l.c., 100, 1853 = *Clausina toreuma* (Gould).
- Chione retroversa*, Deshayes, l.c., 123, 1853 = *Clausinella foliacea* (Ph.).
- Venus roborata*, Hanley, Proc. Zool. Soc. Lond., 1844, 161 = *Clausinella placida* (Ph.).
- Venus alatus*, Reeve, l.c., pl. xviii, fig. 83, June, 1863 = *Clausinella paucilamellata* (Dkr.).
- Venus rostrata*, Sowerby, l.c., 717, pl. clvi, fig. 91, 1853 = *Anomalocardia cuneimeris* (Conrad).
- Venus tenuilamellata*, Sowerby, l.c., 733, pl. clxi, fig. 195, 1853 = *V. campechiensis*, Gmel.

- Venus sugillata*, Reeve, l.c., pl. xiii, fig. 43, June, 1863 = *Chione undatella* (Sow.).
- Venus bilineata*, Reeve, l.c., pl. xxii, fig. 105, June, 1863 = *Chione neglecta* (Sow.).
- Venus simillima*, Sowerby, l.c., 708, pl. cliii, figs. 17, 18, 1853 = *Chione neglecta* (Sow.).
- Venus ornatissima*, Broderip, Proc. Zool. Soc. Lond., 1835, 44, 1st June, 1835 = *Chione gnidia* (Brod. & Sow.).
- Venus histrionica*, Sowerby } Proc. Zool. Soc. Lond., 1835, 41, 1st
Venus fuscolineata, Sowerby } June, 1835 = *Chione grata* (Say).
- Venus discors*, Sowerby, Proc. Zool. Soc. Lond., 1835, 42, 1st June, 1835 = *Chione grata* (Say).
- Venus plumbea*, Reeve, l.c., pl. xvi, fig. 65, June, 1863 = *Chione granulata* (Gmel.).
- Venus intersecta*, Sowerby, Thes., ii, 714, pl. clv, figs. 59, 60, 1853 = *Chione pectorina*, Lam.
- Venus sphærisulca*, "Deshayes MS.", in Reeve, l.c., pl. ii, fig. 6, is an error for *sphæricula*, Desh.
- Venus mundulus*, Reeve, l.c., pl. xiv, fig. 51, June, 1863 = *Protothaca staminea* (Conr.).
- Venus varicosa*, Sowerby, l.c., 723, pl. clv, fig. 67, 1853 = *Chione latilirata*, Conr.
- Chione regularis*, Deshayes, l.c., 146, 1853 = *C. japonica* (Gmel.).
- Venus labuana*, A. Ad. & Rve., Zool. "Samarang", Moll., 79, pl. xxi, fig. 16, 1848 = *Chione japonica* (Gmel.).
- Tapes ceylonensis*, Sowerby, l.c., 683, pl. cxlvii, figs. 24, 25, 1852 = *Chione opima* (Gmel.).
- Chione ruderata*, Deshayes, Cat. Conch. Brit. Mus., 136, 1853 = *Protothaca staminea* (Conr.).
- Tapes arctica*, Reeve, Conch. Icon., xiv, pl. x, fig. 52, Feb. 1864 = *Marcia nitida* (Q. & G.).
- Tapes faba*, Reeve, l.c., pl. viii, fig. 39, Feb. 1864 = *Marcia nitida* (Q. & G.).
- Tapes sinensis*, Reeve, Conch. Icon., xiv, pl. v, fig. 24, Jan. 1864 = *Hemitapes marmoratus* (Lam.).
- Tapes orientalis*, Reeve, l.c., pl. viii, fig. 34, Feb. 1864 = *Hemitapes marmoratus* (Lam.).
- Tapes bicolorata*, Reeve, l.c., pl. ix, fig. 42, Feb. 1864 = *Hemitapes marmoratus* (Lam.).
- Tapes ferruginea*, Reeve, l.c., pl. x, fig. 51, Feb. 1864 = *Hemitapes marmoratus* (Lam.).
- Tapes tenuistriata*, Sowerby, l.c., 687, pl. cxlviii, figs. 78, 79, 1852 = *Hemitapes marmoratus* (Lam.).
- Tapes ustulata*, Deshayes, l.c., 153, 1853 = *Hemitapes marmoratus* (Lam.). The name *ustulata* frequently appears in literature as *vitulata*, e.g. in Reeve, from a misreading of Deshayes' label in the Brit. Mus.

- Tapes turgidula*, Deshayes, l.c., 166, 1853 = *Paphia turgida* (Lam.).
Tapes similis, Deshayes, l.c., 167, 1853 = *Paphia dura* (Gmel.).
Tapes grata, Deshayes, l.c., 170, 1853 = *Paphia obscurata* (Desh.).
Tapes quadriradiata, Deshayes, l.c., 171, 1853 = *Paphia obscurata* (Desh.).
Tapes belcheri, Sowerby, l.c., 685, pl. cxlvii, figs. 50, 51, 1852 = *Paphia obscurata* (Desh.).
Tapes vernicosa, Reeve, l.c., pl. x, fig. 48, Feb. 1864 = *Paphia undulata* (Born.).
Tapes lentiginosa, Reeve, l.c., pl. vi, fig. 25, Jan. 1864 = *Paphia gallus* (Gmel.).
Tapes biradiata, Deshayes, l.c., 170, 1853 = *Paphia luzonica* (Sow.).
Tapes punicea, Deshayes, l.c., 179, 1853 = *Paphia philippinarum* (A. Ad. & Rve.).
Tapes japonica, Deshayes, l.c., 181, 1853 = *Paphia philippinarum* (A. Ad. & Rve.).
Tapes variegata, Sowerby, l.c., 696, pl. cli, figs. 133-8, 1852 = *Paphia philippinarum* (A. Ad. & Rve.).
Venus tessellata, A. Ad. & Rve., Zool. " Samarang ", Moll., 79, pl. xxii, fig. 11, 1848 = *Paphia philippinarum* (A. Ad. & Rve.).
Tapes denticulata, Sowerby, l.c., 694, pl. cl, fig. 114, 1852 = *Paphia philippinarum* (A. Ad. & Rve.).
Tapes semidecussata, Reeve, Conch. Icon., xiv, pl. xiii, fig. 67, March, 1864 = *Paphia philippinarum* (A. Ad. & Rve.).

The three following specific names in Martyn's Universal Conchologist have been overlooked and must be adopted:—

- Paphia cœlata*¹ (Martyn) for *P. ala-papilionis* (Bolten).
Meretrix nimbata (Martyn) for *M. morphina* (Lam.).
Meretrix virgulata (Martyn) for *M. lusoria* (Lam.).

The last two I regard as colour forms of *M. meretrix* (L.). The white shell with broad black area posterior to the umbones must, from Linné's reference to Argenville's figure, be taken as the type form of this species.

¹ In some copies of the work this is printed *cœtata*.

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ERRATA.

- p. 255, line 2 from bottom, for "Linn." read "Müll."
 p. 256, line 24, for "great masses" read "peat mosses".

THE MALACOLOGICAL SOCIETY OF LONDON.

RULES.

I.

That the Society be called THE MALACOLOGICAL SOCIETY OF LONDON.

II.

That the object of the Society be to facilitate the study of the Mollusca and Brachiopoda, both recent and fossil, by the holding of meetings for the reading of papers, the publishing of Proceedings, and by such other means in furtherance of the above object as the Council may from time to time determine.

III.

That the Society consist of Ordinary, Honorary, and Corresponding Members, the latter resident without the British Islands, and that women be eligible for election. Honorary members to be limited to Five, and to be nominated by the Council, such nomination to be confirmed at the ensuing Annual General Meeting.

IV.

That Members have the privilege of attending the Meetings of the Society, of introducing two Visitors at any Ordinary Meeting, and be entitled to receive a copy of such Circulars and Proceedings of the Society as may be issued during their Membership.

V.

That every Candidate for election be proposed by two or more Members, who shall sign a certificate in recommendation of such Candidate. The certificate shall set forth the name and place of residence of the Candidate, and the Proposer

whose name stands first shall have personal knowledge of the Candidate, or his works, and certify the same upon the certificate.

VI.

That the certificate of the Candidate be read out by the Secretary at the Ordinary Meeting following its receipt, and that the election take place at the succeeding Meeting.

VII.

That the method of voting at the election of Members be by ballot, and that the negative votes of one-third of the Members voting exclude a Candidate.

VIII.

That Members pay an admission fee of One Guinea. That the Annual Subscription for Ordinary Members be One Guinea, which may be commuted by a payment of Ten Guineas, and that for Corresponding Members the Annual Subscription be Fifteen Shillings, which may be commuted by a payment of Seven Guineas. That Institutions be not eligible for Life Membership.

IX.

That Subscriptions be due on the 1st of January in each year; but in the case of a new Member, immediately after his or her election. Members elected during the months of November and December shall not be required to pay for the year in which they are elected.

X.

That no Member be entitled to any of the privileges of the Society whose Subscription shall be twelve months in arrear; and that any Member whose Subscription is two years in arrear shall cease to be a Member of the Society, unless the Council decide otherwise.

XI.

That the management of the Society be vested in a President, six Vice-Presidents, a Treasurer, a Secretary, an Editor, and nine other Members, who shall constitute a Council, to be elected annually at the Annual General Meeting by ballot; and that the two senior Vice-Presidents and three other Members

of Council shall retire annually and shall not be eligible for re-election to their respective offices until the next Annual General Meeting.

XII.

That the Members of the Council attending each Meeting of such Council sign their names in a book to be kept for the purpose ; five Members to form a quorum.

XIII.

That the Council may be divided into such Committees as its Members find desirable, and may associate Ordinary Members on any such Committee.

XIV.

That for the purpose of the legal protection of the property of the Society, all the funds, books, and other property of the Society be declared as vested in three or more Trustees, who shall be Members of the Society, to be appointed by the Council ; but that the Council shall have power, by the vote of a majority of its whole number, to sell or otherwise dispose of any property which it may not seem to them advisable to retain.

XV.

That minutes be kept of the meetings of the Society and of the Council, and that the minutes of each Meeting be read as the first business of the ensuing Meeting of the same kind.

XVI.

That the Ordinary Meetings of the Society be held on the second Friday in each month (except during the months of July, August, September, and October) at 6 p.m., but that the Council may alter the date of meeting on due notice.

XVII.

That the Council may, when they think fit, and they shall, upon a Requisition signed by not less than twelve Members, convene a Special General Meeting of the Society. That one month's notice shall be given from the chair of every Special General Meeting, and the object stated, and a printed notice sent to every Member of the Society resident in the United

Kingdom not less than seven days before such Meeting ; and that no business shall be considered at such Meeting except that for which it was specially convened.

XVIII.

That the Accounts of the Society shall be made up to the 31st December in each year, and audited by two auditors, who shall be appointed at the Meeting following ; and that the Balance-sheet shall be submitted, together with a Report of the progress of the Society during the preceding year, to an Annual General Meeting, which shall be held at such hour before the Ordinary Meeting in February as the Council shall appoint.

XIX.

That in case of a vacancy arising in any office of the Society, or in the Council, the Council shall have power to fill up such vacancy until the next Annual General Meeting of the Society.

XX.

That a copy of these Rules be delivered to each Member upon election to Membership of the Society.

XXI.

That no Rule be altered except by a majority of votes of those present at a Special General Meeting called for the purpose.

LONDON.

April, 1923.

MALACOLOGICAL SOCIETY OF LONDON.

FOUNDED 1893.

LIST OF MEMBERS.

* * * The date preceding each name indicates the year of election. The letter H prefixed denotes an honorary member, O an original member, while those who have compounded for their annual subscription are indicated by L. The members to whose names a * is attached have contributed papers for the Proceedings.

(Corrected up to May, 1923.)

- 1919 Alderson, Rev. E. G., M.A., Hartford Vicarage, near Huntingdon.
1898 Aldrich, T. H., sen., 1026 Glen Iris Avenue, Birmingham, Ala., U.S.A.
1912 Arnold, Dr. Ralph, 639 South Spring Street, Los Angeles, Cal., U.S.A.
1922 *Ashby, Edwin, F.L.S., M.B.O.U., "Wittunga," Blackwood, South Australia.
1905 Australian Museum, Sydney, New South Wales.
1912 Barnard, K. H., M.A., F.L.S., South African Museum, Cape Town, Cape of Good Hope.
1901 Bentley, R. H., 60 Rosebery Road, Muswell Hill, London, N. 10.
1914 Berkeley University, *see* California.
1919 *Berry, S. Stillman, A.M., Ph.D., 745 West Highland Avenue, Redlands, Cal., U.S.A.
1919 Biggs, H. E. J., 21 St. Andrew's Road, Enfield.
O Bles, E. J., D.Sc., F.Z.S., Elterholm, Cambridge.
1898 *Bloomer, H. Howard, F.L.S., 40 Bennett's Hill, Birmingham.
1912 Boettger, Dr. Cæsar R., Humboldstrasse 42, Frankfurt a/M.
1907 L*Bowell, E. W., M.A., M.R.C.S., etc., 21 Princess Road, S. Norwood, London, S.E. 25.
1915 L*Boycott, Dr. A. E., F.R.S., 17 Loom Lane, Radlett, Herts.
1902 *Bridgman, F. G., 13 St. Vincent's Road, Southend-on-Sea.
1921 Brookes, Albert E., Okania Matamata, Waikato, New Zealand.
1921 Buenos Aires, The Director, Museo Nacional de Historia Natural, Peru 208, Buenos Aires.
1895 *Burne, R. H., M.A., F.Z.S., 3 Stafford Terrace, Kensington, W. 8.
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