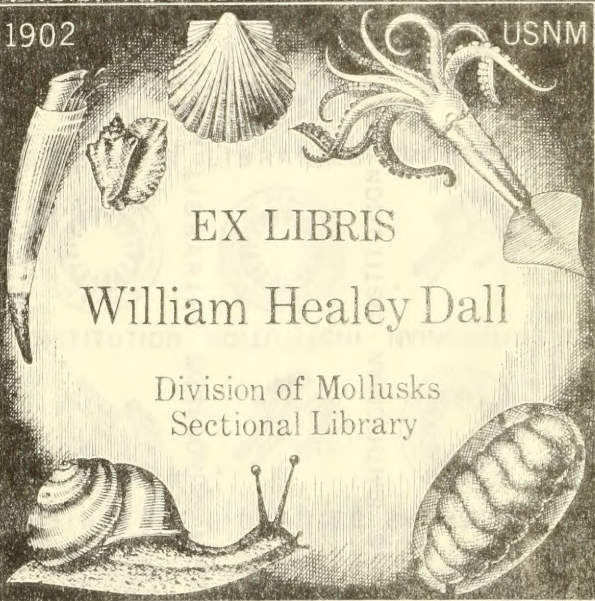


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—
VOL. VI.
1904—1905.

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PROCEEDINGS

OF THE

MALACOLOGICAL SOCIETY

OF LONDON.

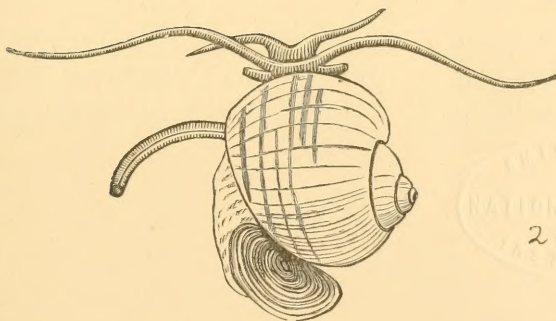
EDITED BY

E. A. SMITH, I.S.O., F.Z.S.

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E R R A T U M.

Page 129, line 15, for "*reticulatu*" read "*reticularis*."

„ „ 16, for "*reticularis*" read "*litterata*."



*Yours very truly,
Henry Woodward.*

PRESIDENT OF THE SOCIETY, 1893-1894.

PROCEEDINGS

OF THE

MALACOLOGICAL SOCIETY OF LONDON.

ORDINARY MEETING.

FRIDAY, NOVEMBER 13TH, 1903.

E. A. SMITH, I.S.O., President, in the Chair.

The following communications were read:—

1. "Descriptions of new species of Land-Shells from Central and South America." By S. I. Da Costa.
2. "Descriptions of *Dolium magnificentum*, n.sp., and *Murex multi-spinosus*, n.sp." By G. B. Sowerby, F.L.S.
3. "Some remarks on the genera *Damayantia*, Issel, *Collingea*, Simr., and *Isselentia*, Cllge." By Walter E. Collinge, M.Sc.
4. "Descriptions of two new species of *Melania* from the New Hebrides." By E. R. Sykes, B.A.
5. "Note on the Dispersal of Mollusca." By E. Caziot.

The following specimens were exhibited:—

Mr. E. A. Smith: Some marine shells from Port Alfred, Cape Colony, including species new to the fauna, others of considerable rarity or in better condition than specimens hitherto obtained. Several specimens belonged to species described by Mr. Sowerby during recent years. Also a specimen of *Murex saxatilis* with the anterior rostrum of the shell passed through a hole in a valve of *Arca similis*, the two being connected or cemented together by the valve of an oyster.

Mr. G. B. Sowerby: Two remarkable specimens of *Cypræa* from the collection of Dr. Cox. One of these was a white variety of *Cypræa umbilicata*, which, if not unique, is at least extremely rare. The other was a monstrosity, in which the apex formed a prominent spiral.

Mr. H. B. Preston: Living specimens of *Acarus* from Ceylon. The colour of the animal was reddish brown, and was uninfluenced by variation of the shell coloration. Also a series of *Pecten latus*, Gld., from Japan, showing colour variation.

Mr. F. G. Bridgman: Species of *Oliva*, including *O. angulata*, Lam., *O. Masaris*, Ducl., and *O. rufula*, Ducl.

Mr. E. R. Sykes: A remarkably large example of *Voluta Ponsonbyi*. As in previously recorded cases, this specimen was obtained from the stomach of a fish. It measured 88 mm. in length.

ORDINARY MEETING.

FRIDAY, DECEMBER 11TH, 1903.

E. A. SMITH, I.S.O., President, in the Chair.

Cuthbert Freyberg and Capt. A. J. Peile were elected to membership of the Society.

The following communications were read:—

1. "On *Pleuromutilus pulcher*, sp. nov." By G. C. Crick, F.G.S.
2. "Description of a new species of *Cassis*." By E. A. Smith, I.S.O.
3. "On the Mollusca procured during the 'Porcupine' Expeditions, 1869-1870." Supplemental Notes, part i. By E. R. Sykes, B.A.
4. "Notes on the Nervous System of the Pelecypoda." By R. H. Burne, B.A.

The following specimens were exhibited:—

Mr. E. A. Smith: Epiphragms of *Thaumastus Sangoæ*, Trosch., and of *Thaumastus biteniatus*, Nyst.

Mr. F. G. Bridgman: Some rare species of *Oliva*.

Mr. H. Fulton: The type-specimen of *Cypræa Thatcheri*, from the collection of Dr. Cox.

ORDINARY MEETING.

FRIDAY, JANUARY 8TH, 1904.

E. R. SYKES, B.A., Vice-President, in the Chair.

The following communications were read:—

1. "On the genus *Eurystoma* of Albers, type *vittata*." By Lieut.-Col. H. H. Godwin-Austen, F.R.S.
2. "On new Gastropoda from the Gulf of Oman, etc." By J. Cosmo Melvill, M.A.
3. "Description of *Berthais*, a proposed gen. nov. allied to *Aclis*." By J. Cosmo Melvill, M.A.
4. "On a curious centrally banded form of *Oliva gibbosa*, Born." By J. Cosmo Melvill, M.A.
5. "On the specific identity of *Vivipara diluviana*, Kunth, and *Vivipara Clactonensis*, S. V. Wood." By A. S. Kennard and B. B. Woodward, F.G.S.
6. "Descriptions of new species of *Ena*, *Pseudoglossula*, and *Subulina* from British and German East Africa." By E. A. Smith, I.S.O.

The following specimens were exhibited:—

Mr. J. Cosmo Melvill: An example of *Cypræa onyx*, L., from the Persian Gulf, showing distortion owing to the growth of a *Balanus*. This specimen was obtained by Mr. F. W. Townsend from the telegraph cable near Fao. The barnacle had attached itself to a portion of the shell covered by the mantle, and had been allowed to grow to a remarkable size before being covered by the enamel of the shell. A specimen of *C. Mauritiana*, L. exists in the British Museum (Nat. Hist.), collected by Col. F. J. Waring, C.M.G., in which a very much larger specimen of *Balanus* is in precisely the same position.

Mr. E. R. Sykes: Marine shells from the Gulf of Oman. These formed part of the proceeds of a single haul of the dredge, taken by Mr. F. W. Townsend in moderately deep water. The haul was remarkable for the enormous number of species obtained. Also (on behalf of Mr. G. B. Sowerby) a curiously banded form of *Oliva gibbosa*, Born.

Rev. R. Ashington Bullen: Specimens of the shells of *Testacella haliotideæ*, Drap., from "The Hermitage," Woking; also remarkably large specimens of *Chrysodomus antiquus* from the English Channel, and of *Patella vulgata* from Constantine Bay, Cornwall.

Mr. H. B. Preston: Central African land and fresh-water shells, including co-types and species recently described by Dr. Putzeys.

NOTES.

NOTE ON THE DISPERSAL OF MOLLUSCA. (*Read 13th November, 1903.*)—After rough weather I have sometimes found on the blocks of stone which protect the harbour of Bastia, on the north-east of the island of Corsica, quite a variety of shells of land and fresh-water mollusca, which have been carried there by marine currents, aided by the Sirocco, from the shores of Tuscany or the Roman Campagna. It seems therefore possible that some of the species now living on the island may have been introduced in this manner, having under favourable conditions survived the voyage. Of the forty-two species which were found, sixteen have not as yet been met with *living* on the island. For fuller details upon this subject see my memoir on the land and fresh-water mollusca of Corsica (Bull. Soc. Sci. hist. nat. Corse, 1903, ann. xxii, pp. 26-31).
E. CAZIOT.

NOTE ON THE EPIPHRAGMS OF *THAUMASTUS SANGOE* AND *T. BILENIATUS*. (*Read 11th December, 1903.*)—The epiphragm of *Thaumastus Sangoe* is a very pretty but fragile structure, being calcareous and about as thick as ordinary writing-paper. Unlike that of other species of Pulmonates with which we are acquainted, its inner surface is not smooth, but exhibits down the central part an irregular and somewhat broken up, delicate ridge, from which a series of very fine thin ridges radiate towards what may be termed the columellar margin, or, in other words, towards the side which, when in position, rests against the columella of the shell. These delicate ridges are irregular in length and form, some being curved and others

tortuous. They may extend from the central ridge to the margin, but, as a rule, they are short, and many of them reach neither the central ridge nor the outer edge. The upper extremity of the central ridge is pierced with a narrow slit a little more than a millimetre in length. Its position is relatively the same as the slit in the epiphragm of *Achatina* as figured in the "Proceedings" of the Society, vol. iii, p. 309. It doubtless corresponds to a slit in the mantle leading to the respiratory orifice. The outer or curved margin exhibits from end to end a series of minute perforations. They look as if they have been pricked through from the inner surface, each being upon a little prominence. On the under surface each perforation is more or less surrounded by a raised short ridge-like loop, the ends of which are open on the inner side. The outer surface is rather uneven, but, with the exception of the outer perforated edge, is generally rather smooth.

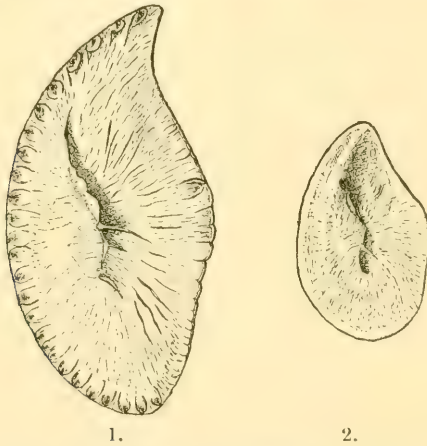


FIG. 1.—Epiphragm of *Thaumastus Sangoæ*.
 FIG. 2. " " *biteniatus*.

The epiphragm of *Thaumastus biteniatus* of Nyst is much more simple in character, having no series of perforations along the outer margin, and very feeble indications of radiating ridges beneath. There is a broken-up thin central keel, with a perforation in the same position as in *T. Sangoæ*. It is, however, not such a narrow slit as in that species. The outer surface is fairly smooth, although uneven.

It is interesting to have for examination the epiphragms of two species from the same locality (Chanchamayo, Peru) and belonging to the same genus, for their differences tend to show that in these structures we may find additional specific characters. Both these epiphragms are white, as is frequently the case in other species. This colour, however, is not universal, for in *Liguus virginicus* and *Orthalicus zebra* it is said to be green, and in the latter species, although thick and solid, it is described as glutinous rather than calcareous (Crosse & Fischer, "Mission Scientifique au Mexique," Mollusques, vol. i, p. 447, pl. xviii, figs. 8, 8a).

E. A. SMITH.

DESCRIPTIONS OF NEW SPECIES OF LAND-SHELLS FROM
CENTRAL AND SOUTH AMERICA.

By S. I. DA COSTA.

Read 13th November, 1903.

PLATE I.

STROPHOCHEILUS (EURYTUS) AURIFORMIS, n.sp. Pl. I, Fig. 1.

Testa acuminato-oblonga, vix umbilicata, tenuicula, fulva, guttis castaneis hic illic aspersis picta, subtilissime corrugata vel granulata, epidermide tenui olivacea induta; anfractus quinque, oblique convoluti, subplano convexi, longitudinaliter oblique granulato-striati, sutura impressa sejuncti; apertura ampla, auriformis, intus violascens; labrum valde expansum et reflexum, pallide violaceum; columella fortiter uniplicata, late reflexa, callo conspicuo dilute violaceo labro juncta. Long. 74, diam. 38 mm.; apertura 43 mm. longa, 26 lata.

Hab.—Bogotá, Colombia.

This species, of which only one specimen has been obtained, has been placed in *Eurytus* on account of the granulated sculpture of its surface and other characters peculiar to that section. It differs, however, from most other species in its very large auriform aperture.

STROPHOCHEILUS MIERSI, n.sp. Pl. I, Fig. 2.

Testa oblongo-ovata, vix perforata, solida, subventricosa, rosacea, epidermide tenui luteo-olivacea induta, spira conica; anfractus quinque, vix convexiusculi, minutissime indentati, ad suturam impressi, submarginati, ultimus descendens, basi rotundatus; columella alba, uniplicata, recedens; apertura oblongo-auriformis, intus albidus; peristoma album, incrassatum, expansum, et reflexum, marginibus callo albido junctis. Long. 72, diam. 35 mm.; apertura intus 35 mm. longa, 15 lata.

Hab.—Minas Geracs, Brazil.

This shell, which was acquired by the writer at the sale of the late Mr. Miers' collection, bears a striking resemblance to *S. contortuplicatus*, Rve.; but differs from that species in many important respects. It is more ventricose in contour, has no microspirial striation, is more coarsely malleated, and the sutures are less impressly marginated.

DRYMÆUS MULTISPIRA, n.sp. Pl. I, Fig. 4.

Testa conico-ovata, vix umbilicata, tenuicula, albidus, strigis obliquis, fusco-nigricantibus picta; anfractus $7\frac{1}{2}$, convexi, læves vel rude striati, ultimus longitudinis $\frac{1}{2}$ subæquans; spira subacuminata; sutura impressa; apertura ovata; labrum simplex, intus plus minus roseo tinctum; columella reflexa, rosea. Long. 20, diam. 11 mm.; apertura 9 mm. longa, 5.5 lata.

Hab.—Chuco Chaca, Bolivia, 4,000 feet.

The shells of this species vary considerably both in form and painting, some being more ventricose than others, while the longitudinal stripes or blotches are more or less confluent, and do not

always reach the base of the body-whorl—in fact, in a long series hardly two specimens are alike. The one selected for the type is an average specimen in most respects, although perhaps rather more ventricose than many.

GLANDINA BOGOTENSIS, n.sp. Pl. I, Fig. 5.

Testa fusiformis, crassiuscula, nitida, purpurascenti-castanea; spira elongata; anfractus septem, convexiusculi, longitudinaliter creberrime plicato-striati, sub lente minute transversim striati, ad suturam subtiliter crenulati, et anguste marginati; columella fere recta, alba, conspicue truncata; apertura parviuscula, purpurascenti-castanea; labrum pallidum, ad marginem subincrassatum. Long. 51, diam. 21 mm.; apertura 21 mm. longa, 10 lata.

Hab.—Bogotá, Colombia.

A few specimens of this shell reached the writer several years ago. It is closely allied to *G. aequatoria*,¹ Da Costa, from Ecuador, but is more fusiform, thinner, has a whorl less, and is without the transverse striation of that species.

STREPTOSTYLA COSTARICENSIS, n.sp. Pl. I, Fig. 3.

Testa cylindraco-oblonga, tenuis, pellucido-cornea; spira brevis, ad apicem obtusa; anfractus $5\frac{1}{2}$, subplano-convexi, ad suturam marginati, læves, politi; columella brevis et contorta; apertura oblonga, anguste auriformis, labro in medio impresso, ad marginem albo. Long. 19, diam. 9 mm.; apertura 13 mm. longa, 3·5 lata.

Hab.—Azajár de Cartago, Costa Rica.

This shell was collected by Mr. Underwood in 1896, and is one of two specimens in the writer's collection. It much resembles *S. cylindracea*, Pfr., but is more ovate and has a shorter aperture.

NEOCYCLOTUS PANAMENSIS, n.sp. Pl. I, Figs. 6–9.

Testa aperte umbilicata, depressa, lutescens; anfractus $4\frac{1}{2}$, rotundati, incrementi lineis striati, et obscure retuse corrugati; peristoma tenue, simplex, marginibus callo junctis; operculum testaceum, aretspiratum, ad suturam filo-carinatum, in medio concavum. Diam. maj. 15, min. 12 mm., alt. 10 mm.

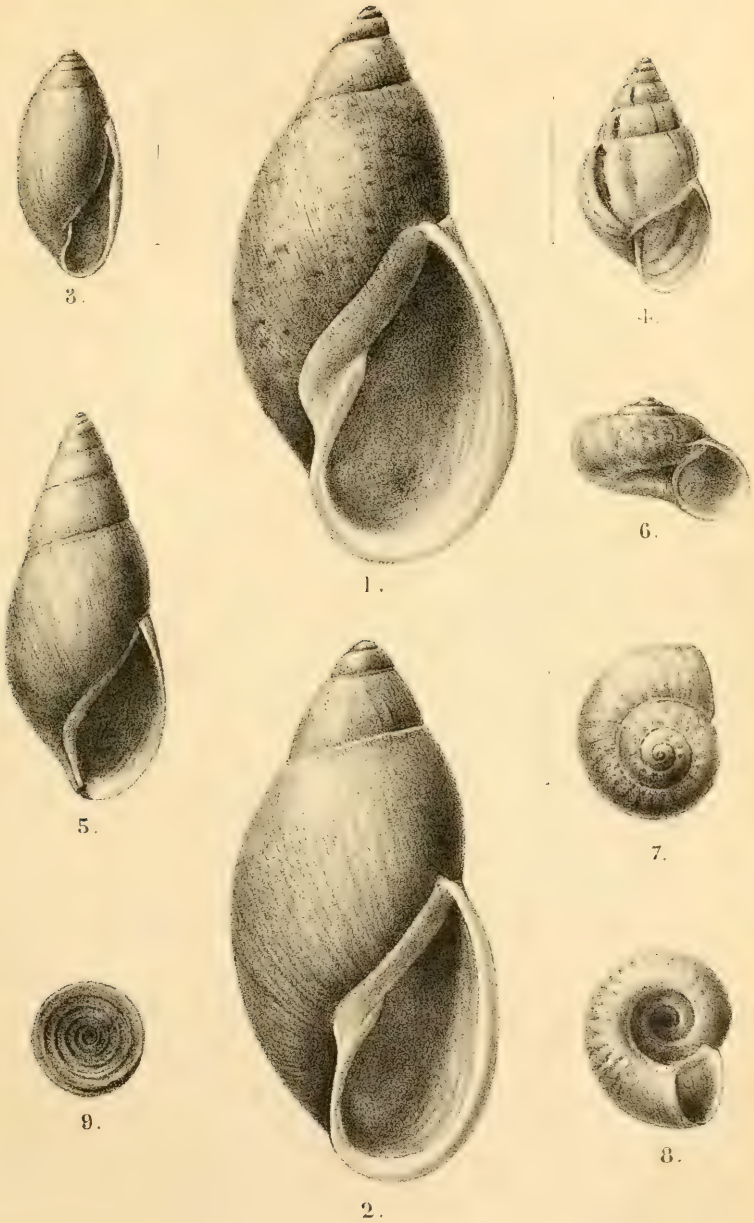
Hab.—Chiriqui.

There are some unnamed specimens in the British Museum from Panama which are identical with this species.

EXPLANATION OF PLATE I.

- FIG. 1. *Strophocheilus (Eurytus) auriformis*, n.sp.
 ,, 2. *Strophocheilus Miersi*, n.sp.
 ,, 3. *Streptostyla Costaricensis*, n.sp.
 ,, 4. *Drymeus multispira*, n.sp.
 ,, 5. *Glandina Bogotensis*, n.sp.
 ,, 6–8. *Neocyclotus Panamensis*, n.sp.
 ,, 9. Id., operculum, upper surface.

¹ Proc. Malac. Soc., vol. iv, p. 67, pl. vii, fig. 4.



J. Green del. et lith.

Mintern Bros. imp.

NEW SPECIES OF LAND SHELLS FROM CENTRAL AND SOUTH AMERICA.

DESCRIPTIONS OF *DOLIUM MAGNIFICUM*, n.sp., AND *MUREX MULTISPINOSUS*, n.sp.

By G. B. SOWERBY, F.L.S.

Read 13th November, 1903.

DOLIUM MAGNIFICUM, n.sp.

Testa subglobosa, tenuis, alba, fusco sex-balteata, flammulis interruptis brevibus irregulariter undulatis castaneis picta; spira breviter conica; anfractus 7, primi 3 minuti, laeves, deinde rapide accrescentes, convexi, irregulariter spiraliter sulcati; sutura angustissime canaliculata; anfractus ultimus per-inflatus, rotundatus, longitudinaliter striatus, hic illic leviter malleatus, sulcis spiralibus

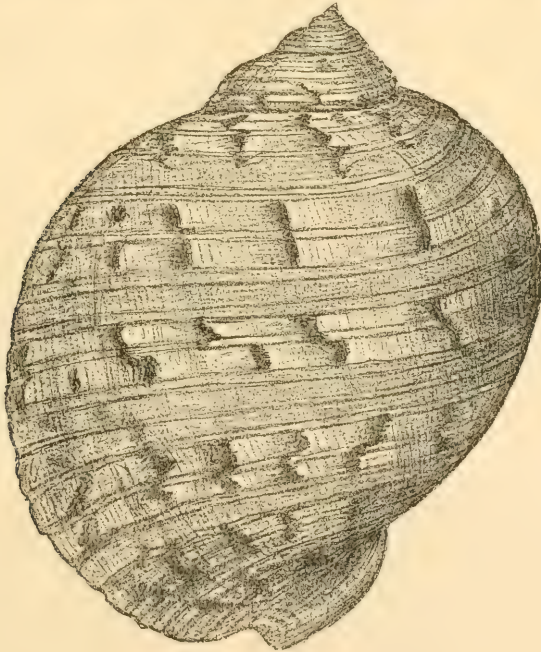


FIG. 1.

numerosis angustis plerumque duplicatis sculptus; apertura ampla, intus alba, pallide fusco tincta, duplicatim lirata. Long. 110, lat. 100 mm.

Hab.—China Sea.

This handsome shell has some affinity with *D. variegatum*, Lamk., and *D. Chinense*, Dillwyn. Its colouring is characteristic. Crossing the white spaces between the brown bands are dark brown wavy

flames, which are clearly defined against the white ground on the right-hand side, and shaded off with lighter colour on the left. The narrow clean-cut grooves are for the most part arranged in pairs, the spaces between them being flat, or nearly so, not rounded as in *D. Chinense* and some other species.

The specimen was brought from China by the late General Tripe.

MUREX MULTISPINOSUS, n.sp.

Testa fusiformis, antice producta, postice conica, sordide albida; spira elato-conica, gradata, ad apicem papillaris, luteo-fusca, leviter obliqua; anfractus $6\frac{1}{2}$, primi $1\frac{1}{2}$ (apicales) læves, rotundati, cæteri obtuse angulati, spiraliter obscure lirati, obtuse bicarinati, longitudinaliter undulatum eximie lamellati, varicibus 9-10 aculeatim spinosis instructi; anfractus ultimus supra convexus, infra rostratus; rostrum elongatum, rectiusculum, supra spinosum, infra lævigatum; apertura ovata, intus lævis. Long. 23, lat. 13 mm.

Hab.—Cebú I., Philippines (Tripe).

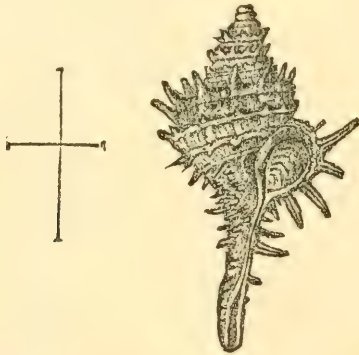


FIG. 2.

Only one specimen of this beautiful little species was found by the late General Tripe during his trip to the Far East. The shell is so unlike any hitherto known, that I am unable to place it with confidence in any of the recognised sections. As a multivaricose *Murex* it might (*sensu lato*) be included in the subgenus *Muricantha*, Swainson; but its long rostrum brings it into affinity with *Rhinocantha*, H. & A. Adams. The operculum, with terminal nucleus, is more like that of *Rhinocantha* than of the typical *Murex*. Possibly the species may find its place in Jousseau's genus *Poirieria*, of which *M. Zealandicus*, Quoy & Gaim., is the type.

SOME REMARKS ON THE GENERA *DAMAYANTIA*, ISSEL,
COLLINGEA, SIMR., AND *ISSELENTIA*, COLLGE.

By WALTER E. COLLINGE, M.Sc.

Read 13th November, 1903.

IN a recent issue of the "Proceedings" of this Society,¹ Lieut.-Col. Godwin-Austen criticises some work of mine upon the Bornean Slug fauna. I should not have troubled to notice this article under ordinary circumstances, for the facts are so clear and the material before me so convincing, but I had previously promised the writer to do so, and further if I were to treat it with silence, malacologists and others unacquainted with these little known genera of land molluscs might possibly think there was some foundation for Lieut.-Col. Godwin-Austen's statements.

Very briefly I must first sketch the history of the material under discussion.

In October, 1893, Mr. Edgar A. Smith sent me for identification a small collection of slug-like molluscs, received by the British Museum from the late Mr. A. H. Everett, and collected by him in Sarawak, N.W. Borneo. These were described by Lieut.-Col. Godwin-Austen and myself in 1895 (2), and named *Damayantia Smithi*, *Microparmarion Pollonerai*, and *M. Simrothi*. In this paper the drawings and descriptions of the generative organs were made by the present writer from his own dissections, together with the "Summary and Conclusion," but the bulk of the drawings were made by the co-author, as also the remarks on "Affinities."

In 1898 Professor Simroth published a valuable paper on some species of *Parmarion*, etc., from China, Java, etc. (4), in which he constituted a new genus (*Collingea*) for a Javan slug previously known as *Microparmarion Strubelli*, and he pointed out that what Lieut.-Col. Godwin-Austen and I had termed *Microparmarion Pollonerai* and *M. Simrothi* must also be referred to the genus *Collingea*, for in all three members of the genus there is a very striking anatomical character, viz., a protrusion of the distal portion of the penis-tube, handle-like, out of its sheath, a feature which, doubtless owing to our then insufficient acquaintance with and knowledge of these *Parmarion*-like slugs, we failed to realise the importance of.

In 1900 I received from the Sarawak Museum a collection of slugs from N.W. Borneo, and in working at these I had occasion to re-examine the previous Bornean material in the British Museum. I should perhaps mention that between 1893 and 1900 I had

¹ Vol. v, p. 311.

examined numerous specimens of *Girasia*, *Austenia*, *Parmarion*, *Microparmarion*, *Damayantia*, and allied genera from India, Ceylon, Borneo, Lombok, Annam, Tonkin, China, the Philippines, etc.

In this second examination I soon discovered that a serious error had been made, for of the three specimens in the bottle labelled *Damayantia Smithi*, I found that the one which Lieut.-Col. Godwin-Austen had figured was different from the one I had dissected. It was at once evident that the former was not referable to Issel's genus *Damayantia*, for in this second Bornean collection I had numerous beautiful examples of *D. dilecta*, Issel, the type of the genus, and of a new species, *D. carinata*, Clge. Further, on examining the anatomy of the specimen figured by Lieut.-Col. Godwin-Austen, I found the handle-like protrusion of the penis, and therefore I transferred this species to the genus *Collingea*, Simr. The remaining two specimens proved to belong to a new genus I was investigating (*Isselentia*), and these I described under the name of *I. globosa*.

This error I pointed out in the paper in which the second Bornean collection was described (1).

In August, 1902, Lieut.-Col. Godwin-Austen wrote me at considerable length, informing me that he was intending to publish his views upon these molluses, which correspondence continued until the end of September. This correspondence is of interest, in that it throws much light upon the views he then held upon the affinities, etc., of the Indo-Malayan slugs and slug-like molluses, but which have since undergone still further change.

Turning now to the criticism, it will perhaps be best if I treat of the species and genera in the same order as Lieut.-Col. Godwin-Austen.

1. DAMAYANTIA CARINATA, Clge.

Lieut.-Col. Godwin-Austen has seen a specimen of this mollusc, and admits that it is "the first Bornean slug-like mollusc . . . in which the external form and proportion of the parts to one another correspond closely with Issel's figure of *Damayantia dilecta*," but he is wrong in stating that I observed a "jagged or toothed appearance of the keeled foot." The foot is not keeled, and what I described was a jagged or toothed appearance on the keel of the dorsum. As this is constant in all the specimens, and the most careful examination fails to show that it is other than normal, I do not share Lieut.-Col. Godwin-Austen's view that it is due to "epidermal destruction." The shell is rightly described as being internal, yet so recently as September 10th, 1902, Lieut.-Col. Godwin-Austen emphatically denied this, stating that it only appeared so owing to the expansion [!] of the shell-lobes. This is extremely interesting, as showing his conception of the genus at that date.

It is a matter of little moment whether or not this species is distinct from *D. dilecta*, Issel. I have examined about thirty specimens of this last-mentioned species from Borneo, and I am of opinion that *D. carinata* is specifically distinct from it; on the other hand, Lieut.-Col. Godwin-Austen, who has never seen a member of this genus until he examined this specimen of *D. carinata*, thinks it is not.

2. *COLLINGEA SMITHI*, Clg. & Godw.-Aust. (= *Damayantia Smithi*, Clg. & Godw.-Aust.).

When in 1900 I re-examined this species, I found that the specimen which Lieut.-Col. Godwin-Austen had figured (2, pl. xi, figs. 1-5) was not the one I had dissected. My dissection was of a species of *Isselentia* (which I have since named *globosa*), while the specimen described and figured by Lieut.-Col. Godwin-Austen turns out on re-examination to be a member of the genus *Collingea*, Simr. With Mr. Edgar A. Smith's kind permission, I made a careful examination of the generative organs, and found the peculiar handle-like protrusion of the penis, thus leaving no doubt whatever as to the generic position of this mollusc. Personally, I must admit that had I at the time seen Issel's figures of *Damayantia* (3), I should most certainly never have dreamt of placing this slug in this latter genus, and I think my co-author would have acted more wisely had he, even at this late date, admitted so palpable an error. But apart from the internal structure, the merest tyro in malacology would not hesitate to at once distinguish any species of *Damayantia* from the mollusc under discussion, in which the shell is exposed, and all the external features point to a relationship with the genus *Parmarion* of Fischer.

3. *ISSELENTIA*, Clg.

Respecting the remaining two specimens in the bottle containing *Collingea Smithi*, they are members of the genus *Isselentia*, and of course, the figure given by me in the Transactions of the Royal Society of Edinburgh (1, pl. iii, fig. 50) agrees pretty closely with that I had previously given in the Proceedings of the Zoological Society (2, pl. xi, fig. 9) of the same specimen, then regarding it as a *Damayantia*. The "wonderful similarity" noted by Lieut.-Col. Godwin-Austen is thus easily explained.

As to the views that the wavy crinkled edge of the keel of the dorsum (not the foot) and that the plications of the mantle-lobes are due to the action of alcohol, or a *post mortem* state due to contraction, "which in all probability would not be seen in the living animal, or in one killed in water and then put into spirit," one can scarcely believe that the author is serious. I have examined upwards of two dozen specimens of *I. plicata*, Clg., all of which I believe were killed in water. They were in a beautiful state of preservation, and in every case exactly like the original figures (1, pl. i, figs. 13-15). As to the validity of the genus, I have already described and figured it in some detail, and if Lieut.-Col. Godwin-Austen is unable to distinguish it from *Damayantia*, Issel, on the one hand, and *Collingea*, Simr., on the other, I fear no further figures or description can be of any use to him.

There are two other points which I must deal with, but being of a personal nature I am loth to touch upon them except in the very briefest manner.

When I had dissected the specimens described in the P.Z.S. (2), I made drawings of them, and together with the specimens forwarded them to my co-author; they were ultimately returned to me, and

my drawings were published. Figures very similar to these were published later by Lieut.-Col. Godwin-Austen, in pt. 8, vol. ii, of the "Mollusca of India," with these remarks: "I illustrate the anatomy of *Microparmarion* with my original drawings (those in the P.Z.S., 1895, being copies of them)." I have elsewhere (*Z*, p. 304) pointed out the incorrectness of this statement, and on September 21st, 1902, Lieut.-Col. Godwin-Austen himself wrote to me acknowledging that the P.Z.S. drawings were the original ones, and made by me from my dissections. I therefore not unnaturally feel aggrieved to find in these "Proceedings," vol. v, p. 312, that he again states, in a footnote, that the figures in the "Mollusca of India" are his original drawings, while those in the P.Z.S., pls. xi-xiv, were copied from them. In justice to myself, I must again correct this misstatement of fact.

The second point is the charge of misplacing the specimens in the bottles at the British Museum. When I re-examined the material which formed the subject of the above-mentioned conjoint paper, I found it exactly as Lieut.-Col. Godwin-Austen returned it to me, and in which condition it left my hands in February, 1894, viz. in perfect order, and in such condition I left it. It has since been examined by Lieut.-Col. Godwin-Austen, and if he left it as he found it the material is still in perfect order.

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2. *Collinge* (*Walter E.*) and *Godwin-Austen* (*H. H.*).—"On the Structure and Affinities of some new species of Molluscs from Borneo": *Proc. Zool. Soc.*, 1895, pp. 241-250, pls. xi-xiv.
3. *Issel* (*A.*).—"Molluschi Borneensi": *Ann. Museo Civico Genova*, 1874, vol. vi, pp. 366-486, pls. iv-vii.
4. *Simroth* (*Heinrich*).—"Ueber die Gattungen *Parmacochlea*, *Parmarion*, und *Microparmarion*": *Zool. Jahrb.*, 1898, Bd. xi (Abth. f. Syst.), pp. 151-172, T. 15.

DESCRIPTIONS OF TWO NEW SPECIES OF *MELANIA* FROM THE
NEW HEBRIDES.

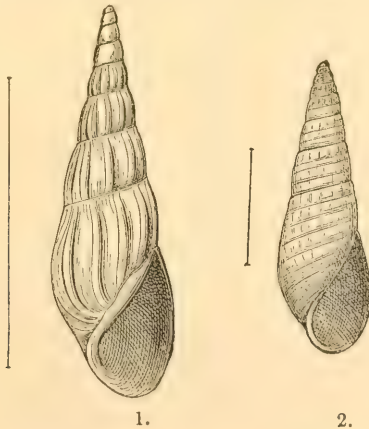
By E. R. SYKES, B.A., F.L.S.

Read 13th November, 1903.

THE two species now described were sent recently by Mr. H. S. Mort, with a note stating that he and other workers had been unable to identify them, and inviting me to describe them if they proved to be new. Having been unable to trace them, either in the British Museum collection, in Dr. Brot's excellent monograph, or in other works, I now venture to offer diagnoses. The habitat is Espiritu Santo, New Hebrides.

MELANIA MORTI, n.sp. Fig. 1.

Shell elongate, subulate; colour varying from a very dark olive-green to almost black, the earlier whorls being eroded and yellowish-white. Sculpture: well-marked longitudinal ribs, varying considerably in their relative distance apart, but usually about twenty in number on the last whorl, at the base of which several minute spiral lines may be seen; the earlier whorls appear to be smooth. Whorls probably about ten in number, flattened, with a well-marked suture, the longitudinal ribs usually fading out as they approach the suture. Mouth pyriform, olivaceous to black inside, thickened and lightly reflexed at the columella, with a thin white callus joining the margins. Alt. (spec. decoll.) 38 mm., diam. max. 6.5 mm.



An interesting form, which I have much pleasure in naming after Mr. Mort. Its most noteworthy features are the well-marked longitudinal ribs, which stand out prominently on the later whorls.

MELANIA CINGULIFERA, n.sp. Fig. 2.

Shell very elongately pyramidal, horn-colour. Sculpture: the earlier whorls are marked by longitudinal riblets, which are cut by a few spiral lines; on the later whorls the longitudinal riblets fade out, being represented by semi-obsolete nodules below the suture, and the spiral lines (about ten on the last whorl) are more marked. Whorls about nine in number, much flattened, the suture not being very conspicuous. Mouth ovate pyriform, the columellar margin being very lightly reflexed and thickened, and a light callus joining the margins. Alt. 14·5, diam. max. 4·5 mm.

Apparently belonging to the group of *M. verrucosa*, Hinds, from New Ireland, but the whorls increase more rapidly in breadth, and the sculpture is not so 'verrucose.'

DESCRIPTION OF A NAUTILOID, *PLEURONAUTILUS PULCHER*,
 N.SP., FROM THE CARBONIFEROUS ROCKS OF ENGLAND.

By G. C. CRICK, F.G.S.,

Of the British Museum (Natural History).

Read 11th December, 1903.

PLATE II.

THE new species, *Pleuonautilus pulcher*, described in the present paper is based upon four examples and a fragment; of these, two and the fragment are in the British Museum collection, the others in the collection of Dr. Wheelton Hind, of Stoke-upon-Trent.

It may be characterized as follows:—Shell small, evolute, with the aperture only just in contact with the preceding whorl, thick-discoid, rapidly increasing in diameter, and having a central vacuity; greatest thickness at about the middle of the lateral area, from six- to seven-elevenths of the diameter of the shell; height of outer whorl from about four-elevenths to two-fifths of the diameter of the shell. Whorls two in number; inclusion very slight, but apparent at the completion of the first whorl; umbilicus deep, exposing the inner whorl, with steep sides and convex margin, from about two-fifths to about one-third of the diameter of the shell in width, and having a central vacuity. Whorl depressed elliptical or sub-tetragonal in cross-section, rather wider than high; scarcely indented by the preceding whorl; periphery broad, feebly convex, somewhat flattened in the centre and bevelled or even slightly concave on each side, separated from each lateral area by a narrow well-marked zone (the lateral ventral zone); sides rather narrow, somewhat flattened and divergent; umbilical shoulder rounded, ill-defined; inner area (or umbilical zone) convex, not sharply defined. Body-chamber occupying fully half of a whorl; aperture not seen, but, judging from the ornaments of the test, with a feeble sinus on the lateral area and a broad deep hyponomic sinus on the periphery. Chambers (cameræ) not very shallow, being near the base of the body-chamber about one-third of the height of the whorl in depth; suture-line with a feeble sinus on the lateral area, a broad shallow sinus on the periphery, and a small distinct dorsal or internal lobe. Siphuncle small, about two-fifths of the height of the whorl below the periphery apparently at all stages of growth. Test rather thick and beautifully ornamented; at about the end of the first half-whorl the shell becomes somewhat suddenly swollen, and two distinct longitudinal parallel ridges originate on each side of the peripheral area, the outer one on each side coinciding with the boundary of that area, and limit a distinct 'lateral ventral zone,' which is clearly defined almost to the aperture of the shell; at the same place there appear on the lateral area of the whorl feeble, broad, somewhat forwardly-inclined folds which become very prominent, forming almost a node, at the raised lateral margin of the lateral ventral zone; these folds soon assume the form of distinct

costæ, and near the commencement of the second whorl the inner or umbilical end of each costa becomes a little more swollen; near the base of the body-chamber this swelling diminishes, and before the completion of the second whorl, i.e. on the body-chamber, the outer nodes also disappear; then the folds themselves gradually become obsolete, the last half of the body-chamber being almost smooth. The whole of the surface of the test is ornamented with very fine regular raised lines; on the first half-whorl these lines pass obliquely backward across the lateral area and traverse the periphery in a deep broad backwardly-directed sinus; when the whorl suddenly becomes swollen the lines become more nearly direct, and on the rest of the shell they are parallel to the costæ over the lateral area and the lateral ventral zone as far as the margin of the periphery, whilst they cross the latter in a broad deep backwardly-directed sinus; in the adult the peripheral portion of the test bears also extremely faint longitudinal lines. The 'normal line' in the centre of the peripheral area is displayed in an internal cast, more especially on the body-chamber. Muscular attachment consisting of a finely punctated semi-oval area on each side close to the base of the body-chamber, that passes dorsally into a narrow punctated band which crosses the dorsal surface of the body-chamber, forming the impressed zone on a broad shallow sinus; ventrally the two semi-oval areas are connected by an exceedingly narrow, but apparently non-punctated band, crossing the peripheral area close to the edge of the base of the body-chamber. Epidermids consisting of very fine punctations, visible only with a very strong lens, that exhibit a tendency to dispose themselves in lines, which on the inner area (or umbilical zone) of the whorl pass rather more obliquely backward than, but elsewhere have the same direction as, the shell-ornaments.

The larger of the British Museum examples (No. C. 5277) has been selected as the type-specimen, because it displays all the characters of the species (Pl. II, Figs. 1-4). It is 27.5 mm. in diameter and consists of a little more than two whorls, the anterior part of the body-chamber leaving the coil very slightly; it has been broken in such a manner as permits of the examination of the different stages of growth of the shell. The first half-whorl, ornamented with simple reclined raised lines, constitutes the nepionic stage; this passes with a rather abrupt swelling into the neanic stage with its incipient costæ and distinct lateral ventral zone, and this in turn passes almost imperceptibly into the epebic stage with its distinct nodose costæ, the gerontic stage being indicated on the internal cast of the body-chamber by the weakening of the ornaments and the gradual disappearance of the lateral ventral zone.¹ The

¹ In the Triassic example of *Pleuromutilus superbus* figured by Mojsisovics (Abhandl. d. k.-k. geol. Reichsanst., Bd. vi, 1873, pl. iv, figs. 1a-e) and Hyatt ("Phylogeny of an acquired characteristic": Proc. Amer. Philos. Soc., vol. xxxii, No. 143, 1894, pl. xii, fig. 3), the nepionic stage, consisting of an entire whorl, is also striated and passes quite abruptly into the costated neanic stage.

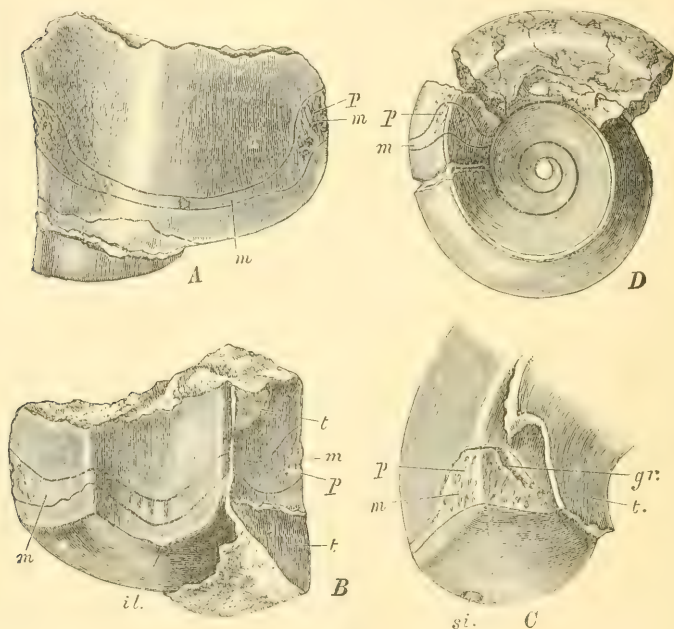
nepionic stage of the shell is preserved as an internal cast; it was not free, but abutted against the succeeding whorl; the test is wanting on its peripheral and lateral areas, but a fragment, with its characteristic sculpture, is preserved on the dorsal area, though the greater part of this area is concealed by matrix, which likewise obstructs the end view of the anepionic substage. There are, however, on the peripheral part of the tip of the internal cast of the first chamber indications of a vertical cicatrix. Even in the nepionic stage the cross-section of the whorl is depressed elliptical, a form which is maintained up to the base of the body-chamber. The siphuncle in the neanic stage, just before the end of the first whorl, is at about two-fifths of the diameter from the periphery, a position which it also occupies at the last septum, thus maintaining the same position in all stages of growth. The sculpture of the test of the epebieic stage is particularly well shown. The form of the muscular attachment is also displayed. On each side close to the base of the body-chamber there is a transverse semi-oval area, having its greatest height, 3 mm., at the lateral boundary of the lateral ventral zone; its broad ventral end, situated on the peripheral boundary of the same zone, is connected with the area on the opposite side by an exceedingly narrow band immediately above the last septum; dorsally each area gradually diminishes in width as far as the umbilical shoulder, i.e. for a distance of about 7 mm., whence it passes as a narrow band, somewhat wider than the ventral band and adjoining the edge of the last septum, across the suture of the shell or 'line of involution,' and over one-fourth of the width of the impressed zone, the rest of its course on the impressed zone being obscured by a film of the test. The semi-oval area on each side and the dorsal band are minutely punctated; the ventral band is so excessively narrow that it is difficult to say whether it is punctate or not, but puncturation appears to be lacking. The semi-oval area on one side bears two small pieces of shelly matter, the surface of which is also punctate. The form of the muscular attachment closely resembles that of *Vestinautilus cariniferus* (see accompanying figures). This specimen also shows the character of the epidermids. It belonged to the collection of the late J. W. Davis, of Halifax; the precise locality whence it was obtained has not been recorded, but the matrix agrees with that of the other examples which are from Hebden Bridge.

The smaller example in the British Museum collection (No. C. 213) belongs to the Gilbertson Collection, but in this case also the locality has not been recorded. It is 25 mm. in diameter; the inner whorl is fairly well preserved; the last third of the outer whorl is occupied by the body-chamber, but the greater part of this is imperfect both laterally and ventrally, so that the dimensions of the specimen can be best taken at a diameter of 21.5 mm. It exhibits very well the sculpture of the nepionic and neanic stages, and the suture-line in the epebieic stage.

The fragment in the National collection (No. C. 8631) is about 10 mm. long, and consists of the internal cast of the posterior portion of the body-chamber and of the two preceding cameræ; it is terminated

posteriorly by a septal surface, of which the ventro-dorsal diameter (= height of the whorl) is 6 mm., and the transverse (= thickness of the whorl) 8 mm., displaying the small internal (or dorsal) lobe, and the siphuncle at about two-fifths of the height of the whorl below the periphery. The specimen belonged to the collection of the late Mr. G. H. Morton, F.G.S., and is stated to be from the "Millstone Grit" of Hebden Bridge, Yorkshire.

FIGS. *A, B, C, D.*



Vestinautilus cariniferus, J. de C. Sowerby, sp., from the Carboniferous Limestone, Cork, Ireland.—*A.* Ventral or peripheral aspect of the internal cast of the posterior portion of the body-chamber (nat. size), showing at *m, m* the impression of the muscular attachment (*m* in all the other figures has the same meaning); *p* in all the figures refers to the pitted and rugose surface of the muscular impression. *B.* Dorsal (internal) aspect of the same fragment; *t*, test; *il.*, internal or dorsal lobe of a septum. *C.* Lateral aspect of the internal cast of the posterior portion of the body-chamber of a larger specimen; *t*, test; *gr*, groove; *si*, siphuncle. *D.* Reduced figure of a nearly perfect example of this species, from which the fragment lettered *A* and *B* was removed. (After Foord & Crick.) Reproduced by permission of the Trustees of the British Museum.

Dr. Wheelton Hind's examples are 17.5 and 27 mm. in diameter respectively. The smaller specimen is immature (Pl. II, Fig. 5); it consists of one and a half whorls, the body-chamber occupying nearly one-half of the outer whorl. The inner whorl is remarkably well preserved, and shows the ornaments of the test of the nepionic

and neanic stages, as well as the extent of the central vacuity; the anapneionic shell is seen abutting against the succeeding whorl, but the terminal view of this substage is obstructed by matrix; at the end of the first whorl the shell has a diameter of 9.5 mm.

The larger example consists of two whorls; the inner whorl is less perfectly preserved than in the smaller specimen, and only portions of the test are present. There are nineteen or twenty costae in the outer whorl. The body-chamber occupies nearly one-half of the last whorl; the penultimate and antepenultimate chambers are each 2.5 mm. deep at the centre of the periphery, the whorl here having an altitude of 6.25 mm.; the last chamber is somewhat shallower than the penultimate, a fact which, notwithstanding the comparatively small size of the specimen, is usually regarded as a sign of maturity. On the whole this shell is rather stouter than the example selected as the type, but this may be due either to individual variation, or, as is more probable, to sexual difference.

The dimensions of the specimens arranged in the order of their respective greatest diameters are given in the following table; dimensions at other diameters being added for the sake of comparison. (I) is the smaller example in Dr. Wheelton Hind's collection; (II) the smaller specimen in the British Museum collection [No. C. 213]; (III) Dr. Wheelton Hind's larger example; (IV) the larger specimen (the type) in the British Museum collection [No. C. 5277]. The measurements are in millimetres.

TABLE OF DIMENSIONS.

| | I | | II | | | III | | | IV | | |
|--------------------------|------|-----|------|------|-----|------|------|---|------|------|------|
| Diameter of shell | 17.5 | 15 | 25 † | 21.5 | | 27 | 21.5 | | 27.5 | 21.5 | |
| Radius of shell *..... | 10 | 9 | 14.5 | 13.5 | 9 | 17 | 14 | 9 | 16.5 | 13.5 | 9 |
| Width of umbilicus ... | 6.5 | 6 | 9.5 | 7.5 | 6 | 9.5 | 7.5 | 6 | 11 | 8 | 5.5 |
| Height of outer whorl . | 6 | 6 | 9 | 9 | 6 | 11.5 | 9 | 6 | 10 | 8.5 | 6.5 |
| Thickness of outer whorl | 8.5 | 6.5 | ? | 12.5 | 8.5 | 17 | 14 | 9 | 15 | 13 | 10 ‡ |

With regard to the systematic position of the species, it seems to belong to Mojsisovics' genus *Pleuronautilus*¹ (emended by Foord²) except that in that genus, according to Foord, the siphuncle is a little below the centre, whereas in the present species it is a little above the centre in all stages of growth. The range of the genus is considered to be from the Devonian, where it is represented by *P. subtuberculatus*, G. & F. Sandberger,³ to the Trias, from which formation several forms have been described by Mojsisovics and others.

* I.e., a line drawn from the centre of the coil to the periphery of the shell.

† The last fourth of the whorl being imperfect both laterally and ventrally, these measurements are only approximate; they can be best taken where the diameter is 21.5 mm.

‡ Test well preserved on each side.

¹ E. v. Mojsisovics: "Die Cephalopoden der Mediterranen Triasprovinz" (Abhandl. der k.-k. geol. Reichsanst., Band x), 1882, p. 273.

² A. H. Foord: Cat. Foss. Ceph. British Museum, pt ii (1891), p. 134.

³ G. & F. Sandberger: "Verstein. rhein. Schichtensyst. Nassau," 1854-56, p. 133, pl. xii, figs. 3a-e (*Nautilus tuberculatus*).

From *Pleuromutilus falcatus*, J. de C. Sowerby,¹ sp., and *P. subdistinctus*, A. H. Foord,² from the Coal-measures of Shropshire, the present species can be easily distinguished by the relatively greater width of the cross-section of its whorls, by the character of its ornaments, and by the straighter course of the peripheral portion of its suture-line.

The specimen figured as *Nautilus tetragonus* by J. Phillips in his "Geology of Yorkshire," pt. ii (1836), pl. xxii, fig. 34, may belong to the present species, but in the absence of the original it is not possible to arrive at a definite conclusion.

The only specimens known to the writer that are properly localised are from the Carboniferous rocks of Hebden Bridge, Yorkshire, where they occur in the Pendleside series.

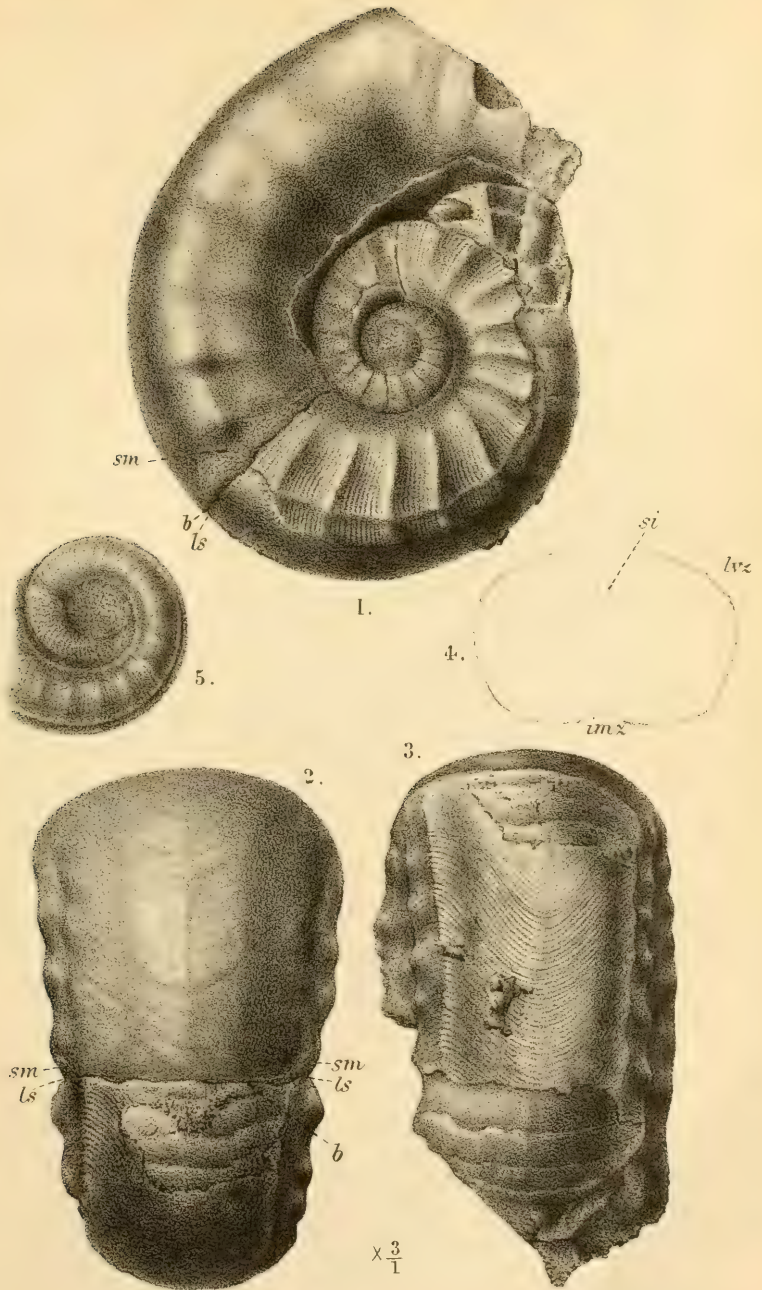
EXPLANATION OF PLATE II.

- FIG. 1.—Lateral aspect of type-specimen in the British Museum collection (No. C. 5277) from the Carboniferous (Pendleside Series): probably Yorkshire. *ls* indicates the position of the last septum; immediately above this is seen the band of attachment, *sm* being the punctated area indicating the position of the shell-muscle, and *b* the narrow band connecting the ventral ends of the shell-muscles.
- „ 2.—Peripheral aspect of the same, showing also the band of attachment close to the base of the body-chamber; the lettering as in Fig. 1.
- „ 3.—Peripheral aspect of same, showing sculpture of the test.
- „ 4.—Anterior aspect of the last septal surface of the same, showing the position of the siphuncle (*si*), the lateral ventral zone (*lvz*), and the impressed zone (*imz*).
- „ 5.—Lateral aspect of the nepionic and neanic portions of an example in the collection of Dr. Wheelton Hind. The sudden swelling at the end of the first half whorl indicates the end of the nepionic stage. Carboniferous (Pendleside Series): Hebden Bridge, Yorkshire.

All the figures are drawn three times the natural size.

¹ J. de C. Sowerby: Trans. Geol. Soc. [2], vol. v, pt. 3 (1840), expl. of pl. xl, fig. 9 (*Nautilus falcatus*).

² A. H. Foord: Cat. Foss. Ceph. British Museum, pt. ii (1891), p. 139.



J. Green del. et lith.

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PLEURONAUTILUS PULCHER, n.sp.

DESCRIPTION OF A NEW SPECIES OF *CASSIS*.

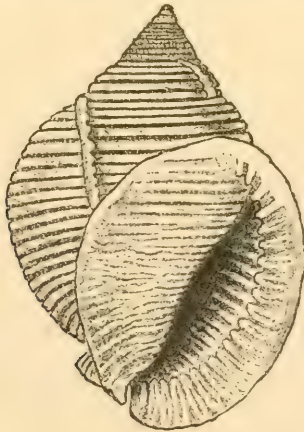
By EDGAR A. SMITH, I.S.O.

Read 11th December, 1903.

THE species about to be described is based upon a shell which was in the Cuming Collection when it was purchased by the British Museum in 1866. A label upon which is written "*Cassis Hancei*. Kauai" was with the specimen. I have not been able to discover that any species bearing that name has been described, and consequently I am of opinion that it is merely a manuscript designation. Although the label gives the locality, "Kauai," the correctness of this cannot be guaranteed without some confirmation, as the Cuming Collection is notorious for many errors of localization.

CASSIS (*SEMICASSIS*) *FORTISULCATA*.

Testa globosa, supra acuminata, alba, apicem versus pallide sordide lilacea, umbilicata; anfractus 8 regulariter crescentes, superiores $2\frac{1}{2}$ (protoconcha) convexi, læves, cæteri convexi, sutura canaliculata se-juncti, spiraliter profunde sulcati, liris intercalatis in anfr. superioribus granosis, in ultimo et partim in penultimo lævibus, complanatis;



spira conica, acuminata, varicibus paucis instructa; apertura angusta, obliqua, intus fuscescens, fortiter sulcata et lirata; labrum valde incrassatum, reflexum, pone sulcatum et crenulatum, in sulcis rufo tinctum, intus profunde sulcatum et liratum, liris prominentibus, peculiariter sed haud profunde aratis, fere ad marginem externum productis; columella obliqua, rectiuscula, tenuiter sed profundissime

sulcata, liris interjectis supra callum liberum arcuatum ad sinistram continuis. Long. 57 mm.; diam. maj. 40, min. 32 mm.; apertura intus 30 mm. longa, in medio 9 lata.

Hab.—Kauai, Hawaiian Islands.

This species is remarkable for the deep sulci, especially upon the two last whorls, and for the flat-topped intervening ridges. These in the penultimate whorl are six in number, and in the last there are nineteen, those upon the lower half of the whorl being less flattened than those above. The body-whorl exhibits one varix besides the labrum, the penultimate has one varix, and the antepenultimate two varices. The sulci within the aperture extend over the thickened labrum almost to the outer edge, and the intervening ridges are very peculiarly indented. The transverse sulci upon the columella are very deeply cut in, the ridges between them consequently being very conspicuous. They are produced upon the free callus on the left of the aperture. This callosity has a curved outline, is united above with the outer lip, the contour of both together being of an ovate form. There does not appear to be any species very closely allied to the present form with which to suggest a comparison.

ON THE MOLLUSCA PROCURED DURING THE "PORCUPINE"
EXPEDITIONS, 1869-1870. SUPPLEMENTAL NOTES, PART I.

By E. R. SYKES, B.A., F.L.S.

Read 11th December, 1903.

PLATE III.

It will be a familiar fact to students of the Mollusca that Dr. Gwyn Jeffreys passed away, in 1885, ere the completion of his work on the "Porcupine" Mollusca, and that part ix was seen through the press by Mr. E. A. Smith.

In the present paper I commence a supplement to his work, and dealing firstly with the genera which he did not consider, I propose subsequently to endeavour to give additional details relative to the residue of the Mollusca. When Jeffreys commenced his work much of the material was unsorted, and therefore there remains a good deal of information to be given.

The dredgings were divided by Jeffreys between himself and Mr. J. T. Marshall; at Jeffreys' death a large portion of this part of his collection was acquired by the British Museum, together with all his manuscript notes relating to it, and recently Mr. Marshall's collection, worked out with the most painstaking care, has passed into my hands. Mr. Marshall has most generously presented me with his interleaved copy of the "Porcupine" reports, and a quantity of valuable notes made by him with a view to a supplement being written, and Mr. Smith has placed Jeffreys' manuscripts at my disposal. My task, therefore, is rather that of an editor than of the writer of an original work, and while I take full responsibility for all statements herein contained, it must be borne in mind that the more valuable portions of the work are due to those by whose labours I have profited. Where possible, I have endeavoured to acknowledge in the text on whose authority the statements are made.

Some difficulty has arisen in chronicling the Museum collection owing to the fact that at Jeffreys' death his material was not fully prepared for detailed labelling. Much information no doubt remained unwritten, and he appears to have been in the practice, probably for his own convenience, of recording on the boxes, not only the station from which the specimens came, but also other localities where the species was found. In the case of one of the Bullidæ, for example, a box containing one specimen bears three station numbers. I have endeavoured rather to err on the side of omission than to give stations as to which I feel any doubt.

I have not attempted to give a very full synonymy, but have referred rather to monographs, etc., where this may be found. In addition to the shells now catalogued, there are a few species which I regard as being, in view of the fact that they are either broken or in very bad condition, for the present indeterminable. Specimens in

similar condition have been described from other scientific expeditions, but in my opinion no real gain is achieved by giving names to such material.

It must be assumed that, where molluscs are not recorded as 'live' in the following pages, only dead specimens were taken. Occasionally it has been doubtful whether the shells were really 'live' or only fresh dead specimens, and in such cases I have recorded them as dead shells.

Nine parts of the "Report" were written by Jeffreys, namely:—

| | | |
|------|-------------------------------|--|
| Part | I. Brachiopoda. | P.Z.S., 1878, pp. 393-416, pls. xxii, xxiii. |
| ,, | II. Pelecypoda. | ,, 1879, pp. 553-588, pls. xlv, xlvi. |
| ,, | III. ,, | ,, 1881, pp. 693-724, pl. lxi. |
| ,, | IV. ,, | ,, 1881, pp. 922-952, pls. lxx, lxxi. |
| ,, | V. Scaphopoda and Gastropoda. | ,, 1882, pp. 656-687, pls. xlix, l. |
| ,, | VI. Gastropoda. | ,, 1883, pp. 88-115, pls. xix, xx. |
| ,, | VII. ,, | ,, 1884, pp. 111-149, pls. ix, x. |
| ,, | VIII. ,, | ,, 1884, pp. 341-372, pls. xxvi-xxviii. |
| ,, | IX. ,, | ,, 1885, pp. 27-63, pls. iv-vi. |

In the first place, it becomes necessary to correct a few of the details as to stations, etc., given by Jeffreys (P.Z.S., 1878, pp. 394-397), the following notes being due to Mr. Marshall. In the cruise of 1869, Station 1 was really at $51^{\circ} 51' N.$ and $11^{\circ} 50' W.$, and the depth was 370 fathoms. In the cruise of 1870, the depths of Stations 17 and 17a should be 600-1095 and 740 fathoms respectively. In Mr. Marshall's view "Tangiers Bay, 35 fathoms" was an accidental substitution for "Station 35, 335 fathoms"; it appears duly, however, with a list of some shells obtained there, in Jeffreys' notebook, while under the deep-water locality Jeffreys records that the bottom was "clayey mud," and that there was "no dredging." It is only right, however, to warn students that though the locality is herein quoted as "Tangiers Bay, 35 fathoms," there is some little uncertainty on the point. In the second cruise in the Mediterranean, Station 53, Algerine Coast, 112 fathoms, was omitted. Further, Mr. Marshall writes: "Dr. Gwyn Jeffreys has substituted, by error, Station 55 for Station 56 throughout his papers on the Porcupine Expedition, and the differences between the two are most material. Station 55 was off the coast of Algiers in 1456 fathoms, whence the dredge came up loaded with 'barren mud,' while Station 56 was close to the Island of Pantellaria, in 390 fathoms, and was a most successful haul as regards Mollusca. All the dredgings passed through my hands, and there were no bags labelled 'St. 55.' This is important,

¹ Proc. Roy. Soc., No. 125 (1870), p. 174.

as the Marquis de Monterosato and other authors have recorded numerous species from the greater depth of 1456 fathoms that can only claim to come from 390 fathoms, and from a different part of the Mediterranean. This particular dredging was carried out under Dr. Carpenter's charge and was very rich in Mollusca. Gwyn Jeffreys used the term 'Station 55' readily enough in his preliminary report,¹ and I cannot imagine how he came to change the number in writing his detailed report ten years later."

For completeness the stations and localities are here reprinted from Jeffreys' paper, one or two emendations and corrections being made.

EXPEDITION OF 1869.

| Number of Station. | North Latitude. | West Longitude. | Depth in Fathoms. | Bottom Temperature. |
|--------------------|-----------------|-----------------|-------------------|---------------------|
| 1 | 51° 51' | 11° 50' | 370 | 49°·0 Fahr. |
| | Dingle Bay | | 30-40 | |
| 2 | 51° 22' | 12° 25' | 808 | 41°·4 |
| 3 | 51° 38' | 12° 50' | 370-722 | 43°·0 |
| 4 | 51° 56' | 13° 39' | 251-539 | 49°·5 |
| 5 | 52° 7' | 12° 52' | 364 | 48°·8 |
| 6 | 52° 25' | 11° 40' | 90 | 50°·0 |
| 7 | 52° 14' | 11° 48' | 159 | 50°·4 |
| 8 | 53° 15' | 11° 51' | 106 | 51°·2 |
| 9 | 53° 16' | 12° 42' | 165 | 49°·7 |
| 10 | 53° 23' | 13° 29' | 85 | 49°·5 |
| | Galway Bay | | 15-20 | |
| 13 | 53° 42' | 13° 55' | 208 | 49°·6 |
| 14 | 53° 49' | 13° 15' | 173 | 49°·6 |
| 15 | 54° 5' | 12° 17' | 422 | 47°·0 |
| 16 | 54° 19' | 11° 50' | 816 | 39°·5 |
| 17 | 54° 28' | 11° 44' | 1230 | 37°·8 |
| 18 | 54° 15' | 11° 9' | 183 | 49°·4 |
| | Donegal Bay | | 25-40 | |
| 19 | 54° 53' | 10° 56' | 1360 | 37°·4 |
| 20 | 55° 11' | 11° 31' | 1443 | 37°·0 |
| 21 | 55° 40' | 12° 46' | 1476 | 36°·9 |
| 22 | 56° 8' | 13° 34' | 1263 | 37°·3 |
| 23 | 56° 7' | 14° 19' | 630 | 43°·5 |
| 23a | 56° 13' | 14° 18' | 420 | 46°·4 |
| 24 | 56° 26' | 14° 28' | 109 | 46°·4 |
| 25 | 56° 41' | 13° 39' | 164 | 46°·5 |
| 27 | Rockall Bank | | 54 | 48°·3 |
| 28 | 56° 44' | 12° 52' | 1215 | 37°·1 |
| 30 | 56° 24' | 11° 49' | 1380 | 37°·1 |
| 31 | 56° 15' | 11° 25' | 1360 | 37°·2 |
| | Lough Swilly | | 3-13 | |
| | Lough Foyle | | 10 | |
| | North Channel | | 40 | |
| 33 | 50° 38' | 9° 27' | 74 | 49°·6 |
| 34 | 49° 51' | 10° 12' | 75 | 49°·6 |
| 35 | 49° 7' | 10° 57' | 96 | 51°·3 |
| 36 | 48° 50' | 11° 9' | 725 | 43°·9 |
| 37 | 47° 38' | 12° 8' | 2435 | 36°·5 |
| 38 | 47° 39' | 11° 33' | 2090 | 36°·3 |
| 39 | 49° 1' | 11° 56' | 557 | 47°·0 |

¹ Rep. Brit. Assoc., 1873, p. 113.

| Number of Station. | North Latitude. | West Longitude. | Depth in Fathoms. | Bottom Temperature. |
|--------------------|-----------------|-----------------|-------------------|---------------------|
| 40 | 49° 1' | 12° 5' | 517 | 47°·7 Fahr. |
| 41 | 49° 4' | 12° 22' | 584 | 46°·5 |
| 42 | 49° 12' | 12° 52' | 862 | 39°·7 |
| 43 | 50° 1' | 12° 26' | 1207 | 37°·7 |
| 44 | 50° 20' | 11° 34' | 865 | 39°·4 |
| 45 | 51° 1' | 11° 21' | 458 | 48°·1 |
| 45 <i>a</i> | | | 180 | |
| 45 <i>b</i> | | | 113 | |
| 47 | 59° 34' | 7° 18' | 542 | 43°·8 |
| 51 | 60° 6' | 8° 14' | 440 | 42°·0 |
| 52 | 60° 25' | 8° 10' | 384 | 30°·6 |
| 55 | 60° 4' | 6° 19' | 605 | 29°·8 |
| 56 | 60° 2' | 6° 11' | 480 | 30°·7 |
| 57 | 60° 14' | 6° 17' | 632 | 30°·5 |
| 58 | 60° 21' | 6° 51' | 540 | 30°·8 |
| 60 | 61° 3' | 5° 58' | 167 | 44°·3 |
| 61 | 62° 1' | 5° 19' | 114 | 45°·0 |
| 62 | 61° 59' | 4° 38' | 125 | 41°·6 |
| 64 | 61° 21' | 3° 44' | 640 | 30°·0 |
| 65 | 61° 10' | 2° 21' | 315 | 30°·0 |
| | | East Longitude. | | |
| 68 | 60° 23' | 0° 33' | 75 | 44°·0 |
| 69 | 60° 1' | 0° 18' | 67 | 43°·8 |
| 70 | 60° 4' | 0° 21' | 66 | 45°·1 |
| 89 | 59° 38' | 7° 46' | 445 | 45°·5 |
| 90 | 59° 41' | 7° 34' | 458 | 45°·2 |
| | The Minch. | | 60-80 | |
| | Little Minch. | | 45-50 | |
| | Near Belfast. | | 70 | |
| | Loch Torridon. | | 40 | |
| | Off Lerwick. | | 10-66 | |

EXPEDITION OF 1870.

| | | | | |
|-------------|--------------------|---------|----------|-------------|
| 1 | 48° 38' | 10° 15' | 567 | |
| 2 | 48° 37' | 10° 9' | 305 | 48°·5 Fahr. |
| 3 | 48° 31' | 10° 3' | 690 | |
| 3 <i>a</i> | | | 500 | |
| 6 | 48° 26' | 9° 44' | 358 | 50°·3 |
| 8 | 48° 13' | 9° 11' | 257 | 50°·0 |
| 9 | 48° 6' | 9° 18' | 539 | 48°·0 |
| 10 | 42° 44' | 9° 23' | 81 | 53°·5 |
| 11 | 42° 32' | 9° 24' | 332 | 51°·5 |
| 12 | 42° 20' | 9° 17' | 128-232 | 52°·5 |
| | Vigo Bay. | | 20 | |
| | Off Cape Mondego. | | 100-380 | |
| 13 | 40° 16' | 9° 37' | 220 | 52°·0 |
| 14 | 40° 6' | 9° 44' | 469 | 51°·5 |
| 16 | 39° 55' | 9° 56' | 994 | 40°·3 |
| 17 | 39° 42' | 9° 43' | 600-1095 | 39°·7 |
| 17 <i>a</i> | 39° 39' | 9° 39' | 740 | 49°·3 |
| 17 <i>b</i> | | | 785 | |
| 19 | 39° 27' | 9° 39' | 248 | 51°·7 |
| | Setubal Bay. | | 64 | |
| | Off Cape Espichel. | | 740 | |
| 22 | 38° 15' | 9° 33' | 718 | 52°·0 |
| 24 | 37° 19' | 9° 13' | 292 | 52°·7 |
| 25 | 37° 11' | 9° 7' | 374 | 53°·5 |
| | Off Cape Sagres. | | 45-58 | |

| Number of Station. | North Latitude. | West Longitude. | Depth in Fathoms. | Bottom Temperature. |
|--------------------|----------------------|-----------------|-------------------|---------------------|
| 26 | 36° 44' | 8° 8' | 364 | 52°·7 Fahr. |
| 27 | 36° 37' | 7° 33' | 322 | 51°·3 |
| 28 | 36° 29' | 7° 16' | 304 | 53°·3 |
| 28 α | | | 286 | |
| 29 | 36° 20' | 6° 47' | 227 | 55°·0 |
| 30 | 36° 15' | 6° 52' | 386 | 52°·7 |
| 31 | 35° 56' | 7° 6' | 477 | 50°·5 |
| 32 | 35° 41' | 7° 8' | 651 | 50°·0 |
| 33 | 35° 33' | 6° 54' | 554 | 49°·7 |
| 34 | 35° 44' | 6° 53' | 414 | 50°·0 |
| 36 | 35° 35' | 6° 26' | 72-128 | 55°·0 |
| | Tangier Bay. | | 35 | |
| | Gibraltar Bay. | | 3 | |
| | Algeriras Bay. | | 1-15 | |
| 40 | 36° 0' | 4° 40' | 586 | 55°·0 |
| 41 | 35° 57' | 4° 12' | 730 | 55°·0 |
| 45 | 35° 36' | 2° 29' | 207 | 54°·7 |
| | Capo de Gata. | | 40-69 | |
| | Cartagena Bay. | | 60-84 | |
| 50 | { Algerine | | { 5-51 | |
| 50 α | { Coast. | | { 152 | |
| | Off Jijeli. | | 40-84 | |
| | | East Longitude. | | |
| 51 | 36° 55' | 1° 10' | 1415 | 54°·7 |
| 53 | 36° 53' | 5° 55' | 112 | 55°·5 |
| 54 | 37° 41' | 6° 27' | 1508 | 55°·0 |
| 56 | 37° 3' | 11° 36' | 390 | 56°·5 |
| | Gulf of Bona. | | 25 | |
| | Benzert Road. | | 40-65 | |
| | Rasel Amoush. | | 45 | |
| | Gulf of Tunis. | | 25-85 | |
| | Adventure Bank. | | 30-92 | |
| | Off Rinaldo's Chair. | | 60-160 | |
| 58 | 36° 43' | 13° 36' | 266 | 56°·5 |

CEPHALOPODA.

The Cephalopods were dealt with and described by Dr. W. E. Hoyle in the "Challenger" Report, where full references may be found. For completeness I have extracted from that work and from some notes by Dr. Hoyle the following bare list of names and localities:—

OCTOPUS ARCTICUS, Prosch.

"Porcupine" Expedition, 1869, Stations 57, 65.

SEPIOLA RONDELETI, Leach.

"Porcupine" Expedition, 1869, The Minch, 60-80 fathoms.

ROSSIA MACROSOMA (delle Chiaje).

"Porcupine" Expedition, 1869, The Minch, 60-80 fathoms.

ROSSIA GLAUCOPIS, Lovén.

"Porcupine" Expedition, 1869, Station 65.

TAONIUS HYPERBOREUS, Steenstrup.

"Porcupine" Expedition, 1869, 140 miles north-west of the Irish coast, July 2, 1869: lat. 56° 10' N., long. 13° 16' W., surface.

GASTROPODA.

OTINA, Gray.

Otina, Gray: Proc. Zool. Soc., 1847, p. 156 (type *O. otis*).

Though I am using this familiar generic name, it may be noted that there is a serious question whether it should not be superseded by *Galericulum* of Brown, and a discussion of this point leads one also to consider *Velutina* of Fleming. *Velutina* was proposed by Fleming (Edinb. Encycl., vol. xiv, p. 626)¹ for "the *Bulla velutina* of Müller," which has been usually accepted as a synonym of the *Helix lævigata*, Linn., though some slight doubt has been thrown on the identification by Hanley (Ipsa Linn. Conch., p. 388). In 1828 Fleming ("British Animals," p. 326) placed in the genus *Helix lævigata*, L., *Helix otis*, Turton, and *Phasianella stylifera*, Turton, which latter he suggested might form a new genus, *Stylina*. Meanwhile, in 1827, Brown (Ill. Conch. Gt. Brit., expl. pl. xxxviii) proposed the genus *Galericulum* for *Helix lævigata* and *G. ovatum*, n.sp., the latter equalling the *Helix otis* of Turton (1819). It therefore becomes an interesting point whether, one of Brown's species being the type of the prior *Velutina*, the name *Galericulum* should not be used for *Helix otis*, in preference to the later *Otina*, which, as pointed out by Forbes & Hanley (Brit. Moll., vol. iii, p. 320), was proposed by Gray, in his "List of Genera," in an unsatisfactory manner.

OTINA OTIS (Turton).

Helix otis, Turton: Conch. Dict., 1819, p. 70.

"Porcupine" Expedition, 1870, Gibraltar.

Distribution.—English, Belgian, and French coasts, and in the Mediterranean.

SIPHONARIA, Sowerby.

SIPHONARIA ALGESIRÆ, Quoy.

"Porcupine" Expedition, 1870, Cadiz.

ACTEON, Montfort.

Acteon, Montfort: Conch. Syst., vol. ii, p. 314 (type *Bulla tornatilis*, L.).

I have left one broken shell from the cruise of 1870, Station 17, unrecorded.

ACTEON AZORICUS, Locard.

Actæon Azoricus, Locard: Expéd. Scient. Trav. Talisman, vol. i (1897), p. 85, pl. iii, figs. 8-11.

Actæon ovatus, Jeffreys: Ann. Nat. Hist., ser. v, vol. vi, p. 318 [nom. nud.]; Rep. Brit. Assoc., 1880, p. 387 [nom. nud.].

"Porcupine" Expedition, 1870, Station 16.

Distribution.—Azores, 1258 metres (Locard).

¹ Probably "about 1825 to 1828" (B. B. Woodward).

Three specimens, now in the British Museum, and identified by Jeffreys as his *A. ovatus*, are referred here; I have, however, not seen an authentic specimen of *A. Azoricus*. Mons. Locard refers *A. ovatus* to *A. Monterosatoi*, but, judging from specimens of the latter species identified by the Marquis de Monterosato, they are quite distinct.

ACTEON EXILIS, Jeffreys.

Actæon exilis, Jeffreys: Ann. Nat. Hist., ser. iv, vol. vi, p. 85 (1870); ser. iv, vol. xix, p. 335 (1877); Rep. Brit. Assoc., 1880, p. 387; Dautzenberg, Camp. Scient. Albert I^{er}, fasc. i, p. 20, pl. i, fig. 1; Jordan, Proc. Malac. Soc., vol. i, p. 267, pl. xvi, fig. 8.

"Porcupine" Expedition, 1869, Stations 28, 42; 1870, Stations 3, 16, 17, 17a, 28, 28a, 29, 50, 53, 56, Adventure Bank in 92 fathoms.

Distribution.—Apparently widely scattered over the Atlantic and Mediterranean in deep water; for details see Pilsbry (Man. Conch., vol. xv, p. 156) and Locard (Expéd. Scient. Trav. Talisman, vol. i, pp. 80-82). Fossil in Pliocene of Sicily and Calabria, also Red Crag (J. G. J.).

In the Report of the "Valorous Expedition," Jeffreys cites "Channel slope and Bay of Biscay, 227-994 fath." of the "Porcupine" Expedition, but the former depth was at Station 29, off the Spanish coast, and the latter at Station 16, off the Portuguese coast (J. T. Marshall). The specimens from Stations 17, 17a are shorter, broader, thinner, and smoother than usual.

Amongst Jeffreys' notes occurs the following description of the animal: "Body whitish, with a faint tinge of brownish-yellow. Snout broad, cloven in front and even with the foot in that part. Tentacles broad, triangular. Eyes, none perceptible in three specimens examined. Foot large and fleshy (like that of *Stylifer*), broad in front, and bilobed behind."

ACTEON GLOBULINUS (Forbes). Pl. III, Fig. 2.

Tornatella globulina, Forbes: Rep. Brit. Assoc., 1843 (1844), p. 191.

Actæon globulinus, Forbes: Jeffreys, Rep. Brit. Assoc., 1873, p. 113.

Actæon pusillus, Forbes, juv.: Jeffreys, Ann. Nat. Hist., ser. iv, vol. vi, p. 85.

"Porcupine" Expedition, 1870, Adventure Bank in 92 fathoms.

Distribution.—Ægean Sea, 0-95 fathoms (Forbes); Atlantic also (Jeffreys, Rep. Brit. Assoc.). Fossil in the Pliocene of Calabria.

Jeffreys in the reference above cited states that this species "appears to be a younger state of *A. pusillus*, having the striae rubbed down, but showing traces of the puncture-like markings." In his manuscripts, however, he has given it specific rank, noting "see *Tornatella depressa*, Libassi." I do not think that the fragment from the Azores recorded by Dr. Watson (Challenger Report, Gastropoda, p. 627) really belongs to this species; it is thinner, and hardly shows any trace of a fold on the columella wall, which latter is straighter. May it be *A. Azoricus*, Locard?

ACTEON MONTEROSATOI, Dautzenberg.

Actæon Monterosatoi, Dautzenberg: Camp. Scient. Albert I^{er}, fasc. i, p. 20, pl. i, figs. 2*a*–2*d*; Pilsbry, Man. Conch., vol. xv, p. 155, pl. xix, figs. 1–3; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 84.

“Poreupine” Expedition, 1870, Adventure Bank, 92 fathoms.

Distribution.—Azores, 1287 metres (Dautzenberg); several localities off Spain, Portugal, and Morocco, in 322–1960 metres (Locard); Tripoli, 40–120 fathoms.

ACTEON PUSILLUS (Forbes).

Tornatella pusilla, Forbes: Rep. Brit. Assoc., 1843 (1844), p. 191.

Actæon pusillus, Forbes: Jeffreys, Ann. Nat. Hist., ser. iv, vol. vi, p. 84; ser. v, vol. x, p. 34; Dall, Bull. Mus. Harvard, vol. xviii, p. 39; Sturany, Denk. Ak. Wien, vol. lxxiii, p. 14, pl. i, fig. 13; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 82, pl. iii, figs. 4–7.

Actæon pupillus, Forbes: Monterosato, Journ. de Conchyl., vol. xxvi (1878), p. 160.

“Poreupine” Expedition, 1870, Stations 24, 26, 27, 30, 36, 50; Adventure Bank, 92 fathoms; Benzert Road, 40–65 fathoms.

Distribution.—Various localities in the Mediterranean, from 10–300 fathoms; also Madeira and Cape Verds; off the south of Portugal, 1205 metres (Locard); off Havana in 450 fathoms, and Sand Key in 111 fathoms (Dall); Sombrero I. in 450 fathoms (Watson). Fossil in the Pliocene of South Europe.

Jeffreys gives the following notes on the animal of a specimen from Station 26: “Body white; mantle folded back on the front of the shell; head hood-like, bilobed, with broad, pointed corners; tentacles large and thick, triangular; eyes black, subcutaneous, placed in front at some distance apart; auricles in front, triangular, or bluntly rounded behind; verge falcate, short. Animal like that of *Bulla*. It crawls with considerable rapidity. The edges of the head and foot in front are parallel or symmetrical, the former overlying the latter.”

ACTEON TORNATILIS (Linn.).

Bulla tornatilis, Linné: Syst. Nat., 10th ed., p. 728 (cf. Hanley, Ipsa Linn. Conch., p. 212).

Actæon tornatilis, Linné: Pilsbry, Man. Conch., vol. xv, p. 152.

“Poreupine” Expedition, 1869, Lough Swilly; 1870, Station 50; Adventure Bank, 92 fathoms (with vars. *minor*, *Monts.*, and *subulata*, S. Wood); Gulf of Tunis, 25–85 fathoms.

Distribution.—Lofoten and Iceland to the Ægean, from the shoreline to 100 fathoms. Fossil in the Miocene and Pliocene of Europe.

Several other station numbers appear on the boxes in the British Museum, but though I have strong suspicions as to which cruise they relate, I think it safer to leave them unrecorded. I suspect that the *Voluta luteofasciata* of Muhlfeldt is a synonym.

RETUSA, Brown.

The name *Retusa* was proposed by Brown in the scarce first edition of his Ill. Conch. Gt. Brit., published in 1827, for *Bulla obtusa*, Mont., and two new species, *plicata* and *discors*; he gave no diagnosis, but the forms were figured. In the first edition of his "Conchologist's Textbook" the only example is *R. plicata*. Save for the protoconch, which may or may not be a generic character, this appears to agree with *Tornatina*, Adams.

RETUSA EXCAVATA (Jeffreys). Pl. III, Figs. 7, 7a.

Utriculus excavatus, Jeffreys: Rep. Brit. Assoc., 1880 (1881), p. 387 [nom. nud.]; Pilsbry, Man. Conch., vol. xv, p. 214.

"Porcupine" Expedition, 1870, Stations 9, 14, 17.

Distribution.—Bay of Biscay (Jeffreys). Pliocene of Ficarazzi (Jeffreys).

I propose to fix a 'type' from amongst the specimens in the British Museum of this species, and from an examination of it the following notes are compiled. Shell forming an oblong cylinder, slightly inflated in the middle, opaque and fairly glossy, marked by slight lines of growth; spire almost flat, the whorls being angular and shouldered at the top, and separated by a deep suture; the apical whorl is large, shining, and globular; mouth narrow above and expanded below, not reaching to the top of the whorl; inner lip fairly well marked and continuous with the outer lip above, reflected over the pillar, leaving a slight indication of an umbilical chink. Alt. 2.5, diam. max. 1.2 mm.

RETUSA LACTEA (Jeffreys). Pl. III, Fig. 4.

Utriculus lacteus, Jeffreys: Ann. Nat. Hist., ser. iv, vol. xix, p. 334.

Retusa lactea, Jeffreys: Pilsbry, Man. Conch., vol. xv, p. 213.

"Porcupine" Expedition, 1869, Station 20.

Distribution.—"Valorous" Expedition, Station 12, 1450 fathoms.

The specimen figured is that from the "Porcupine" Expedition referred to by Jeffreys; it is, as he states, broken.

RETUSA MAMILLATA (Phil.).

Bulla mamillata, Philippi: Enum. Moll. Sicil., vol. i, p. 122, pl. vii, fig. 20.

Retusa mamillata, Philippi: Pilsbry, Man. Conch., vol. xv, p. 206.

"Porcupine" Expedition, 1870, Station 50; Vigo Bay; Adventure Bank, 92 fathoms.

Distribution.—Atlantic from Norway to the Canaries; Mediterranean and Adriatic Seas (Pilsbry). Miocene and Pliocene of Europe.

RETUSA MARSHALLI, n.sp. Pl. III, Figs. 5, 6, 6a, 6b.

Shell ovate, white, thin, smooth save for very fine lines of growth. Protoconch large, sinistral, and set at an angle to the shell. Spire flat, being slightly concave, with a deep, channelled suture. Whorls 4.

Mouth as long as the last whorl, which latter is slightly inflated, columella slightly twisted and reflexed, forming a fold, with a slight 'chink' in the umbilical region. Alt. 2, diam. max. 1.1 mm.

"Porcupine" Expedition, 1870, Station 17.

The species is noteworthy for its depressed and channelled spire; one specimen, broken, is considerably larger than the type. Compared with *R. obesa* (Jeffreys) from equally deep water off Spain and Morocco, the present form may be distinguished by its narrower body-whorl.

RETUSA (CYLICHNINA) NITIDULA (Lovén).

Cyllichna nitidula, Lovén: Ind. Moll. Skand., p. 10; Öfv. Kon. Vet. Ak. Förh., vol. iii (1846), p. 142.

Utriculus nitidulus, Lovén: Sars, Moll. Reg. Arct. Norveg., p. 286, pl. xvii, fig. 13; pl. xxvi, fig. 3.

Retusa nitidula, Lovén: Pilsbry, Man. Conch., vol. xv, p. 212.

"Porcupine" Expedition, 1869, Dingle Bay, 18 (live), 18a (live); 1870, Stations 2, 9, 17, 35, 50, 53, 56; Vigo Bay; Adventure Bank, 92 fathoms.

Distribution.—Norway and Sweden, and the Atlantic coast of Europe, south to the Mediterranean; Madeira (Watson). Pliocene of Sicily, Calabria, and Ficarazzi; Post-Pliocene of Belfast and Christiania.

It has been recorded from the American coasts by Miss Bush (Rep. Comm. Fisheries, 1883, p. 714) amongst the molluses dredged by the "Fish-Hawk" in 155–487 fathoms. Jeffreys notes that this is not *Bulla nitidula* of Dillwyn from Solander's MS., and that the figures of the present species and of *R. umbilicata* on plate xcii of the "British Conchology" have accidentally had the numbers transposed.

RETUSA OBTUSA (Montagu).

Bulla obtusa, Montagu: Test. Brit., vol. i, p. 223, pl. vii, fig. 3.

Retusa obtusa, Montagu: Pilsbry, Man. Conch., vol. xv, p. 214.

"Porcupine" Expedition, 1870, Stations 24, 50; Adventure Bank, 92 fathoms.

Distribution.—European seas from Godhavn, Greenland, to the Mediterranean (Pilsbry). Pliocene of Europe.

Some of the specimens from "Adventure Bank" belong to the form *lajonkaireana*, which name Mr. Pilsbry states, in his very careful notes, must give place to that of *turrita*, Möller.

RETUSA TORNATA (Watson).

Utriculus tornatus, Watson: Journ. Linn. Soc., Zool., vol. xvii, p. 335; Challenger Rep., Gastropoda, p. 651, pl. xlvi, fig. 10.

Retusa tornata, Watson: Pilsbry, Man. Conch., vol. xv, p. 209.

"Porcupine" Expedition, 1870, Vigo Bay; Adventure Bank, 92 fathoms.

Distribution.—Madeira, dredged (Watson); Tenerife, 78 fathoms (Watson).

RETUSA TRUNCATULA (Brug.).

Bulla truncatula, Bruguière: Ency. Méth., vol. vi (1792), p. 377.

Retusa truncatula, Bruguière: Pilsbry, Man. Conch., vol. xv, p. 205.

"Porcupine" Expedition, 1870, Station 35; Adventure Bank, 92 fathoms.

Distribution.—Coast of Norway to the Canaries; Mediterranean and Adriatic Seas (Pilsbry). Miocene and Pliocene of Europe.

One form, from the Adventure Bank, is smaller, more uniformly cylindrical, more slightly sculptured and thinner, exhibiting the diaphanous bands more than usual; this is the *Bulla semisulcata* of Philippi (J. T. Marshall).

RETUSA (CYLICHNINA) UMBILICATA (Montagu).

Bulla umbilicata, Montagu: Test. Brit., vol. i, p. 222, pl. vii, fig. 4.

Retusa umbilicata, Montagu: Pilsbry, Man. Conch., vol. xv, p. 210.

Cylichna umbilicata, Montagu: Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 66.

"Porcupine" Expedition, 1870, Stations 35 (with var. *strigella*, Lov.), 50, 53 (with var. *strigella*, Lov.); Vigo Bay; Benzert Road, 40-65 fathoms; Adventure Bank, 92 fathoms.

Distribution.—Lofoten Islands and Norway, south to West Africa, and in the Mediterranean, etc. (for details see Locard, l.c.). Fossil in Tertiary of South Europe and Post-Tertiary of Norway.

VOLVULA, A. Adams.

If this name be considered to clash with *Volvulus*, Oken, then *Volvulella*, Newton, may be used. *Rhizorus*, Montfort, has been referred here, but cannot be the same, as that author states "sommet enfoncé, ombiliqué," and figures a shell well open at the apex.

VOLVULA ACUMINATA (Brug.).

Bulla acuminata, Bruguière: Ency. Méth., vol. i, p. 376.

Volvula acuminata, Bruguière: Pilsbry, Man. Conch., vol. xv, p. 235.

"Porcupine" Expedition, 1870, Stations 24, 50, 56; Vigo Bay; Adventure Bank, 92 fathoms.

Distribution.—Atlantic from Norway to the Gulf of Gascony and the Mediterranean; Gulf of Suez (Cooke). Fossil in the European Tertiary.

One box in the Museum, labelled "2, 18, 18b," contains several live as well as dead specimens. There is nothing to show in which cruise they were obtained, but it may be noted that there is no Station 18b in either cruise, and no Station 18 in that of 1870.

If the suggestion made by Mr. Pilsbry as to the possible identity of this species with *V. oxytata*, Bush, and *V. persimilis*, Möreh, is well founded, then the range is extended to the eastern coast of North America.

The present form is not the *Bulla acuminata*, Sby., of the "Mineral Conchology," which equals *Bulla Sowerbyi*, Nyst, and this, again, must not be confused with the *Cylindrobulla Sowerbici* (Montr.).

SCAPHANDER, Montfort, 1810.

SCAPHANDER LIGNARIUS (Linn.).

Bulla lignaria, Linn. : Syst. Nat., 10th ed., p. 727.

Scaphander lignarius, Linn. : Pilsbry, Man. Conch., vol. xv, p. 245.

"Porcupine" Expedition, 1869, Stations 9, 17 (live), 28 (live), 33; 1870, Stations 24, 26, 30, 50; Vigo Bay; Tunis, 25-85 fathoms; Adventure Bank, 92 fathoms.

Distribution.—Atlantic Ocean from Norway to Gibraltar; Mediterranean Sea (Pilsbry). Fossil in the European Tertiary.

Several other station numbers appear on the boxes in the Museum, but I do not feel able to trust them.

Jeffreys notes "a remarkable variety occurred in my Shetland dredgings. It is very short, and unusually expanded and gibbous."

SCAPHANDER PUNCTOSTRIATUS (Mighels).

Bulla punctostriata, Mighels : Proc. Boston Soc., vol. i (1841), p. 49.

Scaphander punctostriatus, Mighels : Pilsbry, Man. Conch., vol. xv, p. 246; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 45; Dautzenberg & Fischer, Mém. Soc. Zool. France, vol. ix, p. 401; vol. x, p. 143.

"Porcupine" Expedition, 1869, Stations 16, 22 (fragments), 23, 23a, 28, 30, 39, 41, 65 (live); 1870, 1 (live), 3, 9, 16, 17, 17a.

Distribution.—From Spitzbergen to the Mediterranean, and off the Azores; on the American coast from Davis Strait to the West Indies; always in fairly deep water. Fossil in the Pliocene of Sicily.

The specimens from Stations 16, 17, 17a of the 1870 cruise appear to belong to Dall's variety *clarus*; see also Dautzenberg & Fischer (l.c.).

Jeffreys notes that one of the specimens from Station 1 had the "body orange-colour."

ATYS, Montfort.

ATYS (ALICULA) DIAPHANA (Aradas).

Bulla diaphana, Aradas : Cat. Rag., 1840, p. 40.

Atys diaphana, Pilsbry : Man. Conch., vol. xv, p. 278.

"Porcupine" Expedition, 1870, Station 50; Adventure Bank, 92 fathoms.

Distribution.—Widely scattered over the Mediterranean. Fossil in the Pliocene of Sicily.

I have followed the traditional identification, though Jeffreys notes "Weinkauff states in the Bull. Mal. Ital. for 1870 at p. 91, on the authority of Benoit, that the *Bulla diaphana* of Aradas could not be identified, and that the type specimen had been lost."

ATYS (ROXANIA) UTRICULUS (Brocchi).

Bulla utriculus, Brocchi : Conch. Foss. Subap., vol. i, p. 633, pl. i, fig. 6.

Atys utriculus, Brocchi : Pilsbry, Man. Conch., vol. xv, p. 279.

"Porcupine" Expedition, 1869, Station 18; 1870, Stations 11, 17a, 50; Adventure Bank, 92 fathoms; Benzert Road, 40-65 fathoms; off Cape Sagres, 45-58 fathoms.

Distribution.—Finmark to the Mediterranean and Canary Islands. Fossil in the European Tertiary.

The Mediterranean specimens usually belong to the var. *oblonga*, Jeff. Several other station numbers appear in the collection.

CYLICHNA, Lovén.

Our knowledge of the various forms referred to this group is very scanty. If *Cylichna* be objected to on the ground of the prior *Cylichnus*, Burmeister, then *Mnestia*, A. Adams, may be used.

In addition to the forms catalogued, there is a single worn dead shell from Station 65, of the 1869 cruise, resembling a very large *C. Hoernesii*, and not being so swollen as *C. ovata*.

CYLICHNA ALBA (Brown).

Volvaria alba, Brown : Ill. Conch. Gt. Brit., 1827, pl. xxxviii, figs. 43, 44.

Cylichna alba, Brown : Pilsbry, Man. Conch., vol. xv, p. 290 ; Friele and Grieg, Norske Nordhavs-Exped., Mollusca, pt. iii, p. 108.

"Porcupine Expedition," 1869, Stations 19*a* (live), 23*a*, 31, 47, 61 ; 1870, Stations 9, 16, 17, 17*a*, 29.

Distribution.—Circumpolar, down to the Azores, Pernambuco, and California ; for details see Friele & Grieg (l.c.). Recently recorded from Spitzbergen (Knipowitsch). Fossil in Europe and North America.

The following notes are by Mr. J. T. Marshall :—

"Gwyn Jeffreys (Ann. Nat. Hist., ser. iv, vol. xix, p. 333) cites this species from the Porcupine Expedition of 1870 from the 'Bay of Biscay, 795-944 f.,' but there was no dredging at the first-named depth, and the latter depth was off the coast of Portugal. Again, he writes (Ann. Nat. Hist., ser. iv, vol. xx, p. 237) that in the Expedition of 1870 'a closely allied species, if more than a variety, came from depths of 227 f. and 539 f. in the Bay of Biscay.' The former depth, however, occurred at Station 29, off Cadiz, and the latter was at Station 9, on the slope of the English Channel. All through the 'Valorous Report' he has cited 'Bay of Biscay' to many dredgings that were obtained hundreds of miles away, as in the above instances. As a matter of fact, the 'Porcupine' did not dredge at all in the Bay of Biscay. (See Carpenter & Jeffreys, Proc. Roy. Soc., vol. xix, p. 154.)"

CYLICHNA CYLINDRACEA (Pennant).

Bulla cylindracea, Pennant : Brit. Zool., vol. iv (1777), p. 47, pl. lxx, fig. 85.

Cylichna cylindracea, Pennant : Pilsbry, Man. Conch., vol. xv, p. 289.

"Porcupine" Expedition, 1869, Stations 67 (live), 68 (live), off Lerwick, 10-66 fathoms ; 1870, Stations 2, 3 (var. *linearis*), 4, 9 (live), 18 (live), 35, 50, 56 ; Vigo Bay ; Benzert Road, 40-65 fathoms ; Adventure Bank, 92 fathoms.

Distribution.—European seas from Norway to the Azores, Canaries, and Madeira ; Mediterranean ; Whydah, W. Africa ; St. Helena ;

Ascension; Tristan da Cunha; Bombay. Later Tertiaries of Europe; also in the Clyde Beds and Quaternary of Bohuslan (Jeffreys).

The following station numbers, apparently relating to the 1870 cruise, are also noted on the boxes in the Museum: 1, 6, 11, 14, 15, 23. Two dead specimens from Station 17 of the 1870 cruise are referred here with doubt; they are more slender and may be distinct, but are in too bad condition for description.

I have examined two specimens from Bombay, presented by Mr. Abercrombie to the Museum; they are in poor condition, but I am unable to detect any salient characters to separate them from the present species.

CYLICHNA DISCUS, Watson.

Cylichna discus, Watson: Journ. Linn. Soc., Zool., vol. xvii, p. 319; Challenger Rep., Gastropoda, p. 664, pl. xlix, fig. 10; Friele & Grieg, Norske Nordhavs-Exped., Moll., pt. iii, p. 109.

“Porcupine” Expedition, 1870, Stations 16, 17a.

Distribution.—Culebra I. (Watson); Norwegian North Atlantic Expedition, several stations at 412–1163 fathoms; “Michael Sars” Expedition to Jan Mayen in 1100 fathoms (Friele).

Friele & Grieg state that “the specimens from smaller depths, such as at Stations 18, 31, and 87, bore a strong resemblance to *C. alba*,” and I suspect that the two may prove to be varying forms of one species. Jeffreys, however, notes: “Intermediate between *C. cylindracea* and *C. alba*, broader than the former and narrower than the latter. Sculpture peculiar to this genus indistinct and scarcely visible. The truncated apex has a coating so slight that there is nearly always a small pore or opening, which is sometimes enlarged by attrition so as to expose the concealed spire.” I have found great difficulty in separating the forms, and one specimen from Station 23a of the 1869 cruise, included by Jeffreys in a series of *C. alba*, may belong here.

CYLICHNA (?) ELONGATA (Jeffreys). Pl. III, Figs. 8, 8a.

Bullina elongata, Jeffreys: Rep. Brit. Assoc., 1880 (1881), p. 387; Ann. Nat. Hist., ser. v, vol. vi, p. 318; Pilsbry, Man. Conch., vol. xv, p. 394.

“Porcupine” Expedition, 1870, Stations 16, 17, 17a.

Jeffreys suggests, and from an examination of the figure given I think it may well be so, that this is the *Bullina undata*, Della Chiaje, of Seguenza (Mem. Acc. Lincei, ser. III, vol. vi, p. 251, pl. xvi, fig. 9).

CYLICHNA HOERNESI (Weinkauff). Pl. III, Fig. 1.

Bulla Hoernesii, Weinkauff: Journ. de Conchyl., vol. xiv, p. 238; Conch. des Mittelmeeres, vol. ii, p. 187.

Cylichna cuneata, Tiberi: Journ. de Conchyl., vol. xvi, p. 180.

Bulla conulus, Hoernes *nee* Deshayes.

“Porcupine” Expedition, 1870, Stations Vigo Bay, off Cape Sagres, 35, 50, 52, 56, Adventure Bank.

Distribution.—Bay of Naples (Tiberi); Palermo and St. Vito (Monterosato). Tertiary of Europe.

Lest there be any mistake in the form discussed, it is now figured (Pl. III, Fig. 3). Authors in general have referred this form to the briefly diagnosed and unfigured *Bulla striatula* of Forbes. Fortunately, guided by a note of Jeffreys, I have succeeded in finding a specimen presented by Forbes himself to the British Museum. Jeffreys notes that *Bulla striatula* is probably a synonym of *Retusa mamillata* (Phil.); this may be so, but in the single specimen, which is in very bad condition, the protoconch appears rather to be sunk. Next, there has been a difficulty as to whether *C. Hoernesii* be not the same as the *Bulla pyramidata* of A. Adams from China seas; the type of the latter is in the British Museum, and the two species are very closely related, but *C. pyramidata* is a trifle more pyramidal, i.e. the relative proportions taken near the base and apex are different, and the last whorl is slightly more inflated. Further material of the latter species is needed.

CYLICHNA JEFFREYSI (Weinkauff).

Bulla (*Cylichna*) *Jeffreysi*, Weinkauff: Journ. de Conchyl., vol. xiv, p. 238; Conch. des Mittelmeeres, vol. ii, p. 199.

Bulla ovulata, Jeffreys: Ann. Nat. Hist., ser. II, vol. xvii, p. 188, pl. ii, figs. 18, 19 [*nec* Brocchi].

“Porcupine” Expedition, 1870, Stations Benzert Road; Adventure Bank; Gulf of Tunis.

Distribution.—Various localities in the Mediterranean. Pliocene of South Europe.

CYLICHNA OBSCURA, n.sp. Pl. III, Figs. 9, 9a.

Shell cylindrically ovate, thin, shining, smooth, with faint traces of lines of growth; aperture narrow above, wide below; columella rather straight, but slightly inclined to the left, and a little thickened, leaving a small umbilical chink visible. Apex deeply sunk, with a narrow, funnel-shaped, obtusely edged umbilicus. Alt. 2·5, diam. max. 1·2 mm.

“Porcupine” Expedition, 1870, Station 3.

Only two specimens, one dead and one live. It appears to be akin to *C. obesiuscula*, Bruguière, but is more slender and the columella is straighter. Also related to *C. ovata*, Jeff., but that shell is somewhat pyramidal in shape, whilst this is rather Bulloid.

CYLICHNA OVATA, Jeffreys.

Cylichna ovata, Jeffreys: Proc. Roy. Soc., vol. xix, p. 156; Rep. Brit. Assoc., 1880, p. 387; Ann. Nat. Hist., ser. v, vol. x, p. 34; Watson, Challenger Rep., Gastropoda, p. 664, pl. xlix, fig. 9; Dautzenberg, Camp. Scient. Albert 1^{er}, fasc. i, p. 23; Dautzenberg & Fischer, Mém. Soc. Zool. France, vol. ix, p. 403; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 69; Smith, Ann. Nat. Hist., ser. vi, vol. iv, p. 422.

Retusa (?) *ovata*, Jeffreys: Dall, Bull. Mus. Comp. Zool., vol. xviii, p. 49.

Retusa ovata, Jeffreys: Pilsbry, Man. Conch., vol. xv, p. 232.

“Porcupine” Expedition, 1869, Stations 23, 36, 42; 1870, Stations 16, 17, 17a; off Cape Espichel.

Distribution.—Widely scattered over the North Atlantic from Norway to the Azores, etc., and on the eastern coast of North America to the West Indies and Pernambuco; also in the Mediterranean. Fossil in the Pliocene of South Europe.

CYLICHNA (?) PARVULA, Jeffreys.

Cylichna parvula, Jeffreys: Ann. Nat. Hist., ser. v, vol. xi, p. 400, pl. xvi, fig. 9.

“Porcupine” Expedition, 1870, Station 13.

Distribution.—Bay of Biscay, 1192 fathoms (Jeffreys).

The specimens are, apparently, live shells, but very young.

CYLICHNA PROPINQUA (Sars).

Bulla propinqua, M. Sars, in G. O. Sars: Moll. Reg. Arct. Norveg., p. 284.

I record this name as there are two specimens, so identified by Jeffreys, from the 1869 cruise, in a box labelled “65, 345 f. and 74, 75, 200–25 f.” Jeffreys does not mention in his list Stations 74 or 75, and probably they really came from Station 65, where the depth given would be correct. As to the proper name for this form, see Pilsbry (Man. Conch., vol. xv, p. 292), and Friele & Grieg (Norske Nordhavs-Exped., pt. iii, p. 109).

DIAPHANA, Brown.

This generic name was proposed by Brown in 1827 (Ill. Conch. Gt. Brit., 1827, explanation of pl. xxxviii) for *D. minuta*, *pellucida*, *candida*, n.spp.; in 1833, in the first edition of his “Conchologist’s Textbook” (p. 98), the only example he gives of the genus is *D. candida*, which may therefore be treated as the type.

With reference to the question mentioned by Mr. Pilsbry (Man. Conch., vol. xv, p. 280), I may say that I have seen several editions of Brown’s “Textbook,” including the first, and they appear to be identical, though I have not collated them line by line. One copy bears the appellation “fourth edition” on the cardboard cover and “fifth edition” on the title-page.

Two broken specimens of a species were found at Station 17, of the 1870 cruise, which are in too bad condition for description. Mr. Marshall notes “Near *U. ventrosus* [*D. ventricosus*], but different crown and pillar.” There is also a single, apparently immature, specimen from Station 56, of the 1870 cruise, as to which Mr. Marshall notes “Like *U. expansus*, but has an umbilicus and a different crown.”

DIAPHANA EXPANSA (Jeffreys).

Amphisphyra expansa, Jeffreys: Rep. Brit. Assoc., 1864 (1865), p. 330; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 77.

Diaphana expansa, Jeffreys: Pilsbry, Man. Conch., vol. xv, p. 284.

Amphisphyra quadrata, Monterosato: Journ. de Conchyl., vol. xxii (1874), p. 280.

"Porcupine" Expedition, 1869, Stations 11 (live), 12, 47; 1870, Station 3.

Distribution.—Greenland (Torell); Norway (Sars, etc.); British Isles and Shetlands (Jeffreys, etc.); Gulf of Gascony, 677 metres (Locard); Sicily (Monterosato). Quaternary of Sicily (Locard).

I give *D. quadrata* as a synonym, on the authority of Mr. J. T. Marshall.

DIAPHANA CANDIDA, BROWN.

Diaphana candida, Brown: Ill. Conch. Gt. Brit., 1827, pl. xxxviii, figs. 13, 14.

Diaphana minuta, Brown: Pilsbry, Man. Conch., vol. xv, p. 282.

Bulla hyalina, Turton *nec* Gmelin.

"Porcupine" Expedition, 1869, Station 18 (live).

Distribution.—"From Spitzbergen (Torell) to the Egyptian coast of the Mediterranean (Schneider); Madeira and the Canaries (McAndrew); Davis Strait to Cape Cod. One of the glacial fossils of Scotland and Scandinavia" (Jeffreys).

DIAPHANA SEGUENZÆ (Watson).

Amphisphyra Seguenzæ, Watson: Challenger Rep., Gastropoda, p. 646, pl. xlvi, fig. 5.

Diaphana Seguenzæ, Watson: Pilsbry, Man. Conch., vol. xv, p. 282.

"Porcupine" Expedition, 1870, Stations 16, 17, 17a.

Distribution.—West of the Azores, 1000 fathoms (Watson). Pliocene of Calabria.

BULLA, Linn.

BULLA PINGUICULA, Jeffreys.

Bulla subrotunda, Jeffreys: Rep. Brit. Assoc., 1873 (1874), p. 113 (nom. nud.).

Bulla pinguicula, Jeffreys: Ann. Nat. Hist., ser. v, vol. vi (1880), p. 318 (nom. nud.); Rep. Brit. Assoc., 1880 (1881), p. 387 (nom. nud.); Seguenza, Mem. Acc. Lincei, ser. III, vol. vi (1879), p. 250, pl. xvi, fig. 7; Watson, Challenger Rep., Gastropoda, p. 638.

Bulla abyssicola, Dall: Bull. Mus. Comp. Zool., vol. ix (1881), p. 97; vol. xviii, p. 56, pl. xvii, fig. 11.

Bulla Guernei, Dautzenberg: Camp. Scient. Albert I^{er}, fasc. i (1889), p. 24, pl. i, fig. 5.

"Porcupine" Expedition, 1870, Stations 3, 22, off Cape Espichel, 30, 56, off Jijeli.

Distribution.—Deep water off Spain, Portugal, the Azores, etc.; Mediterranean, off Palermo; Yucatan Strait; Santa Cruz.

In his manuscripts, Jeffreys unites *subrotunda* and *pinguicula*, neither of which he ever described, and I use the latter name on account of Seguenza's paper. Dr. Dall stated that his *abyssicola* and Jeffreys' *pinguicula* were the same thing. The Marquis de Monterosato in 1890 placed the four named forms together. Recently, however, Mons. Locard (Expéd. Scient. Trav. Talisman, vol. i, pp. 58-62), while agreeing that *Guernei* and *subrotunda*—which he calls *subrotundata*—are identical, has given separate specific rank to *pinguicula* and *abyssicola*, a course in which I cannot follow him.

BULLA SEMILÆVIS (Jeffreys), Seguenza.

Bulla semilævis, Jeffreys: Seguenza, Mem. Ac. Lincei, ser. III, vol. vi (1879), p. 251, pl. xvi, fig. 5; Pilsbry, Man. Conch., vol. xv, p. 337; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 57.

Bulla semilævis, Jeffreys: Rep. Brit. Assoc., 1880 (1881), p. 387.

“Porcupine” Expedition, Stations 16, 17, 17a.

Distribution.—From the south-west of Ireland and the Bay of Biscay, to Marseilles and the Azores, always in very deep water. Fossil in the Pliocene of Calabria.

AKERA, Müller.

AKERA BULLATA, Müller.

Akera bullata, Müller: Zool. Danica, p. 242, pl. lxxi, fig. 1; Pilsbry, Man. Conch., vol. xv, p. 377.

“Porcupine” Expedition, 1869, Station 18 (live).

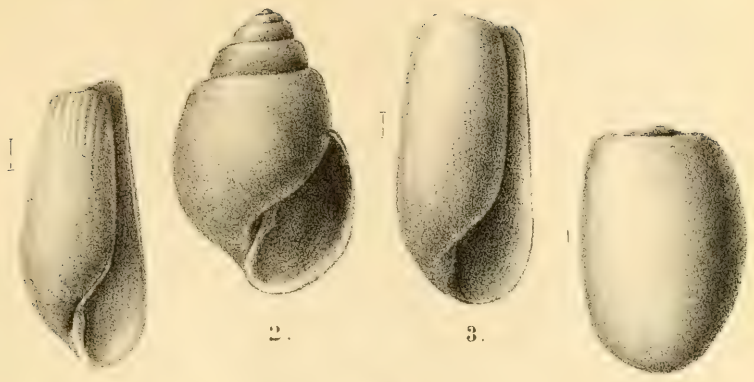
Distribution.—From Finmark to the Mediterranean.

One young specimen only.

EXPLANATION OF PLATE III.

- FIG. 1. *Cylichna Hoernesii* (Weinkauff).
 ,, 2. *Acteon globulinus* (Forbes).
 ,, 3. *Bulla striatula*, Forbes.
 ,, 4. *Retusa lactea* (Jeffreys).
 ,, 5, 6, 6a, 6b. *Retusa Marshalli*, n.sp.
 ,, 7, 7a. *Retusa excavata* (Jeffreys).
 ,, 8, 8a. *Cylichna* (?) *elongata* (Jeffreys).
 ,, 9, 9a. ,, *obscura*, n.sp.

Specimens represented in Figs. 2, 5, 6, 9 are in coll. Sykes; others in the British Museum.



1.

2.

3.

4.



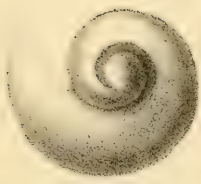
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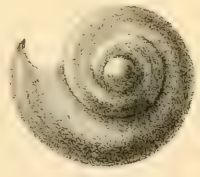
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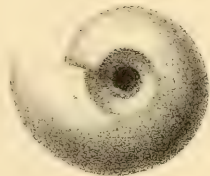
6a.



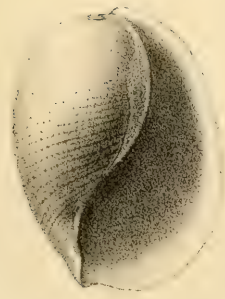
6b.



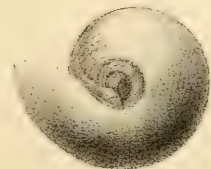
7a.



9a.



8.



8a.



9.

NOTES ON THE NERVOUS SYSTEM OF THE PELECYPODA.

By R. H. BURNE, B.A.

Read 11th December, 1903.

IN *Nature*¹ for October 29th is a letter from Mr. Latter, of Charterhouse School, in which attention is called to the presence in an individual specimen of *Anodonta* of a ganglionic enlargement situated on the left cerebro-visceral connective in front of the pericardium. Such abnormal ganglia have apparently been noted before, and are of considerable interest in so far as they assist in the determination of the homologies of the different masses of ganglionic matter that compose the central nervous system of the Pelecypods.

In the case before us Mr. Latter, taking for granted the soundness of the generally accepted view that in the cerebro-visceral system of Pelecypods are to be found representatives of the cerebral and pleural ganglia of the Gastropod in a degenerate condition, speaks of this ganglion as the "pleural," and infers therefore that the Pelecypod cerebral ganglion is cerebral pure and simple, strictly comparable to the cerebral ganglion of the Gastropod, and not, as is now most frequently taught, a fusion of originally separate cerebral and pleural ganglia.

Assuming that any direct comparison between the individual nerve centres of the cerebro-visceral system of Pelecypods and Gastropods is justifiable, there seems little reason to criticise Mr. Latter's interpretation of this abnormal ganglion, but as, for my part, I very much doubt whether we have any right to such an assumption, I am glad to take this opportunity to emphasise views lately put forward on this subject by Dr. Gilman Drew,² and to add some details in corroboration of such views.

The point of view, the objections to which I wish to urge, was propounded by Pelseener, and so far as concerns the Pelecypods is briefly stated in the *Comptes Rendus* for 1890,³ and at greater length in the *Archives de Biol.* for the following year.⁴ In these papers he points to the presence in certain members of the Protobranchs of two serially disposed ganglia in place of the simple cerebral ganglion normal to the Pelecypoda, and also to separate connectives passing from these two enlargements to the pedal ganglia, as evidence of the possession by the Pelecypod stock of a nervous system of the Gastropod type, characterised by independent cerebral and pleural ganglia each united by a connective to the pedal ganglia.

¹ *Nature*, vol. lxxviii (1903), p. 623.

² Drew, "The Life-History of *Nucula delphinodonta*": *Quart. Journ. Micro. Sci.*, vol. xlv (1901), p. 372.

³ Pelseener, "Sur l'identité de composition du système nerveux central des Pélécy-podes et des autres Mollusques": *C.R. Ac. Sci.*, t. cxi, p. 245.

⁴ Pelseener, "Contribution à l'étude des Lamellibranches": *Arch. Biol.*, t. xi.

On the other hand, Drew, in dealing with the central nervous system of *Nucula delphinodonta*,¹ strongly insists upon its essentially primitive nature, and finds neither in the developmental processes through which it passes nor in the adult condition any sure indication of the Gastropod type of specialisation. Apart from the generalised structure of the nervous system as a whole, his two main points are—(1) that the cerebral ganglia develop from a single rudiment on either side, without signs of a pleural enlargement, and (2) that there is no indication of a pleural enlargement in the adult either of this species of *Nucula* or in the other forms of Protobranchiata examined by him. Another fact of some importance in connection with his general conclusions is furnished by the mode of development of the cerebro-visceral connectives. He writes:² "They are first found very close to the surface, almost, if not quite, in contact with the ectoderm. Later they sink deeper into the body. The cerebro-visceral commissures are quite thick, and differ from the cerebro-pedal commissures in having much the same structure as the ganglia themselves."

It will be remembered that Pelseuer's comparison was suggested not only by the double cerebral ganglia found by him and Stempell³ in several Protobranchs, but also by the corresponding duplicity of the cerebro-pedal connectives. This duplicity of the connectives has been confirmed by Drew, but he suggests that possibly the posterior of the two roots—the pleuro-pedal connective according to Pelseuer and Stempell—is the proximal end of the otocystic nerve, and not really a connective at all. In Peleceypods the otocystic nerve arises in the cerebral ganglion, and normally accompanies the cerebro-pedal connective, intimately blended with it, to a point near the pedal ganglion, and then branches off to the otocyst. In *Solenomya*, however,⁴ the nerve has been found to leave the cerebral ganglion independently behind the pedal connective, and to run entirely free to the otocyst. This fact suggested to Drew that possibly in the Protobranchs with two roots to the cerebro-pedal connectives, a transitional stage between *Solenomya* and the normal condition is realised, in which the proximal and distal ends of the otocystic nerves are free, while the intermediate parts are fused with the cerebro-pedal connectives. This idea is strengthened by the fact that the distal, free part of the otocystic nerve in *Nucula* is of the same calibre as the posterior root of the cerebro-pedal connective. The only objection, and a very important one, is that in *Solenomya* each pedal connective, although emerging single from the cerebral ganglion, arises within the ganglion by two independent roots. This is a point that requires further confirmation, but if confirmed it would be fatal to Drew's suggestion.

¹ Drew, l.c., p. 370.

² Drew, l.c., p. 372.

³ Stempell, "Beiträge zur Kenntniss der Nuculiden": Zool. Jahrb. (Fauna Chilensis), i (1898), p. 403.

⁴ Stempell, "Zur Anatomie von *Solemya togata*": Zool. Jahrb., Bd. xiii (1899), p. 147.

In summing up, Drew concludes, in general terms, that¹ "it seems more likely that the nervous systems of all molluscs have been derived from some such generalised type as found in *Chiton*, and that each class has developed ganglia according to its needs, than that the ancestors of the Lamellibranchs possessed the comparatively complex system of ganglia found in Gastropods."

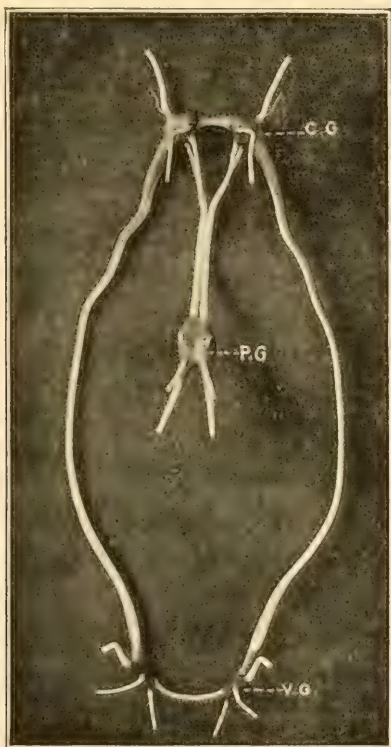


FIG. I.--Model of nervous system of *Nucula nucleus*, seen from the ventral aspect. c.g. cerebral ganglion; p.g. pedal ganglion; v.g. visceral ganglion.

During the last few years I have examined minutely several specimens of *Nucula nucleus*, and amongst other things have made a careful study of the nervous system by means of transverse and horizontal sections and by reconstruction after the Born (or rather Newton²) method. Upon the general conformation of this nervous

¹ Drew, l.c., p. 373.

² Newton, "On the Brain of the Cockroach": Quart. Journ. Micro. Sci., vol. xix (1879), p. 341.

system I need not dwell; it agrees in essentials with previous descriptions (Fig. I), but there are several points to which I must more particularly call attention. (1) There is no sign of any separation of the cerebral ganglion into cerebral and pleural enlargements. This point was shown in the first place in a model reconstructed from sections taken transversely to the long axis of the animal, and was confirmed by horizontal sections (Fig. II). (2) The cerebral ganglion has no definite posterior limit, but gradually tapers away (as described by Drew) into the cerebro-visceral connective, while the whole of this connective, or, in fact, the entire ring formed by the cerebral and visceral ganglia with their commissures and connectives, is to some extent ganglionic throughout. (3) The two roots of each cerebro-pedal connective rise from the inner side of the

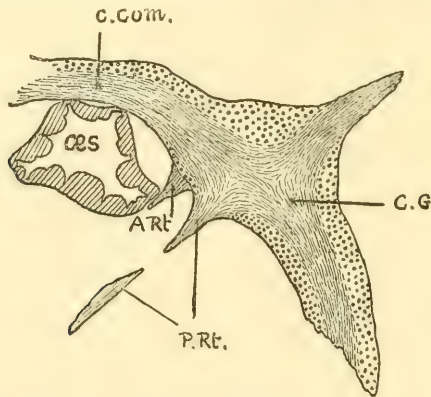


FIG. II.—Horizontal section of right cerebral ganglion of *Nucula nucleus*. A.Rt. anterior root of cerebro-visceral connective; P.Rt. its posterior root; C.COM. cerebral commissure; C.G. cerebral ganglion; CÆS. œsophagus.

cerebral ganglion, close together and both at a point posterior to the origin of the anterior pallial nerve, which according to Pelseneer should spring from the pleural enlargement. (4) The distal free part of the otocystic nerve is of practically the same diameter as the hinder root of the cerebro-pedal connective (as stated by Drew). (5) The pedal ganglia are united by two serially arranged commissures (Fig. III): a multiple connection between these ganglia, suggestive of the ladder-like condition in Amphineura and low Gastropods, has been noted by Rawitz in *Unio*,¹ and by Stempel² in certain Protobranchs, but has not hitherto been recorded for *Nucula*.

In conclusion, a few words with regard to Drew's comparison between the nervous systems of *Nucula* and an Amphineuran. In the Chitons (the most generalised Amphineura so far as concerns the nervous

¹ Rawitz, "Das zentrale Nervensystem der Acephalen": Jena Zeits., Bd. xx (1887), p. 438.

² Stempel: Zool. Jahrb. (Fauna Chilensis), i, p. 405.

system) the central nervous system, ignoring the parts concerned in the innervation of the buccal mass, consists essentially of an elongated loop (the cerebro-pallio-visceral loop) that encircles the body in a position just above the branchial furrow, and innervates the head, mantle, gills and viscera, and of two pedal cords in the foot, connected in front with the cerebral portion of this loop, and united irregularly by commissures. The cerebro-pallio-visceral loop has the same structure and similar relations to the body (except for its union posteriorly *above* and not below the gut) as the loop in *Nucula* formed by the cerebral and visceral ganglia with their commissures and the cerebro-visceral connectives. Both are ganglionic

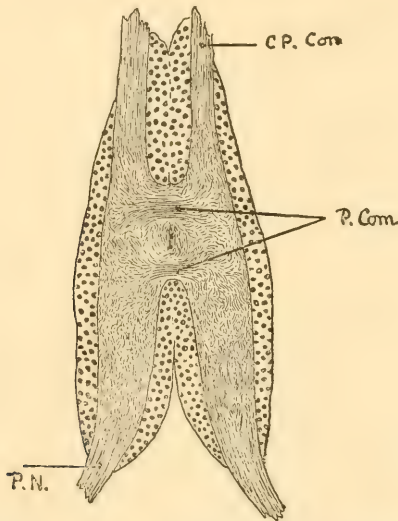


FIG. III.—Longitudinal section of the pedal ganglia of *Nucula nucleus*. C.P.CON. cerebro-pedal connective; P.COM. pedal commissures; P.N. pedal nerve.

throughout, both have the same position, and both innervate the same organs and regions of the body. In fact, they are without question homologous structures. The differences that do exist show that the loop in *Nucula* is somewhat specialised—the ganglionic matter is concentrated principally towards the anterior and posterior regions of the loop, forming definite though not sharply limited cerebral and visceral ganglia. These develop independently of the rest of the loop, although their connectives by their mode of development and adult structure show clearly enough that they once formed part of a continuous loop of ganglionic matter, now in process of replacement by connective fibres. The anterior and posterior concentration of ganglionic matter in this portion of the nervous system of Pelecypods is doubtless correlated to some extent with the special localisation of organs, characteristic of the class—as, for instance, the adductor muscles (derivatives of the pallial musculature), one at either end of

the body, the highly developed labial palps at the anterior end, the gills at the posterior end, and also, even probably to some extent in primitive forms, the extra sensitiveness of the hinder part of the mantle border.

The pedal ganglia show a higher grade of specialisation, even in the lowest types of Pelecypods, than in either Amphineura or low Prosobranchs. In the latter cases the ladder-like form, consisting of two longitudinal cords of ganglionic matter united at intervals by commissures, persists, and is no doubt intimately associated with a long creeping sole. In the Pelecypods, one of whose most striking characters is the adaptation of the general body form for digging, the foot has already been specialised as a digging organ even in the most primitive forms. For this purpose it has assumed a more or less cylindrical shape, with greatly restricted sole area. Corresponding to this change of form, the long pedal cords, which we may assume were present in ancestral forms, became shortened up to form rounded ganglia in which occasionally traces of the original ladder-like formation may be found in multiple commissures.

There is no doubt that the double cerebro-pedal connectives found in several of the Protobranchia, unless their posterior roots prove to be the otocystic nerves, constitute a difficulty when comparing the Pelecypod nervous system with one of the Amphineuran type. Were it not for the occurrence of both otocystic nerve and double (though intra-ganglionic) roots to the cerebro-pedal connectives in *Solenomya*, there would be no question in my mind that Drew's interpretation of the posterior root of the cerebro-pedal connective as the otocystic nerve is correct. But in case further investigation of *Solenomya* should prove his view to be untenable, I venture to put forward the following suggestion:—May not the posterior root be the vestige of Amphineuran latero-pedal connectives? These connectives between the pallio-visceral loop and the pedal cords, it will be remembered,¹ reach their greatest and most characteristic development in the most generalised types of Polyplacophora (*Hanleya*, *Lepidopleurus*), but as specialisation increases they first become very variable both in position and number, and finally in the higher forms (*Toncia*, *Ischnochiton*, *Acanthochiton*) vanish. As these connectives are characteristic of the lowest known form of molluscan nervous system, it is no great stretch of imagination to suppose that they also occurred in the forerunners of the Pelecypods, and in this group, as in the Chitons, vanished in proportion to the increase in general specialisation, until at the present day their remains persist in some few Protobranchs as a posterior root to the cerebro-pedal connective. In the light of this suggestion, it is interesting to recall that connections occasionally occur in Pelecypods between the visceral and pedal ganglia.²

Whether some such comparison as this, with a nervous system of the present-day Amphineuran type, is justified or not by the facts to

¹ Plate, Zool. Jahrb. (Fauna Chilensis), Bd. ii (1902), p. 493.

² D'Hardvillier, "Sur quelques faits qui permettent . . ." : C.R. Ac. Sci., t. cxvii (1893), p. 250.

be observed in the most generalised living Pelecypods, I think there can be no doubt that the early progenitors of the Pelecypods and Gastropods were already distinct before there was any question of specialised ganglia in the cerebro-visceral part of the nervous system. This can be inferred from the occurrence at the present time, in each of these groups, of genera (e.g. *Pleurotomaria*, *Nucula*) in which this part of the nervous system shows only the very slightest indication of specialisation into individual ganglia.¹ Now each of these forms is far more specialised and typical of its class than its ancestors could have been when first they diverged from the common molluscan stock. So that it is legitimate to assume that at that time the cerebro-visceral system was an entirely unspecialised ganglionic loop.

Thus the facts at our disposal, and the inferences to be justly drawn from them, seem strongly to favour Drew's general conclusion, that the nervous systems of Gastropods and Pelecypods have arisen in a common generalised form, probably of the Amphineuran type, and that each class has developed ganglia independently, according to its needs.

To return finally to Mr. Latter's letter. It is clear that according to Drew's views set forth above, ganglia appearing sporadically upon the visceral connectives would have no direct homology to any particular ganglion of normal occurrence in this or any other group of molluscs, but would be a local retention of the ganglionic condition once common to the whole cerebro-visceral system, and are thus a reversion, not to a more specialised, but to a more generalised condition.

¹ These nervous systems certainly do not represent the degenerate condition of a once more specialised type. Degeneration from a state with specialised and separate ganglia could hardly result in the formation of continuously ganglionic cords. Such are a sure sign of primitive generalisation.

ON THE GENUS *EURYSTOMA* OF ALBERS (TYPE *VITTATA*,
MÜLLER), ITS ANATOMY AND REFERENCE TO OTHER
INDIAN SPECIES.

By Lieut.-Colonel H. H. GODWIN-AUSTEN, F.R.S.

Read 8th January, 1904.

PLATE IV.

LAST July I received from Dr. W. T. Blanford some specimens of this species preserved in alcohol, which had been obtained in the Tinnevely District, Madras, through Dr. Thurston, of the Madras Museum, to whom our thanks are once more due for supplying us with the animals of several interesting land-shells. This species (*vittata*) is of interest as it was made the type of a genus by Dr. J. C. Albers under the title of *Eurystoma*,¹ and is the first of the two species that author included in it. The second species, *H. deflexa*, Pfr. (*exdeflexa* of Pilsbry), from Cuba, is placed by the latter author in *Eurycampta*.

The genus was founded on shell character alone, and is thus described from a Ceylon example:—"Testa umbilicata, depressoglobosa, solida, spira brevis, obtusa; anfractus 5 planulati, ultimus basi inflatus, antice descendens; apertura lunari-ovata; peristoma expansum, marginibus conniventibus, callo junctis, columellari umbilicium semitegente."

Conchologically the type shell has been associated by early writers with *Helix* (*Arianta*) *arborum*; Adams places it in *Macrocyelis*, a South American genus; G. Nevill² has it in *Planispira*, and records a single specimen from Java as coming from Ferdinand Stoliczka's collection, but extension to this island would be remarkable, and its occurrence there requires verification.

Description of Animal.—The visceral sac (Fig. 3) has no markings of any kind, being a rich ochre colour throughout, more intense on the apex, and near the mantle-zone it is burnt sienna colour. From the appearance of the foot in spirit it would appear to be broad and rounded at the posterior end in the living animal. There is no peripodial line; the surface of the sides is smooth, broken up by close-set radiating grooves. The main divisions of these are well seen on the sole of the foot, gradually fining out towards a plain central area. This last becomes more pronounced anteriorly, and nearer the head it is strongly divided down the middle, and is further split up and finely streaked longitudinally; the muscles of the foot apparently have this arrangement, which is intensified by contraction in the spirit. A central and the side areas of the sole of the foot are a conspicuous character (Fig. 2). The mantle-edge is quite straight and simple. The

¹ "Die Heliceen," 1850, p. 126.

² Handlist, p. 76.

right dorsal lobe is large, the left very small. The pulmonary cavity is not very capacious. The renal organ (Fig. 6) is elongate, with an even width, the heart being situated at the posterior end.

The generative organs (Figs. 9-11) are very simple, there being neither dart-sac nor digitate glands, and no cæcum to the spermatheca duct. The albumen gland is remarkably large. The spermatheca is a long narrow duct with a pear-shaped swelling at the distal end. The penis has a short flagellum, at the base of which the vas deferens is attached. There is a bulbous swelling or knob, below which the retractor muscle is attached, and this muscle, spreading over the sheath, gives rise to another strong retractor, having its attachment on the body-wall near the reproductive aperture.

The jaw (Fig. 5) has six well-marked folds and an indistinct one on each outer side, thus eight in all.

In the radula (Figs. 4, 8) the formula is 34·16-1-16·34 or 50-1-50. The central teeth are broad, not very pointed, with no side cusps, only a slight emargination, the merest indication of them; at about the 22nd median tooth a small lateral ectocone makes its appearance; in the outer teeth, about the 36th, both mesocone and ectocone become bicuspid on a more elongate oblong plate, thence the plates become narrower and narrower towards the extreme margin with irregular denticles here and there, showing only a trace of the form of the 35th tooth.

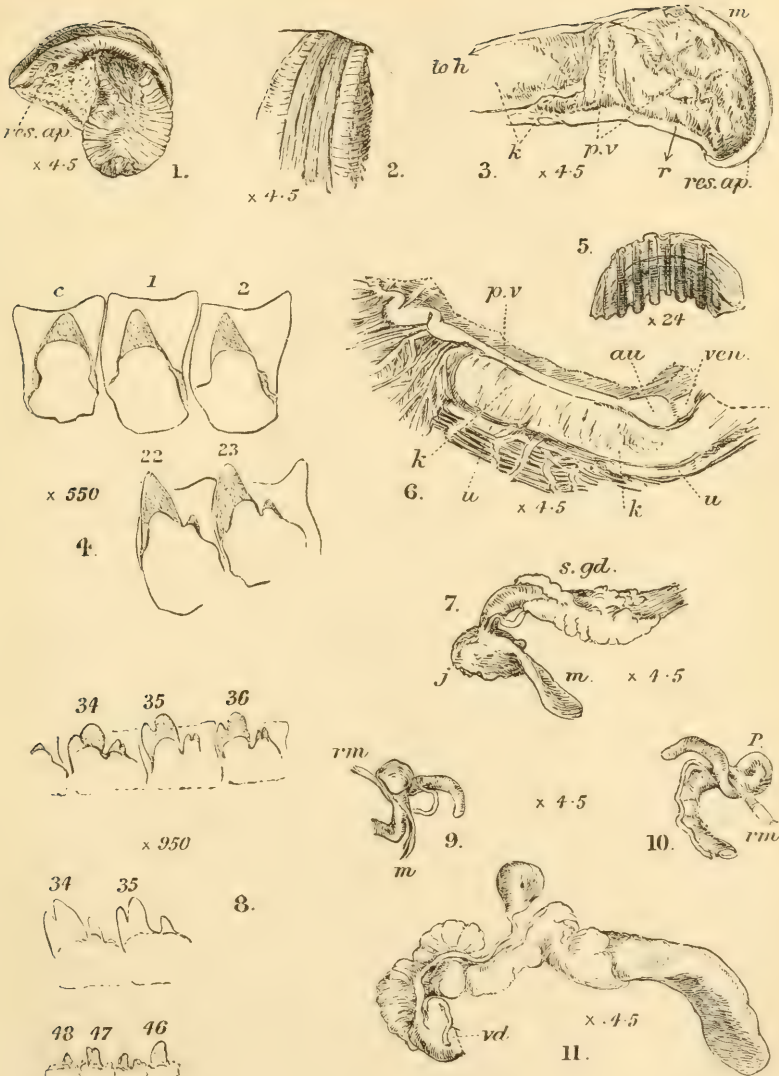
As might be expected, this genus of the Helicidæ differs widely from European genera represented by *Pomatia* (*pomatia*), *Tachea* (*nemoralis*), *Euparypha* (typical *Pisana* and *desertorum*), *Arianta* (*arbustorum*), etc. I have not sufficiently gone into the anatomy of the genera of Helicidæ to make any useful comparison, and many Indian species remain to be examined before changes are made in classification.

Ferdinand Stoliczka made perhaps the first dissections of Indian Helicidæ. In the Journal of the Asiatic Society of Bengal, 1871, pp. 223-228, he described the genus *Trachia*, of which the type is *asperella*, Pfr., from Bengal. The species described by Stoliczka is *delibrata*, a species with a wide range in eastern India. Pl. xvi, figs. 1-3 show that the genitalia are of the same simple type, with no glands, appendages, or dart-sac present. The jaw especially and radula, however, differ, but not materially. In 1873, in the same journal, pp. 24-26, Stoliczka described *Trachia Penangensis*. In this species we find the generative organs approach nearer to those of *E. vittata*, especially in the form of the spermatheca. The jaw is also similar in having fewer ribs, and the radula is evidently of the same type, but the teeth are on narrower plates and more pointed. As far as the animals are concerned, *Eurystoma* and *Trachia* with *Planispira* (vide *H. argillacea*, Fér., from Timor: Semper, pl. xv, fig. 19) come near each other. On the other hand, their shells differ very much in form, and particularly in type of sculpture. In this instance it is unfortunate that Stoliczka says nothing about the sole of the foot in his description of the animals of *Trachia* which he dissected, and from this I infer there was nothing remarkable to note. The divided

anterior portion (Fig. 2), present in three specimens I have looked at, is of importance, for it is of a different nature altogether from the division of the sole of the foot as seen in genera of the Zonitidæ, and it is not a feature in the foot of the true Helicidæ. If this character should not be found in *Trachia asperella*, *delibrata*, etc., *vittata* cannot then be included with them. It should also be ascertained how far other Indian species of Helicidæ agree in this respect with *vittata*. Albers' name *Eurystoma*, used in this paper, I am informed cannot be retained, being preoccupied, but this is not of importance particularly, should the animal of *vittata* be finally found to be similar in all respects to that of *asperella*, the type of *Trachia*, and this species has yet to be examined. In searching through the Helicidæ in Semper's work, "Reisen im Archipel der Philippinen," for species with similar characters, I was struck by the great and interesting similarity of the generative organs of *Buliminus (Petræus) Siamensis*, Redfield (pl. xiv, fig. 15), and also of the radula (pl. xvii, fig. 23) with those of *vittata*. I have lately been working at the anatomy of *Glossula*, and, as shown in the species *tenuispira*, Benson, there is no great difference in its generative organs and those of *Eurystoma*. Although the shells of these genera are dissimilar in every respect, from a phylogenetic point of view the animals of Indian forms of the Helicidæ, such as those under review, and as far as they are known, more nearly resemble those of species of *Stenogyra* and *Buliminus* than they do the true Helices of the Palæarctic region. This, however, may be only parallel development on similar lines. It is very apparent that Indian forms of Helicidæ have started from a very distinct and separate stem to that of their more western congeners.

EXPLANATION OF PLATE IV.

- Fig. 1. Aperture, showing mantle-lobes and sole of foot. $\times 4.5$.
 ,, 2. Sole of foot, anterior part. $\times 4.5$.
 ,, 3. Anterior portion of visceral sac.
 ,, 4. Central and admedian teeth of the radula.
 ,, 5. Jaw. $\times 24$.
 ,, 6. Renal organ, heart, etc.
 ,, 7. Buccal mass with salivary glands.
 ,, 8. Outer teeth of the radula, 34th to 36th, and 46th to 47th.
 ,, 9, 10. Penis, viewed from different sides.
 ,, 11. Portion of the genitalia, spermatheca, ovotestis, and albumen gland.
- | | |
|-------------------------------|--------------------------------------|
| <i>au.</i> auricle. | <i>res.ap.</i> respiratory aperture. |
| <i>k.</i> renal organ. | <i>s.gd.</i> salivary gland. |
| <i>m.</i> mantle-edge. | <i>u.</i> ureter. |
| <i>p.v.</i> pulmonary vein. | <i>v.d.</i> vas deferens. |
| <i>r.m.</i> retractor muscle. | |



H. H. G.-A. del.

ANATOMY OF EURYSTOMA VITTATA.

DESCRIPTIONS OF TWENTY-THREE SPECIES OF GASTROPODA
FROM THE PERSIAN GULF, GULF OF OMAN, AND ARABIAN
SEA, DREDGED BY MR. F. W. TOWNSEND, OF THE INDO-
EUROPEAN TELEGRAPH SERVICE, IN 1903.

By J. COSMO MELVILL, M.A., F.L.S.

Read 8th January, 1904.

PLATE V.

THE following species of Gastropoda were mostly dredged by Mr. F. W. Townsend at one particularly favourable station in the Gulf of Oman, early in April, 1903. It will be long before a complete catalogue can be drawn up of the exceeding riches of this one spot. In the meantime twenty-three new forms are now added to the fauna, the larger part of them being, as usual, Pleurotomidæ. I must again express my great indebtedness to Dr. W. H. Dall and Mr. Edgar A. Smith, I.S.O. Mr. J. W. Jackson has also kindly spent much time in sorting shell-sand from the dredging just mentioned, as have Mr. Ernest R. Sykes, Mr. G. B. Sowerby, and Mr. Robert Standen.

LOTORIUM (COLUBRARIA) CONCINNATUM, n.sp. Pl. V, Fig. 1.

L. testa oblongo-fusiforimi, mediocri, solidiuscula, brunneo-rufescente, anfractibus 8, quorum tres vel quatuor apicales læves, læte brunnei, globulosi, cæteris irregularibus, superficialiter pulchre decussatis, ad juncturas lirarum arcute gemmulatis, varicibus crebris, transversim albis et brunneo-rufis fasciis variegatis, apertura triangulatim oblonga, labro incrassato, intus multidenticulato, regione columellari nitida, alba, canali brevi, vix recurva. Long. 21.5, lat. 8 mm. (sp. maj.).

Hab.—Persian Gulf, Gulf of Oman, lat. 25° 23' N., long. 50° 40' E., 35 to 41 fathoms. Also off the Mekran coast, Charbar, 9½ fathoms.

The example taken as the type came from Charbar; the smaller specimens all show the apical whorls, smooth, globular, semi-pellucid brown, very clearly. The whorl surface is clearly decussate, the liræ at the points of junction being gemmulate. The varices are numerous, and elegantly banded with alternate white and reddish-brown fasciæ.

Allied to *L. (Colubraria) reticulatum*, Blvle., from the Mediterranean, and *L. Ceylonense*, Sowb., also an inhabitant of the Arabian Sea and Persian Gulf.

BULLIA (PSEUDOSTROMBUS) STRENNARIA,¹ n.sp. Pl. V, Fig. 10.

B. testa fusiformi, rapide attenuata, solidula, anfractibus 11, quorum apicales tres-quatuor, albo-vitrei, pellucidi, perlæves, tumiduli, mamillares, cæteris apud suturas impressis atque crenulatis, superne

¹ *Strena*, a New Year's gift.

crassieostatis, costis rugosis, undique spiraliter rudiliratis, penultimo et ultimo lævioribus, costis irregularibus, intermissis vel, interdum, omnino absentibus, superficie spiraliter undique tenuilirata, liris aretis, apertura late ovata, labro tenui, expanso, canali brevi, columella paullum excavata.

- (a) *typica*: colore omnino albido vel pallide stramineo, unicolore.
 (b) *melaleuca*: colore pallescente, undique spiraliter uni vel bizonata, zonis livido-nigrescentibus.
 (c) *plumbea*: colore livido-plumbeo, regione labiali, cum columellari, solum exceptis, albescentibus.

Long. 30, lat. 10 mm. (sp. typ. maj.).

Hab.—Persian Gulf (W. D. Cumming in Mus. Brit.), Maskat, 7–15 fathoms; Galig Island, 8 fathoms (var. *b*, *melaleuca*); Ormara beach (*a*, *typica*). Also in several other places along the Mekran coast, usually in shallow water, say 3–10 fathoms.

This interesting *Bullia* has, until now, been confounded with the similar but coarser-grained *B. Cumingiana*, Dkr, and I am very much indebted to Mr. E. A. Smith for having called my attention to its specific distinctions. I take as the typical form, because the most generally distributed, the white or pale stramineous form, never clouded or banded with any darker colour. The intermediate (var. *melaleuca*) is of a very pale bluish-white ground colour, the whorls once or twice banded spirally, these bands being of a dark livid hue. Examples of this variety are mostly smaller than the type. The third variety (*plumbea*) is almost entirely of a dark leaden grey, relieved only by the whiteness of the labial and columellar regions, standing out in sharp contrast.

I somewhat doubt the occurrence of the true *B. Cumingiana* in the Persian Gulf area.

COLUMBELLA (ASTYRIS) AGATHA, n.sp. Pl. V, Fig. 11.

C. testa ovata, semipellucida, lactea, nitida, perlævi, anfractibus 6–7, apicali parvo, omnibus lævissimis, simplicibus, parum ventricosulis, ultimo effuso, apertura ovata, labro tenui, expanso, canali brevi, columella obliqua. Long. 7, lat. 2·5 mm. (sp. max.).

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms. Also lat. 23° 55' N., long. 57° 48' E., 22 fathoms.

A thin, semi-pellucid, unicolorous shell, giving every evidence of being an inhabitant of the deep sea. All the many specimens found were dead shells, but in good and clear condition. I am in this, as in several other instances, indebted to Dr. W. H. Dall for his opinion as to the subgenus of this interesting new form. It may be compared with *C. (Astyris) diaphana*, Verrill, and *C. profundæ*, Dall,¹ from the United States, both species having been dredged from 65 to 805 fathoms at various stations between Rhode Island and Havana.

¹ Bull. Mus. Comp. Zool., vol. xviii, No. 29, pp. 191, 192, pl. xxxv, figs. 3, 9.

SCALA (*ACRILLA*?) *COPHINODES*,¹ n.sp. Pl. V, Fig. 17.

S. testa attenuato-fusiforimi, gracili, delicata, alba, parum nitida, anfractibus (probabiliter) 15-16, quorum apicales tres, perlæves, diaphani, cæteris—certe anfr. 9-10—multum apud suturas impressis, tumidulis, acerrissime undique longitudinaliter obliquiliratis, liris acutis, lævibus, interstitiis sub lente spiraliter pulchre striatulis, apertura rotunda, peristomate paullum expanso, haud continuo, marginem apud columellarem incrassato, lævi, albo, nitido. Long. 10, lat. 2·5 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

When preparing an account of the *Scalae* of the Persian Gulf, Mr. R. Standen and I were compelled to omit this very distinct species, owing to our only possessing two fragments. Since then, Mr. J. W. Jackson has found in the shell-sand an apical tip, and a small but quite perfect juvenile example, possessing nine whorls in all. With the aid of these I am able, to some extent, to diagnose it, but it is not possible to say what size a full-grown specimen would attain to. It is most likely an *Acrilla*, allied to *S. acuminata*, Sowb., which occurs in the same region. The acute longitudinal riblets are nearly 50 on the largest whorl examined, this being probably the antepenultimate. It differs from other *Acrillæ*, however, in the close spiral striolation, the surface not becoming decussate, as the riblets themselves remain smooth.

ACLIS BELTISTA,² n.sp. Pl. V, Fig. 18.

A. testa obtecte umbilicata, gracillima, attenuata, alba, anfractibus 13-14, quorum apicales tres parvi, perlæves, vitrei, cæteris apud suturas multum impressis, ventricosis, undique spiraliter arcate carinulatis, carinulis anfractuum superiorum duabus, antepenultimi et penultimi tribus, ultimi anfractus quatuor, superficie ipsa lævi, nitida, apertura fere rotunda, labro ad basin paullum expanso, fere continuo. Long. 6, lat. 1·5 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

A very graceful species, conspicuously keeled, its nearest ally in its fauna being *A. calotropis*,³ M. & S., a much smaller species, with only one carina in the centre of each whorl. A few examples only.

RISOA (*SCROBS*) *COLUMEN*,⁴ n.sp. Pl. V, Fig. 21.

R. testa cylindrica, albo-lactea, delicata, nequaquam nitente, anfractibus 6, quorum apicales duo, apice ipso planato, fere immerso, cæteris ad suturas impressis, gradatulis, ultimo fere recto, cylindrico, apertura ovata, peristomate continuo, incrassato, albo, expanso, columella obliqua. Long. 4, lat. 1·3 mm. (sp. maj.); long. 3, lat. 1 mm. (sp. min.).

¹ κοφινώδης, basket-like.

² βελτιστός, the best.

³ Proc. Zool. Soc., June, 1901, p. 357.

⁴ *Columen*, a column.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

A delicate milky-white opaque *Rissoa*, the peristome being in some specimens almost, in others entirely, separated from the body-whorl, this peculiarity forming the chief characteristic of differentiation in the subgenus *Scrobs*, proposed by Dr. Boog Watson (cf. Voy. Challenger, vol. xv, pp. 611, 612). I am indebted to Dr. W. H. Dall for his opinion on this matter. Mr. C. Hedley¹ raises it to generic rank.

CYCLOSTREMA GYALUM,² n.sp. Pl. V, Fig. 22.

C. testa mediocri, placentiformi, solidula, albo-straminea, anfractibus 5, apicali minutissimo, ultimo rapide accrescente, acute tricarinato, carina una infra, juxta suturas, altera apud peripheriam, tertia regionem umbilicarem circumambiente, superficie omni sub lente leniter et obscure spiraliter striolato, umbilico perprofundo et lato, apertura quadratula, labro angulato, tenui. Alt. 2, diam. 5 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Conspicuous for its thrice acutely keeled body-whorl, the basal carina encircling the umbilicus, which is particularly large and deep in comparison with the proportions of the shell. Allied to *C. angulatum*, A. Ad., and *C. Beauvi*, Fischer, but smaller and differing altogether in form.

FOSSARUS (COUTHOUYIA) QUINQUECARINALIS, n.sp. Pl. V, Fig. 19.

F. testa anguste umbilicata, alba, oblonga, solidiuscula, versus apicem rapide attenuata, anfractibus 6, quorum apicales duo, parvi, globulares, vitrei, cæteris gradatulis, supernis tribus longitudinaliter obscure liratis, haud angulatis, penultimo acute bicarinato, ultimo anfractu quinque carinis prædito, quarum duæ, inter suturas peripheriamque, percuspicuæ et gemmuliferæ, tres inter peripheriam et basin minores, regionem circa umbilicarem carina duplicata fortis, apertura ovato rotunda, labro extus subquingulari, intus simplici, tenui, columella fere recta. Long. 3, lat. 1.25 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

A very small, but highly sculptured species. A few examples only have, so far, occurred.

FOSSARUS (COUTHOUYIA) THELACME,³ n.sp. Pl. V, Fig. 20.

F. testa parva, profunde umbilicata, ovata, alba, haud nitente, delicata, anfractibus 5, apicalibus tribus, mammosis, parvis, vitreis, uniformibus inclusis, ultimo permagno, rapide accrescente, undique delicatissime et arcte spiraliter striato, lineis microscopicis longitudinaliter intertextis, apertura magna, lata, ovata, labro tenui, effuso, simplici. Long. 3, lat. 1.5 mm.

¹ Mem. Austr. Mus., vol. iv, pt. 6 (1903), p. 353.

² γυάλον, a hollow, from the wide umbilicus.

³ θηλή ἀκμή, nipple-tipped.

Hab.—Persian Gulf, Gulf of Oman, lat. $24^{\circ} 58' N.$, long. $56^{\circ} 54' E.$, 156 fathoms.

Distinguished by its mammæform apex and proportionately large body-whorl, the surface being shagreened by close microscopical spiral liræ crossed by still more minute striæ. These two species of *Fossarus* occurred together, neither very plentifully.

TURBONILLA ANGUSTISSIMA, n.sp. Pl. V, Fig. 13.

T. testa pergracili, multum attenuata, semipellucida, albo-lactea, anfractibus 11–12, quorum apicales duo-tres conspicue heterostrophii, cæteris apud suturas impressis, ventricosulis, undique longitudinaliter obliquiliratis, litarum numero anfractum apud ultimum circa 14, apertura ovata, labro tenui, apud basin expanso, columella fere recta. Long. 3, lat. .75 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. $24^{\circ} 58' N.$, long. $56^{\circ} 54' E.$, 156 fathoms.

Easily discerned from its congeners by its excessive narrowness of whorl in proportion to its length. The longitudinal liræ are oblique, and not crowded. There are a few other hitherto unknown *Turbonilla* sifted from the same dredging that await description, but none so remarkable as *T. angustissima*.

SYRNOLA AMBAGIOSA,¹ n.sp. Pl. V, Fig. 12.

S. testa cylindrico-fusiforimi, albo-lactea, nitida, subpellucida, anfractibus 8–10, quorum apicales duo vitrei, bulbosi, heterostrophii, cæteris præcipue supernis, tumidis, superficie perlævi, lineis internis spirilibus conspicuis, apertura ovata, labro simplici, columella breviter uniplicata. Long. 3, lat. .75 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. $24^{\circ} 58' N.$, long. $56^{\circ} 54' E.$, 156 fathoms.

Many specimens occurred at the above station of this small, glassy, shining, milk-white species, conspicuous for its remarkably blunt, bulbous, glassy, heterostrophe apex and swollen whorls, giving a sinuous appearance to the lateral contour of the shell, and suggesting the trivial name proposed for it. The opaque internal spiral lineation is also very marked in this species. I know no *Syrnola* very comparable; it may, however, be slightly akin to *Odostomia* (*Turbonilla*) *amebæa*, Wats.,² from Cape York, N. Australia, 153 fathoms, although this species is acutely carinate. The line of demarcation between the smaller *Syrnola* and the larger *Odostomia* is often ill-defined.

EULIMELLA GEDROSICA, n.sp. Pl. V, Fig. 14.

E. testa aciculato fusiformi, lactea, tenui, anfractibus 6, quorum apicales duo lactei, læves, omnino heterostrophii, cæteris longis, ad suturas paullum gradatis, sub lente aretissime et delicatissime striatis, fere rectis, apertura oblonga, angusta, labro simplici, columella obliqua. Long. 3.75, lat. 1 mm.

¹ *Ambagiosus*, sinuous.

² Cf. Rep. Challenger Expedition, xv, p. 495, pl. xxxiii, fig. 1.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Judging from the figures of *E. simplex* (Orb.)¹ from Jamaica, and *E. laxa*, Wats., from Raines Island, Capé York, 155 fathoms ("Challenger" Expedition), some affinity exists between them and this species. *E. simplex* is also very finely spirally striate, *E. laxa* is "spirally microscopically scratched."² *E. Philippiana*, Dkr., from Japan, is also rather similar in form, but this is a smooth and shining species. Gedrosia is the ancient name of a maritime province of Southern Persia.

EULIMELLA VENUSTA, n.sp. Pl. V, Fig. 15.

E. testa aciculata, pergracili, alba, nitidissima, solidula, anfractibus 14, quorum apicales duo heterostrophi, vitrei, cæteris apud suturas impressis, infra medium tumide subangulatis, semipellucidis, perlævibus, nitidis, apertura quadratula, labro simplici, columella recta. Long. 7, lat. 1.25 mm. (sp. maj.).

Hab.—Arabian Sea, lat. 18° 58' N., long. 71° 45' E., 40 fathoms.

An extremely graceful shining white species, being a typical *Eulimella*, whose whorls, impressed at the sutures, are slightly pagodiform, each being tumid and bluntly angled below, just above the sutures, and pinched in at the upper portion. This is the fourth species of the genus now described from these seas. A smaller and imperfect example of what is probably the same species also occurred in the prolific dredging in the Gulf of Oman at 156 fathoms.

FENELLA XANTHACME,³ n.sp. Pl. V, Fig. 16.

F. testa imperforata, attenuato-fusiformi, alba, solidula, anfractibus 12, quorum apicales quatuor fulvi, apice ipso lævi, dein huic proximis obscure longitudinaliter striatis, cæteris 8, multum apud suturas impressis, ventricosis, undique crasse reticulatis, ad juncturas lirarum costarumque gemmulatis, interstitiis fere quadratis, ultimo anfractu numero costarum longitudinalium circa 15, lirarum 6, infra peripheriam usque ad basin 5 lirato, apertura rotundo-ovata, labro tenui. Long. 7, lat. 2 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

An interesting *Fenella*, the fulvous apical whorls being very conspicuous without the aid of a lens. The network, uniformly ornamenting the somewhat ventricose whorls, is coarse for the size of the shell, the interstices being almost square and somewhat large.

ANCISTROSYRINX ORIENTIS, n.sp. Pl. V, Fig. 3.

A. testa eleganter fusiformi, parum nitida, pallide brunnea, delicata, tenui, anfractibus 8, quorum apicales duo parvi, globulares, vitrei, cæteris lævibus, ad medium acutangulatis, carina peripherali centraliter

¹ D'Orbigny: Moll. Cuba, pl. xvi, fig. 29.

² Cf. Rep. Challenger Expedition, xv, pp. 497, 498, pl. xxxiii, fig. 6.

³ ξανθακμή, with yellow point.

decorata, spinigera, spinis paucis regularibus, latis, brevibus, numero ultimum apud anfractum circa 12-13, ultimo apud basin producto, apertura anguste oblonga, labro paullum expanso, ad medium angulato, tenui, sinu indistincto, canali longa, paullum recurvirostri. Long. 9.5, lat. 4 mm. (sp. maj.).

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

The author of the genus, having kindly examined my specimens, pronounces them generically the same as the Western *A. elegans* and *A. radiata*, Dall,¹ the first from Florida (Pourtales) and Cuba, dredged at 805 fathoms, the second found in various stations in the Gulf of Mexico and West Indies during the "Blake" Expedition. The old *Pleurotoma cedo-nulli*, Reeve, likewise is transferred to the same genus. This is supposed to have come from Panama (Cuming). *A. orientis*, being the first species yet recorded from the Old World, is for that reason alone worthy of description at the present juncture, although none of the five or six examples procured from shell-sand and globigerina-ooze are otherwise than in very juvenile condition. In all probability, when full grown, some sculpture would be present on, at all events, the body-whorl; and the size would be at least doubled, say 18 mm.

PLEUROTOMA TRYPANODES,² n.sp. Pl. V, Fig. 2.

P. testa fusiformi, albida, eleganter tornata, anfractibus 11-12, quorum apicales 3½ globulares, parvi, vitrei, cæteris spiraliter tornatis, flicarinatis, et liratis, liris cum carinis alternantibus, una carina infra, juxta suturas, duabus infra medium anfractuum, striis indistinctis longitudinaliter conjugatis, ultimo anfractu spiraliter magnopere carinato et lirato usque ad basin, apertura ovata, labro tenui, sinu lato sed non profundo, canali producta, columella recta. Long. 21, lat. 7 mm.

Hab.—Arabian Sea, lat. 18° 58' N., long. 71° 45' E., 40 fathoms.

A most refined species, near *Pl. oxytropis*, Sowb., but with more regular angled carinæ and alternating lirations.

MANGILIA BATHMIS,³ n.sp. Pl. V, Fig. 4.

M. testa ovato-fusiformi, utrinque attenuata, solida, alba, anfractibus 6, quorum tres apicales perlæves, vitrei, nitidi, cæteris conspiciue gradatis, ad suturas quasi canaliculatis, longitudinaliter oblique crassicostatis, costis apud ultimum anfractum numero circa 14, liris spiralibus, in penultimo circa 6, decoratis, ultimo producto, apertura oblonga, labro paullum incrassato, canali lata. Long. 6, lat. 2 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Of peculiar form, the thickened ribs and terraced whorls being noteworthy. Of very rare occurrence at the above locality.

¹ Bull. Mus. Comp. Zool., xviii, No. 29, pl. xii, fig. 12, and pl. xxxvii, fig. 3.

² *τρυπανώδης*, screw-like.

³ *βαθμῖς*, a terraced flight of steps.

MANGILIA ECPHORA,¹ n.sp. Pl. V, Fig. 5.

M. testa parva, ovato-fusiformi, albida, anfractibus 6, quorum apicales tres pulcherrime cancellati, cæteris superne fortissime angulatum projectis, dein ad suturas declivibus, longitudinaliter crassicostatis, costis numero ultimum apud anfractum circa 14, undique spiraliter arcte liratis, interstitiis præcipue oblongo-quadratis, profundis, ultimo apud basin gracili, canali producta, fusoide, apertura oblonga, labro incrassato, eleganter transversim lirato et gemmulato, sinu perlato, haud profundo, columella fere recta. Long. 5, lat. 2 mm. (sp. maj.).

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

Remarkable for its acutely angled ridge surmounting the upper portion of the whorls. Very elegant in form, fusoid towards the base. The nuclear whorls are seen with a lens to be very finely cancellate; the longitudinal ribs and spiral liræ are extremely pronounced, the interstices being squarely and deeply cut.

Allied to *Daphnella Amphitrites* and *nevæidum*, M. & S., from the same locality; perhaps, indeed, these two species might be transferred to *Mangilia* without detriment.

MANGILIA (GLYPHOSTOMA) PYCNOCHILA,² n.sp. Pl. V, Fig. 6.

M. testa ovato-fusiformi, crassa, albida, persolida, anfractibus 8, quorum tres apicales subvitrei, lactei, læves, glabrati, cæteris infra medium unangulatis, perobscure longitudinaliter costatis, costis crassis, undique spiraliter crassiliratis, liris numero ultimum apud anfractum 29–30, interstitiis pulcherrime et arcetissime longitudinaliter striatis, apertura anguste oblonga, labro percrasso, intus, simul ac margine columellari, albo, lævi, nitido, canali brevi. Long. 9, lat. 3·5 mm.

Hab.—Persian Gulf, Mussandam, 47 fathoms.

A *Glyphostoma* with somewhat obscure but thick longitudinal ribs, closely spirally lirated, the interstices being most finely striate. The outer lip is most peculiarly thickened, more so, proportionately speaking, than in any other Pleurotomoid of my acquaintance.

CLATHURELLA AMPHIBLESTRUM,³ n.sp. Pl. V, Fig. 7.

C. testa fusiformi, albida, tenui, anfractibus 8, quorum apicales quatuor ochracei, sub lente pulchre cancellati, cæteris ad suturas gradatis, supra unangulatis, longitudinaliter costatis, costis crassis, fere rectis, numero ultimum apud anfractum 14, spiraliter liratis, liris paucis, interstitiis oblongis, costis ad juncturas lirarum pulchre gemmulatis, apertura oblonga, labro incrassato, sinu suturali lato, haud profundo, margine columellari recto, canali brevi. Long. 7·5, lat. 2·5 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

This species has some points in common with *Mangilia ephora* just described, but the very prominent angled ridge being absent, its

¹ ἔκφορα, a projection

² πικνοχέϊλος, with thickened lip.

³ ἀμφίβληστρον, a net.

appearance is far more normal. All the examples are dead, and consequently it is impossible to say what the coloration may be.

CLATHURELLA EPIXANTHA,¹ n.sp. Pl. V, Fig. 8.

C. testa ovata, curta, solida, pallide ochracea, anfractibus 8, quorum tres apicales (apice ipso parvo, vitreo, huic duobus proximis sub lente obscurissime longitudinaliter striatulis), cæteris costatis, costis crassis, et spiralliter crassiliratis, interstitiis oblongo-quadratis, apertura ovata, labro incrassato, intus paucidenticulato, sinu lato et profundo, columella fere recta, canali brevi. Long. 6, lat. 2 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 54° 56' E., 156 fathoms. Also lat. 23° 55' N., long. 57° 48' E., 22 fathoms.

A coarsely reticulated, brightly coloured little shell, with well-defined sinus, and short canal. It exhibits no special peculiarity, but neither monographs nor the National collection have been able to afford any aid towards its identification.

CLATHURELLA HEDLEYI, n.sp. Pl. V, Fig. 9.

C. testa ventricoso-fusiformi, parva, tenui, albida vel pallide brunnea, anfractibus 9, quorum tres apicales parvi, eleganter longitudinaliter striatuli, cæteris apud suturas multum impressis, tumidis, duobus supernis (exclusis apicalibus), tribus carinis spiralibus, antepenultimo et penultimo quatuor, ultimo anfractu quinque carinis præditis, costulis longitudinalibus tenuibus circiter 25, undique ad juncturas carinarum costularumque breviter sed acute echinatis, interstitiis lævibus, ultimo infra peripheriam liris spiralibus ad basin decorato, apertura ovata, labro tenui, acuto, sinu suturali lato, profundo, canali mediocri, margine columellari fere recto. Long. 9, lat. 4 mm.

Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

When describing *Clathurella Sykesii*,² it was mentioned that a near ally had lately come to light. Allusion was then made to the present species. The type of *C. Sykesii* was not in very good condition for figuring, unfortunately, and the shell is hardly fairly represented, excepting as regards its general form. It is almost as echinulate as *C. Hedleyi*, but much narrower, and the longitudinal ribs are fewer in number. The apical whorls are either quite smooth or obscurely striolate longitudinally.

By a curious coincidence, on the very day I had commenced to study the species now under discussion, I received from Mr. C. Hedley the second portion³ of his elaborate treatise on the Mollusea of the "Thetis" Expedition, my attention being therefore at once drawn to the description, with figure, of *Pleurotoma vepratica*, Hedley, sp. nov., from four or five stations off the coast of Australia, dredged from 24 to 75 fathoms. This species seems almost exactly intermediate,

¹ ἐπίξανθος, somewhat tawny, in allusion to the colour.

² Ann. & Mag. Nat. Hist., ser. vii, vol. xii, p. 314, pl. xxiii, fig. 4.

³ Mem. Austr. Mus., vol. iv, pt. 6 (October, 1903).

though quite distinct, between *C. Hedleyi* and *C. Sykesii*, the former being the most abbreviated, ventricose, and multicostate, the latter the narrowest, most fusoid, and fewest ribbed. I cannot trace the least resemblance, either, to an *Ancistrostyx* which Mr. Hedley mentions exists in his *C. vepratice*. Doubtless *C. asperulata*,¹ E. A. Smith, from the North Arabian Sea, is likewise akin to these.

It gives me much pleasure to name this species after my friend Mr. Charles Hedley, who is prosecuting such successful researches amongst the rich molluscan fauna of Australia and the South Pacific Ocean.

PHILINE SYKESII, n.sp. Pl. V, Fig. 23.

P. testa minuta, subquadrata, pertenui fragilissima, haud nitida, albo-lactea, superficie ultimi anfractus undique spiraliter pulcherrime et arcte catenulata, spira celata, apertura maxima, labro superne producto, angulato, haud multum effuso, tenui, margine minute crenulato, columella lente obliqua. Alt. 2·5; diam. 1·5 mm.

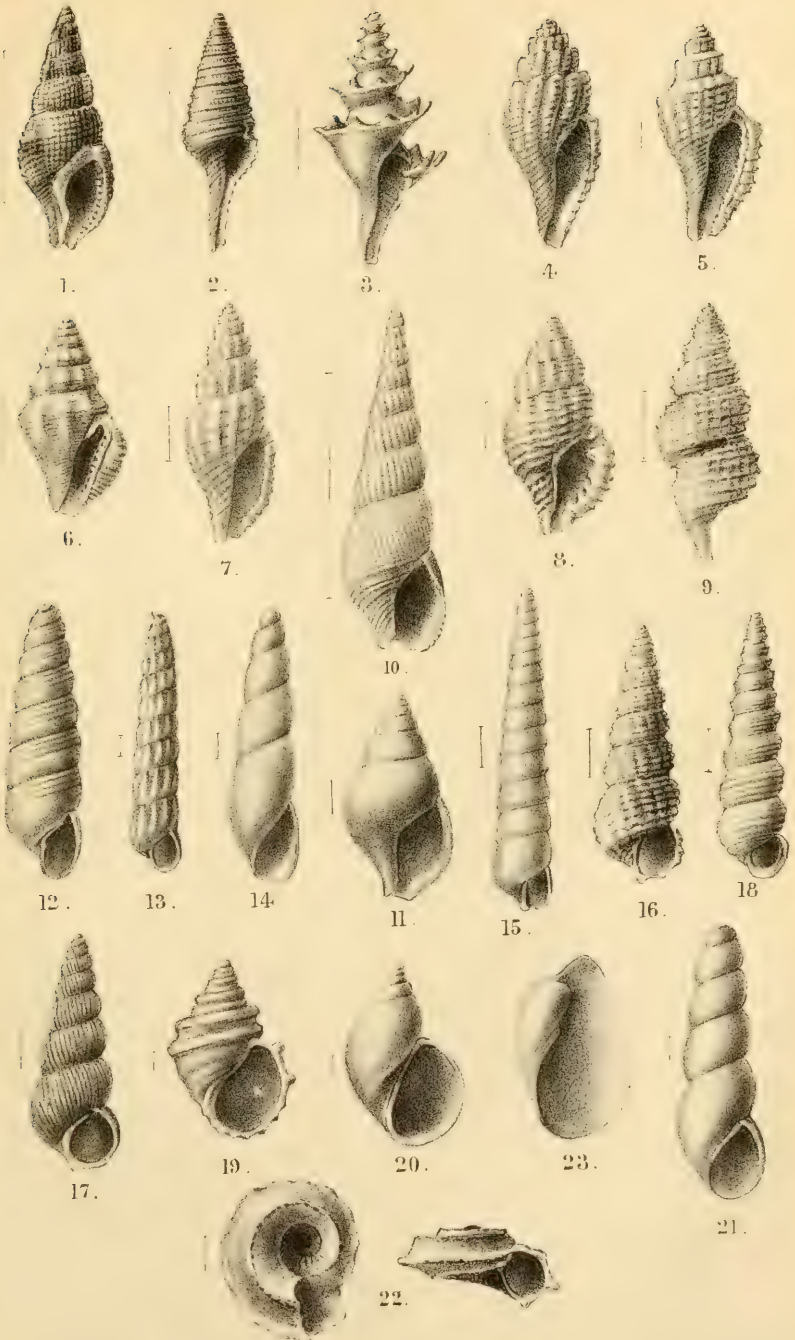
Hab.—Persian Gulf, Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

I am grateful to Mr. E. R. Sykes for calling my attention to this small *Philine*, which I had thought but a juvenile form of *P. orientalis*, A. Ad., a species also occurring in the same seas. The frontal projection of the outer lip is peculiar, and like no species with which I am acquainted. The shagreened chain-like spiral ornamentation, visible only with a very strong lens, resembles that of other species. I have only seen two or three examples, all dead shells, and some encrusted with *Globigerina* and other Foraminifera.

EXPLANATION OF PLATE V.

- FIG. 1. *Lotorium (Colubraria) concinmatum*, n.sp.
 ,, 2. *Pleurotoma trypanodes*, n.sp.
 ,, 3. *Ancistrostyx orientis*, n.sp.
 ,, 4. *Mangilia bathmis*, n.sp.
 ,, 5. ,, *ecphora*, n.sp.
 ,, 6. ,, (*Glyphostoma*) *pycnochila*, n.sp.
 ,, 7. *Clathurella amphiblestrum*, n.sp.
 ,, 8. ,, *epixantha*, n.sp.
 ,, 9. ,, *Hedleyi*, n.sp.
 ,, 10. *Bullia (Pseudostrombus) strenaria*, n.sp.
 ,, 11. *Columbella (Astyris) agatha*, n.sp.
 ,, 12. *Syrnola ambagiosa*, n.sp.
 ,, 13. *Turbonilla angustissima*, n.sp.
 ,, 14. *Eulimella gedrosica*, n.sp.
 ,, 15. ,, *venusta*, n.sp.
 ,, 16. *Fenella xanthacme*, n.sp.
 ,, 17. *Scala (Acrilla?) cophinodes*, n.sp.
 ,, 18. *Actis beltista*, n.sp.
 ,, 19. *Fossarus (Couthouyia) quinquecarinalis*, n.sp.
 ,, 20. ,, ,, *thelacme*, n.sp.
 ,, 21. *Rissoa (Scrobs) columen*, n.sp.
 ,, 22. *Cyclostrema gyalum*, n.sp.
 ,, 23. *Philine Sykesii*, n.sp.

¹ Ann. & Mag. Nat. Hist., 1882, vol. x, p. 296.



J. Green del. et lith.

Mintern Bros. imp

ON *BERTHAÏS*, A PROPOSED NEW GENUS OF MARINE
GASTROPODA FROM THE GULF OF OMAN.

By J. COSMO MELVILL, M.A., F.L.S.

Read 8th January, 1904.

A FEW months ago I published,¹ in conjunction with Mr. R. Standen, the description of a small but peculiar Gastropod from the Gulf of Oman, as follows:—

SCALA (CONSTANTIA) INTERTEXTA, sp.n.

“S. testa gracili, fusiformi, albida, delicata, anfractibus 10, quorum apicales tres parvi, vitrei, læves, cylindrici, cæteris ad suturas multum impressis, pulcherrime regulariter decussatis (aut reticulatis), ad juncturas lirarum spiraliū cum costulis fimbriolatis, ultimo anfracta paullum prolongato; apertura obliqui-ovata, labro effuso; columella paullum incrassata, simplici. Long. 7, lat. 1·75 mm.

“*Hab.*—Gulf of Oman, lat. 24° 58' N., long 56° 54' E., 156 fathoms.”

The following remarks were added:—“Rarely has a small mollusk caused such perplexity as in the present instance. Two examples alone have occurred, but both have the apex perfect, this being non-heterostrophe, though in most other particulars the form and texture recall such pyramidelloid genera as *Mormula*, *Pyrgulina*, or *Mumiole*, especially one species of the latter genus, *M. spirata*, A. Ad., which also occurs in the same seas.

“Mr. Edgar Smith considers *Onoba egregia*, A. Ad. (which should be removed from that genus), the nearest approach to our shell, and suggests that it might, at all events provisionally, be located in *Aclis*. In lip-characters it assimilates this genus, while superficially resembling in the decussating sculpture *Cirsotrema*, e.g. *dentiscalpium*, Wats. But perhaps the subgenus *Constantia* of *Scala* is best fitted for its reception, for it seems comparable with *C. Standeni*, Melv., in more than one point.”

This species was extracted from shell-sand dredged at 156 fathoms, in the station as given above, which it is no exaggeration to say has produced a greater number of hitherto unknown mollusca, mostly minute, at one sweep of the dredge, than has occurred since the “Challenger” Expedition and their famous hauls at Stations 23 (Culebra Island) and 122 (Pernambuco), perhaps even surpassing them.

Shortly after the above remarks were written, it occurred to me to forward the *C. intertexta* to Dr. W. H. Dall, at Washington, for his

¹ Ann. & Mag. Nat. Hist., ser. vii, vol. xii, pp. 290 sqq.

opinion. He was kind enough to reply in October last:—"This shell is unknown to me, and doubtless a new genus. I do not think it belongs either to Pyramidellidæ or Scalidæ. The nucleus recalls that of a section of *Aclis* which I named *Amblyspira*, from the West Indian region, but the aperture and sculpture are very distinct."

The animal is unknown, and I fear the chances of its being dredged alive are not very great; it is therefore necessary to draw all conclusions and inferences from the shell itself. Happily the type is a good, well-grown, and quite perfect example; and not long ago, in sorting more of the shell-sand, I extracted another unmistakable (though smaller and rather imperfect) specimen.

The great difficulty is to seek successfully its nearest ally; and I cannot help thinking that *Aclis* is its congener, as it harmonises especially with the somewhat reticulate species of the section *Graphis*, and perhaps this genus should be removed from the Scalidæ and constituted as the type of a separate family, Aclididæ.

I still consider *Constantia* not far removed from our species; the type of this genus is, however, perforate, and the form of the aperture quite different from my shells, in which, likewise, the character of the reticulations are not as in *Scala*, where longitudinal lamellæ often interlaced with inferior spiral liræ predominate, the sculpture and lirations of *intertexta* are uniform, and the points of junction between these liræ, longitudinal and spiral, are slightly beaded. It is therefore in this particular quite unlike any *Scala* or *Constantia*, and still more unlike *Aclis*, though the nucleus does resemble that of this last genus, as is corroborated by Dr. Dall.

Deciding, then, for the present, if only as a temporary arrangement, to consider this shell as belonging to the above alliance, I may characterize it as the type of a new genus, as follows:—

BERTHAÏS, gen. nov.

Testa fusiformis, gracilis, albida, delicata, parva, imperforata, anfractus 9-10, apicalibus tribus minutis, vitreis, lævibus, cylindricis, cæteri ad suturas multum impressi, pulcherrime regulariter decussati vel reticulati, ultimus anfractus paullum prolongatus, apertura obliqui-ovata, labrum paullum effusum, columella simplex.

BERTHAÏS INTERTEXTA (Melv. & Stand.). Fig. I.

Scala (*Constantia*) *intertexta*, M. & St.: Ann. & Mag. Nat. Hist., ser. VII, vol. xii, pp. 305, 306, pl. xxii, fig. 6.

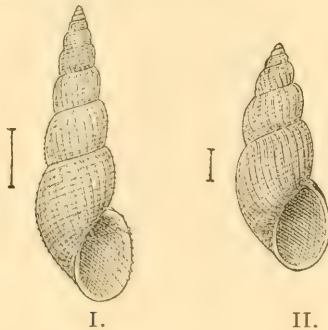
As already stated, as suggested by Mr. E. A. Smith, it is almost certain that *Onoba egregia*, A. Ad., is also a species of *Berthais*, to be known in future as *B. egregia* (A. Ad.).

The species was thus characterized¹ by its author:—

¹ Ann. & Mag. Nat. Hist., ser. III, vol. xi (1863), p. 349.

ONOBA EGREGIA, A. Adams. Fig. II.

"*O. testa subulato-turrita, sordide alba; anfractibus 6, planiusculis, spiratis, postice rotundate angulatis, lamellis longitudinalibus erectis undulatis, interstitiis transversim pulcherrime striolatis instructis; suturis profundis; apertura aperta, ovali; peristomate tenui, continuo; labro subdilato, margine simplici, undulato.*"



I.

II.

"*Hab.*—Sato Uchi, Japan, 17 fathoms; Yobuko, Japan, 10 fathoms.

"A very charming species, with lamellar, undulating, longitudinal riblets, and the interstices crossed by fine spiral elevated lines. The aperture is somewhat expanded, and there is no external varix on the outer lip."

The specimen figured is in the British Museum.

In all probability it will be found that several other species, some described as *Pyramidellidæ*, others as *Rissoidæ*, should be placed in this genus.

NOTE UPON *OLIVA GIBBOSA*, BORN, AND ITS LIMITS OF VARIATION.

By J. COSMO MELVILL, M.A., F.L.S.

Read 8th January, 1904.

THIS well-known and very conspicuous mollusc, whose headquarters have been reported as tropical West African,¹ but which nevertheless seems to have a wide distribution over a great portion of the extensive Indo-Pacific province, having been reported from Ceylon, Andaman Islands (Booley), Mauritius (Barelay), Mergui Archipelago (Anderson), and the Philippines, may, in its typical form, be described as a broad, massive shell, a fine example measuring a good $3\frac{1}{2}$ inches to even $3\frac{1}{2}$ longitudinally by $1\frac{1}{2}$ inches in breadth, the normal coloration being a livid mottled grey, the broad basal fasciole ochreous, much spotted or suffused with cinereous. When the outer cuticle is removed, the mottled surface shows much more clearly, the colour then being a fine chocolate or sepia. The white spaces are seen to be mostly narrow, long, often triangular or cuneiform, or shaped like the letter L.



The spire and the whole of the columellar region exhibit an unusual amount of callosity. On the one hand, its nearest approaches, through its most cylindrical variety, are the closely allied *O. nebulosa*, Lamk., a species so identical in colour and marking as to suggest a common ancestor, and *O. intricata*, Murrat, by many considered only a variety of *nebulosa*, Lamk., though to my mind it seems peculiar in its marking. On the other side, the still more massive *Olivancillaria Brasiliiana*, Lamk., from the New World, is nearly allied, but the sutural canaliculations in *gibbosa* form an undoubted line of demarcation here.

¹ Probably on insufficient grounds. Specimens so labelled in the Cumingian Collection may not be correct.

The following is the synonymy:—

Voluta gibbosa, Born, Test. Mus. Cæs., p. 215.

Oliva cingulata; Chemnitz, x, pp. 1369–70.

Voluta utriculus, Gmelin, Syst. Nat., p. 3441.

Oliva utriculus (Gmel.), Lamk., Ann. du Mus., xvi, p. 323.

Oliva gibbosa (Born), Reeve, Conch. Icon., *Oliva*, pl. viii, figs. 12a–b.

Anazola gibbosa, Gray, List of Mollusca Brit. Mus., 1865.

Utriculina utriculus (Gmel.), Gray.

Placed by some authors in the genus *Olivancillaria*, by others it is considered an *Agaronia*.

Three distinct varieties, in colour and marking, occur, which may be characterized thus:—

(a) *Flavescens*.—Shell of a pale stramineous or yellow hue, sometimes suffused with orange or fulvous, the mottled markings as in the type.

(b) *Fulgurans*.—Markings in zigzag longitudinal lines, the spaces between clear and plain. I have never noticed this variation in the typical livid-grey form. I fancy it may be restricted in its habitat to the Philippines and other Eastern islands. It is figured in Reeve (i.e., fig. 12b) as collected by the late Mr. Hugh Cuming. To the type it bears much the same relationship as *O. intricata* does to *O. nebulosa*, Lamk.

(c) *Candicans*.—Mr. J. M. Williams, of Liverpool, whose collection of the genus is probably the finest extant, possesses a pure albino example, typical in form. It was procured in France, and, so far, is unique.

In addition to these, an extraordinary monstrosity of the typical shell exists, in which the basal fasciole is reproduced across the centre of the body-whorl, the result being very striking. About fourteen years ago, in November, 1889, I exhibited the specimen from my collection, now shown, at a meeting of the Manchester Literary and Philosophical Society, and then proposed for it the name var. monstr. *mediocincta*. Since then I have seen two other examples of the same abnormality, but where I cannot now recollect, and Mr. G. B. Sowerby has kindly allowed me to inspect a very large and fine example, with the additional fasciole particularly well developed. The example I have was formerly in the collection of Mr. John Dennison, of Liverpool. It formed one of "20 Olivas, various," sold at Stevens' Auction Rooms on April 24th, 1865, being lot 23 in the sale. Mr. F. P. Marrat, author of the monograph "*Oliva*" in Sowerby's Thes. Conch., catalogued this collection, and it is curious he did not specially mention such a wonderful anomaly as is presented by this specimen.

Claneophila gibbosa, Gray (Proc. Zool. Soc., 1858, p. 48) = *Oliva claneophila*, Duclos, Mon., t. xxix, fig. 89, must not be confounded with the present shell under discussion, being a variety, in all probability, of *O. auricularia*, Reeve, now included in *Olivancillaria*.

ON THE SPECIFIC IDENTITY OF *VIVIPARA DILUVIANA*, KUNTH,
AND *VIVIPARA CLACTONENSIS*, S. V. WOOD.

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

Read 8th January, 1904.

IN 1878 the late Mr. S. V. Wood provisionally described and figured two shells from the Pleistocene of Clacton, Essex, as *Paludina Clactonensis*,¹ but he pointed out that a shell from the Pleistocene of Templehof, near Berlin, *P. diluviana*, Kunth,² greatly resembled the Clacton examples, and might prove to be identical. It may be noted that the Clacton shells, which were found by the Rev. O. Fisher, had previously been recorded as *Paludina lenta*.³

The late Professor C. L. F. Sandberger, however, considered that the two forms were distinct, and that the nearest allies to the Clacton shell were *P. Lenzi*, *Moisisovicsi*, and *Brusinai*, Neumayr, from the Congeria beds of Slavonia.⁴

A third example was found at Clacton by Mr. A. Bell, and when in 1897 we revised the Clacton records, these were the only examples we could trace.⁵ Since then the Rev. J. W. Kenworthy presented to the Essex Field Club a series of non-marine mollusca from Clacton, which had been obtained by himself some years previously. This collection contained a fine series of *Vivipara Clactonensis*, which was noted by Mr. W. M. Webb in 1902,⁶ whilst in 1901 we recorded the occurrence of this form in the Pleistocene gravel at Swanscomb, Kent.⁷ Last year a series of Pleistocene mollusca was sent to one of us by Dr. E. W. Wüst, of Halle, and on comparing the examples of *V. diluviana* from several German localities with the Clacton and Swanscomb shells, it was at once seen that they were identical, in which opinion we have the support of Dr. Wüst, and since *diluviana*, Kunth, has priority by many years, *Clactonensis* must be considered a synonym for that form. *V. diluviana* is apparently not a widely distributed form on the Continent, but it is known from Templehof bei Berlin, Baumgartenbrüch bei Potsdam, Latdorf bei Magdeburg, Sperenberg, and several localities near Halle. In size the Swanscomb

¹ S. V. Wood, "Crag Mollusca," 2nd supplement, 1878, p. 69, and tab. i, figs. 4a, b.

² Zeitschrift Deutsch. Geol. Gesellschaft, Berlin, 1865, tab. vii, fig. 8.

³ S. V. Wood, jun.: Geol. Mag. 1866, p. 350.

⁴ Palæontographica, Bd. xxvii, p. 98.

⁵ A. S. Kennard & B. B. Woodward, "The Post-Pliocene Non-Marine Mollusca of Essex": Essex Nat., vol. x, pp. 97-100.

⁶ W. M. Webb, "Pleistocene Non-Marine Mollusca from Clacton-on-Sea": Essex Nat., vol. vi, pp. 225-227.

⁷ A. S. Kennard & B. B. Woodward, "The Post-Pliocene Non-Marine Mollusca of the South of England": Proc. Geol. Assoc., 1901, vol. xvii, pp. 238-9.

examples are the largest we have seen, specimens from this locality attaining 27 mm. in altitude, with a maximum breadth of 19·5, the largest Clacton specimen noted being 25 by 19 mm. Up to the present this shell is only known in this country from Clacton and Swanscomb, and additional evidence is thus afforded of the importance of the old Thames-Rhine river system in the distribution of fresh-water mollusca.

DESCRIPTIONS OF NEW SPECIES OF *ENA*, *PSEUDOGLESSULA*,
AND *SUBULINA* FROM BRITISH AND GERMAN EAST AFRICA.

By EDGAR A. SMITH, I.S.O.

Read 8th January, 1904.

ENA (*CERASTUS*) *LAGARIENSIS*, sp.n. Fig. I.

Testa ovata, supra acuminata, solidiuscula, anguste umbilicata, cornea vel fuscescens; spira conica, ad apicem subobtusa; anfractus 7, superiores $2\frac{1}{2}$ convexi, fere læves, cæteri minus convexi, lineis incrementi costuliformibus obliquis instructi, inter costulas minute spiraliter striati, sutura subobliqua sejuncti, ultimus antice oblique descendens, costulis minus validis et striis transversis minute subgranosis; apertura inverse auriformis, intus fuscescens; peristoma incrassatum, albidum, rotunde reflexum, margine columellari ad insertionem leviter expanso.

Long. 26·5, lat. 14 mm.; apertura cum perist. 11·5 mm. longa, 9 lata.

Hab.—Lagari, British East Africa, 469 miles up the Uganda Railway.

Three specimens of this species were collected at the above locality by Mr. Steuart Betton, who presented them to the British Museum. The species is closely allied to *Buliminus rectirugis* of Martens,¹ but has the aperture shorter in proportion to the total length of the shell, and lacks the curious malleation or wrinkling which is characteristic of that species. The fine spiral striæ are crossed by others in the direction of the line of growth, so that the surface (especially of the body-whorl) has a very finely granose appearance under the lens. This feature is not referred to as existing in *B. rectirugis*, which moreover is described as red-brown.

PSEUDOGLESSULA *PRESTONI*, sp.n. Fig. II.

Testa ovata, supra producta, tenuis, saturate olivaceo-fusca, semipellucida; spira ad apicem obtusa; anfractus 7 oblique confertim tenuiter costulati, mediocriter convexi, ultimus ad peripheriam carina obtusa cinctus, infra carinam magis nitidus, costisque minus validis, antice haud descendens; apertura inverse auriformis, intus cærulescens vel opalescens, longit. totius fere $\frac{2}{3}$ adæquans; labrum tenue, arcuatum; columella tortuosa, antice incrassata, pallida, subtruncata, callo tenuissimo labro juncta.

Long. 28, diam. 13 mm.; apertura 12 mm. longa, 7 lata. Another specimen is 30 mm. long and 13 broad.

Hab.—Ukami, German East Africa, about 100 miles south-west of Zanzibar.

¹ "Weichthiere Ost-Africas," p. 60, pl. iii, fig. 25.

This species is very like *P. Kirki*, Craven, but differs in form and in having one whorl less. The spire in that species is a trifle more slender, the body-whorl smaller, and the columella is so reflexed as to form a narrow umbilical fissure. There is also the difference of colour in the two forms. Named after Mr. H. B. Preston, from whom the specimens were obtained.

PSEUDOGLESSULA GRACILIOR, sp.n. Fig. III.

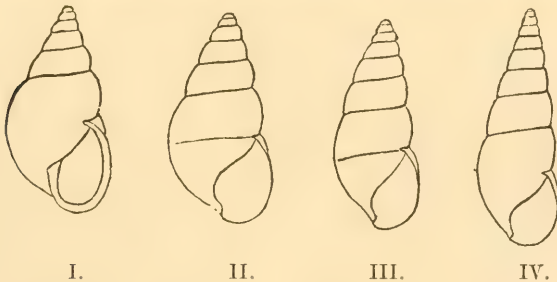
Testa *P. Prestonii* similis, sed angustior, elongata, dilute fuscescens; anfractus 8 convexiusculi, oblique tenuiter costulati; apertura longit. totius $\frac{1}{3}$ paulo superans.

Long. 28, diam. 11.5 mm.; apertura 10 mm. longa, 6 lata.

Var.: testa pallide viridi-olivacea.

Hab.—Same as *P. Prestonii*.

The two forms of *Pseudoglessula* here described, together with *P. Kirki*, Craven, and *P. Leroyi*, Bourguignat, form a little group of species which are all closely related, having the same character of sculpture, form of aperture, and columella, and differing principally



in their general form and tone of coloration. A feature common to all is a faint carination around the middle of the body-whorl, and a more glossy surface below it. *P. gracilior* is the most slender of all the forms, and *P. Prestonii* the broadest. *P. Leroyi* has nine whorls, *P. gracilior* and *P. Kirki* eight, and *P. Prestonii* only seven. With the exception of *P. Kirki*, which is often banded, all the species are of an uniform tint, varying from light brown to a dark olive brown. *P. subcarinifera*, Smith, is a diminutive form belonging to the same group.

SUBULINA LAGARIENSIS, sp.n. Fig. IV.

Testa elongata, subtenuis, sub epidermide tenuissima lutescente albida; spira producta, ad apicem mammillata; anfractus 9 convexiusculi, lineis incrementis tenuibus leviter obliquis sculpti, 3-4 ultimi spiraliter striati, plus minus decussati; apertura inverse auriformis longit. totius $\frac{1}{3}$ haud æquans; labrum tenue, arcuatum; columella subtortuosa, callo tenuissimo induta, antice anguste truncata.

Long. 31, lat. 10 mm.; apertura 9.5 mm. longa, 5 lata.

Hab.—Lagari, British East Africa.

Allied to *S. Mamboiensis*, Smith, but smaller, with shorter and more convex whorls, and sculptured with spiral striæ upon the last three or four whorls, a character which is absent in that species. As in *Mamboiensis*, the periostracum here and there is indistinctly streaked with brown. The lines of growth are rather stronger just below the suture than upon the rest of the surface of the whorls, and have almost a puckered appearance.

MALACOLOGICAL SOCIETY OF LONDON.

INCOME AND EXPENDITURE FOR THE YEAR ENDED 31st DECEMBER, 1903.

| Dr. | £ s. d. | Cr. | £ s. d. |
|---|-----------|------------------------------------|-----------|
| To Balance from last year | 26 5 6 | By Cost of "Proceedings"— | |
| Annual Subscriptions— | | Printing and Postage | £70 11 6 |
| Ordinary Members | £40 19 0 | Illustrations | 16 9 2 |
| Corresponding Members | 21 19 6 | | |
| Annual Subscriptions in arrear— | 62 18 6 | Printing Circulars, etc. | 87 0 8 |
| Ordinary Members | £2 2 0 | Postage | 2 18 0 |
| Corresponding Members | 6 7 6 | Linnean Society— | 1 6 4 |
| Annual Subscriptions in advance— | 8 9 6 | Electric Lighting | £1 1 0 |
| Ordinary Members | £1 1 0 | Gratuities to Attendants | 2 10 0 |
| Corresponding Members | 5 11 6 | | |
| Entrance Fees | 6 12 6 | Lantern Operator | 3 11 0 |
| Sale of "Proceedings" | 2 2 0 | Sundry Expenses— | 5 0 |
| Dividends on £50 Metropolitan 2½% Stock | 13 16 6 | Secretary | £2 6 6 |
| Donations for Illustrations | 1 5 0 | Editor | 10 0 |
| Advertisement Receipts | 6 10 0 | | |
| | 5 0 0 | Balance in hand | 35 2 0 |
| | £132 19 6 | | £132 19 6 |

We have this day examined the accounts of the Treasurer of the Malacological Society of London, and we find the above statement to be correct.

JOHN H. PONSEBY, Hon. Treasurer.
January 22nd, 1904.

Auditors { HENRY WOODWARD.
 { WILFRED BENDALL.

ANNUAL GENERAL MEETING.

FRIDAY, 12TH FEBRUARY, 1904.

E. A. SMITH, I.S.O., President, in the Chair.

Mr. F. G. Bridgman and Mr. Alexander Reynell were appointed scrutineers.

The following report was read:—

“Your Council, in presenting their eleventh Annual Report, are again able to record another year of satisfactory progress.

During the past twelve months seven new members have been elected. On the other hand, the Society has lost ten members: one, Dr. O. F. von Moellendorff, by death, eight by resignation, and one under the provisions of Rule X.

The membership of the Society on December 31st, 1903, stood as follows:—

| | | | | | | |
|-----------------------|-------|-------|-------|-------|-------|-----|
| Ordinary members | ..... | ..... | ..... | ..... | ..... | 88 |
| Corresponding members | ..... | ..... | ..... | ..... | ..... | 77 |
| | | | Total | ..... | ..... | 165 |

On the same date in 1902 the total membership was 168, and in 1901, 171.

Your Council have, with much regret, to report a serious loss to the Society in the retirement of Mr. B. B. Woodward from the editorship, a post which he has held, with marked ability and to the great advantage of the Society, since its foundation.

The finances of the Society are in a flourishing condition. After payment of all liabilities, there is a balance of £35 2s. in the Treasurer's hands, whilst the sum of £50 still remains invested in Metropolitan 2½ per cent. Stock.

Since the last Annual General Meeting three more numbers of the ‘Proceedings’ have been issued, completing Vol. V, comprising pages 257 to 416, title-page, contents, and index, with nine plates and numerous illustrations in the text.

Your thanks are due to the following gentlemen, who have borne a portion of the cost of illustration, or have assisted by furnishing drawings:—Dr. W. T. Blanford, C.I.E., R. H. Burne, G. C. Crick, Sir C. N. E. Eliot, K.C.M.G., Lieut.-Col. H. H. Godwin-Austen, G. K. Gude, J. Cosmo Melvill, R. Murdoch, R. B. Newton, H. B. Preston, E. A. Smith, I.S.O., Messrs. Sowerby & Fulton, E. R. Sykes, and J. H. Van Stone.

Further, your thanks are specially due to the Council of the Linnean Society, through whose kindness the Society has been permitted, as in previous years, to hold its meetings in Burlington House."

On the motion of Mr. S. I. Da Costa, seconded by Mr. F. G. Bridgman, the above was adopted as the Annual Report of the Society.

The following were elected as Officers and Council for the year 1904 :

President.—E. R. Sykes, B.A., F.L.S.

Vice-Presidents.—W. T. Blanford, C.I.E., LL.D., F.R.S. ; Professor W. A. Herdman, F.R.S. ; B. B. Woodward, F.L.S. ; H. Woodward, LL.D., F.R.S.

Treasurer.—J. H. Ponsonby, F.Z.S.

Secretary.—R. H. Burne, B.A., F.Z.S.

Editor.—E. A. Smith, I.S.O.

Other Members of the Council.—Lieut.-Col. H. H. Godwin-Austen, F.R.S. ; Professor G. B. Howes, LL.D., F.R.S. ; J. Cosmo Melvill, M.A., F.L.S. ; R. Bullen Newton, F.G.S. ; Rev. Canon Merle Norman, D.C.L., F.R.S. ; W. G. Ridewood, D.Sc., F.L.S.

On the motion of Dr. W. T. Blanford, seconded by Mr. Bullen Newton, a vote of thanks was passed to the Retiring Officers and Members of Council, and to the Auditors and Scrutineers, the retiring President and Editor being specially thanked for their valuable services.

OBITUARY NOTICE.

It is with much regret that we have to record the death, on August 17th last year, of Dr. OTTO FRANZ VON MOELLENDORFF, who had been a member of this Society since the year 1894. He was born at Hoyerswerda, in Eastern Prussia, in the year 1848.

Moellendorff was a great conchologist, although his studies were practically limited to land and fresh-water mollusca, and during his residence abroad, in the Consular service, he had great opportunities of amassing a magnificent collection, partly through his own collecting, and also by exchanges with numerous other collectors. He first of all investigated the fauna of Bosnia, and published in 1873 the "Beiträge zur Fauna Bosniens," forty-three of the seventy-two pages of which the work consists being devoted to an account of the Mollusca.

In 1873 he obtained an appointment in China, where he remained for about seven years, and was subsequently transferred to a position in the Philippine Islands, which he retained for a long period. It was during his residence in this part of the world that many of his important papers were written.

In 1896, through ill-health, he was compelled to return to Europe, and first of all resided at Kovno, in Western Russia, and subsequently, in 1901, he removed to Frankfort. He was not destined long to

enjoy his new position in that city, for, after a lingering illness, he peacefully passed away during the Summer of last year.

It is as a conchologist we wish to speak of him in this place, but that he was a man of great general culture and high principles may be gathered from a very interesting memoir of him by his intimate friend, Dr. W. Kobelt, published in the *Nachrichtsblatt der deutschen Malakozoologischen Gesellschaft* of November last. To give an idea of the extent of Moellendorff's work, it may be stated that he wrote about 2,000 pages upon conchological subjects, published in about 100 different memoirs and papers. These were printed in various periodicals published in Germany, England, Russia, India, and Australia, and principally treated upon the faunæ of China, Loo Choo, Japan, Korea, Central Asia, the Philippine Islands, Perak, Kelantan, Annam, Tonkin, Siam, Java, Bongao, Sulu Islands, Tenimber, Celebes, Talaut, New Guinea, the Caroline Islands, Bosnia, Serbia, Montenegro, and Russia in Europe. Some of his papers were valuable criticisms upon the works of others, and catalogues of certain groups of land mollusca. He also wrote half a dozen papers in conjunction with Messrs. Quadras, Kobelt, and Rolle. Much of his work is very valuable to the students of land-shells of those eastern countries which he knew so well, but, at the same time, it must be stated how regrettable it is that so many of his descriptions of species were issued without any illustrations.

ORDINARY MEETING.

FRIDAY, 12TH FEBRUARY, 1904.

E. R. SYKES, B.A., President, in the Chair.

The following specimens were exhibited:—

By S. I. Da Costa: *Pleurodonta ænigma*, *Pecten Ruschenbergeri* (a new form from Japan), and some rare *Bulimuli* from Central America, including the type-specimens of *B. corticosus*, *B. Koppeli*, and *B. Dacosta*, a remarkably fine *B. Dombeyanus*, and the very rare *B. tenuilabris*.

By R. Bullen Newton: A collection of Quaternary shells from the Pampean formation of South America, collected by Mr. W. F. Reid. These were mostly marine shells, but are found in conjunction with the remains of large land mammals, such as *Megatherium* and *Glyptodon*.

By H. B. Preston: A group of remarkably fine specimens of *Ætheria tubifera*, Sow., from the upper Belgian Congo.

By F. G. Bridgman: Examples of *Oliva erythrostoma* and its varieties, together with a deformed specimen of the same species.

By R. H. Burne: Instances of extreme individual variation.

ORDINARY MEETING.

FRIDAY, 11TH MARCH, 1904.

E. R. SYKES, B.A., President, in the Chair.

Dr. W. G. Ridewood gave a resumé (illustrated by lantern slides) of recent work upon the gills of Pelecypods. He reviewed briefly the main types of structure found in the gills, and pointed out the great variability noticeable in the more specialised forms. He then dealt somewhat fully with the gill structure of *Euciroa* and *Verticordia*, and finally traced the gradation from the gills of these genera to the aberrant condition in the Septibranchia.

The following communications were read:—

1. "Description of a new species of *Opisthostoma* from Borneo." By E. A. Smith, I.S.O.
2. "New species of Mollusca from New Zealand." By Rev. W. H. Webster, B.A.

The following specimens were exhibited:—

By B. B. Woodward: Original illustrations and photographs of original illustrations of all figured species of *Opisthostoma*, with photographs of five unfigured species.

By Rev. R. Ashington Bullen: A living specimen of *Testacella scutulum* from St. Mary Cray, also eggs and isolated shells.

By E. R. Sykes: Valves of *Anomia striata*, Brocchi, *Macoma calcarea*, Chem., and *Astarte borealis*, Chem., from 70 miles off the Fastnet, and specimens of *Cassidaria rugosa*, Linn., from the west coast of Ireland.

ORDINARY MEETING.

FRIDAY, 8TH APRIL, 1904.

E. A. SMITH, I.S.O., in the Chair.

The following communications were read:—

1. "Descriptions of new species of non-marine shells from Java and a new species of *Corbicula* from New South Wales." By the Rev. R. Ashington Bullen, F.L.S.
2. "The Hawaiian species of *Opeas*." By E. R. Sykes, B.A.
3. "Report on a small collection of Helicoids from British New Guinea, with description of a new species." By G. K. Gude, F.Z.S.
4. "On some non-marine Hawaiian Mollusca." By C. F. Ancy.

The following specimens were exhibited:—

By Rev. R. Ashington Bullen: A carinated variety of *Amphidromus palaceus* from Java. (Pl. VI, Fig. 6.)

By Mr. H. Fulton: Similar specimens of *Amphidromus*, also an interesting series of *Ancilla australis*, the var. *depressa*, and allied species, from New Zealand.

By Rev. R. Ashington Bullen, E. R. Sykes, G. K. Gude, and C. F. Ancy: Specimens in illustration of their papers.

PRESIDENTIAL ADDRESS.

SOME REMARKS ON THE MOLLUSCA OF LAKE TANGANYIKA.

By EDGAR A. SMITH, I.S.O.

Read 12th February, 1904.

THIS interesting subject, the molluscan fauna of Lake Tanganyika, has been much discussed during the last few years, especially by Mr. J. E. S. Moore, and the final results of his investigations are embodied in his work "The Tanganyika Problem." To the uninitiated the study of this fauna is quite a limited matter, involving, according to Mr. Moore, the consideration of only forty-six species of molluscs belonging to twenty-eight different genera.¹

This apparent simplicity rapidly vanishes as soon as a serious investigation is made of the literature which has been published upon this subject. The late M. Bourguignat was the chief cause of all the difficulty, having multiplied both the genera and species in an absurd manner. Speaking of this writer, Mr. Moore² observes, "the characters which were used by this author as sufficient to define species and genera have not generally been held to be valid, even in a conchological sense; they throw no light on the matter in hand, and it is not necessary to discuss them further here." This is a very simple method of dealing with a most difficult subject, but will not be accepted by the systematist. Bad and useless as many of the species and even some of the genera may be, still they have to be considered, and an endeavour must be made to give to them their proper rank as good species as understood by most conchologists, or to relegate them to their true position as varieties or synonyms. To do this is one of the objects of the present paper. M. Bourguignat has described 242 species, and of these only 13 appear in Mr. Moore's list! Surely the remaining 229 are not *all* synonyms. His genera are 21 in number, of which only four are quoted in "The Tanganyika Problem." I quote these facts so as to show the general reader that the study of the molluscs of this lake is not the limited affair he might conjecture from a perusal of Mr. Moore's book. In addition, there are other writers besides M. Bourguignat whose works or names are not even mentioned by Mr. Moore. MM. Ancey, Giraud, Grandidier, Mabille, Martel, and Dautzenberg have described seventeen so-called species between them. Moreover, Professor E. von Martens has published

¹ "The Tanganyika Problem," p. 138.

² *Loc. cit.*, p. 220.

several species of which no cognizance is taken, and the writings of Pelseener and Nicolas also are not referred to.

In the second place I propose to offer a few observations on the supposed resemblance between some of the 'halolimnic' species and the Jurassic fossils with which they have been compared, and in this place I may call attention to the fact that M. Bourguignat had, long before the invention of the compound 'halolimnic,' employed the term 'thalassoid' with reference to these Tanganyika shells. 'Thalassoid' is a very descriptive word, and it is a pity, if its use in connection with these molluscs was known to Mr. Moore, that it was not adopted. It has been used by Professor von Martens and others.

It might be interesting, if not useful, to speculate upon the cause of so many shells from this lake having this marine aspect. Can the quality of the water, as hinted at by Bourguignat (ii, p. 78), have anything to do with it, or, as with a few exceptions all appear to be littoral or shallow-water forms, have these thick shells been developed to withstand the rough usage of the surf during storms? It does not follow, even if these species are the descendants of ancient marine types, that they should have thick shells. Many fresh-water species have excessively strong shells, *Unios* for example, whereas others, which may be found in the same rivers, are very thin. It is the same with many marine genera. Some of the species are strong and thick, whereas others are comparatively thin; but it is generally recognised that species found on the shores between tide-marks and in shallow water have stronger shells than those found in greater depths beyond the reach of the waves' action. If the fact of these Tanganyikan shells being met with near the shore has anything to do with their solidity, we might expect to find the same thing obtain in other large lakes, such as Nyassa and the Victoria Nyanza, but, with the exception of one or two species in the former, such is not the case. There must therefore be some other reason for this thickened thalassoid character, and it may be that they are, as supposed by Mr. Moore, the descendants of some very ancient stock which have retained in an exceptional degree their marine facies. The thalassoid genera comprise those forms which are found only in Tanganyika and have more or less the appearance of being of marine origin, and it is curious that, as far as we know them, they are restricted to the Gastropoda. None of the Pelecypods exhibit other than a fresh-water aspect. The Gastropod genera are about twenty-three in number, exclusive of about ten others which I consider synonyms. Only of nine of these do we know anything of the soft parts, and that almost exclusively from the investigations of Mr. Moore and Miss Digby. It will be interesting to know the conclusions which may be arrived at when these same forms have been investigated by others, as they certainly will be some day. The genera which have been studied are *Tiphobia*, *Bathanalia*, *Chytra*, *Limnotrochus*, *Bythoceras*, *Paramelania*, *Tanganyicia*, *Lavigeria* (= *Nassopsis*), and *Spekia*, and the following still remain to be investigated, namely, *Bridouxia*, *Baizea*, *Syrnolopsis*, *Anceya*, *Giraudia*, *Joubertia*, *Randabelia*, *Leroya* (?), *Edgaria*, *Hirthis*, *Stanleya*, *Rumella*, *Lechaptosia*, and *Burtonilla*. Of these *Randabelia*, *Joubertia*, and

Edgaria will probably prove closely related to *Lavigeria*, and *Leroya* may be merely a solid form of *Lanistes*, as suggested by Dr. von Martens. Most of the remainder are quite small forms, and it will certainly be a very long time before their complete history is known. It therefore becomes mere conjecture to suppose that they bear any relationship with marine forms, either living or extinct, merely because they have a thalassoid appearance. Many fresh-water shells in other parts of the world have this same facies. A good example of this solid marine aspect is met with in the so-called *Melania brevis* of D'Orbigny, from the rivers of Cuba. A feature common to this species and the Tanganyikan thalassoid shells is the feeble development of the periostracum, it being in some apparently entirely absent, whilst in others it is extremely thin or hardly noticeable. In considering the supposed resemblance between some of these Tanganyikan shells and certain Jurassic fossils, I will take the species in the order in which they occur in "The Tanganyika Problem."

1. PARAMELANIA DAMONI and PURPURINA BELLONA.

There certainly is a very strong resemblance in this case, and I must agree with Mr. Moore that the two forms appear to be generically inseparable, but I cannot endorse the opinion which, according to Mr. Moore's work, I am supposed to have expressed, that "even within a specific range, there is no valid conchological distinction" between them. Slight differences in the general form, in sculpture, and the aperture, preclude such a decision. But this species of *Paramelania* has also been considered by Mr. C. A. White and Dr. Leopold Tausch as belonging to the fresh-water genus *Pyrgulifera*, which occurs in the Bear River Laramie beds of Wyoming and Utah, and also in the Upper Chalk at Ajka in Hungary, and I must confess that there is little to distinguish these fossils generically from *Paramelania*. One species, especially *Pyrgulifera Pichleri*, displays all the features of the Tanganyikan shell in a remarkable manner. The general form and character of the sculpture is of the same type in both, and the apertures are quite similar, both having continuous peristomes and a peculiar effusion at the anterior end. It is interesting to again call attention to the similarity of these lacustrine forms, because we should rather expect to find a fossil representative of the Tanganyikan shell in these Cretaceous deposits than in the older Jurassic formations.

2. NASSOPSIS NASSA and PURPURINA INFLATA.

The shell depicted by Moore appears to be the *Lavigeria coronata* of Bourguignat, and it certainly is not the *Melania nassa* of Woodward. I should here mention that the genus *Nassopsis* is a synonym of *Lavigeria*, which has two years' priority.

The genus *Lavigeria* I do not consider the same as *Purpurina*, for it differs in having a tubercular prominence on the columella, which seems to be entirely absent in the fossil form.

If we admit that both *Paramelania* and *Nassopsis* are congeneric with *Purpurina* we are placed in a very awkward position. These

two forms are known to be anatomically distinct, and therefore it becomes certain that they cannot both be the same as *Purpurina*. However, as I have above observed, I consider *Nassopsis* (= *Lavigeria*) distinct.

3. BATHANALIA HOWESI and AMBERLEYA.

These two forms are very similar in general outline, but differ in the former being umbilicated, and having a thin continuous peristome. *Amberleya* is imperforate, and the columellar margin of the peristome is thickened and reflexed. I may mention that Mr. Moore's figures of *Bathanalia* both in the Quarterly Journal of Microscopical Science and in "The Tanganyika Problem" have this margin of the aperture reflexed in an exaggerated manner, so that it does somewhat resemble that of *Amberleya*. I do not propose to assert that the fact of *Bathanalia* being umbilicated distinguishes it generically from *Amberleya*, but merely point it out as a feature which, in conjunction with the other difference referred to, seems to indicate that these ancient and recent forms are not the same. Something more than a mere general resemblance is wanted before we can say that such genera as these are identical. I may add, however, that if we knew that the animals of the shells in question were similar, there would be no attempt to part these forms on conchological grounds, but as we have not this knowledge it seems to me very hazardous to unite them, more especially considering the countless ages which have passed since Jurassic times.

4. LIMNOTROCHUS THOMSONI and LITTORINA SULCATA.

In this case also the Tanganyikan shell is umbilicated and the *Littorina* imperforate, but the columellar margin of the peristome in the *Limnotrochus* is less reflexed and the whorls are spirally ridged, and without the longitudinal plicæ which are found in the *Littorina* referred to. Here, again, the shells do not offer any very striking differences, but still I should hesitate to unite them, as they do not absolutely agree in all respects.

5. CHYTRA KIRKII and ONUSTUS.

The form of Oolitic *Onustus* with which Mr. Moore compares the Tanganyikan shell is radiately costate, whereas *Chytra* exhibits only spiral ornamentation. The peristome is not continuous, as in the latter form, nor is the lower margin of it deeply sinuated in the same manner. In one feature *Chytra Kirkii* differs entirely from *Onustus* (or *Xenophora*), namely, in the character of the operculum. In this respect it approaches certain forms of Littorinidæ, e.g. *Pagodus* and *Echinella*.

6. SPEKIA ZONATA and NERIDOMUS.

In this instance, Mr. Moore observes that "the shells of the Tanganyika genus *Spekia* are practically indistinguishable from the fossil remains of the shells of the marine Jurassic genus *Neridomus*." This, in my opinion, is entirely wrong, as the character of the base

of the shell is quite different. I may here mention that the figure given by Mr. Moore of *Spekia* is nothing like that shell, and I can hardly believe that it was taken from it. *Neridomus*, or *Neritodomus* as emended by Fischer, is a globose shell with a convex columellar callus, such as may be observed in some species of Naticidæ and *Neritina*, whereas the most remarkable basal excavation in *Spekia* at once distinguishes that species. In this respect and in general form it bears a strong resemblance to *Lacunopsis Jullieni*, Deshayes, and *L. Harmandi* of Poirier, fresh-water forms from Cambodia, but probably the animals are very different; at all events, they do not agree in respect either of the radula or opercula.

7. MELANIA ADMIRABILIS and CERITHIUM SUBSCALARIFORME.

In respect of these forms Mr. Moore writes:—"There is among the Gastropods of the halolimnic group a very remarkable and characteristic shell which Smith named *Melania admirabilis*. It is a Cerithoid form totally unlike any other living type which is known, but it has been found by comparison that it is practically indistinguishable from the Inferior Oolitic fossil known as *Cerithium subscalariforme*." I certainly cannot agree in the above opinion, and I have no hesitation in saying that, in this instance, the supposed resemblance is purely imaginary. The *Melania admirabilis* possesses all the characters of that genus, and is not unlike in style of sculpture certain other species, for example, *Melania cancellata*, Benson, *M. Henriette*, Gray, *M. Gredleri*, Bttgr., and others. Longitudinal costæ upon the whorls with spirals around the base of the body-whorl are features which occur in a considerable number of species. The aperture is exactly that of *Melania*, and bears no resemblance to that of *Cerithium*, which has a distinct anterior or basal canal, entirely wanting in true *Melania*s. All the specimens hitherto found of this species have been dead shells and devoid of epidermis. In this condition they have a less fluviatile appearance, and, being solid, they might at a first glance be mistaken for a marine form. However, the exact agreement with *Melania*, in every respect, leaves no doubt as to their true location. In regard to solidity and marine aspect I would again call attention to *Melania brevis*, D'Orbigny, from the rivers of Cuba, also to many species of fresh-water *Neritina*, the *Lithoglyphi* of the Danube, *Pachydrobia*, *Lacunopsis*, and *Jullienia* from Cambodia, *Melanopsis* from Syria, and the remarkable genus *Miratesta* from Celebes. All of these have quite as thalassoid an appearance as many of the Tanganyikan species.

8. TIPHOBIA and PURPUROIDEA.

This is the final comparison which Mr. Moore suggests with regard to these Tanganyikan shells, and, I must confess, it is a very unfortunate one. He observes, "*Tiphobia* of Tanganyika is matched by an Oolitic fossil genus, *Purpuroidea*, from which it is very difficult, if not impossible, on conchological grounds, to distinguish it." As a conchologist of some experience, I fail to perceive the great resemblance between these forms, and we might just as well compare

Tiphobia with some of the recent *Purpuras*. Besides being quite of thin texture, the Tanganyikan shell has a peculiarly prolonged rostrum, which is hollowed out or grooved on the inner side; moreover, the spines at the angle of the whorls are hollow and delicate, whereas in *Purpuroidea* the nodules in the same position are shorter and solid. The anterior canal in the latter genus is somewhat like that of *Purpura*, being shallow, broad, and short; in fact, I may say it bears no resemblance to the grooved rostrum of *Tiphobia*.

Thus we come to the conclusion of the consideration of these so-called 'halolimnic' forms with reference to their supposed Jurassic prototypes, and with what result? Of the eight genera discussed, one only, in my opinion, can be regarded as satisfactorily agreeing with the fossil form, namely, *Paramelania* with *Purpurina*, but this is the one instance, I have shown, in which the genus in question has a representative in a later period, namely, *Pyrgulifera* of Upper Cretaceous times.

With regard to the rest of the genera, I think it has been clearly demonstrated that, in my opinion, they do not correspond to the Jurassic forms from which they are said to be indistinguishable. In some cases they exhibit a general resemblance of outline, and that is all, but when we come to take into consideration their other characters, especially with regard to the aperture, we find so much difference, that it cannot be said that any one of them is absolutely identical with the Jurassic type.

That these Tanganyikan shells have had a marine ancestry, the same as other fresh-water shells, of course must be recognised, and that they may have retained a more thalassoid facies than others is possible, but that it can be said that they are indistinguishable from certain Jurassic types I cannot admit. Other lakes besides Tanganyika have their special faunas, including forms which are found nowhere else, for example, Lake Baikal and the Caspian and Aral Seas, and in all three we find living together both fresh-water and marine types.

Fresh-water molluscs do not, of course, form a natural class of themselves. The different families have their relationships with various marine groups, and this connection may be more or less intimate. Although they may have had common ancestors in remote ages, yet the divergence of characters existing between them at the present day precludes the possibility of affirming definitely their common origin. All fresh-water molluscs have had their position in the system of classification assigned to them, and in this connection I may refer to a few examples.

The genera *Clea* and *Canidia* appear to be closely allied to the marine *Nassas* and *Buccinums*; the *Melantias*, according to Bouvier, show a near relationship to the *Cerithia*; *Vivipara* should be ranged near the Turbinidæ and Trochidæ, *Ampullaria* is considered to come near the *Viviparas*, *Bithinia* has an affinity with *Littorina*, and *Valvata* with *Bithinia* and the Rissoidæ.

I merely refer to these relationships, in passing, to call attention to the fact that, whether thalassoid in aspect or not, the relationship of fresh-water shells with marine forms is a recognised fact. It is not,

therefore, at all remarkable that these Tanganyikan thalassoid species should in their anatomy exhibit more or less close similarity to marine families. *Tiphobia*, for example, is said to resemble *Xenophora*, *Strombus*, and *Capulus* as regards the radula, whilst, in respect of the nervous system, it approaches both *Melania* (*amarula*) and *Cerithium*. "The whole anatomy of *Chytra* is singularly like that of *Capulus*." *Paramelania* and *Bythoceras* are "regarded as a group of rather primitive Cerithoids," and "*Spekia* would in many ways appear to be very like a primitive *Rissoa*."

This now brings me to the conclusion of the introductory discussion of these most remarkable shells, which, I am well aware, is all too brief and superficial, but still it is the expression of opinion of a professional conchologist which can be compared with the results criticised. I will now give a short resumé of the species which compose the fauna of the lake, but before doing so I would call attention to a remarkable classification of the thalassoid forms published by H. Nicolas in 1899. From the fact that some of the genera had been placed in different families by various writers he resorted to the plan of placing the whole of the twenty-four genera which had been previously described in the single family Tanganyikidæ, which had been proposed by M. Nourry in 1897. The genera, he points out, have relationship with eight marine families, which he enumerates, and finally distributes them into the following ten groups or series, namely—Buccinopsidæ with *Bourguignatia* as the typical form, Nassopsidæ with *Paramelania*, Muricidopsidæ with *Tiphobia*, Trochodopsidæ with *Limnotrochus*, Neritopsidæ with *Spekia*, Rissopsidæ with *Ilorea*, Cancellopsidæ with *Lavigeria*, Naticidopsidæ with *Rumella*, Littorinidopsidæ with *Stanleya*, and Pyramidellopsidæ with *Syrnolopsis*.

The absurdity of this classification at once becomes apparent upon a very slight investigation. Here we find *Bourguignatia*, which is generically the same as *Paramelania*, placed in one section, Buccinopsidæ, whilst *Paramelania* is located in Nassopsidæ. Moreover, it has been shown by Mr. Moore that this genus bears relationship to the *Cerithia*, so that these group names suggested by M. Nicolas are misleading with respect to the affinity of the form in question. The same may be said of all the other sectional names suggested by that author for genera which have been studied anatomically. *Lavigeria* (= *Nassopsis*), for instance, placed in Cancellopsidæ, has no relationship with *Cancellaria*, if that genus is referred to, *Tiphobia* has nothing to do with *Murex*, nor *Spekia* with *Nerita* or *Neritopsis*, *Limnotrochus* is not a *Trochus*, *Syrnolopsis* is not a Pyramidellid, and *Bathanalia* is not allied to the Turbinidæ. Of course, these sectional names were suggested to their author by the general form of the shells, but I must confess I do not see the resemblance in several cases; for instance, *Spekia* does not seem to recall *Nerita*, *Lavigeria* a *Cancellaria*, or *Paramelania* a *Nassa*. Here I may also refer to the classification proposed by Bourguignat (i), which was based on a collection brought from Tanganyika by M. Giraud. Here two new families are proposed, Hautteœuridæ and Giraudidæ, the former to include the genera *Tanganikia* and *Hautteœuria*, and the latter to include *Giraudia* and

Reymondia. Later, in another work (iii), he proposed the families Hylacanthidæ, instead of Tiphobidæ, for *Tiphobia*, and Syrnolopsidæ for *Syrnolopsis*.

The following table shows at a glance the genera of thalassoid forms which appear to me admissible, also the number of species described, and the number retainable. In considering some of the described species as synonyms, I very likely may have acted rashly, but in most cases I feel pretty confident that the decisions arrived at will eventually be maintained, whenever the opportunity occurs of studying the actual Bourguignat Collection at Geneva. For convenience sake the genera are given alphabetically:—

| GENERA ADMITTED. | NUMBER OF SPECIES DESCRIBED. | NUMBER RETAINED. | GENERA ADMITTED. | NUMBER OF SPECIES DESCRIBED. | NUMBER RETAINED. |
|----------------------------|------------------------------|------------------|------------------------------|------------------------------|------------------|
| <i>Anceya</i> , Bourg. | 2 | 2 | <i>Lechaptoisia</i> , Ancey. | 1 | 1 |
| <i>Baizea</i> , Bourg. | 2 | 2 | <i>Leroya</i> , Grandid. | 2 | 1 |
| <i>Bathania</i> , Moore. | 1 | 1 | <i>Limnotrochus</i> , Smith. | 3 | 1 |
| <i>Bridouxia</i> , Bourg. | 4 | 1 | <i>Paramelania</i> , Smith. | 5 | 3 |
| <i>Burtonilla</i> , Smith. | 1 | 1 | <i>Randabelia</i> , Bourg. | 2 | 2 |
| <i>Bythoceras</i> , Moore. | 2 | 2 | <i>Rumella</i> , Bourg. | 7 | 1 |
| <i>Chytra</i> , Moore. | 1 | 1 | <i>Spekia</i> , Bourg. | 7 | 1 |
| <i>Edgaria</i> , Bourg. | 42 | 10 | <i>Stanleya</i> , Bourg. | 3 | 3 |
| <i>Giraudia</i> , Bourg. | 14 | 8 | <i>Syrnolopsis</i> , Smith. | 8 | 2 |
| <i>Hirthis</i> , Ancey. | 2 | 2 | <i>Tanganyicia</i> , Crosse. | 34 | 1 |
| <i>Joubertia</i> , Bourg. | 3 | 3 | <i>Tiphobia</i> , Smith. | 4 | 1 |
| <i>Lavigeria</i> , Bourg. | 8 | 8 | | | |

The examination of the above table shows that 138 so-called species, distributed in twenty-three genera, have been described, but of these only about fifty-eight should, in my opinion, be retained.

Nine genera have been described which appear to be synonyms, namely:—

Bourguignatia, Giraud = *Paramelania*.
Cambieria, Bourg. = *Tanganyicia*.
Coulboisia, Bourg. = *Stanleya*.
Hautteccauria, Bourg. = *Stanleya*.
Horea, Smith (preoc.) = *Lechaptoisia*.

Nassopsidea, Martens = *Edgaria*.
Nassopsis, Smith = *Lavigeria*.
Ponsonbya, Ancey = *Baizea*.
Reymondia, Bourg. = *Giraudia*.

In the following list all the important references are given, and, in order to economise space, some of the works referred to are indicated by numbers which will be found in the bibliography at the end of the paper.

I. THALASSOID FORMS.

CHYTRA KIRKII (Smith).

Limnotrochus Kirkii, Smith: iii, p. 426; ii, p. 286, pl. xxxiii, figs. 18–18*b*; Crosse, p. 128; Bourguignat, ii, pl. x, figs. 1–3; iii, p. 135; Martens, p. 209, pl. vi, fig. 40.

Chytra Kirkii, Moore: i, p. 307, pl. xxiii, fig. 6; ii, pp. 228–234, figs. 11–16, and figs. on p. 350; Digby, Journ. Linn. Soc., 1902, vol. xxviii, p. 434, pls. xxxviii–xl.

Kytra Kirki, Moore: Proc. Zool. Soc., 1901, vol. ii, pp. 461, 465, pl. xxvi, fig. 2.

LIMNOTROCHUS THOMSONI, Smith.

Limnotrochus Thomsoni, Smith: iii, p. 425; ii, p. 285, pl. xxxiii, figs. 17-17*b*; Crosse, p. 127; Bourguignat, i, p. 59; ii, pl. x, figs. 4-7; iii, p. 136; Pelseneer, p. 105; Martens, p. 210; Moore, ii, pp. 233-7, figs. 17-20, and figs. on p. 349; i, pl. xxiii, fig. 5; Digby, Journ. Linn. Soc., 1902, vol. xxviii, p. 437, pls. xxxviii and xl.

With this species I unite *L. Giraudi* and *L. cyclostoma*, Bourguignat (ii, iii).

TIPHOBIA HOREI, Smith.

Tiphobia Horei, Smith: i, p. 348, pl. xxxi, figs. 6-6*b*; ii, p. 293, pl. xxxiv, fig. 28, operculum; Crosse, p. 117, pl. iv, figs. 2-2*b*; Martens, p. 203, pl. vi, fig. 45; Moore, i, pp. 181-204, pls. xi-xiv; ii, pp. 221-8, figs. 2-7; Bourguignat, vii, vol. iii, pp. 141-150.

Hylacantha Horei, Bourguignat: ii, pl. ix, figs. 1-4; iii, p. 128; Ancy, Le Naturaliste, 1886, vol. iii, p. 292.

Hylacantha Bourguignati, Bourguignat: ii, figs. 5-7; iii, p. 132.

Hylacantha longirostris, Bourguignat: ii, figs. 8-10; iii, p. 129; Nicolas, C.R. Assoc. Française, 1898, 2^e partie, p. 515, fig. 3.

Hylacantha Jouberti, Bourguignat: ii, figs. 11-13; iii, p. 131.

The characters pointed out by Bourguignat as distinguishing his so-called species, *H. Bourguignati*, *longirostris*, and *Jouberti*, have no specific value whatever, and merely indicate individual variation.

This is a striking instance of the 'species-making' as perpetrated by the Nouvelle école of French conchologists. Any reasonable person can see at a glance that all four forms are merely variations of one and the same species. With regard to the generic name employed by M. Bourguignat, namely, *Hylacantha* of Ancy, I have already shown¹ that this is not admissible, and that *Tiphobia*, which I originally proposed for this genus, must be retained. It is unfortunate that Mr. Moore persistently writes the name as *Typhobia*, which is a genus of Coleoptera, and has altogether a different derivation.

BATHANALIA HOWESI, Moore.

Bathanalia Howesi, Moore: Proc. Roy. Soc., 1898, vol. lxii, pp. 451-2, fig. 2; i, p. 192, pl. xii, figs. 29-33; op. cit., p. 316, pl. xxiii, fig. 3; ii, pp. 227-8, figs. 8-10; Proc. Malac. Soc., 1898, vol. iii, p. 92, fig. 2 on p. 93; Nicolas, C.R. Assoc. Française, 1898, 2^e partie, p. 525, fig. 8 (1899).

¹ Journ. de Conch., vol. xxxix (1891), p. 21.

BYTHOCERAS IRIDESCENS, Moore.

Bythoceras iridescens, Moore: Proc. Roy. Soc., 1898, vol. lxii, p. 452, fig. 1; Proc. Malac. Soc., 1898, vol. iii, p. 93, fig. 1; ii, pp. 237-244, figs. 21-3; Nicolas, C.R. Assoc. Française, 1898, 2^e partie, p. 525, fig. 9 (1899).

BYTHOCERAS MINOR, Moore. Fig. 1.

Bythoceras minor, Moore: ii, pp. 242-4, fig. 24.

As this species has only been very briefly referred to, I append the following description.

Shell ovate, turreted, imperforate, solid, dirty whitish, but more or less covered with a thin brownish olive periostracum; spire elongate, acuminate, turreted; whorls 9 (exclusive of the minute protoconch, which is broken off), slowly increasing, slopingly gradate below the suture, scarcely curved at the sides, sculptured with oblique costæ (14 or 15 in number on the penultimate whorl), which are crossed by spiral sulci, giving the ribs a granose appearance. The rows of granules are usually five on the upper whorls and thirteen on the last. The uppermost row forms a coronation at the upper part of the whorls, and one or two of the granules just behind the labrum are produced into a short recurved spine. The body-whorl is produced anteriorly and forms a short rostration. The longitudinal ribs become more or less obsolete at the middle of this whorl, so that the spiral ridges upon the lower half are less distinctly granose. Under the lens the entire surface of the shell is seen to be covered with minute striæ of growth. Aperture oblique, ovate; peristome continuous in adult specimens, smooth, glossy, iridescent, expanded, of a dirty olivaceous tint, the outer margin sometimes being faintly grooved within.

Length 30, diameter 15 mm.; aperture 10 mm. long, 6 in width.

This species is smaller and more coarsely sculptured than *B. iridescens*, and has a smaller spine above the aperture. Both the costæ and spiral ridges are much more numerous in that species, and the granules are more bead-like. The characters of the aperture and peristome are practically the same in both forms.

PARAMELANIA.

Paramelania, Smith: ii, p. 558; Bourguignat, i, p. 67; ii, pp. 36, 37, pl. xiv, figs. 17, 18; iii, p. 198; Martens, pp. 206, 209; Moore, ii, pp. 244, 245, figs. 25-27.

Pyrgulifera, White: Nature, xxv, p. 101; Tausch, Sitzungsab. Akad. Wiss. Wien, 1884, vol. xc, p. 56.

Bourguignatia, Giraud: Bull. Soc. mal. France, 1885, vol. ii, p. 193, pl. vii, figs. 5-7; Bourguignat, i, p. 66; ii, p. 29, pl. xii, figs. 1-10; iii, p. 165; Martens, p. 207.

The so-called genus *Bourguignatia* is, in my opinion, synonymous with *Paramelania*.

PARAMELANIA DAMONI (Smith).

Tiphobia (Paramelania) Damoni, Smith: ii, p. 559, fig. 1.

Paramelania Damoni, Bourguignat: ii, pl. xiv, fig. 17; iii, p. 200; Martens, p. 209; Martel & Dautzenberg, p. 177, pl. viii, fig. 22; Moore, ii, pp. 243-5, figs. 25, 27, and fig. on p. 345; i, pl. xxiii, fig. 1.

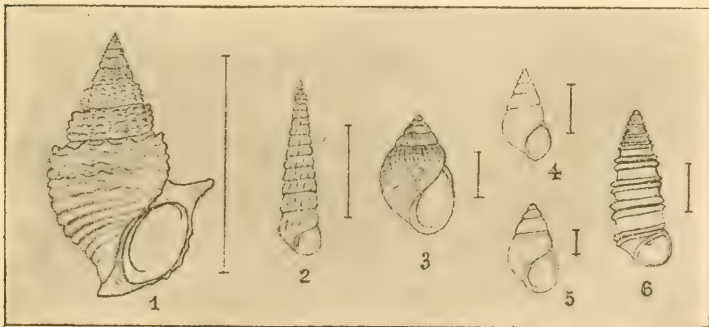
Melania Damoni, Pelseener: p. 108.

Bourguignatia imperialis, Giraud: Bull. Soc. mal. France, 1885, p. 194, pl. vii, figs. 5-7; Bourguignat, i, p. 67; ii, pl. xii, figs. 8-10; iii, p. 169.

Paramelania imperialis, Martel & Dautzenberg: p. 178, pl. viii, figs. 23, 24, vars. *Guillemei* and *Mpalaensis*.

P. (Bourguignatia) imperialis, Martens: p. 207.

Bourguignatia imperialis, the type of the genus, seems to me absolutely synonymous with the present species. In a large series of specimens which I have examined I find all the connecting links between the shells originally described under these two names. There is considerable variation in the size of the specimens, the largest being 39 mm. in length, whereas the smallest, but equally adult example, is only 21. The plicæ vary in number from 10 to 15, and some are much more acutely spined at the angle than others.



PARAMELANIA BRIDOUXI (Bourguignat).

Bourguignatia Bridouxi, Bourguignat: ii, pl. xii, figs. 1-4; iii, p. 166; Nicolas, C.R. Assoc. Française, 1898, 2^e partie, p. 516, fig. 4.

Paramelania (Bourguignatia) Bridouxi, Martens: p. 207.

Var. = *P. Jouberti*, Bourguignat: ii, pl. xii, figs. 5-7; iii, p. 168.

This species does not appear to have been obtained by Mr. Moore. It is remarkable on account of the planulate or even concave upper part of the whorls.

PARAMELANIA CRASSIGRANULATA, Smith.

Tiphobia (Paramelania) crassigranulata, Smith: ii, p. 560, fig. 2.

Paramelania crassigranulata, Bourguignat: ii, pl. xiv, fig. 18; iii, p. 202; Martens, p. 209; Martel & Dautzenberg, p. 180, pl. viii, fig. 25; Moore, ii, p. 245, fig. 26, radula.

This species was originally described from two dead and rather worn shells. The large series of specimens obtained by Mr. Moore shows that it varies considerably, especially in size, the largest example being 32 mm. in length, whereas the smallest is only 19. The latter is quite adult, however, having the thickened, perfected peristome, and the same number of whorls as the larger shell. When describing this species I felt some hesitation in separating it from *P. Damoni*. However, an examination of the large series of both species collected by Mr. Moore shows that they are quite distinct. The distinguishing features originally pointed out are maintained, namely, the narrower excavation or tabulation at the upper part of the volutions, and the more rounded and more coarsely granulated ribs and spiral liræ. The angle of the body-whorl is not spinose as in *P. Damoni*.

JOUBERTIA.

Joubertia, Bourguignat: ii, p. 32, pl. xiii, figs. 5-12; iii, p. 174.

Joubertia, as a subgenus of *Paramelania*, Martens: p. 207.

JOUBERTIA STANLEYANA (Bourguignat).

Paramelania Stanleyana, Bourguignat: i, p. 75.

Joubertia Stanleyana, Bourguignat: ii, pl. xiii, figs. 11, 12; iii, p. 176.

JOUBERTIA BAIZEANA (Bourguignat).

Paramelania Baizeana, Bourguignat: i, p. 74.

Joubertia Baizeana, Bourguignat: ii, pl. xiii, figs. 5-7; iii, p. 174.

JOUBERTIA SPINULOSA (Bourguignat).

Paramelania spinulosa, Bourguignat: i, p. 75.

Joubertia spinulosa, Bourguignat: ii, pl. xiii, figs. 8-10; iii, p. 175.

Paramelania (Joubertia) spinulosa, Martens: p. 207.

LAVIGERIA.

Lavigeria, Bourguignat, ii, p. 33, pl. xiii, figs. 13-17, pl. xiv, figs. 1-7 (1888); iii, p. 178; Martens, p. 207, as a subgenus of *Paramelania*.

Nassopsis, Smith: Ann. & Mag. Nat. Hist., 1890, vol. vi, p. 93; Moore, ii, pp. 250-6, figs. 33-8.

The animal has been described by Moore under the name *Nassopsis*. This genus is separable from *Edyaria* on account of the tubercular prominence on the columella. Its operculum is different from that of *Paramelania*.

LAVIGERIA GRANDIS, Bourguignat.

Tiphobia (Paramelania) nassa, var. *grandis*, Smith: ii, p. 561.

Paramelania grandis, Bourguignat: i, p. 69.

Lavigeria grandis, Bourguignat: ii, pl. xiv, fig. 1; iii, p. 182.

Nassopsis grandis, Martel & Dautzenberg, p. 167.

Nassopsis nassa, Moore: i, pl. xxiii, fig. 2; ii, pp. 250-6, figs. 33-8, and fig. on p. 347.

LAVIGERIA DIADEMATA, Bourguignat.

Lavigeria diademata, Bourguignat: ii, pl. xiii, figs. 15-17; iii, p. 179.

Paramelania (Lavigeria) diademata, Martens: p. 207.

? *Nassopsis grandis*, var. *diademata*, Martel & Dautzenberg: p. 168, pl. viii, fig. 6.

? *Nassopsis grandis*, var. *Jouberti*: iid., p. 169, pl. viii, fig. 7.

LAVIGERIA CORONATA, Bourguignat.

Lavigeria coronata, Bourguignat: ii, pl. xiii, figs. 13, 14; iii, p. 180; Nicolas, C.R. Assoc. Française, 1898, 2^e partie, p. 517, fig. 6 (1899).

Paramelania (Lavigeria) coronata, Martens: p. 207.

Some specimens in the Museum differ slightly from the figure given by Bourguignat in having the upper part of the whorls rather less concave, the aperture a little shorter, and not so acuminate at the upper part of the peristome.

LAVIGERIA CALLISTA, Bourguignat.

Lavigeria callista, Bourguignat: ii, pl. xiv, fig. 2; iii, p. 183.

LAVIGERIA PEREXIMIA, Bourguignat.

Lavigeria pereximia, Bourguignat: ii, pl. xiv, fig. 3; iii, p. 187.

LAVIGERIA JOUBERTI, Bourguignat.

Lavigeria Jouberti, Bourguignat: ii, pl. xiv, fig. 4; iii, p. 185.

Nassopsis grandis, var. *Jouberti*: Martel & Dautzenberg, p. 169, pl. viii, fig. 7.

LAVIGERIA RUELLANIANA, Bourguignat.

Lavigeria Ruellaniana, Bourguignat: ii, pl. xiv, figs. 5, 6; iii, p. 190.

LAVIGERIA COMBSA, Bourguignat.

Lavigeria combsa, Bourguignat: ii, pl. xiv, fig. 7; iii, p. 189.

RANDABELIA.

Randabelia, Bourguignat: ii, p. 31, pl. xiii, figs. 1-4; iii, p. 170; Martens, p. 207, as a subgenus of *Paramelania*.

This genus appears to be very closely related to *Lavigeria*, and it seems possible that the two species of it may be the young state of that genus.

RANDABELIA CATOXIA, Bourguignat.

Randabelia catoxia, Bourguignat: ii, pl. xiii, figs. 1, 2; iii, p. 171.

RANDABELIA HAMYANA, Bourguignat.

Paramelania Hamyana, Bourguignat: i, p. 71.

Randabelia Hamyana, Bourguignat: ii, pl. xiii, figs. 3, 4; iii, p. 173.

Paramelania (Randabelia) Hamyana, Martens: p. 207.

EDGARIA.

Edgaria, Bourguignat: ii, p. 34, pl. xiv, figs. 8-16; iii, p. 192; Martens, p. 208, as a subgenus of *Paramelania*.

Nassopsidia, as a subgenus of *Paramelania*, Martens: l.c., p. 208.

Edgaria may differ from *Lavigeria* in wanting the tubercular prominence on the columella, although in some specimens traces of it are observable. Neither the animal nor the operculum of any of the species are known. I am strongly of opinion that this so-called genus will eventually be united with *Lavigeria*.

EDGARIA PAUCICOSTATA (Bourguignat).

Tiphobia (*Paramelania*) *nassa*, var. *paucicostata*, Smith: ii, p. 561.

Paramelania paucicostata, Bourguignat: i, p. 69.

Edgaria paucicostata, Bourguignat: ii, pl. xiv, figs. 8, 9; iii, p. 193.

Paramelania (*Edgaria*) *paucicostata*, Martens: p. 209.

Paramelania (*Edgaria*) *flexicosta*, Martens: p. 209, pl. vi, fig. 42.

Nassopsis paucicostata, Martel & Dautzenberg: p. 170, pl. viii, figs. 8, 9.

Nassopsis tiarella, Martel & Dautzenberg (*nec* Martens): p. 175, pl. viii, figs. 18, 19.

Edgaria callopleuros littoralis, and *Monceti* of Bourguignat seem to be mere varieties of this species.

EDGARIA TIARELLA (Martens).

Paramelania (*Edgaria*) *tiarella*, Martens: p. 209, pl. vi, fig. 43.

It is allied to *E. paucicostata*, but has fewer spiral liræ.

EDGARIA VARIABILIS (Martel & Dautzenberg).

Nassopsis variabilis, Martel & Dautzenberg: p. 174, pl. viii, figs. 16, 17.

The absence of spiral liræ and the coloration will separate this species from its nearest ally, *E. paucicostata*.

EDGARIA NASSA (Woodward).

Melania (*Melanella*) *nassa*, Woodward: Proc. Zool. Soc., 1859, p. 349, pl. xlvi, fig. 4; Reeve, Conch. Icon., fig. 216; Brot, Conch. Cab., pl. vi, fig. 7; Smith, ii, p. 348; iii, p. 292, pl. xxxiv, figs. 26-26b; Crosse, p. 113; Pelseneer, p. 108.

Tiphobia (*Paramelania*) *nassa*, Smith: ii, p. 561.

Paramelania nassa, Bourguignat: i, p. 76; ii, pl. xvi, figs. 7, 8; iii, p. 227.

Nassopsis nassa, Martel & Dautzenberg: p. 165, pl. viii, figs. 1-5.

Paramelania (*Nassopsis*) *nassa*, Martens: p. 208.

The following species, which are all described and figured by Bourguignat (ii and iii), are, in my opinion, mere variations of this species; they are described under the genus *Paramelania*: *P. arenarum*, *elongata*, *Giraudi*, *Grandidieriana*, *lacrimosa*, *Lessepsiana*, *limnea*, *Livingstoniana*, *Locardiana*, *Mabiliana*, *Milne-edwardsiana*, *nassatella*, *nassatiformis*, *pulchella*, *Randabeli*, *Servainiana*, *Smithi*, *venusta*. *P. Locardiana* is admitted as a species allied to *crassilabris* by

Martel & Dautzenberg, and *P. Milne-edwardsiana* is quoted by Martens as characteristic of his section *Nassopsidia*.

EDGARIA REYMONDI (Bourguignat).

Paramelania Reymondi, Bourguignat: i. p. 72; ii. pl. xv, figs. 20, 21; iii, p. 214.

This, together with the following species, all described by Bourguignat (ii, iii), seems to form another group: *P. bythiniformis*, *Camerontiana*, *Duceyrieriana*, *egregia*, *formosa*, *infralirata*, *Ledouiciana*, *obtusa*, *timida*.

EDGARIA SINGULARIS (Bourguignat).

Paramelania singularis, Bourguignat: ii, pl. xv, figs. 16, 17; iii, p. 211.

EDGARIA BOURGUIGNATI (Bourguignat).

Paramelania Bourguignati, Girard: MSS., Bourguignat, i, p. 73; ii, pl. xv, figs. 18, 19; iii, p. 213.

EDGARIA CRASSILABRIS (Bourguignat).

Paramelania crassilabris, Bourguignat: i, p. 84; ii, pl. xvi, figs. 15, 16; iii, p. 241.

Nassopsis crassilabris, Martel & Dautzenberg: p. 171, pl. viii, figs. 10, 11.

Nassopsis Guillemei, Martel & Dautzenberg: p. 172, pl. viii, figs. 12, 13.

A single specimen received by the Museum from Sir H. H. Johnston agrees very closely with the description of this species. It is, however, larger and the aperture proportionately longer than in the shell figured by Bourguignat.

EDGARIA LECHAPTOISI (Ancy).

Lavigeria (?) *Lechaptosi*, Ancy: Bull. Mus. Marseille, 1898, vol. i, p. 145, pl. ix, fig. 1.

Judging from the figure and description, this figure approximates to *Hirthis globosa*, which may also be a form of *Edgaria*.

HIRTHIA.

Hirthis, Ancy: Bull. Mus. Marseille, 1898, vol. i, p. 142, pl. ix, figs. G, H.

This genus appears to be scarcely separable from *Edgaria*.

HIRTHIA LITTORINA, Ancy.

Hirthis littorina, Ancy: Bull. Mus. Marseille, 1898, vol. i, p. 142, pl. ix, fig. G.

HIRTHIA GLOBOSA, Ancy.

Hirthis globosa, Ancy: Bull. Mus. Marseille, 1898, vol. i, p. 144, pl. ix, fig. H.

SPEKIA.

Spekia, Bourguignat: Descript. Moll. Égypte, etc., 1879, p. 27; i, p. 35; ii, p. 15, pl. iv, figs. 20-27; pl. v, figs. 1-15; iii, p. 60; Martens, p. 205; Moore, ii, pp. 256-264, figs. 39-43.

SPEKIA ZONATA (Woodward).

Lithoglyphus zonatus, Woodward: Proc. Zool. Soc., 1859, p. 349, pl. xlvii, figs. 3-3c; Smith, i, p. 350; ii, p. 287.

Lacunopsis (Spekia) zonata, Crosse: p. 122, pl. iv, fig. 4.

Lacunopsis zonata, Pelseneer: p. 106.

Spekia zonata, Bourguignat: Descrip. Moll. Égypte, etc., 1879, p. 28; i, p. 37; ii, pl. iv, figs. 20-24; iii, p. 63; Martens, p. 205, pl. vi, fig. 41; Moore, ii, pp. 256-264, figs. 39-43, and figs. on p. 351; i, pl. xxiii, fig. 4.

The following so-called species have been described which I think may be united with *S. zonata*, namely, *S. Cameroni*, *Duveyrieriana*, *Giraudi*, *Grandidieriana*, *Hamyana*, *Reymondi* (Bourguignat, ii, iii). I am inclined to think that there is only one species of this genus, varying in the height of the spire and the extent of the basal concavity.

TANGANYICIA.

Tanganyicia, Crosse: p. 123; Martens, p. 204; Moore, ii, pp. 246-253, figs. 28-32.

Tanganikia, Bourguignat: i, p. 41; ii, p. 16, pl. v, figs. 16-21; iii, p. 80.

Five species described by Bourguignat under this genus may be the young of *T. rufofilosa* (Smith), and all the twenty-four so-called species of *Hauttecauria* are probably only variations of the same species. The four species of his genus *Cambieria* also are apparently young stages of this variable shell (see Bourguignat, ii, iii).

The names are as follows, arranged alphabetically:—(1) *Tanganikia Pagotiana*, *Giraudi*, *Maunoiriana*, *opalina*, *ovidea*; (2) *Hauttecauria Bridouxiana*, *Brincatiana*, *Burtoni*, *Cambieri*, *Cameroni*, *Charmetanti*, *Duveyrieriana*, *eximia*, *Giraudi*, *Hamyana*, *Jouberti*, *Lavigeriana*, *Levesquiana*, *Locardiana*, *macrostoma*, *Maunoiriana*, *Milne-edwardsiana*, *minuta*, *Moineti*, *pusilla*, *Reymondi*, *Servainiana*, *singularis*, *soluta*; (3) *Cambieria Jouberti*, *Maunoiriana*, *ovidea*, and *rufofilosa*. (Bourguignat, ii, iii.)

This appears to be an appalling lumping of various forms, but I must confess, without having the actual shells described for examination, it seems impossible to do otherwise.

TANGANYICIA RUFOFILOSA (Smith).

Lithoglyphus rufofilosus, Smith: ii, p. 288, pl. xxxiii, figs. 20, 20a; Moore, Proc. Roy. Soc., 1898, vol. lxii, p. 457, fig. 3.

Tanganyicia rufofilosa, Crosse: p. 125, pl. iv, figs. 5-5b; Martens, p. 204; Moore, ii, pp. 246-250, figs. 28-32.

Cambieria rufofilosa, Bourguignat: ii, pl. vi, figs. 8-10; iii, p. 86.

RUMELLA.

Rumella, Bourguignat: i, p. 89; ii, p. 40, pl. xvii, figs. 20-37; iii, p. 250; Martens, p. 214, pl. vi, fig. 47.

I do not at present see any sufficient reasons for specifically separating any of the forms described by M. Bourguignat. *R. neritinoïdes* (Smith), therefore, will stand as the sole representative of this genus. The other names are *R. callifera*, *Giraudi*, *globosa*, *Jouberti*, *Lavigeriana*, *Milne-edwardsiana*. (Bourguignat, ii, iii.)

RUMELLA NERITINOIDES (Smith).

Lithoglyphus neritinoïdes, Smith: iii, p. 426; ii, p. 287, pl. xxxiii, fig. 19.

Lithoglyphus neritoides (sic), Pelseneer: p. 106.

Tanganyicia (?) *neritinoïdes*, Crosse: p. 126.

Stanleya neritoides (sic), Bourguignat: i, p. 87.

Stanleya neritinoïdes, Martens: p. 214.

STANLEYA.

Stanleya, Bourguignat: i, p. 86; ii, p. 40, pl. xvii, figs. 13-15; iii, p. 246; Martens, p. 214.

Coulboisia, Bourguignat: ii, p. 40, pl. xvii, figs. 16-19; iii, p. 247; Martens, p. 214.

STANLEYA ROTUNDATA, n.sp.

Stanleya neritoides, Bourguignat (nec *neritinoïdes*, Smith): ii, p. 39, pl. xvii, figs. 13-15; iii, p. 246.

A series of curious mistakes has occurred in connection with this species and the genus *Stanleya*. When founding that genus M. Bourguignat¹ gave as his type the *Lithoglyphus neritinoïdes* of Smith, associating with it at the same time two other species for which he subsequently founded his genus *Coulboisia*. But the shell which he regarded as the *Lithoglyphus neritinoïdes* was perfectly distinct from that species, which, however, practically constitutes the genus *Rumella*. Under these circumstances it becomes necessary to rename the shell mistaken by Bourguignat for *neritinoïdes*, and to apply the generic name *Rumella* to the true *neritinoïdes*. Later M. Bourguignat thought it necessary to separate his *Stanleya Giraudi* and *S. Smithiana* from his *S. neritoides* (sic), and to found for them the genus *Coulboisia*. This, however, in my opinion, was unnecessary, for, with the exception of some slight difference in form, they are all practically of the same general character.

The genus *Stanleya* appears to be closely related to *Rumella*, but has the spiral lines *engraved* in the shell, whereas in *Rumella* they are *superficial*. Also the columella callosity is less strongly developed. I have never seen any examples of this genus.

¹ "Moll. région mérid. Tanganika," 1885, p. 86.

STANLEYI GIRAUDI, Bourguignat.

Stanleya Giraudi, Bourguignat: i, p. 88.

Coulboisia Giraudi, id.: ii, pl. xvii, figs. 16, 17; iii, p. 247.

STANLEYA SMITHIANA, Bourguignat.

Stanleya Smithiana, Bourguignat: i, p. 88.

Coulboisia Smithiana, id.: ii, pl. xvii, figs. 18, 19; iii, p. 248.

LECHAPTOISIA.

Horea, Smith (*nee* Bourguignat): III, 1889, vol. ii, p. 175; Martens, p. 211.

Lechaptosia, Ancy: Bull. Soc. zool. France, 1894, vol. xix, p. 29.

M. Bourguignat employed the name *Horea* for the *Melania Tanganyicensis* of Smith a year before it was applied by myself to the species of the present genus. M. Ancy was therefore justified in proposing a fresh name for this group. Apparently closely related to *Stanleya*.

LECHAPTOISIA PONSONBYI (Smith). Fig. 3.

Rissoa (Horea) Ponsonbyi, Smith: III, 1889, vol. iv, p. 175.

Lechaptosia Ponsonbyi, Ancy: Bull. Soc. zool. France, 1894, vol. xix, p. 29.

Horea Ponsonbyi, Martens: p. 211.

BRIDOUXIA.

Bridouxia, Bourguignat: i, p. 29; ii, p. 14, pl. iv, figs. 5-16; iii, p. 53; Martens, p. 205.

This genus is unknown to me except from the description and figures. The four so-called species apparently are mere variations of one and the same form. The names are *B. costata*, *Giraudi*, *Reymondi*, *Villeserriana*. (Bourguignat, ii, iii.)

BAIZEA.

Baizea, Bourguignat: i, p. 33; ii, p. 14, pl. iv, figs. 17-19; iii, p. 58.

Ponsonbya, Ancy: Bull. Soc. mal. France, 1890, vol. vii, p. 346; Martens, p. 296.

Described by Bourguignat as belonging to the Paludinidæ. A solid, smooth, glossy shell, closely resembling in general aspect some of the Naticoid *Lithoglyphi* of South Europe, but differing in the character of the umbilicus, which is neither a perforation nor a slit, but, in miniature, is rather similar to the basal excavation of the genus *Spekia*. Beyond the fact that *Ponsonbya* of Ancy, of which only a single species is known, is upright in growth instead of slightly oblique, it does not differ in any respect from *Baizea*.

BAIZEA GIRAUDI, Bourguignat.

Baizea Giraudi, Bourguignat: i, p. 34; ii, pl. iv, figs. 17-19; iii, p. 60; Ancy, Bull. Soc. zool. France, 1894, vol. xix, p. 28.

BAIZEA LEUCORAPHE (Ancy).

Ponsonbya leucoraphe, Ancy: Bull. Soc. mal. France, 1890, vol. vii, p. 347; Martens, p. 296.

This species closely resembles *B. Giraudi*, but is not oblique in growth, and consequently the aperture is more upright.

GIRAUDIA.

Giraudia, Bourguignat: i, p. 61; ii, p. 28, pl. xi, figs. 16-24; iii, p. 148; Martens, p. 206.

Reymondia, Bourguignat: i, p. 64; ii, p. 28, pl. xi, figs. 1-15; iii, p. 152; Martens, p. 206.

At present I fail to perceive any characters which are sufficient to separate *Reymondia* from *Giraudia*. As the word *Reymondia*, which is very similar to *Reymondia*, had previously been employed in insects, it will be convenient to apply the name *Giraudia* to these shells. Messrs. Martel & Dautzenberg have also united these two genera.

GIRAUDIA PRÆCLARA, Bourguignat.

Giraudia præclara, Bourguignat: i, p. 62; ii, pl. xi, figs. 16-18; iii, p. 149.

Reymondia præclara, Martel & Dautzenberg: p. 176.

GIRAUDIA GRANDIDIERIANA, Bourguignat.

Giraudia Grandidieriana, Bourguignat: i, p. 63; ii, pl. xi, figs. 19-21; iii, p. 150.

This species appears to differ very slightly from *G. præclara*; indeed, it seems doubtful also whether *G. Lavigeriana* is anything more than a small slender variety.

GIRAUDIA LAVIGERIANA, Bourguignat.

Giraudia Lavigeriana, Bourguignat: ii, pl. xi, figs. 22-24; iii, p. 151.

GIRAUDIA QUINTANA (Mabille).

Assimineca quintana, Mabille: Bull. Soc. Philom. Paris, 1901, vol. iii, p. 56.

This and the following species apparently belong to the genus *Giraudia*, and may even be synonymous with some of the species described previously.

GIRAUDIA FOAI (Mabille).

Assimineca Foai, Mabille: Bull. Soc. Philom. Paris, 1901, vol. iii, p. 56.

GIRAUDIA HOREI (Smith).

Melania (—?) *Horei*, Smith: iii, p. 427; ii, p. 292; pl. xxxiv, fig. 27; Crosse, p. 115; Pelseneer, p. 108.

Reymondia Horei, Bourguignat: i, p. 65; ii, pl. xi, figs. 1, 2; iii, p. 153; Martel & Dautzenberg, p. 175, pl. viii, figs. 20-1; Martens, p. 206.

With this species Martel & Dautzenberg have united *R. Giraudi*, *R. Jouberti*, *R. Monceti*, *R. pyramidalis*, and *R. Bridouxiana*, all of Bourguignat (ii, iii), and this decision is probably correct, but without seeing actual examples of each form it is difficult to give a decided opinion. I have, however, a strong belief that their decision will prove well-founded. *R. Foui* is probably another variety (Mabille, Bull. Soc. Philom. Paris, 1901, vol. iii, p. 57).

GIRAUDIA MINOR (Smith). Fig. 4.

Reymondia minor, Smith : III, 1889, vol. iv, p. 174.

Giraudia minor, Ancy : Bull. Soc. zool. France, 1894, vol. xix, p. 28.

GIRAUDIA TANGANYICENSIS (Smith). Fig. 5.

Reymondia Tanganyicensis, Smith : III, 1889, vol. iv, p. 175.

Giraudia Tanganyikana, Ancy : Bull. Soc. zool. France, 1894, vol. xix, p. 28.

LEROYA.

Leroya, Grandidier : Bull. Soc. malac. France, 1887, vol. iv, p. 191.

Leroya, Bourguignat : ii, p. 17, pl. vi, figs. 2-5 ; iii, p. 78 ; Moll. Afrique Équator., 1889, p. 180.

Leroya, as a group of *Lanistes*, Martens : p. 170.

This genus may be synonymous with *Lanistes*, but the two species described, *L. Bourguignati* and *L. Charmetanti*, are more solid than other species of that genus, but the opercula are similar. Both forms are considered by Martens merely varieties of *Lanistes Farleri* of Craven, but of this location I do not feel certain. The greater solidity of their shells and the different character of their peristome seem to distinguish them.

LEROYA BOURGUIGNATI, Grandidier.

Leroya Bourguignati, Grandidier : Bull. Soc. malac. France, 1887, vol. iv, p. 192.

Leroya Bourguignati, Bourguignat : ii, pl. vi, figs. 2-5 ; iii, p. 79 ; Moll. Afrique Équator., 1889, p. 180.

Lanistes Farleri, Craven, var. : Martens, p. 172, pl. vi, fig. 34.

Leroya Charmetanti, Grandidier : l.c., p. 93 ; Bourguignat, Moll. Afrique Équator., 1889, p. 150, pl. vii, figs. 21, 22.

SYRNOLOPSIS.

Syrnolopsis, Smith : iii, p. 426 ; Crosse, p. 118 ; Bourguignat, i, p. 16 ; iii, p. 139 ; Martens, p. 210.

Eight species of this genus have been described, but, as far as I can judge from the descriptions and figures, they might be restricted to two, namely, *S. lacustris* and *S. carinifera*.

M. Bourguignat does certainly point out certain differences in form and in the number of liræ within the aperture, but it seems to me possible that these characters may in some measure be due to difference of age. The other names are *Syrnolopsis Ancyana*, *Giraudi*,

Grandidieriana, *Hamyana*, *minuta* (Bourguignat, ii, iii), and *S. Foai* (Mabille, Bull. Soc. Philom. Paris, 1901, vol. iii, p. 56).

Dr. Tausch has considered this genus synonymous with *Fascinella* of the Upper Chalk at Ajka, Hungary, but I do not feel absolutely certain that such is the case. The figure he gives of that genus, copied from Sandberger, appears to show a different kind of columellar fold, and no mention is made of palatal liræ, which appear to be a feature in *Syrnolopsis*.

SYRNOLOPSIS LACUSTRIS, Smith.

Syrnolopsis lacustris, Smith: iii, p. 426; ii, p. 288, pl. xxxiii, figs. 21-21*b*; Crosse, p. 119, pl. iv, fig. 6; Bourguignat, ii, pl. x, figs. 14-17; iii, p. 142; Pelseneer, p. 107; Martens, p. 210, pl. vi, fig. 46.

Fascinella lacustris, Tausch: Sitzungsber. Akad. Wiss. Wien., 1884, vol. xc, p. 68, pl. i, fig. 11.

SYRNOLOPSIS CARINIFERA, Smith. Fig. 6.

Syrnolopsis carinifera, Smith: III, 1889, vol. iv, p. 174.

ANCEYA.

Anceya, Bourguignat: i, p. 14; Moll. Afrique Équator., 1889, p. 118; Martens, p. 211.

This genus appears to differ from *Syrnolopsis* only in being longitudinally costate.

ANCEYA GIRAUDI, Bourguignat.

Anceya Giraudi, Bourguignat: i, p. 15; Moll. Afrique Équator., 1889, p. 118, pl. vii, figs. 12, 13.

Syrnolopsis (Anceya) Giraudi, var., Smith: III, 1890, vol. vi, p. 94.

ANCEYA ADMIRABILIS, Bourguignat.

Anceya admirabilis, Bourguignat: Moll. Afrique Équator., 1889, p. 119, pl. vii, figs. 10, 11.

BURTONILLA, n.gen. Fig. 2.

Turbonilla (?) terebriformis, Smith: iii, vol. vi, p. 95; Martens, p. 212.

When describing this species I deemed it advisable to place it provisionally in a known genus. Since then our knowledge of the Tanganyikan fauna has been greatly increased, and we now find that none of the forms with a thalassoid facies fall into any of the known marine genera. Such being the case, it seems to me advisable to create a new genus for the reception of this curious and interesting shell. It may be thus characterized:—Shell elongate, slender, imperforate; whorls numerous, longitudinally costate, glossy, apparently without a periostracum; aperture entire, not channelled in front; columella reflexed anteriorly, above obsolete uniplicate; labrum probably thin.

II. NON-THALASSOID SPECIES.

The second part of this paper deals with the rest of the fauna, consisting of the ordinary fresh-water forms. The total number of described species amounts to about 152, but many of these are evidently very slight variations. They are distributed thus among the following genera:—

| | | | SPECIES. | | | | SPECIES. |
|-------------------|-----|-----|----------|---------------------|-----|-----|----------|
| <i>Limnæa</i> | ... | ... | 7 | <i>Corbicula</i> | ... | ... | 3 |
| <i>Planorbis</i> | ... | ... | 7 | <i>Pisidium</i> | ... | ... | 2 |
| <i>Isidora</i> | ... | ... | 2 | <i>Unio</i> | ... | ... | 19 |
| <i>Physopsis</i> | ... | ... | 1 | <i>Grandidictya</i> | ... | ... | 24 |
| <i>Neothauma</i> | ... | ... | 8 | <i>Brazzæa</i> | ... | ... | 13 |
| <i>Vivipara</i> | ... | ... | 2 | <i>Monetia</i> | ... | ... | 6 |
| <i>Cleopatra</i> | ... | ... | 2 | <i>Mutela</i> | ... | ... | 8 |
| <i>Bythinia</i> | ... | ... | 1 | <i>Burtonia</i> | ... | ... | 13 |
| <i>Ampullaria</i> | ... | ... | 2 | <i>Cameronia</i> | ... | ... | 26 |
| <i>Lanistes</i> | ... | ... | 2 | <i>Æthera</i> | ... | ... | 1 |
| <i>Melania</i> | ... | ... | 3 | | | | |

LIMNÆA NATALENSIS, Krauss.

Limnæa Natalensis, Krauss: Südafr. Moll., p. 85, pl. v, fig. 15; Küster, Conch. Cab., pl. vi, figs. 1-3; Martens, Malak. Blätt., 1866, pl. iii, figs. 8, 9; Smith, ii, p. 295.

Six species have been described by M. Bourguignat (ii, iii): *Africana*, *Alexandrina*, *Debaizei*, *Jouberti*, *Laurenti*, and *Lavigeriana*. They are probably all forms of *Natalensis*.

PLANORBIS SUDANICUS, Martens.

Planorbis Sudanicus, Martens: Malak. Blätt., 1870, p. 35; 1874, p. 41; Novit. Conchyl., vol. iv, pl. cxiv, figs. 6-9; Smith, i, p. 349; ii, p. 294; Crosse, p. 109; Bourguignat, ii, pl. i, figs. 13-15; iii, p. 15; Martens, p. 146, var. *major*.

Pl. Tanganikanus, Bourguignat (ii, iii), is probably the same as this species.

PLANORBIS ALEXANDRINA, var.

Segmentina (Planorbula) Alexandrina, Ehrenberg, var. *Tanganyicensis*, Smith: ii, pl. xxxiv, figs. 30-30b; Martens, vol. iv, p. 150. *Planorbula Tanganikana*, Bourguignat; iii, p. 23.

PLANORBIS BRIDOUXIANA, Bourguignat.

Planorbis Bridouxiana, Bourguignat: ii, pl. i, figs. 9-12; iii, p. 20; Martens, p. 149.

PLANORBIS ADOWENSIS, Bourguignat.

Planorbis Adowensis, Bourguignat: ii, pl. i, figs. 1-4; iii, p. 17; Martens, p. 147.

PLANORBIS LAVIGERIANUS, Bourguignat.

Planorbis Lavigerianus, Bourguignat: ii, pl. i, figs. 5-8; iii, p. 19; Martens, p. 148.

PLANORBIS MONCETI, Bourguignat.

Planorbis Monceti, Bourguignat: iii, p. 18.

ISIDORA COULBOISI (Bourguignat).

Physa Coulboisi, Bourguignat: ii, pl. i, figs. 24-5; iii, p. 14.

Isidora Coulboisi, Martens: p. 139.

ISIDORA RANDABELI (Bourguignat).

Physa Randabeli, Bourguignat: ii, pl. i, figs. 26-7; iii, p. 12.

Isidora Randabeli, Martens: p. 140.

PHYSOPSIS TANGANYICÆ, Martens.

Physopsis Tanganyicæ, Martens, p. 144, pl. vi, fig. 12.

NEOTHAUMA.

Neothauma, Smith: i, p. 349; Crosse, p. 111; Grandidier, Bull. Soc. mal. France, vol. ii, p. 162; Bourguignat, i, p. 25; ii, p. 9, pls. ii, iii; iii, p. 24; Martens, p. 202; Moore, Proc. Zool. Soc., 1901, vol. ii, p. 466, pls. xxv, xxvi; ii, p. 264, fig. 46.

Of this genus I can admit only a single species, although M. Bourguignat has split it up into eight. It certainly exhibits very great variation, but I think all the connecting links are observable even in the set of illustrations given in M. Bourguignat's work. There certainly is much less variation shown in this species than in the common whelk, *Buccinum undatum*.

NEOTHAUMA TANGANYICENSE, Smith.

Neothauma Tanganyicense, Smith: i, p. 349, pl. xxxi, figs. 7-7e; ii, p. 293, operculum; iii, 1889, vol. iv, p. 173; Crosse, p. 112; Martens, p. 203; Moore, ii, pp. 264-5, figs. 44-46; Proc. Zool. Soc., 1901, vol. ii, p. 466, pls. xxv, xxvi.

Neothauma Tanganikanum, Grandidier: Bull. Soc. mal. France, 1885, vol. ii, p. 163; Bourguignat, i, p. 26; ii, pl. ii, fig. 1; iii, p. 26.

Pelseneer considered this species a *Paludina*. The other names applied to it are: *bicarinatum*, *eurymphalus*, *Giraudi*, *Jouberti*, *Vysseri*, all of Bourguignat, and *Bridouxiana* and *Servainiana* of Grandidier. (See Bourguignat, ii, iii.)

VIVIPARA BRINCATIANA, Bourguignat.

Vivipara Brincatiana, Bourguignat: ii, pl. iv, fig. 1; iii, p. 41; Martens, p. 183.

V. Bridouxiana, Bourguignat (ii, iii), does not seem to be separable from the present species, which may eventually prove to belong to the genus *Cleopatra*.

CLEOPATRA GUILLEMETI, Bourguignat.

Cleopatra Guillemeti, Bourguignat: ii, pl. iv, fig. 4; iii, p. 46; Martens, p. 186.

CLEOPATRA JOUBERTI, Bourguignat.

Cleopatra Jouberti, Bourguignat: ii, pl. iv, fig. 3; iii, p. 48.

BYTHINIA MULTISULCATA, Bourguignat.

Bythinia multisulcata, Bourguignat: ii, pl. iii, figs. 7, 8; iii, p. 52.

AMPULLARIA OVATA, Olivier.

Ampullaria ovata, Olivier: Philippi in Küster's Conch. Cab., pl. xiv, figs. 5, 6; Reeve, Conch. Icon., vol. x, fig. 64; Smith, i, p. 348; Crosse, p. 110; Bourguignat, Moll. nouv., 1863, p. 79, pl. x, fig. 11; ii, pl. vi, fig. 1; iii, p. 74; Pelseener, p. 104.

A. Kordofana, Parreyss: Philippi, l.c., pl. xiii, fig. 1.

AMPULLARIA BRIDOUXA, Bourguignat.

Ampullaria Bridouxi, Bourguignat: ii, pl. v, fig. 22; iii, p. 72.

LANISTES SINISTRORSUS (Lea).

Meladomus sinistrorsus (Lea), Bourguignat: iii, p. 78.

Lanistes sinistrorsus, Martens: p. 167.

LANISTES JOUBERTI (Bourguignat).

Meladomus Jouberti, Bourguignat: ii, pl. vi, fig. 6; iii, p. 76.

Lanistes Jouberti, Martens: p. 165.

MELANIA ADMIRABILIS, Smith.

Melania (Sermyla) admirabilis, Smith: iii, p. 427; ii, p. 291, pl. xxxiv, fig. 24; Crosse, p. 114; Bourguignat, ii, pl. xi, fig. 25; iii, p. 164; Martens, p. 196; Moore, ii, p. 219, fig. 1, and figs. on p. 353.

MELANIA TUBERCULATA, Müller.

Melania tuberculata, Müller: Smith, ii, p. 291; Bourguignat, ii, pl. xi, figs. 26-7; iii, p. 163; Martens, p. 193.

MELANIA TANGANYICENSIS, Smith.

Melania Tanganyicensis, Smith: iii, p. 427; ii, p. 291, pl. xxxiv, fig. 25; Crosse, p. 115; Martens, p. 197.

Horea Tanganikana, Bourguignat: ii, pl. xi, figs. 28-9; iii, p. 161.

This species constitutes the genus *Horea* of Bourguignat, but I do not see any reason for separating it from *Melania*.

CORBICULA RADIATA (Parreyss).

Cyrena radiata, Parr.: Philippi, Abbild., vol. ii, p. 4, pl. i, fig. 8; Clessin, Conch. Cab. (*Corbicula*), pl. xxviii, figs. 16-18; Smith, ii, p. 295.

Corbicula Tanganikana, Bourguignat: i, p. 104; ii, pl. xviii, figs. 8-10.

C. Foaï, Mabille (Bull. Soc. Philom. Paris, 1901, vol. iii, p. 58), is probably a variety of this species.

UNIO.

Altogether, including the genus *Grandidieria*, which does not seem to be separable from *Unio*, forty-three species of this genus have been named. That many of these are mere synonyms there is very little doubt, but without more material to work with it seems hopeless to attempt to discuss them, many being known by description only. The names are: *U. Niloticus*, Cailliaud; *U. Gerrardi*, Böhm, *rostralis* (= *rostrata*, Bgt.), Martens (pp. 223, 238); *Burtoni*, Woodward; *Tanganyicensis*, Thomson, *Horei*, Smith; *Serrainiana*, Smith, *cyrenopsis*, *granulosa*, *corbicula*, *insignis*, *rhynehonella*, *Bourguignati*, *callista*, *granulosa*, *singularis*, *Anceyi*, *incarnata*, *Giraudi*, *elongata*, *cyrenopsis*, *Locardiana*, *mira*, *rotundata*, *Hautteceuri*, *Ujiensis*, *Charbonnieri*, *Coulboisi*, *Dromauxi*, *Randabeli*, *Visseri*, *Vinckeï*, *Moineti*, *Menardi*, *Lavigerianus*, *Jouberti*, *Josseti*, *Bridouxi*, *Guillemeti*, *calathus*, all of Bourguignat. (i, ii; Bull. Soc. mal. France, 1885, vol. ii, pp. 1-12; Nouveautés Malacol., 1886, pp. 7-23; Espèces nouv. et genres nouv. Oukéréwé et Tanganika, 1885, pp. 15-25.)

MUTEA EXOTICA (Lamarck).

Iridina exotica, Lamarck: Anim. sans Vert., 2nd ed., vol. vi, p. 571; Reeve's Conch. Icon., fig. 2.

I. elongata, Sowerby: Genera, fig. 1; Conch. Icon., fig. 1.

I. Nilotica, Sowerby: Zool. Journ., vol. v, pl. ii; Conch. Icon., fig. 4; Küster, Conch. Cab., pl. xxv, fig. 3.

Mutela exotica, Smith: Proc., i, p. 350; ii, p. 296; Crosse, p. 131.

First collected in the lake by Mr. E. Coode Hore. *M. soleniformis*, Bourg., may be the same as this species. Other forms described from the lake are: *Bridouxi*, *Jouberti*, *Vysseri*, *Moineti*, *Monceti*, *Lavigeriana*, Bourguignat (ii, and Nouveautés Malacol., 1886, pp. 25-31).

Only four of M. Bourguignat's species have been figured, and these look as if they are mere variations of the same form.

BRAZZEA.

Brazzea, Bourguignat: iv, pp. 32, 38; v, p. 44; ii, p. 61, pl. xxviii, figs. 1-6, pl. xxix, figs. 1-5; Martens, p. 258.

Of this genus thirteen so-called species have been described, and judging from the figures of six of them there appears to be very little to distinguish them. The names are: *B. Anceyi*, *ventrosa*, *Randabeli*, *Newcombiana*, *Moineti*, *Lavigeriana*, *Jouberti*, *eximia*, *elongata*, *Coulboisi*, *Charbonnieri*, *Bridouxi*, *Bourguignati*. (Bourguignat, ii, and Nouveautés Malacol., 1886, pp. 45-59.)

MONCETIA.

Moncetia, Bourguignat: iv, pp. 34, 38; ii, p. 65, pl. xxx, figs. 1-8; Martens, p. 258.

There seems little, if anything, to separate this genus from *Spatha*. It appears to be represented by a single variable species, which has been separated by M. Bourguignat under the names *M. Anceyi*, *Jouberti*, *Bridouxi*, *Lavigeriana*, *Moineti*, and *Rochebruniana*.

BURTONIA.

Burtonia, Bourguignat: vi, p. 20; iv, p. 37; v, pp. 32-43, 53, pl. xxiv, figs. 1-4; pl. xxv, figs. 1-3; pl. xxvi, figs. 1-5; pl. xxvii, figs. 1-5; Martens, p. 257.

BURTONIA TANGANYICENSIS (Smith).

Spatha Tanganyicensis, Smith: i, p. 350, pl. xxxi, figs. 8, 8a; ii, p. 296, pl. xxxiv, fig. 32; Crosse, p. 132.

Burtonia Tanganyikana and *Livingstoniana*, Bourguignat: vi, pp. 20, 23; iv, p. 38.

Burtonia Tanganyicensis, Martens: p. 257.

The following forms have also been figured: *B. Lavigeriana*, *Moineti*, *subtriangularis*, *elongata*, *magnifica*, *contorta*, *Grandidivriana*, *Livingstoniana*, and *Bourguignati* (Bourguignat, ii). With the exception of the last, I believe they will all prove to be mere varieties of one polymorphous species. *B. Bridouxi* and *Jouberti*, Bourg., which have not yet been figured, probably belong to the same category. *B. Foui*, Mabile (Bull. Soc. Philom., 1901, vol. iii, p. 58), is probably only a variety also.

PLEIODON SPEKEI, Woodward.

Pleiodon Spekei, Woodward: Proc. Zool. Soc., 1859, p. 348, pl. xlvii, fig. 2; Sowerby, Conch. Icon., vol. xvi, fig. 2; Küster's Conch. Cab. (*Iridina*), pl. lxx, fig. 1; Smith, i, p. 350; ii, p. 296; Martens, S.B. nat. Freunde, Berlin, 1883, p. 71; Pelseneer, p. 109; anatomy, p. 116, figs. 2, 3.

Cameronia Spekei, Bourguignat: Descript. Moll. Égypte, etc., 1879, p. 43; iv, p. 38.

Pleiodon (Cameronia) Spekei, Crosse: p. 130.

Mutela (Iridina) Spekei, Martens: p. 256.

The figured so-called species of this genus from Tanganyika are: *P. Spekei*, Woodward; *Coulboisi*, *Landeaui*, *paradoxa*, *Josseti*, *Bourguignati*, *admirabilis*, *gigantea*, Bourguignat. Unfigured are the following: *P. Ancyi*, *Bridouxi*, *Charbonnieri*, *Vynckei*, *complanata*, *Dromauri*, *Giraudi*, *Guillemeti*, *Jouberti*, *Lavigeriana*, *Locardiana*, *Mabilliana*, *Marioniana*, *Moineti*, *obtusa*, *pulchella*, *Randabeli*, and *Revoiliana*, all described by Bourguignat under the genus *Cameronia*. (See Descript. Moll. Égypte, etc., 1879, p. 42; Moll. fluv. Nyanza Oukéréwé, 1883, p. 19; i, pp. 106-110; Espèces nouv. et genres nouv. Oukéréwé et Tanganika, 1885, pp. 38-9; Nouveautés Malacol., 1886, pp. 66-93; iii, pp. 67-75, pls. xxxi-xxxv.)

Without having a good series of specimens it is impossible to express any decided opinion with regard to the value of the above numerous so-called species, but even judging from the figures already published, this seems to be another case of a polymorphous species having been split up into many. Dr. E. von Martens has also expressed his doubt with regard to the value of several of these forms.

ÆTHERIA ELLIPTICA, Lamarek.

Ætheria elliptica, Lamarek : Sowerby, Conch. Icon., figs. 1a, b ; Smith, i, p. 352 ; Martens, p. 216.

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 „ (v) Nouveautés Malacol., 1886, pp. 1–93 (Unionidæ and Iridinidæ).
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DESCRIPTION OF A NEW SPECIES OF *OPISTHOSTOMA*
FROM BORNEO.

By EDGAR A. SMITH, I.S.O.

Read 11th March, 1904.

ALTOGETHER, including that about to be described, twenty-one species of *Opisthostoma* are now known from Borneo. A list of fifteen was published in the *Annals and Magazine of Natural History* for 1894, vol. xiv, pp. 269-273. Since that date the following species have been described, namely, *O. Linteræ*, Sowb.,¹ *concinnum* and *simplex*, Fulton,² *Sarawacense* (= *Cookei*, Smith) and *Tiesenhauseni* of Gredler,³ and figures of five known species, hitherto unfigured, have been given in the *Proc. Zool. Soc.*, 1895, pl. iv, figs. 19-23.

OPISTHOSTOMA *BEDDOMEI*.

Testa minima, angustissime perforata, rufescens, dextrorsa, pyramidalis; anfractus 6 convexi, lamellis tenuissimis, subremotis, obliquis, in medio undulatis, ornati, supremi 1-2 læves, saturate rufescentes, ultimus infra carino-cristatus, lamellis confertis instructus, antice solutus, retrorsus, et sursum contortus; apertura subcircularis, intus pallide rufescens; peristoma duplex, albidum, margine interno tubæformi, expanso, externo aliquanto angusto, dextrorsum versus spiram interrupto. Long. 1.75, diam. max. 2.25 mm.; apertura cum perist. 1 m. lata.

Hab.—Bidi Mountains, 20 miles from Sarawak.



This little species was collected by Mr. Sydney Beddome, after whom I have much pleasure in naming it. The keel-like crest upon the lower part of the body-whorl commences where the whorl is constricted and its irregular contortion commences. The oblique lamellæ are excessively slender, like the finest threads, and slightly wavy at the periphery. There are about eighteen upon the penultimate whorl. The outer margin of the peristome is rather narrow, not expanded like the inner edge, and interrupted on the right side, or that towards the spire, as is the case also in some other species.

¹ *Ann. & Mag. Nat. Hist.*, vol. xvii (1896), p. 94.

² *Op. cit.*, vol. viii (1901), p. 242.

³ *Nachrichtsb. deutsch. mal. Gesell.*, 1902, p. 57.

NEW MOLLUSCA FROM NEW ZEALAND.

By Rev. W. H. WEBSTER, Waiuku, New Zealand.

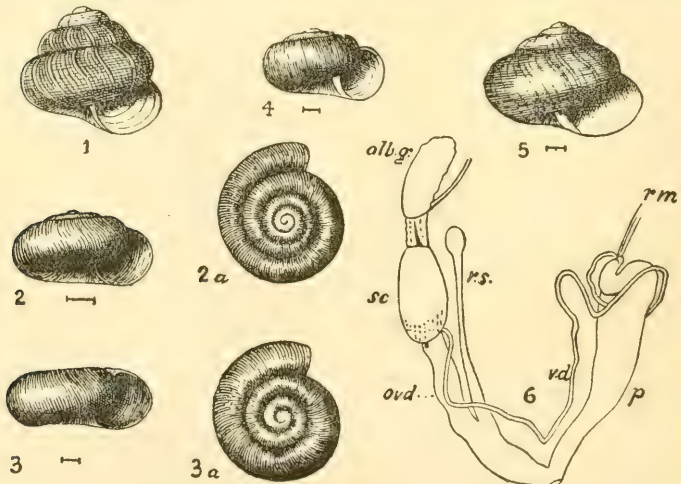
Read 11th March, 1904.

1. *LAOMA* (*PHRIXGNATHUS*) *FRANCESCI*, n.sp. Fig. 1.

Shell turbinate, dark brown, dull; whorls $4\frac{1}{2}$, rounded; protoconch $1\frac{1}{2}$ whorls, concentrically striate, the remaining whorls, besides concentric wavy striae, having 4-5 radiate, brown, white-edged, periostracal processes per millim., directed backward, with many hair-like growth-lines between; suture deep; periphery rounded; umbilicus narrow, pervious; lip simple, margins slightly converging; columella vertical, reflexed above, slightly covering the umbilicus; base rounded. Alt. 1.75, diam. 2 mm.

Hab.—Waiuku, Ti-tree scrub, scarce.

Type in my collection. Named after my son Francis, to whose energy I owe the major part of my collection of non-marine mollusca.

2. *LAOMA* (*PHRIXGNATHUS*) *ELAIODES*, n.sp. Fig. 5.

Shell turbinate, olive-green, shining, whorls $4\frac{1}{2}$, rounded. Protoconch $1\frac{1}{2}$ whorls, concentrically striate, the remaining whorls irregularly, radiately, finely striate and sub-striate, about 10 striations per millim., sub-striations variable in number and extent, both directed backwards; the whole shell concentrically wave-striated; suture deep; periphery rounded; umbilicus narrow, pervious; lip simple, margins slightly converging; columella vertical, reflexed above, slightly covering the umbilicus; base rounded. Alt. 2, diam. 3 mm.

Hab.—Waiuku, scarce.

Type in my collection.

The drawing of the generative system was kindly supplied by Mr. R. Murdoch, of Wanganui, who describes it as follows:—

“The generative system (Fig. 6) is very similar to that of other members of the genus, and the characteristic features scarcely differ from those in *Flammulina* and *Endodonta*. The penis (*p.*) is comparatively large, with the distal portion folded upon itself; the retractor muscle (*r.m.*) is inserted at the apex. The vas deferens (*v.d.*) also separates from the apex; it is a very slender tube and forms a loop round the distal portion of the penis. The receptaculum seminis (*r.s.*) is a narrow tube with a globose termination. The large pouch-like sacculation (*sc.*) of the uterus appears to be a very constant feature in all three genera; the prostate and female ducts (*ord.*) branch from its lower, anterior portion, and the former is partly concealed in the lower, concave surface. Other organs scarcely call for notice; the right ocular retractor passes between the branches of the genital system. Albumen gland (*alb.g.*).”

3. ENDODONTA (CHAROPA) OCHRA, n.sp. Figs. 2, 2a.

Shell discoidal, nearly flat, pale, shining gold when first matured, becoming wan and creamy with age; whorls 4, rounded, last slightly descending; protoconch $1\frac{3}{4}$ whorls, smooth, silvery when first matured, soon becoming white and opaque; remaining whorls ribbed 15 per millim., silky at first, afterwards rough, 3–4 growth-lines between; ribs sloping backwards near the suture, then straight and again backwards over the periphery, slightly sinuated below, microscopically, finely reticulated; suture well marked; periphery narrowly rounded; umbilicus perspective, $\frac{1}{2}$ of the diameter; aperture oblique, rotundly lunate, much excavated by the penultimate whorl; lip simple, margins converging; columella arched; base rounded; foot of animal bright yellow. Alt. .75, diam. 3.5 mm.

Hab.—Waiuku, common.

Type in my collection.

4. ENDODONTA (CHAROPA) CHRYSAUGEIA, n.sp. Figs. 3, 3a.

Shell discoidal, flat, bright golden brown when first matured, silky, whorls 4, rounded, last not descending, increasing rapidly; protoconch $1\frac{1}{2}$ whorls, smooth, silvery, remaining whorls radiately ribbed, 20 per millim. with 3–4 growth-lines between; ribs straight from suture, then backwards over periphery and straight below, in the brythic stage the ribs slope backwards; suture deep; periphery rounded; umbilicus perspective, $\frac{1}{4}$ of the diameter; aperture slightly oblique, inclined to be quadrate; lip simple, margins converging; columella nearly vertical; base rounded; animal with the foot bright orange. Alt. .5, diam. 2 mm.

Hab.—Waiuku, scarce.

Type in my collection.

5. ENDODONTA (CHAROPA) ALLOIA, n.sp. Fig. 4.

Shell discoidal, slightly elevated, amber to rich golden brown, the last whorl darkest, silky; whorls 4, rounded, last not descending, not increasing rapidly; protoconch $1\frac{1}{2}$ whorls, faintly concentrically striate, pale amber, elevated; remaining whorls radiately and very delicately ribbed, 35 per millim., almost straight, sloping slightly at suture and over periphery, microscopically finely reticulated, in the brythic stage the ribs slope backwards; suture deep; periphery rounded; umbilicus open, not perspective, $\frac{1}{5}$ of the diameter; aperture vertical, lunate; lip simple, margins converging; columella nearly vertical; base much rounded; animal with the foot bright yellow. Alt. .75, diam. 2.5 mm.

Hab. — Waiuku, very scarce.

Type in my collection.

DESCRIPTIONS OF NEW SPECIES OF NON-MARINE SHELLS FROM
 JAVA, AND A NEW SPECIES OF *CORBICULA* FROM NEW
 SOUTH WALES.

By the Rev. R. ASHINGTON BULLEN, F.L.S., F.G.S.

Read 8th April, 1904.

PLATE VI.

THE four apparently new species of Javanese land and fresh-water shells are from a small collection of about forty species which I recently purchased direct from the island. A somewhat carinate specimen of *Amphidromus palaceus*, Mousson, was also obtained from the same source (Pl. VI, Fig. 6). Messrs. Sowerby and Fulton, to whom they were first sent, picked out three species as not represented in their collections, and I have since consulted Mr. E. A. Smith and Mr. E. R. Sykes, with gratifying results. To all these gentlemen my sincere thanks are due.

1. *CORBICULA SUBROSTRATA*, n.sp. Pl. VI, Figs. 7-9.

Testa solida, periostraco olivaceo-fusco induta, antice late rotundata, postice aliquanto rostrata, concentrice lirata et sulcata, iris versus latus posticum attenuatis, subobsoletis; umbones prominentes, contigui, erosi, albi; superficies interna albida, infra umbones purpurea, et ad marginem ventralem subfusca; dentes laterales purpurei, striati. Long. 30, alt. 27 mm.

Hab.—Java.

Messrs. Sowerby and Fulton dubiously referred this species to *C. Javanica*, Mousson, but as they have no type-specimen and lament the unsatisfactory state of the classification of the Corbiculidæ, which needs thorough revision, they do not look upon the identification as final. There are no specimens of the species in the British Museum, so we are driven to Mousson's figure. There is no resemblance between the *Corbicula* in my collection and Mousson's figure, other than a generic one.

Indeed, the three specimens all exhibit such a peculiar feature in the formation of a shallow, though well-marked, indentation on the posterior ventral margin, that that region of the shell is somewhat rostrated. The other distinctly rostrated *Corbicula* with which I am acquainted is the *C. Moltkiana*, Prime, from Sumatra, the type of which is in the Museum at Copenhagen. This species, however, is a comparatively longer and squarer shell, quite distinct from the Javanese specimens under discussion. The latter, judging from their massive valves and clean condition, evidently come from a clear, quickly flowing stream. I propose to give them the name of *Corbicula subrostrata*.

2. *VIVIPARA ROUYERI*, n.sp. Pl. VI, Fig. 3.

Testa olivaceo-viridis, anguste umbilicata; spira conoidea, ad apicem medioeriter acuta; anfractus sex, convexiusculi, spiraliter tenuiter striati, lineisque incrementi obliquis arcuatis sculpti, ultimus ad peripheriam leviter carinatus; apertura subrotundata, intus cærulescens; peristoma tenue, sed margine columellari leviter incrassato et anguste reflexo. Long. 26, diam. maj. 19 mm.; apertura 12 mm. longa, 10 lata.

Hab.—Java.

Although resembling *V. Javanica* slightly, it is quite distinct from that species. The body-whorl is more ventricose, and the spire more acutely conical.

3. *LAGOCHILUS OBLIQUISTRIATUS*, n.sp. Pl. VI, Figs. 4, 5.

Testa turbinata, umbilicata, fusco-cornea; spira conica, acuta; anfractus sex, convexi, liris spiralibus tenuibus (in anfr. penult. 6-7, in ultimo circiter 16-18) instructi, lineis incrementi obliquis tenuiter striati, ultimus ad peripheriam rotundatus, liris infra medium magis distantibus quam supra; apertura intus lilacea; peristoma anguste expansum, intus ad marginem album. Diam. maj. 7, min. 5.5 mm.; alt. 7 mm

Hab.—Java.

Mr. Sykes considers this species nearest to *L. longipilum*, Mldff., but the striation and lineation of the new shell are so pronounced as to produce a superficial appearance very different from the more shining and delicately marked periostracum of Moellendorff's species.

4. *MELANIA VARIA*, n.sp. Pl. VI, Figs. 1, 2.

Testa parva, turrita, decollata, ad apicem detrita, olivacea, rufo maculata et punctata; anfractus —?, supra medium angulati, ad angulum serie spinarum brevium sursum directarum instructi, liris pluribus inæqualibus et striis incrementi tenuibus ornati, ultimus liris 4-5 circa medium fortioribus quam cæteris; apertura ovalis, sordide cærulescens; columella antice incrassata, reflexa, albida, ad basim subanaliculata. Long. 17, diam. 9 mm.; apertura 8 mm. longa, 4 lata.

Hab.—Java.

The specific name *varia* has reference to the reddish spots on the transverse liræ, *varius* having the sense of spotted in classical Latin.

5. *CORBICULA FABA*, n.sp. Pl. VI, Figs. 10, 11.

Testa ovata, subcompressa, tenuis, luteo-brunnea, concentricè tenuiter lirata, liris postice fere obsolete; umbones parum prominentes, sæpe valde erosi; pagina interna sordide cærulea, umbones versus rufescenti-albida; dentes laterales tenues, striati. Long. 19, alt. 15, diam. 9.5 mm.

Hab.—Richmond River, New South Wales.



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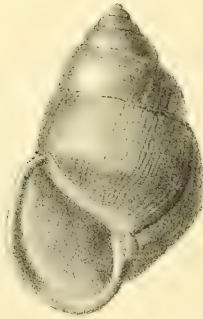
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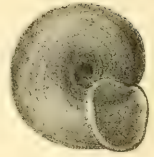
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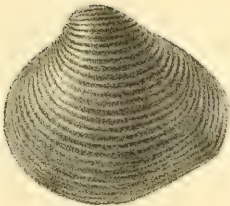
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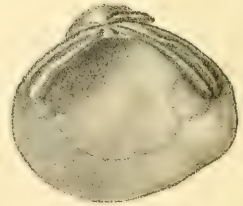
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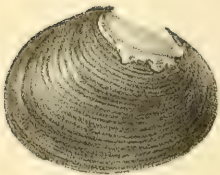
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10.



11.

A.H. Searle del. et lith.

Mintern Bros. imp.

LAND AND FRESHWATER SHELLS FROM
JAVA AND AUSTRALIA.

From their condition it is evident that the specimens described lived in stagnant waters, as they are much eroded. The repairs to some of the specimens, being externally concave, give the shells a deceptive appearance of solidity. They are, however, quite thin.

EXPLANATION OF PLATE VI.

- FIG. 1, 2. *Melania varia*, n.sp.
,, 3. *Vivipara Rouyeri*, n.sp.
,, 4, 5. *Lagochilus obliquistriatus*, n.sp.
,, 6. *Amphidromus palaceus*, with angulated body-whorl.
,, 7-9. *Corbicula subrostrata*, n.sp.
,, 10, 11. *Corbicula faba*, n.sp.
-

THE HAWAIIAN SPECIES OF *OPEAS*.

By E. R. SYKES, B.A., F.L.S.

Read 8th April, 1904.

RECENTLY, when cataloguing the Hawaiian fauna,¹ I admitted three species of this genus, namely, *O. junceus* (Gld.), *O. Prestoni*, Sykes, and *O. pyrgiscus* (Pfr.); also noting the manuscript name of *O. striolata*, Pease. Further material, collected in Hawaii by Professor Henshaw, has been submitted to me by him, and I am now enabled to give some additional details. Figures are also given in order that the forms discussed may be the more readily identified.

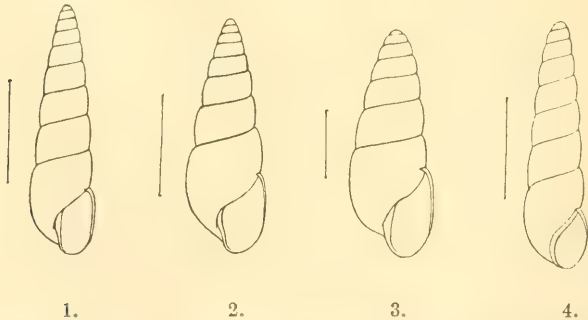
1. *OPEAS JUNCEUS* (Gould). (Fig. 1.)

Hab.—Hawaiian Islands (Gould); all the islands (Baldwin); Oahu, Waianae Mountains (Perkins); Hawaii, Kohala, Kau (Henshaw).

2. *OPEAS HENSHAWI*, n.sp. (Fig. 2.)

Shell subperforate, turreted, somewhat solid, with closely-set, well-marked, curved, longitudinal striæ; light-yellowish horn-colour. Spire well drawn out, suture well-marked, but the whorls not so shouldered as in *O. junceus*. Whorls $8\frac{1}{2}$, plano-convex, the last whorl inflated, and measuring about half of the total length of the shell, somewhat compressed at the base. Mouth somewhat axe-shaped, the columellar margin reflexed and rather sinuous above. Alt. 12·5 mm.; diam. max. 4 mm.

Hab.—Hawaii, Hilo (Henshaw).



The salient features of this form are its yellow colour, the well-marked, curved striæ, the size and inflation of the last whorl, and the slightly sinuous columellar margin, which bends to the left above and

¹ "Fauna Hawaiïensis," vol. ii, p. 383.

is not vertical. I have seen about twenty specimens, a few of which are slightly narrower in proportion to the length. This may, very possibly, be the manuscript *O. striolata* of Pease.

3. *OPEAS PRESTONI*, n. var. *HAWAIIENSIS*. (Fig. 3.)

Hab.—Hawaii, Kawaiiloa, Mauna Loa at 1,500 feet (Perkins); Hawaii, Hilo (Henshaw).

In the "Fauna Hawaiiensis" I referred this shell to the species described by me from Ceylon. After a careful re-examination of a good series of specimens from both Hawaii and Ceylon, undertaken at the suggestion of Professor Henshaw, there appear to be certain constant differences between the shells collected in the two localities. Whether these be of specific value or not it is very hard to say, bearing in mind the abnormal distribution of the genus, but they seem worthy of, at least, a varietal name.

The Hawaiian form is more cylindrical, i.e. the earlier whorls increase more rapidly and the later ones less so, the colour is pale yellowish white, whereas the Ceylon shell is a light horn-colour, the texture of the shell is slightly thinner and more transparent, and the specimens that I have seen are, on the average, smaller in size.

4. *OPEAS PYRGISCUS* (Pfeiffer). (Fig. 4.)

I have not as yet seen anything that agrees exactly with the series in the British Museum. Of the shells sent by Mr. Henshaw specimens from Kohala, Kau, approach it most nearly; also some specimens collected by Mr. Thwing in an extinct crater, Kona, appear to be closely related. Final determination must be reserved, as both sets of shells are immature.

All figures are taken from specimens in my own collection, except Fig. 4, which is a copy of that given by Pfeiffer.

REPORT ON A SMALL COLLECTION OF HELICOIDS FROM
BRITISH NEW GUINEA.

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

Read 8th April, 1904.

DURING a residence of two years (1902 and 1903) in the interior of New Guinea, Mr. E. A. Pratt collected a number of land-shells, mostly in exceptionally fine condition, which he has kindly placed at my disposal. There is only a limited number of species, and with the exception of a *Euplecta* which appears to be undescribed, they are all known forms. The locality whence they were obtained is stated to be "Dinawa," British Central New Guinea, altitude 3,600 feet.

The following is an enumeration of the species:—

1. *EUPLECTA PRATTI*, n.sp.

Shell depressed, conoid, narrowly perforated; dull, pale fulvous, ornamented with hair-like raised striae, giving the shell a silky lustre above; lighter, shining, and polished below. Spire depressed, apex acute, slightly exerted, suture channelled. Whorls $5\frac{1}{2}$, increasing slowly, the last not widened towards the mouth, not descending in front, slightly convex above, tumid below, acutely keeled at the periphery, the keel slightly pinched above and below. Aperture a little oblique, securiform; margins distant, united by a thin callus on the parietal wall. Peristome thin, acute, the columellar margin slightly dilated above, and overhanging the narrow umbilical perforation. Diam. maj. 18, min. 16 mm.; alt. 8.5 mm.

Four specimens. Type in my collection.



Compared with *Euplecta infelix* (Smith),¹ its nearest ally, the new species is smaller and more depressed, the whorls are less convex, the last whorl is much less preponderating, and the aperture consequently much smaller, while the sculpture on the upper side is much coarser. The species is dedicated to its discoverer, Mr. E. A. Pratt.

¹ Conchologist, vol. ii (1893), p. 109; Journ. of Malac., vol. v (1896), pl. ii, figs. 6, 7.

2. *HEMIPLECTA CAMPYLONOTA* (Tapp.-Can.).

Nanina campylonota, Tapparone-Canefri: Ann. Mus. civ. Genova, xix (1883), p. 199, pl. v, fig. 11.

A fine series was obtained showing great uniformity as regards colouring, but a certain amount of variation of form, ranging from globose, with elevated spire and bluntly angulated periphery, to flattened with depressed spire and keeled periphery. As the extreme forms are linked by intermediate ones, I have refrained from giving a varietal name to the extreme deviation from the type. The following measurements will give an idea of the variation of form:—

| | | | | | |
|------------|-------|------|---------|------|--------|
| Diam. maj. | 34·5, | min. | 29 mm.; | alt. | 22 mm. |
| „ | 32, | „ | 27·5 | „ | 21 „ |
| „ | 33, | „ | 28 | „ | 19 „ |
| „ | 32, | „ | 27·5 | „ | 18 „ |

3. *RHYSOTA HERCULES*, var. *FLYENSIS*, Hedley.

One specimen.

4. *PLANISPIRA* (*CRISTIGIBBA*) *MUSGRAVEI* (Smith).

Ann. & Mag. Nat. Hist. (6), xv (1895), p. 233; xvi, p. 363, pl. xx, figs. 13-15.

A single dead specimen.

5. *CHLORITIS* (*SULCOBASIS*) *REHSEI* (Mart.).

A small form, darker than the type. Diam. maj. 39, min. 30 mm.; alt. 30 mm.

Four specimens.

6. *PAPUINA GOLDIEI* (Braz.).

Darker and smaller than the type, a little more globose below, apex more prominent; the spiral bands darker and more distinct. Diam. maj. 32, min. 25 mm.; alt. 18·5 mm.

One specimen.

7. *PAPUINA TAYLORIANA* (Ad. & Rve.).

A pretty pale form, with small oblique purplish flammules, the carina bordered by a creamy zone edged by a narrow purplish band. Diam. maj. 24, min. 19·5 mm.; alt. 14 mm.

8. *PAPUINA NASO* (Mart.), var. *GEMINA*, Fulton.

Helix naso, von Martens: Jahrb. Deutsch. Malak. Gesellsch., x (1883), p. 82; Conch. Mitth., iii (1894), p. 12; Arch. für Naturg., lxiii (1897), p. 42, pl. viii, figs. 7, 8.

Papuina gemina, Fulton: Ann. & Mag. Nat. Hist. (7), ix (1902), p. 183.

Five specimens were received; they all possess three rosy violet supraperipheral bands varying in width. The relative dimensions and the inflected outer margin of the peristome also vary. This form

appears to me to be only a well-marked variety of *P. naso*, although Mr. Fulton admits it to specific rank. Diam. maj. 32, min. 25 mm.; alt. 22 mm.

9. *THERSITES* (*SPHÆROSPIRA*) *BROADBENTI* (Braz.).

Thirty specimens, more depressed than the type. All have the basal margin of the peristome strongly sinuate, a character not shown in the published figures. Diam. maj. 46, min. 38 mm.; alt. 35 mm.

10. *GANESELLA EUCONUS* (Mülldff.).

Satsuma euconus, Müllendorff: Proc. Malac. Soc., i (1895), p. 235,
pl. xv, fig. 2.

A single dead specimen.

ON SOME NON-MARINE HAWAIIAN MOLLUSCA.

By C. F. ANCEY.

Read 8th April, 1904.

PLATE VII.

SUCCINEA KUHNSI, n.sp. Pl. VII, Fig. 1.

Testa magna et pro genere solida vel solidiuscula, opacula, obliqua, conico-ovata, infra ampliata, parum nitens, irregulariter rugoso-plicatula, rugis obliquis subflexuosis, lutea vel fulvida, basi et circa aperturam et columellam late et diffuse daucina vel rufo-tincta. Spira producta, apice pallido, mammillato, conoideo. Anfractus 3 convexi, laxè evoluti, sutura perobliqua et prope aperturam præsertim valde descendente ac perimpressa discreti, ultimus maximus, obliquus. Apertura obliqua, superne attenuata, inferne lata. Columella incrassata, regulariter convoluta, longe arcuata sed haud plicifera. Margines callo nitido conspicuo juncti.

Long. 23, diam. 12·5, alt. apert. (oblique) 15 mm.

Hab.—Kāiwicki, Hilo, Hawaii (Kuhns).

Obs.—Variat unicolor, cerasiana, vel granatina, apertura intus ejusdem coloris.

This is a fine robust species, quite variable in colour, as shown above, and often of a quite solid structure. It is a much stronger shell than *S. aurulenta*, Anc., *casta*, Anc., or *Thaanumi*, Anc., also from Hawaii and very distinct from them. It is named after its first discoverer, at the request of Mr. Baldwin, and was subsequently found in the same district by Professor Henshaw and Mr. Thaanum.

SUCCINEA CASTA, Anc.

S. casta, Anc.: Proc. Malac. Soc., vol. iii (1899), p. 272, pl. xii, fig. 10.

Hab.—Olaa, Hawaii, 925 ped. supra mare (Thaanum, Henshaw).

The following forms, although at first sight very different in shape from the typical *casta*, appear to be local varieties, according to Professor Henshaw. I extract the following data from a letter dated April 14th, 1902:—"The shells from 925 feet are from near the type locality of *casta*, and there is no doubt that many from this locality are very different from those above or below. They are much broader, and the spire is less prolonged. Still, there are individuals from this locality that seem to me not separable from the form above. . . . The same striking variation in colour observable in *casta* obtains in *Kuhnsi*. I have found red, white, and parti-coloured shells in the same locality, and even on the same plants. *Thaanumi* again occurs in the three colour varieties, red, white, and parti-coloured."

Var. *OROPHILA*, n. var.

Testa intense luteo- vel sæpius late rufo-cornea, concolor, sericio nitens. Spira humilior, apice minus papilliformi. Anfractus $2\frac{1}{2}$.

Hab.—Kaiwiki, Hawaii, 2,500 ped. s.m. (Henshaw).

Var. *HENSHAWI*, n. var.

Testa magis elongata, pyriformis, tenuissima, colore pervariabilis, omnino lutea vel rubra, vel lutea et basi circa columellam late rubro-tincta, interdum dorso etiam rubra, spira pallidiore vel rubella. Spira conoidea, papillata, obtusa. Anfractus $2\frac{1}{2}$ celerime crescentes, convexiusculi, sutura perobliqua divisi, ultimus superne attenuatus, infra ampliatus, lineis incrementi obliquis atque flexuosis subpliciformibus plus minusve obsolete notatus. Apertura obliqua, extus sinuata et basi recedens et effusa. Columella superne vix incrassatoplicatula, dein arcuata.

Long. 14, lat. 8, alt. apert. (oblique) 10, diam. ejusd. 6 mm.

Hab.—Olaa, Hawaii, 2,425 ped. supra mare (Henshaw).

SUCCINEA TENERRIMA, n. sp. Pl. VII, Fig. 2.

Succ. tenerrima, Anc. (nom. nud.): in Baldwin, Cat. Shells Hawaiian Islands, 1893, et in Sykes, Fauna Hawaiiensis, 1900, p. 390.

Testa tenuissima, pellucida, virenti-cornea, apice corneo-rubello, subnitida, striis incrementi irregularibus confertisque notata, striis obliquis, in ultimo subflexuosis, oblongo-attenuata. Spira sat producta, apice obtusulo, subpapillato. Anfractus 3 celeriter accrescentes, sutura impressa, valde obliqua separati, convexi; ultimus oblongus, vix obliquus. Apertura ovalis, superne attenuata, obliqua, inferne subdilatata. Columella tenuis, simplex, longe arcuata, callo parietali inconspicuo.

Long. 11.5, lat. 6-6.25, alt. apert. (oblique) 7.75, diam. ejusd. 5 mm.

Hab.—Kaiwiki, Hawaii, alt. 2500-2600 ped. s.m. (D. Thaanum, Henshaw).

Var. *COCCOGLYPTA*.

Præcedenti statura, forma et colore testæ simillima, sed apice haud rubello, testa postice paulo magis dilatata præsertim sculptura microscopice plus minusve granulata differt.

Hab.—Hilo, Hawaii (Baldwin).

SUCCINEA APICALIS, n. sp. Pl. VII, Fig. 3.

Succ. apicalis, Anc. (nom. nudum): in Baldwin, Cat. Shells Hawaiian Islands, 1893, et in Sykes, Fauna Hawaiiensis, 1900, p. 390.

Testa fragilis, pellucida, luteo- vel spadiceo-virens, apice late et diffuse rubello, sericeo-subnitida, irregulariter lineis incrementi obliquis, dorso subflexuosis, obsoleteque notata, suboblongo-attenuata. Spira sat producta, summo papillato, obtuso, sat minuto. Anfractus 3 convexi, celeriter crescentes, convexi, sutura impressa; ultimus leviter obliquus, subdilatatus. Apertura obliqua, oblonga, superne regulariter attenuata. Columella tenuis, vix incrassatula, simplex, supra fere haud plicatula, postice longe arcuata.

Animal maculis nigris irregularibus pictum.

Long. 13·25, diam. 7·25, alt. apert. (obl.) 9·5, diam. ejusd. 6·25 mm.

Hab.—Makawao, E. Maui (Baldwin).

SUCCINEA TETRAGONA, n.sp. Pl. VII, Fig. 4.

Testa *Succ. quadratæ* characteribus plurimis affinis, sed depressior, magis oblonga, virenti-cornea, apice pallido, sæpe albescente vel decorticato. Anfractus ultimus magis quadratus, subobliquus, penultimus altior, sutura magis horizontalis, apertura superne magis dilatata et rotundata, ampliata, haud flexuosa, supra subattenuata, vix angulata, marginibus callo tenui sed distincto junctis.

Long. 12, lat. 7·25, alt. apert. 9·5, diam. ejusd. 6·5 mm.

Hab.—Makawao, E. Maui (Baldwin).

SUCCINEA QUADRATA, n.sp. Pl. VII, Fig. 5.

Testa tenuis, subpellucida, confertim et irregulariter rugoso-striata, rufo-cornea, apice decorticato, rubello, oblongo-ovata. Spira mediocris, summo obtuso, papillato, sat magno. Anfractus 2½ valde convexi, sutura obliqua profundeque impressa separati, celeriter accrescentes, embryonali lævi, sequentes flexuose et ruditer rugoso-striati, ultimus magnus, subobliquus, ovato-oblongus. Apertura subobliqua, extus flexuosa, margine extero ante medium distincte sinuato, basali paulum recedente, oblonga, supra parum attenuata. Columella fere simplex vel initio levissime incrassata et subpliciformis, cæterum longe arcuata.

Long. 10·5, lat. 7, long. apert. 8, diam. ejusd. 5·5 mm.

Hab.—Olaa, Kaiwiki, Hawaii (D. Thaanum, Professor Henshaw), 2,550 ped. supra mare.

Obs.—The living shell is often covered with mud, like the preceding species.

MICROCYSTIS RUFOBRUNNEA, n.sp.

Testa globoso-conoidea, tenuis, nitidissima, rufo-brunnea vel cinnamomea, interdum pallidior, imperforata, lineis incrementi perobsoletis. Spira conoidea, obtusa, satis elevata. Anfractus 5–5½ convexi, regulariter lenteque accrescentes, sutura appressa, lineari. Ultimus utrinque convexus, turgidus, initio solum tantisper subangulatus, cæterum rotundatus, basi centro impressus, imperforatus. Apertura subobliqua, lunata, semicircularis. Peristoma acutum, rectum, marginibus distantibus, columellari minute albo-incrassato, arcuato-declivi.

Diam. maj. 7, min. 6·5, alt. 4·75, alt. apert. 3 mm.

Hab.—Olaa, Hawaii (D. Thaanum).

A fine-coloured shell, like *M. Lymaniana*, Anc., of Oahu, in that respect, but smaller and otherwise quite distinct.

KALIELLA THAANUMI, n.sp. Pl. VII, Fig. 6.

Testa conico-pyramidalis, dilute cornea, fere imperforata, tenuissima, pellucida, nitens, supra striis incrementi confertis sub valida lente sculpta, infra lineis incisus spiralibus numerosis microscopice notata. Spira depresso conoidea, rectilinearis, apice minuto, obtusulo, lævi.

Anfractus $5\frac{1}{2}$ convexi, lente et regulariter accrescentes, sutura impressa, ultimis ad peripheriam angulatus, basi subconvexior. Apertura parum obliqua, transverse oblonga, valde lunata, extus subangulata. Peristoma simplex, acutum, marginibus distantibus, columellari vix angustaque expansiusculo.

Diam. 3·5, alt. 2·5 mm.

Hab.—Olaa, Hawaii (D. Thaanum).

Unlike the sharply keeled *K. Konaensis*, Sykes, of the same island. It may perhaps be a *Guppya*, like the following.

KALIELLA LUBRICELLA, n.sp. Pl. VII, Fig. 7.

Differt a præcedente testa minore, supra haud sericeo-micante sed utrinque nitidissima, perforatione magis conspicua etsi punctiformi, spira minus abrupte conica, striis superne obsoletis, lævibus nec capillaribus, anfractu ultimo paulo altiore, obtuse tantum angulato, angulo prope aperturam evanescente, inde apertura ampliore minusque angusta, anfractibus $5-5\frac{1}{4}$.

Diam. 3·2, alt. 2·5 mm.

Hab.—Olaa, Hawaii (Thaanum).

VITREA HAWAIIENSIS, n.sp. Pl. VII, Figs. 8-8b.

Differt a *V. Molokaiensi* et a *V. Lanaiensi*, Sykes, testa magis elevata, anfractibus altius convolutis et umbilico paulo minore; a *V. pauxillo*, Gould, cui peraffinis differt etiam testa minus depressa, paulo convexiore, colore pallido luteo-virescente, umbilico profundiore, circulari.

Diam. maj. 4·33, min. 3·66, alt. 2·20 mm.

Hab.—Olaa, Hawaii (Thaanum).

AURICULELLA MALLEATA, n.sp. Pl. VII, Fig. 12.

Testa solida, perforata, oblongo-conoidea, nitens, opaca, alba, apice plerumque rufulo vel fusciscente, interdum albo, sinistrorsa, lineis incrementi lævibus sub lente subimpressa. Spira elongatula, convexo-conoidea, apice minuto, obtusiusculo. Anfractus $6\frac{1}{2}-7$, primi convexiusculi, sequentes planulati, rugis nonnullis elevatis antrorsum descendentibus, more Linnæarum multarum, persæpe malleati. Apertura subauriformis, supra angulata, infra effusa atque recedens, obliqua, lamina parietali subtenui vel mediocri et plica columellari parum prominente, subobtusa, aliquando indistincte duplicata armata. Peristoma crassum, ad basin expansum, extus marginatum, marginibus callo ad junctionem tuberculifero vel intumescente junctis, extero planulato, medio antice subprovecto.

Long. 9, diam. 4·25, alt. apert. (oblique) 4·5 mm.

Hab.—In cacumine montis Kaala (4000' s.m.), insulæ Oahu (Rev. Thwing).

Related to *A. obliqua*, Anc., found on Oahu, but much more slender, malleated, and tinged with brown on the earlier whorls.

AURICULELLA CANALIFERA, n.sp. Pl. VII, Fig. 11.

Testa sinistrorsa, imperforata, ovato-conica, subtenuis, nitens, lineis incrementi obliquis lævibus obsoletisque impressa, unicolor fulva, vel in medio ultimi anfractus zona fusca cingulata, aut etiam intense fulvo-castanea zonaque albescente peripherica suturam supra concomitante circumdata. Spira conica, sat producta, apice obtuso. Anfractus $6\frac{1}{2}$ planiusculi, sutura appressa, ultimus dilatatus, rotundatus, abbreviatus, haud ascendens. Apertura obliqua, irregulariter ovata, infra dilatata, emarginata, lamina parietali compressa, albida, mediocri, intus debiliore armata. Columella appressa, leviter contorto-plicatula, plicæ albida, extus in spinulam erectam desinentem munita, oblique intuenti minute bisinuata. Peristoma tenue, vix nisi ad columellam incrassatum, leviter expansum, marginibus callo simplici nitidoque, haud tuberculifero junctis.

Long. 6·75, lat. 3·6, alt. apert. (oblique) 2·5 mm.

Hab.—Halawa, Molokai (Baldwin).

A very characteristic species, remarkable on account of the features of its columella, and unlike any others in that respect. The shell has the texture of *A. diaphana*, but has a more produced spire, different columella, and is imperforate.

I avail myself of the opportunity of mentioning the locality of *A. expansa*, Pease. It is from Maui.

PARTULINA PHYSA, Newc., var. PHÆOSTOMA, n.var.

Testa nitens, pallide coffea, apice albo, postea tessellato, lineis spiralibus confertis et striis rudibus incrementi notata; apertura et columella brunneæ, fauce micante, fusca, limbo paulo pallidiore.

Long. 23, diam. 14·5, long. apert. (oblique) 11·5 mm.

Hab.—Hawaii (Thaanum).

AMASTRA LUCTUOSA, Pfr., var. SULPHUREA, n.var. Pl. VII, Fig. 9.

Testa typo similis sed pallide lutea, concolor, prope aperturam vestigiis epidermidis dilute fuscæ induta.

Long. 15·5, lat. 9·5, long. apert. 7 mm.

Hab.—Waialae, Oahu (Baldwin).

AMASTRA HENSHAWI, Baldwin. Pl. VII, Fig. 10.

Amastra Henshawi, Bald.: Nautilus, vol. xvii (1903), p. 34.

Hab.—Olaa, Hawaii, 2,550 ped. supra mare (Professor H. W. Henshaw), S. Kona (Baldwin), alt. 1800–4000 ped.

Related to *A. flavescens*, Newc., which is found in another district.

CARELIA TURRICULA, Migh., var. AZONA, n.var.

Testa similis, cum forma tum characteribus testæ formæ typicæ, ab ea differt colore fusco, infra nigrescente, sutura inferne pallidiore, ultimo anfractu fascia lutea destituta.

Long. 58·5–60, diam. 19·5–21, alt. apert. 19–19·5 mm.

Hab.—Kauai (Baldwin).

CARELIA FULIGINEA, Pfr., var. SUTURALIS, n.var.

Testa similis typicæ *C. fuliginæ*, sed lineis superficialibus spiralibus in anfractu ultimo magis conspicuis notata; parte supera anfractuum inferiorum late diffuseque albo-luteo marginata, interdum lineis nonnullis spiralibus ejusdem coloris exilibus, infra zonam suturalem cingulata.

Long. 38, diam. 16·5, alt. apert. 18·5 mm.

Hab.—Kauai (Baldwin).

In this variety, the pale band is not well defined as in *C. bicolor*, Jay, which is usually considered as a form of the same species.

NESOPUPA BALDWINI, n.sp. Pl. VII, Fig. 13.

Testa breviter cylindraceo-oblonga, aperte sed minute perforata, fusco-rufa, sericeo-nitidula, præter lineas incrementi tenuissimas, sub valida lente tantum vix conspicuas, sculptura fere destituta. Spira obtusa. Anfractus 5½ convexi, tres primi celeriter diametro crescentes, reliqui subæquales, sutura impressa. Ultimus oblongus, haud tumidus, basi subattenuatus, pone aperturam sulcis duobus parum profundis suturæ parallelis coarctatus, antice leviter ascendens. Apertura verticalis, extus prope medium antice angulatim dilatata, truncato-ovalis, plicis vel lamellis armata, scilicet: parietalibus 2, quarum una angularis, elongata, sed sequente brevior; altera submediana, paulo magis profunda, longa; columellari 1 acuta, dentiformi; et palatalibus 2 elongatis, sulcis exteris correspondentibus, parallelis, quarum supera marginem fere attingit. Peristoma angustum, concolor, fuscum, subincrassatum, vix nisi ad columellam breviter expansiusculum, marginibus sat remotis, extero parte supera subsinuato.

Long. 1·5, lat. ·8, alt. apert. ca. ·5 mm.

Hab.—Molokai (Baldwin); Kaupakalua, Maui (Baldwin).

Var. CENTRALIS.

Paulo minor et minus cylindrica, anfractus 5, cæterum typo haud dissimilis.

Hab.—Olaa, Hawaii (Thaanum).

NESOPUPA PLICIFERA, n.sp. Pl. VII, Fig. 14.

Testa parvula, ovata, intense rufo-brunnea, tenuiuscula, subnitens, apice excepto oblique et confertim pliculosa, plicis lævibus, distincte perforata. Spira obtusa, ovata vel cylindraceo-ovata. Anfractus 5 conspicue convexiusculi, sutura impressa simplicique, ultimus basi attenuatus et concentricè sulcato-impressus, sulco lamellæ palatali inferè correspondente, circa rimam subcompressus. Apertura parum obliqua, basi leviter recedens, ovato-truncata, lamellis instructa, scilicet: parietalibus 2, quorum supera angularis marginem superum attingens et cum margine extero connexa, valde elongata; infera magna, paulo profundius sita et subspiraliter prodiens; columellari 1 parva, acuta, dentiformi; demum palatalibus 2 elongatis, parallelis, supera marginem fere attingente. Peristoma fuscum, incrassatum, anguste expansum,

marginibus distantibus, callo inconspicuo junctis, supero extus subangulatim producto.

Long. 1·5, lat. vix 1, long. apert. ·5 mm.

Hab.—In valle Nuuanu, Oahu (D. Thaanum).

NESOPUPA THAANUMI, n.sp.

Testa dextrorsa, minute rimato-perforata, læte corneo-lutea, nitidula, subpellucida, costulis membranaceis argenteo-micantibus debilibus atque valde deciduis, inter se sat distantibus decorata, subconicoideo-ovata, obtusa. Anfractus $4\frac{1}{2}$ convexi, sutura impressa, summo sat minuto; ultimus subsaccatus, basi vix attenuatus, ad finem tantisper ascendens, pone aperturam extus levissime impressus, breviter ovatus. Apertura recta, truncato-ovalis, subrotundata, extus producta et antice sinuata (ante mediam partem marginis dextri), *lamellis validis albis* armata, scilicet: angulari arcuata, elongata sed brevi, marginem attingente, palatali 1 paulo profundiore, longe intrante; columellari 1 transversa, interna, et palatalibus 2, superiore magis extera, ambabus elongatis sed haud valde longis. Peristoma anguste expansum, marginibus sat remotis.

Long. 1·33, lat. 1, alt. apert. ·5 mm.

Hab.—Olaa, Hawaii (D. Thaanum).

Somewhat allied to *N. Newcombi*, Pfr., like the two following, but of lighter colour, and remarkable on account of its white aperture and laminae. The true *Newcombi*, which seems to be rare, was found by Mr. Thaanum at Waipio pali, Hawaii. It is very globose, very much like *N. admodesta* and *N. acanthinula* in that respect, and the angular lamella is punctiform, reduced to a mere tubercle.

NESOPUPA WESLEYANA, n.sp. Pl. VII, Fig. 16.

Testa oblonga, tenuis, perforata, vix nitida, sub valida lente granulata, fusco-cornea, costulis membranaceis obliquis et distantibus plus minusve deciduis, in ultimo anfractu subflexuosis ornata. Spira *oblonga*, obtusula. Anfractus 5 convexi, sutura impressa discreti, ultimus oblongus, ad finem tantisper subascendens, basi leviter attenuatus, prope aperturam vix dilatatus. Apertura verticalis, truncato-ovata, basi levissime recedens, $\frac{1}{3}$ altitudinis subæquans, intus fuscula, 5-plicata; peristoma haud continuum, undique expansum et reflexum, crassiusculum, sublabiatum, labio concolore fusco. Plicæ angularis arcuata, elongata, subflexuosa, parietalis 1 paulo profundior, submediana; columellaris 1 acuta, profunda; palatales 2 elongatæ, parallelæ, infera magis profunda.

Long. 2, lat. 1, long. apert. ca. ·75 mm.

Hab.—Hilo, Hawaii (D. Thaanum); Waipio pali, Hawaii (H. W. Henshaw, D. Thaanum); Kaupakalua, Maui (D. D. Baldwin); "Waianae Mountains," Oahu (D. D. Baldwin).

An abundant and widely spread species, which I took at first for the true *Newcombi*, a much more rounded shell, with different lamellæ. Named in honour of the late Dr. Wesley Newcomb, a well-known writer on Hawaiian and West Coast shells.

NESOPUPA KAUAIIENSIS, n.sp. Pl. VII, Fig. 17.

Testa suboblunga, abbreviata, corneo-fusca, costulis incrementi confertis et rudiuseulis oblique rugulosa, minute perforata, parum nitida, tenuiuscula. Spira obtusa, breviter subcylindrica, attamen leviter conoideo-attenuata. Anfractus 5 convexi, regulariter crescentes, sutura impressa; ultimus breviter ovatus, ventricosus, subsaccatus, antice haud ascendens, lateraliter non compressus, circa umbilicum rotundatus. Apertura leviter obliqua, non sinuata, truncato-subcircularis, haud effusa, plicis dentiformibus ornata, scilicet: parietalibus 2, quarum una angularis parva, tuberculiformis, et secunda mediana aut submediana elongata, profundior, mox desinens; columellari una acuta parva; et palatalibus 2 subæqualibus brevibus, subelongatis, parallelis. Peristoma undique anguste expansum et incrassatum, ad columellam vix magis dilatatum, lividum, marginibus sat distantibus.

Long. 2, lat. 1.33, alt. apert. .75 mm.

Hab.—Kipu, Kauai (Baldwin).

Differs from *N. Newcombi*, hitherto peculiar to Hawaii, in being more ovate, in the number of whorls, and sculpture.

LYROPUPA LYRATA (Gould).

Pupa lyrata, Gould: Proc. Bost. Soc., i (1843), p. 139; Pfeiffer, Mon. Helic. viv., iii, p. 560, et iv, p. 686, et Verz., p. 177 (*Vertigo*); *Vertigo lyrata*, H. & A. Ad., Gen. ii, p. 172; non *Pupa lyrata*, Boettger, Conch. Mittheilungen, 1883, p. 61, pl. xii, fig. 17 (possibly referable to *L. Magdalencæ*, Anc.?).

Testa sinistrorsa, ovata, solidula, haud nitida, intense vinoso-fusca, aperte perforata, opaca, summo excepto liris acutis validis, inter se distantibus, obliquis, in ultimo subflexuosis, medio sæpe magis prominentibus conspicue costata. Spira oblongo-attenuata, obtusula. Anfractus 5-5½ convexi, præter costas tenuissimæ et microscopice lineis incrementi notati, sutura undulato-impressa; apicales lævigati, ultimus liris 11-12 instructus, basi pone aperturam constrictis, lateraliter sulco parum profundo sed distincto, suturæ parallelo impressus, circa umbilicum crista rotundata præditus. Apertura vix obliqua, parvula, continua, ovato-truncata, supra extus angulata, dein sub-sinuata, lamellis et plicis obstructa, scilicet: angulari una minutissima, nodiformi, interdum evanescente vel ægre perspicua, supra marginem incipiente; parietali una mediana, profunda, valida, marginem haud attingente; columellari profunda, semilunari; denique palatalibus 2 parallelis, infera profundiore, supra sulco extero correspondente, valde approximatis. Peristoma dilute luteo-fuscum, incrassatum et expansum.

Long. 2.25, lat. vix 1.5, alt. apert. .66 mm.

Hab.—Olaa, Hawaii (Thaanum).

This I consider as the true *Pupa lyrata* of Gould, as it agrees better with his description than any others of the same group. It is quite distinct from my *L. Magdalencæ*, which Mr. Sykes thinks to be identical, and which is found on Oahu. Dr. Boettger has figured the latter or

a form nearly allied to it, but not Gould's *lyrata*, under the latter name. A very similar form was found in a subfossilized condition in the Waimea district, Hawaii, by Professor Henshaw, and I can scarcely sever it from my species, though it is somewhat less obese and the riblets are stronger.

LYROPUPA CLATHRATULA, n.sp. Pl. VII, Fig. 19.

Testa sinistrorsa, oblonga, rimato-perforata, opaca, subsericea, intense purpureo-nigra, concolor, subtenuis, apice excepto liris acutis lamellosis obliquis, inter se distantibus (12 in ultimo anfractu) sculpta; præterea lineis elevatis membranaceis perparum prominentibus, sed in duobus anfractibus ultimis præsertim, in intervallis cincta et eleganter clathratula. Spira ovata, obtusa. Anfractus 5 convexi, sutura impressa discreti, lineis incrementi sub valida lente notati, ultimus prope aperturam impressione parum distincta suturæ parallela instructus, circa perforationem vix angulatus, ovatus, parum attenuatus. Apertura subobliqua, appressa, irregulariter ovata, superne extus angulata. 5 lamellis vel plicis obstructa, scilicet 2 laminis parietalibus, quarum una submediana, libera et secunda brevior, magis extera cum margine conjuncta; columellari profunda semilunari, oblique intuenti conspicua; palatalibus 2 longis, supera marginem fere attingente, infera magis remota, sulco extero superficiali correspondente. Peristoma expansiusculum, purpureo-fuscum, marginibus superne approximatis sed haud continuis.

Long. 2.25, lat. 1.5 mm.

Hab.—Olaa, Hawaii, cum præcedente (Thaanum).

The fine spiral cuticular riblets recorded in the description are very deciduous, and visible only in very fresh specimens. The species is quite distinct from *L. lyrata* and more like the following.

LYROPUPA CARBONARIA, n.sp. Pl. VII, Fig. 21.

Testa sinistrorsa, ovata, solidula, costulis exceptis haud nitida, intense nigro-fusca, aperte perforata, opaca, summo excepto oblique et valide lirata, liris in medio subarcuatis, basi subflexuosis. Spira oblongo-conoidea, obtusa, apice sat minuto. Anfractus 6 convexi, sutura impressa, ultimus ad aperturam longiuscule tantisper subascendens, basi sulco brevi lamellæ palatali inferæ correspondente constrictus, subattenuatus, antice circa perforationem obtuse subcristatus, liris ca. 17 costatus. Apertura fere recta, cum peristomate fusco-tincta, continua, irregulariter ovato-truncata, supra externe sinuata, tum angulata, lamellis ac plicis coactata, scilicet: angulari 1 longa, lamelliformi, cum peristomate connexa ac sinulum formante; parietali 1 mediana, præcedenti parallela, profundius posita atque spiraliter volvente; columellari 1 profunda, semilunari; tandem palatalibus 2, supera longa, suturæ parallela et prope marginem desinente, infera profundiore, brevior, paululum subdivergente. Peristoma continuum, undique expansum, subinerassatum.

Long. 2.5, lat. 1.5, alt. apert. vix 1 mm.

Hab.—In valle Nuuanu, prope Honolulu, Oahu (Thaanum).

Another modification of the same type, of very dark colour.

LYROPUPA MAGDALENÆ, Anc.

Hab.—Palama, Oahu (Baldwin). Also young examples from the Waianae Mountains, Oahu, and from Honolulu, Maui, may belong there.

LYROPUPA MIRABILIS, Anc. Pl. VII, Fig. 18.

Hab.—Waianae Mountains, Oahu (Baldwin); Waimea, Hawaii (Prof. H. W. Henshaw), subfossil.

LYROPUPA MICROTHAUMA, n.sp. Pl. VII, Fig. 20.

Testa præcedente minor et minus cylindræca, scilicet magis conoideo-oblonga; anfractibus 5, margine supero externe minus producto, lamella angulari magis elongata et distincta, palatali supera elongata, prope marginem exterum subabrupte truncata, infera magis elongata, haud guttiformi, præcedenti haud omnino parallela, sed paulatim antrorsum divergente præterea differt.

Long. 1·8, lat. 1, long. apert. ·66 mm.

Hab.—In valle Nuuanu, ins. Oahu (Thaanum).

The smallest of the group.

LYROPUPA STRIATULA (Pease).

Insufficiently characterized, but probably distinct from *lyrata*.

Hab.—Hawaii (Pease).

LYROPUPA PERLONGA, Pease. Pl. VII, Fig. 15.

Hab.—Oahu (Pease); Kauai (Perkins); an extinct crater of the Kona coast, Hawaii (Baldwin); Waimea district, Hawaii (Professor Henshaw).

The specimens from Hawaii were all dead and subfossil, though some are in good condition. As I have no specimens from Oahu for comparison, their identification is somewhat doubtful, but they agree fairly well with Pease's shell.

BIFIDARIA LYONSIANA, Anc.

Hab.—Punahou, Oahu (Lyons), also Waianae Mountains, Oahu (Baldwin); Lahaina, Maui (Baldwin).

BIFIDARIA PEDICULUS, Shutt., var. NACCA, Gld.

Hab.—Punahou, near Honolulu, Oahu (Baldwin); Hawaii (Gould); Waipio valley, Hawaii (D. Thaanum).

HELICINA BALDWINI, n.sp. Pl. VII, Fig. 24.

Testa conoideo-lenticularis, solidula, subnitidula, sub epidermide tenui lutescente vel ochracea sordide alba, vertice rubello vel luteo, lineis incrementi tenuibus sub lente sculpta, et stria unica parum impressa supra angulum medianum sita et suturam sequente exarata. Spira conoideo-depressa, vertice minuto. Anfractus fere 5, planulati, superiores subexserti, ultimus ad peripheriam biangulatus, angulo

inferiore altero valde approximato, infra medium sulco exili circumcinctus, basi convexus. Callum basale lividum, intus luteum, granulatum. Apertura obliqua, subtriangularis, angulo extero rotundato. Peristoma simplex, rectum, margine columellari cum basali angulum rotundatum efficiente.

Diam. maj. 6, min. 5·66, alt. 4, alt. apert. (oblique) 3·25 mm.

Hab.—Kipu, Kauai (D. D. Baldwin).

The largest species hitherto found in the Sandwich Islands, but of the same general type.

HELICINA DISSOTROPIS, n.sp. Pl. VII, Figs. 22, 23.

Testa lenticularis, utrinque depresso-convexa, solidula, subnitidula, striis capillaribus incrementi sub lente oblique sculpta, acute carinata, rubella, supra infraque ad callum basalem albo strigata. Spira depressa, late conoidea, apice obtuso. Anfractus 4 plani, superiores exserte carinati, sutura parum profunda; ultimus superne plano-declivis, præter carinam superam altera ille approximata et interdum tertia minus distincta circumdatus. Callum circumscriptum, granulatum, lividulum. Apertura obliqua, supra regulariter declivis, extus angulata, basi subarcuata. Peristoma acutum, basi vix expansiusculum.

Diam. 4·2, alt. 2·25, alt. apert. (oblique) fere 2 mm.

Hab.—Oahu (Thaanum).

A distinct species of compressed form and with two or three acute keels on the last whorl. Surely not a variety of *H. Sandwichensis*, Souleyet, of which I have typical specimens from the Waianae Mountains, Oahu (D. D. Baldwin). Some subfossil examples also are in my hands from Waimea, Hawaii (Henshaw).

HELICINA SULCULOSA, n.sp. Pl. VII, Fig. 25.

Testa parva, subgloboso-conoidea, solidiuscula, subnitens, lineis incrementi obsoletis, prope aperturam perspicuis oblique notata, præterea sulcis linearibus distantibus 5-8 circumdata (duobus superioribus anfractus superiores quoque cingentibus), rubella, concolor vel prope suturam pallido maculata. Spira conoidea, acutiuscula. Anfractus 4, inferiores convexiusculi, sutura parum profunda; ultimus supra convexo-declivis, basi convexus, haud carinatus, ad peripheriam initio vix angulatus. Callum basale circumscriptum, elevatum, tenuiter granulatum, lividum, breve. Apertura obliqua, subtriangularis, extus angulatum rotundata. Peristoma simplex, vix basi expansiusculum. Operculum testaceum, lividum, crassiusculum, ad partem sinistram anguste rubro-marginatum.

Diam. 3·33, alt. 2·5, alt. apert. 1·5 mm.

Hab.—Olaa, Hawaii (Thaanum).

MELANIA TAHITENSIS, Pease, var.

Hab.—Lahaina, Maui (Baldwin). Identified by Dr. Brot, and new for the Sandwich Islands. I have similar specimens received from the Museum Godeffroy as collected in the Society Islands.

EXPLANATION OF PLATE VII.

- FIG. 1. *Succinea Kuhnsi*, n.sp.
 ,, 2. ,, *tenerrima*, n.sp.
 ,, 3. ,, *apicalis*, n.sp.
 ,, 4. ,, *tetragona*, n.sp.
 ,, 5. ,, *quadrata*, n.sp.
 ,, 6. *Kaliella Thaamumi*, n.sp.
 ,, 7. ,, *lubricella*, n.sp.
 ,, 8-8b. *Vitrea Hawaiensis*, n.sp.
 ,, 9. *Amastra luctuosa*, Pfr., var. *sulphurea*, n.var.
 ,, 10. ,, *Henshawi*, Baldwin.
 ,, 11. *Auriculella canalifera*, n.sp.
 ,, 12. ,, *malleata*, n.sp.
 ,, 13. *Nesopupa Baldwini*, n.sp.
 ,, 14. ,, *plificifera*, n.sp.
 ,, 15. *Lyropupa perlouga*, Pease.
 ,, 16. *Nesopupa Wesleyana*, n.sp.
 ,, 17. ,, *Kauaiensis*, n.sp.
 ,, 18. *Lyropupa mirabilis*, Anc.
 ,, 19. ,, *clathratula*, n.sp.
 ,, 20. ,, *microthauma*, n.sp.
 ,, 21. ,, *carbonaria*, n.sp.
 ,, 22, 23. *Helicina dissotropis*, n.sp.
 ,, 24. *Helicina Baldwini*, n.sp.
 ,, 25. ,, *sulculosa*, n.sp.
-



A.H.Searle del. et lith.

Mintern Bros. imp.

HAWAIIAN LAND SHELLS.

ORDINARY MEETING.

FRIDAY, 13TH MAY, 1904.

E. R. SYKES, B.A., President, in the Chair.

The following communications were read:—

1. "On a new form of Carboniferous Nautiloid (*Amphoreopsis paucicamerata*) from the Isle of Man." By G. C. Crick, F.G.S.
2. "List of Mollusca collected during the Commission of H.M.S. 'Waterwitch' in the China Seas, 1900-1903, with descriptions of new species." By Surgeon K. Hurlstone Jones, M.B., R.N., and H. B. Preston, F.Z.S.
3. "Notes on the genus *Anoma*, Albers." By E. R. Sykes, B.A.
4. "New Land-Shells from New Zealand." By Henry Suter.

Specimens were exhibited by the following:—

F. G. Bridgman: A series of Olives belonging to the "*reticularis* group." The exhibitor pointed out that *Oliva reticulata*, Lam., is connected by a complete chain of transitional forms to *O. reticularis*, Lam., on the one hand, and to *O. hepatica*, Lam., on the other.

H. B. Preston: A specimen of *Oliva Julieta*, with abnormal colour-arrangement on the newer parts of the shell.

S. Pace (on behalf of the Marine Biological Association): Living specimens of Nudibranchs.

E. R. Sykes: A distorted example of *Aulopoma* from Ceylon.

ORDINARY MEETING.

FRIDAY, 10TH JUNE, 1904.

E. R. SYKES, B.A., President, in the Chair.

James John Walker, R.N., was elected a member of the Society.

A discussion (summarised, p. 130), in which the President, Dr. W. T. Blanford, Mr. E. A. Smith, Mr. Bullen Newton, and others spoke, took place upon two debatable points of nomenclature.

The following communications were read:—

1. "On *Damayantia Smithi*, Collinge & Godwin-Austen." By Lieut.-Colonel H. H. Godwin-Austen, F.R.S.
2. "Descriptions of twenty-eight species of Gastropoda from the Persian Gulf, Gulf of Oman, and Arabian Sea, dredged by Mr. F. W. Townsend, 1903-1904." By J. Cosmo Melvill, M.A.
3. "*Conus Coromandelicus*, its probable affinities and systematic position in the family Conidae." By J. Cosmo Melvill, M.A.

4. "Descriptions of six new species of Marine Mollusca from the collection of the late Admiral Keppel." By G. B. Sowerby, F.L.S.
5. "Note on *Voluta Brazieri*, Cox." By E. A. Smith, I.S.O.
6. "On the *Doris planata* of Alder & Hancock." By Sir C. N. E. Eliot, K.C.M.G.
7. "Description of a Helicoid Land-Shell (*Xanthomelon Bednalli*) from Central Australia." By J. H. Ponsoyby.

SUMMARY OF THE DISCUSSION AT THE MEETING HELD ON
JUNE 10TH UPON THE TWO FOLLOWING QUESTIONS OF
NOMENCLATURE.

By R. H. BURNE, B.A.

- I.—*A species is described as belonging to genus A and is subsequently transferred to genus B, in which there is already a species bearing the same name. Which species, assuming that the one described in genus A is prior in date, requires a new name?*

THE President prefaced the discussion by giving in detail the case (Hedley, Mem. Austral. Mus., iv, p. 389) upon which the question was founded.

The discussion was opened by Mr. E. A. Smith, I.S.O., who maintained that the name of prior date should stand, because a describer is supposed to ascertain what species fall into the genus the species of which he is describing, although they may have been placed in other genera.

Mr. G. B. Sowerby concurred, insisting that the law of specific priority should always be maintained.

Dr. W. T. Blandford, C.I.E., was entirely of the same opinion, and pointed out that if the reverse rule (priority in the genus) were followed, most of the old specific names, those for instance of Linnæus, would have to be altered.

Mr. Bullen Newton, Mr. Melvill, Mr. Da Costa, and the President having spoken in the same sense, letters dealing with this question, received from corresponding and ordinary members and others, were read:—

The opinion expressed by Professor Boettger that "the species described in genus A and subsequently transferred to genus B retains its name *because prior in date*, and the species in genus B, *because posterior in date*, requires a new name," was also held by Professor Brusina, M. Cossmann, W. H. Dall, Ph. Dautzenberg, W. E. Hoyle, A. J. Jukes-Browne, Professor Machrenthal, S. Pace, H. A. Pilsbry, C. W. Stiles, and B. B. Woodward.

Professor Brusina further remarked that, although this is correct theoretically, it is even more necessary from the practical standpoint, as genera and subgenera will for long be unstable quantities, and will in the future undergo many transformations, as their limits are

gradually made more and more definite by appeal, not only to shell-characters, but to embryology and anatomy.

M. Dautzenberg added: "Species alone are clearly defined entities; genera, on the contrary, ought to be considered, at least at present, as unstable, and only more or less ingenious attempts in the formation of groups. If Hervier had known of the existence of *Pleurotoma* (*Drillia*) *suavis*, Smith, he would have taken care not to give the same name to another species of the same group. Hervier, however, committed an error which had to be rectified, and the introduction into the genus *Drillia* of *Pleurotoma suavis*, Smith, should naturally result in the disappearance of *suavis*, Hervier. Mr. Hedley was wrong in replacing *suavis*, Smith, by *prosuavis*, Hedley.

"The case before us is relatively harmless—a name has unintentionally been employed twice, and calls for only a single rectification,—but a much more serious state of things is produced by the intentional use of the same name for species in allied genera. This is to be noticed most frequently among the Helicoids, owing doubtless to the difficulty of finding new specific names in this group. But the genera of Helicoids are probably far from stable, and I am convinced that certain of them are superfluous, and that species with the same name will have to be transferred from one genus to another, when they are more completely studied, anatomically and conchologically. Under these circumstances, authors who give the same name to different species seem to be doing harm, for if the alterations which I foresee are realised, disturbances of nomenclature will result—serious in proportion to the number of duplicate specific names."

The contrary opinion (viz. that the species in genus B retains its name) was held by Colonel Beddome, G. K. Gude, C. Davies Sherborn, and Lieut.-Colonel Wilmer, the reason being assigned that the specific name of longest standing *in genus B* has the priority.

The meeting then unanimously passed a resolution that in their opinion the specific name originally given in genus A stands.¹

II.—*A form is described as a variety of one species, and subsequently is described as a new species, with a new name. Which name stands?*

After the President had explained the actual case (Pilsbry, Manual of Conchology, Monograph of *Anoma*) by which the question was called forth, Dr. Blanford, in opening the discussion, pointed out that this was a much more complicated question than the first, and that the answer depended apparently to a great extent upon what is actually meant by a variety. In the case of mere variations, such, for instance, as those of garden plants, depending upon differences

¹ Since the discussion a letter has been received by the President from Mr. Hedley, in which he expresses the view that a specific name should be regarded only from its date of insertion in a genus, and that the name longest in the genus has, therefore, priority. He points out that the contrary view might lead to much confusion, as it might involve a change of name in the case of the type of a genus, should a second species of similar name be subsequently transferred to that genus.

of colour, the varietal names (*alba*, *rufa*, etc.) certainly have not the same standing as specific names, and in the formation of new species may conveniently be ignored. A true subspecies is, however, on a very different footing. Its name is of equal value with a specific name, and should be retained when the subspecies is raised to specific rank.

Mr. Sowerby was of opinion that the varietal name should be retained. But it was suggested by Mr. Da Costa that if this rule were consistently enforced great confusion would almost inevitably arise, owing to the fact that varietal names are usually founded on trivial characters, and would in all probability already be in use in the genus as specific names.

Mr. Melvill and Mr. Smith were of opinion that the new specific name should stand, the latter considering that the credit of founding a species should rest with the man who first correctly recognised it. On the other hand, Mr. Fulton and Mr. Bullen Newton held that the varietal name should be retained. Mr. Newton, however, would allow considerable discretion in the application of the rule in individual cases.

Letters dealing with this question from corresponding and ordinary members and others were then read:—

Professor Boettger, M. Cossmann, W. H. Dall, Ph. Dautzenberg, G. K. Gude, A. J. Jukes-Browne, Professor v. Machrenthal, S. Pace, H. A. Pilsbry, C. Davies Sherborn, and C. W. Stiles were of opinion that the varietal name should be retained.

M. Dautzenberg further pointed out that this is complementary to the common custom of transforming the specific into the varietal name, when a species after being described is considered to be the variety of another species.

Mr. Pilsbry wrote also: "This view is generally, though not universally held, and was discussed in the celebrated case of *Cypræa gregori*, var. *coloba*. It might be well to obtain an expression of opinion upon the question of whether in one genus two *varieties* may bear the same name. Thus:

Cyclostoma angustum, var. *rufilabre*.
 „ *jayanum*, var. *rufilabre*."

The opposite opinion (*viz.* that the new specific name should be used) was expressed by Colonel Beddome, Professor Brusina, W. E. Hoyle, and Colonel Wilmer, on the grounds that the author of the variety had failed to properly understand it (Brusina), that varietal names have no status as against specific (*Hoyle*), and that varietal names are seldom suitable for use as specific names (Brusina, Beddome, Hoyle).

Mr. B. B. Woodward wrote: "There are varietal names that are eminently good so long as they are used as such, but which would be meaningless when used for specific designation. These would have to yield place were the specific distinctness of form proved. If the new specific name be given under the belief that the form is a valid species, and it should prove that this is not the case, then the new name becomes a synonym for the varietal one. It should, however,

be a general rule on the elevation of a variety into a species to retain the varietal as the new specific name.”

The President having stated that, on the whole, he was of opinion that the new specific name should be used, the meeting agreed by a small majority that, *in the case upon which the question was based*, Mr. Pilsbry was justified in giving Adams' varietal name of *tessellata* precedence over Pfeiffer's later specific name.

NOTES.

NOTE ON *DAMAYANTIA SMITHI*, COLLINGE & GODWIN-AUSTEN. (Read 10th June, 1904.)—There are many passages in Mr. Collinge's paper in vol. vi, pp. 9–12, of this journal I should like to reply to, but it is quite time this argument came to an end. I have only to refer to a point of nomenclature, and I shall endeavour to be as brief as possible. *Damayantia Smithi* was described and very clearly figured in the P.Z.S., 1895, pl. xi, by Mr. Collinge and myself. In 1901 Mr. Collinge created a new genus *Isselentia* (allied to *Damayantia*), making the type *plicata*, Collge., a species similar in all important characters to the figures of *D. Smithi* in the P.Z.S., pl. xi, and, I may add, all the figures, not 1–5 as quoted on p. 11, vol. vi. The species we described together in 1895 I consider should stand as *Isselentia Smithi*. It would be quite wrong to transfer the specific name *Smithi* to another very distinct species of the genus *Collingea*. This last species should therefore be named; it was not figured in 1895. In this connection compare my drawings of the generative organs of *Damayantia Smithi*, figs. 7, 7a, 7b, and 7c, Land and Fresh-water Moll. India, pl. lxxiii, and Mr. Collinge's figs. 9 and 10, pl. xi, P.Z.S., all made in the same year; also look at the drawings of the jaw and radula of *Damayantia Smithi*, figured in the P.Z.S., Moll. Ind., and Proc. Malac. Soc., vol. v, pl. xi, figs. 2b, 2c, which may now be seen in the Natural History Museum with the label *D. Smithi*, written at the time it was mounted. Not a single figure on pl. xi, P.Z.S., applies to *Microparmarion* or *Collingea*, and all, except figs. 9 and 10, drawn by Mr. Collinge, were copied by Mr. Smit from my drawings on autographic paper.

H. H. GODWIN-AUSTEN.

ON A NEW FORM OF CARBONIFEROUS NAUTILOID (*AMPHOREOPSIS PAUCICAMERATA*) FROM THE ISLE OF MAN.

By G. C. CRICK, F.G.S.

Read 13th May, 1904.

PLATE VIII.

THE Cephalopod forming the subject of the present communication belongs to the collection of Mr. R. Law, F.G.S., to whom I am indebted for the loan of the specimen; it was brought under my notice by Mr. G. W. Lamplugh, of the Geological Survey, and Mr. E. T. Newton, to whom also my thanks are due.

In his work on "The Geology of the Isle of Man" (Mem. Geol. Survey, United Kingdom), published in 1903, Mr. Lamplugh recognises the following succession of beds (here given in descending order) in the Carboniferous Basin of the south of the island (p. 189):—

5. Volcanic Series of Scarlet.
4. Posidonomya Beds.
3. Poolvash or Pale Limestones.
2. Castletown or Lower Dark Limestones.
1. Basement Conglomerate.

The Nautiloid described in the present paper was obtained from the Poolvash Limestone, at Poolvash, on the southern coast of the island.

The fossil is ovoid, having its greatest thickness a little nearer the anterior than the posterior end; it is about 100 mm. long, tapers slowly anteriorly, and rather more rapidly posteriorly; its transverse section is subcircular, the ventro-dorsal and transverse diameters at its thickest part being 47.5 and 48 mm. respectively, so that the fossil is very slightly depressed. It is very gently curved, the outer or ventral surface being a little more convex than the dorsal, and the posterior end of the fossil turned a little towards the less convex or dorsal surface. By far the greater part of the specimen is occupied by the body-chamber, which is filled partly with limestone and partly with calcite; it is 83 mm. long. The septate part is very short, being only about 17 mm. in length. The test is wanting on the dorsal area and on the greater part of the sides of the body-chamber; although a large portion of that which is present on the ventral surface is much eroded, the parts that are well preserved show that the test was almost perfectly smooth. The lateral and dorsal portions of the anterior end of the body-chamber are wanting, but a small piece of the peristome preserved on the dorsal surface shows that the aperture was simple (*a*, Figs. 1 and 2). On the anterior part of the internal cast of the body-chamber there is a fairly deep depression (*d*, Figs. 1, 2, and 4),

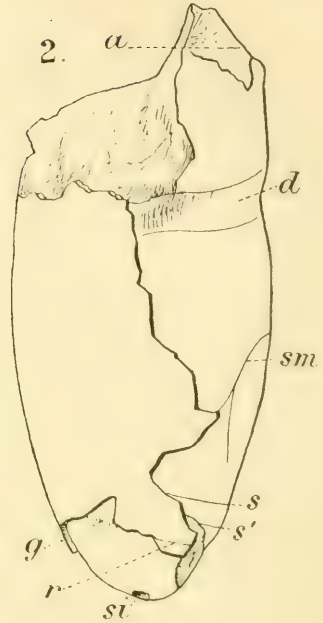
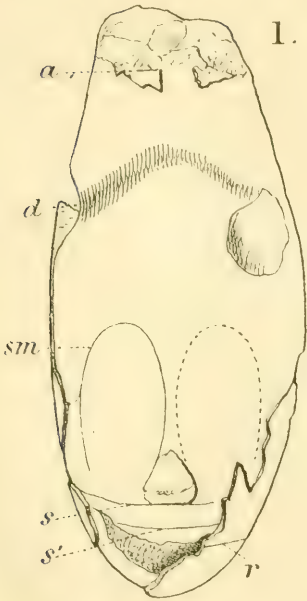
about 10 mm. wide and rather more than 1 mm. deep, which seems to have been continuous around the body-chamber, but owing partly to the imperfection of the dorsal surface of this part of the body-chamber, and partly to the presence of test there, its direction on the dorsal area cannot be traced; it crosses the cast almost horizontally on the lateral area, its centre being about 31 mm. from the edge of the aperture; it then rises in a broad obtuse V-shaped curve on the dorsal surface, its centre in the middle of this surface, where it is a little shallower than elsewhere, being 26 mm. below the edge of the aperture. This depression was due to a corresponding thickening of the internal surface of the shell. The septate part is very short, only about 17 mm. long or about one-fifth of the length of the body-chamber; the test is present only on one lateral area and the adjoining portion of the dorsal surface, and is continued over the posterior septal surface; apparently there are only two camerae; the septa are oblique, nearly horizontal in the siphuncular region and strongly arched upwards in the ventral region, so that the suture-lines are nearly straight on the sides, form a broad, very shallow, backwardly-directed curve on the dorsal surface, and a broad, forwardly-convex curve on the ventral area. The internal cast of the last chamber is well-preserved, and shows that its depth at the flattened dorsal surface of the fossil is 4 mm. The dorsal portion of the internal cast of the penultimate chamber is broken, and shows (beneath the ridge marked *s'* in the figures) a portion of the posterior surface of the internal cast of the last chamber; one side and a piece of the adjoining dorsal area of the posterior surface of the internal cast of the penultimate chamber are covered by the test continuous with that on the sides, the rest of the posterior surface is devoid of test; the test is so fractured that it now only partly covers the siphuncle, but it appears originally to have completely covered this structure; it is slightly thicker here than on the body-chamber, but seems, like the rest of the test, to be quite smooth. The siphuncle (*si* in Figs. 2 and 3) seems to be moniliform; it is subcentral, being situated on the shorter (ventro-dorsal) diameter, a little nearer the dorsal than the ventral surface. Parallel to, and at a distance of 7 mm. from, the edge of the penultimate septum, the test on the lateral area and the adjacent dorsal surface is traversed by a feeble depression bounded anteriorly by a well-defined, slightly-elevated shoulder (*r*); the depression is continued as a very shallow groove (*g*) over the posterior surface of the internal cast of the penultimate chamber to a small fragment of the test on the opposite lateral area (see Fig. 2), which also exhibits a feeble depression bounded anteriorly by a slightly-elevated shoulder (*r* in Fig. 2). The appearance of the posterior part of the specimen shows that, like some other Nautiloids,¹ this species was in the habit of discarding its earlier chambers and covering the posterior septal surface with shelly matter; the slight shoulder, just mentioned, indicating the position of the edge of the septum immediately behind which the earlier chambers were

¹ E.g. *Orthoceras truncatum*, Barrande, from the Silurian of Bohemia and England.

detached, the corresponding groove on the posterior surface of the internal cast being most probably due to the thickening produced where the septum meets, and is, as it were, fused to the shell-wall. On the lower part of the dorsal surface of the internal cast of the body-chamber, at about 6 mm. from the last septum and a little to the left of the median line, a curved line (*sm* in Figs. 1 and 2) originates; this passes upwards and a little to the right, until it is 12 mm. from the septum, when, continuing its upward course, it bends slightly to the left until it is 32 mm. from the septum, when it curves at first outwards and then backwards, until it is about 16 mm. from the last septum; then it appears to divide; one part continues on towards the last septum, for a short distance, and then disappears, the other turns almost horizontally, and soon passes beneath a portion of the test. This curved line, just described, thus forms part of the boundary of an ellipse, of which the major and minor axes are 32 and 20 mm. respectively, the major axis being directed forwards and inclined towards the median line of the dorsal surface. In a corresponding position on the right side of this surface there appear to be indications of a similar elliptical area,¹ meeting the one on the left at a place a little to the right of the median line, but the fossil is here so much weathered that the course of the boundary of the area cannot be satisfactorily followed. These areas are believed to be the muscle-sears, and the short horizontal branch proceeding from the one on the left appears to be the anterior boundary of a part of the annulus.

I have not been able to find any record of a similar Nautiloid from the Carboniferous rocks. It cannot possibly be referred to any of the described species of Nautiloidea recorded on pp. 261 and 262 of Mr. G. W. Lamplugh's work on "The Geology of the Isle of Man" (Mem. Geol. Surv.), published in 1903. In the list of Carboniferous fossils (named by Count Keyserling) from the Isle of Man, given by the Rev. J. G. Cumming on pp. 354-359 of his work on "The Isle of Man," published in 1848, besides a number of Nautiloidea which had already been described, the following new species are mentioned:—*Cyrtoceras Poolvashi*, from the Poolvash Limestone; *C. tessellatum*, from the Posidonomya Beds; *Orthoceras catetes*, from the Posidonomya Beds; and *O. prolongatum*, from the Poolvash Limestone and Posidonomya Beds. No descriptions of these fossils are given. The only species which seems likely to have been the one here described is *Cyrtoceras Poolvashi*. Possibly the examples of these new species were in the Cumming Collection, which is still preserved in the Museum of King William's College at Castletown, Isle of Man, but Mr. Lamplugh states (*op. cit.*, p. 251) that, when he saw the collection, it had fallen into disorder, so that the majority of the specimens were then either without labels or with labels insufficient for their identification, and, further, it was suspected that the labels had in some cases been shifted from their original specimens. Under the circumstances, therefore, it appears to be now impossible to identify these species, and the names must remain *nomina nuda*.

¹ Indicated by the dotted line in Fig. 1.



A NEW FORM OF CARBONIFEROUS NAUTILOID FROM THE ISLE OF MAN.

The character of the aperture at once distinguishes this fossil from *Gomphoceras*, and the form of the specimen shows that it is not a truncated example of *Orthoceras*. Its affinities are rather with the *Poterioceratidæ* and *Cyrtoceratidæ*. Though somewhat resembling a truncated form of *Poterioceras*, it differs from that genus in several respects: (1) in having the greatest convexity of the body-chamber on the outer instead of the inner curvature; (2) in the length of the body-chamber, the last septum in that genus being at about the point of greatest inflation of the shell, whilst, in the present specimen, the greatest inflation is at about the mid-length of the body-chamber; and (3) in the character of the muscular attachment, this being quite different from the attachment, so far as we have observed it, in undoubted examples of that genus. On the whole, and particularly as regards the character of the muscular attachment, the form appears to belong to the *Cyrtoceratidæ*. It does not, however, seem to be included in any of the members of that family already recognised. It comes nearest the genus *Cyrtoceras*, especially that section for which Foord¹ has adopted Hyatt's name *Meloceras* as a subgeneric title, but differs from that genus in the general form and relatively large size of the body-chamber. I feel compelled, therefore, though reluctantly, to regard it as a new genus. On account of its form I propose for this genus the name *Amphoreopsis*,² and in allusion to the fewness of the camerae (or so-called air-chambers) suggest, as the trivial name, *paucicamerata*.

EXPLANATION OF PLATE VIII.

Type-specimen of *Amphoreopsis paucicamerata*, G. C. Crick, from the Poolvash Limestone (Carboniferous), Poolvash, Isle of Man. Fig. 1, dorsal aspect; Fig. 2, left lateral aspect; Fig. 3, ventral aspect; Fig. 4, right lateral aspect. About three-fourths of the natural size. *a*, portion of the peristome; *d*, constriction on the anterior part of the internal cast of the body-chamber; *g*, groove on posterior surface of the internal cast of the penultimate chamber; *r*, 'shoulder' indicating place of detachment of earlier chambers; *s*, last septum; *s'*, ridge indicating edge of penultimate septum; *si*, siphuncle; *sm*, boundary of impression of muscle-scar.

¹ Carboniferous Cephalopoda of Ireland (Mon. Pal. Soc.), pt. 2, 1898, pp. 33 et seqq.

² ἀμφορεύς, a wine-jar, and ὄψις, aspect.

LIST OF MOLLUSCA COLLECTED DURING THE COMMISSION OF
H.M.S. "WATERWITCH" IN THE CHINA SEAS, 1900-1903,
WITH DESCRIPTIONS OF NEW SPECIES.

By Surgeon K. HURLSTONE JONES, M.B., R.N., and H. B. PRESTON, F.Z.S.

Read 13th May, 1904.

THE shells referred to in the present paper were collected by Surgeon K. H. Jones, R.N., as opportunity occurred, in the various localities which H.M.S. "Waterwitch" was employed to survey. These localities were spread over about thirty-three degrees of latitude, namely, from about 4° to 37° North, that is to say, from the boundary between British North Borneo and Dutch Borneo, on the east coast of the island, to the vicinity of Wei Hai Wei in Northern China.

The localities examined were all at considerable distances from one another, and include, in addition to those above mentioned, the island of Hong Kong and a considerable portion of the adjoining mainland, and the neighbourhood of Shanghai, with certain islands off the coast of Chekiang, in which province Shanghai is situated.

A somewhat more particular description of the above localities, with special reference to their physical features, may not be here out of place. It should perhaps be mentioned that all the places referred to in this paper are in close proximity to the sea, if not actually on the seashore.

British North Borneo and the neighbouring islands are eruptive, with rich alluvial deposits overlying their igneous rocks, and are covered, except in those few spots where civilization has effected a clearing, with luxuriant jungle. In Labuan, however, the old jungle was entirely destroyed by fire some thirty-two years ago, and a good deal of the native fauna disappeared after the disaster. Terrestrial molluscs are undoubtedly plentiful in the old jungles, but are most difficult to find. Marine molluscs swarm in the warm seas which surround the great island and its smaller offshoots.

The country round about the island of Hong Kong is rocky, precipitous, and contains much waste land, although the natives manage with infinite toil to cultivate large quantities of rice in the narrow valleys, and by means of terraces on the steep hillsides, and, indeed, high up the mountains. More than half the "Waterwitch's" commission was spent either at Hong Kong or in the survey of the newly acquired British territory on the mainland adjoining, which therefore received a large share of attention. Geologically this district is composed of igneous rocks, sandstone, greenstone, and granite predominating; and, like most localities in which these conditions exist, it was not found very favourable for terrestrial mollusca.

The country in the vicinity of Shanghai is formed entirely of the alluvial deposit of the great Yangtze River, and is cultivated to the utmost.

The island of Shawei Shan, a patch of volcanic matter a few acres in extent, situated at the entrance to the northern mouth of the Yangtze River, and twelve miles from the nearest land, requires to be mentioned here, as also do the Chusans, an archipelago of mountainous, highly cultivated islands, none of them of large size, which lie off the coast, about eighty to a hundred miles from Shanghai itself, and which appear to be rather rich, for China, in fluviatile molluscs.

Wei Hai Wei, as generally understood, consists of a small island, Leu Kung Tau, on which the naval establishment is situated, and the adjoining mainland; and, in addition to this, some fifty miles of the coast of Shantung was surveyed by the "Waterwitch," as well as a place called Shi Tao at the south-east corner of the Shantung Promontory, and some seventy miles from Wei Hai Wei by sea. The country is barren, sandy, and dry, with rocky hills and few rivers and streams; it is poorly wooded, but, as in most other parts of China, is cultivated to its fullest extent. It is a disappointing country from a molluscan point of view, although four new species of *Limnæa* were obtained from it.

It must be admitted that the results of the collecting in the various above-named localities was, on the whole, disappointing. Terrestrial molluscs are, however, nearly always the reverse of abundant where igneous rocks are found, and China did not, at least in those parts visited, display the expected variety of fluviatile forms; whilst, with regard to marine species, although plentiful, it is regretted that time did not permit for more extended and careful search on their behalf.

LIST OF SPECIES.

1. *HEMIPLECTA Densa* (Ad. & Rve.).

Obtained in British North Borneo.

2. *MACROCHLAMYS CONSUL* (Pfr.).

Doat Island, near Labuan; British North Borneo, in old jungle.

3. *MACROCHLAMYS JUCUNDA* (Pfr.).

Doat Island, near Labuan; British North Borneo.

4. *CAMÆNA XANTHODERMA*, Mlldff.

A few dead specimens at Hoi Ha in the new territory, opposite to Hong Kong.

5. *CAMÆNA CICATRICOSA* (Müll.).

Found commonly in the garden of the British Yamen in the heart of Canton native city, and also in gardens at Hong Kong. Only dead shells were obtained.

6. *EULOTA RAVIDA* (Bens.).

Found, more or less frequently, from Hong Kong to Wei Hai Wei, but, except on Shawei Shan Island, not commonly. The form which occurs in the last-named locality differs somewhat from those seen elsewhere, in the rather darker colour and in the striation, which may perhaps be accounted for by its isolation.

7. *EULOTA SIMILARIS* (Fér.).

This species occurred plentifully at Woo Sung, near Shanghai, and was also found, though not so commonly, at Hong Kong and on the adjoining mainland.

8. *EULOTA REDFIELDI* (Pfr.).

Specimens of this species were obtained at Shanghai.

9. *EULOTA FASCIOLA* (Drap.).

Specimens of this species were also only obtained at Shanghai, on garden walls.

10. *EULOTA TOURANNENSIS* (Soul.).

At Wan Ha, on the mainland near Hong Kong. A few dead shells on the seashore.

11. *EULOTA GLOBOSA*, n.sp.

Shell globose, narrowly perforate, solid, coarsely striated by the lines of growth; whorls 6-7, very convex; suture impressed; peristome reflexed; aperture broadly lunate; a callosity connecting the



columella with the peristome above. Diam. maj. 14, min. 12.5 mm.; alt. 12 mm.

A few dead shells obtained at Shi Tao, in Shantung.

12. *SUCCINEA CHINENSIS*, Pfr.

A single specimen of this species was obtained at Shanghai.

13. *PYTHIA SCARABÆUS* (Linn.).

This species was found commonly at Labuan, off the coast of British North Borneo, in damp marshy spots and in old jungle.

14. *PYTHIA TRIGONA* (Troschel).

Found, but less commonly, in similar localities to the last species, at Labuan, and in some of the neighbouring small islands.

15. *AURICULA AURIS-JUDÆ* (Linn.).

Plentiful in marshy places in British North Borneo, and in the island of Labuan, and very frequently entirely decorticated.

16. *AURICULA AURIS-MIDÆ* (Linn.).

Somewhat less plentiful than the last, and found only in Labuan Island. Like the former species, it is very often much decorticated, and to obtain a specimen in good condition is not easy.

17. *CASSIDULA MUSTELINA* (Desh.).

This species is plentiful in marshy places in Labuan.

18. *CASSIDULA AURIS-FELIS* (Brug.).

Plentifully in association with *C. mustelina*, Desh., *Auricula auris-Midæ*, and *Auricula auris-Judæ*, in marshy spots in Labuan.

It appears not improbable that the reason the loss of the periostracum is so common in all these molluscs, is that they not infrequently, when the tide falls, find themselves exposed to the full heat of the tropical sun, in spite of the fact that they are very well able to bury themselves in the mud.

LIMNÆA.

Considering the profusion of *Limnææ* elsewhere, and considering the very unusual amount of suitable or apparently suitable ground for the genus, the members of it are neither numerous nor widely distributed in China. In the neighbourhood of Hong Kong, where a very large area has been minutely examined, there are only three localities in which *Limnææ* occur, all of which are separated by miles of mountainous country from one another, and in one instance, the colony, one of *L. Swinhoei*, only amounted to a couple of dozen specimens all told, and is situated on an island of small size. All three areas are extremely limited in extent.

In the Chusans also there is one limited area, sparsely populated with *Limnæa plicatula*.

The most curious point about the distribution of the genus, as regards the portions of China visited, is that it should be so abundant on the Shantung seaboard, of all places physically the last in which it might be expected to flourish. Yet every shallow sandy stream in this part of the empire appears to produce a species or two.

The Shantung coastline is, however, the resort, in Autumn and Spring, of immense numbers of ducks and geese, travelling on migration, and the great fondness of these birds for *Limnææ* as articles of food may perhaps account for the introduction of these molluscs in such plenty, the egg-cases and young being carried on the legs or plumage of the migrants.

19. *LIMNÆA MARS*, n.sp. Fig. 2.

Shell narrowly acuminate, very thin, glossy, fulvous horn-colour, very finely striated with lines of growth; whorls 5; aperture inversely auriform, about $\frac{1}{2}$ of the whole height of the shell; columella twisted,

and extending into a very thin callosity, barely reaching to the lip above; umbilicus shallow and very narrow; peristome simple above, slightly reflexed below. Alt. 16, diam. 7.5 mm.; height of aperture 11, breadth 4.5 mm.

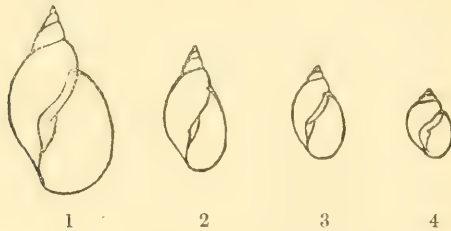
Hab.—Liu Shi Tao, north-east promontory of Shantung, in a large fresh-water lagoon.

20. *LIMNÆA* (*GULNARIA*) *WHARTONI*, n.sp. Fig. 1.

Shell ovate acuminate, pale brownish horn-colour, striated with somewhat coarse lines of growth; whorls 5-6; aperture ovately and inversely auriform, about $\frac{1}{3}$ of the total height of the shell; columella strongly twisted and extending into a callosity which reaches the lip above; umbilicus very narrow; peristome simple above, slightly reflexed below. Alt. 23, diam. 12.5 mm.; height of aperture 15, breadth 7 mm.

Hab.—Liu Shi Tao, north-east promontory of Shantung.

Plentifully in a large fresh-water lagoon.



21. *LIMNÆA* (*GULNARIA*) *SHANTUNGENSIS*, n.sp. Fig. 4.

Shell ovate, fulvous, corneous, striated with somewhat irregular lines of growth; whorls 5; aperture oval, about $\frac{2}{3}$ of the whole height of the shell; columella straight, extending into a faint callosity occupying half the distance to the lip above, and reflexed over the umbilical region; umbilicus narrow; peristome simple, except where it approaches the columellar region, where it is slightly reflexed. Alt. 9, diam. 5 mm.; height of aperture 6, breadth 3.5 mm.

Hab.—Wei Hai Wei; Shantung.

Plentifully in a small rocky stream.

22. *LIMNÆA* (*GULNARIA*) *PETTITI*, n.sp. Fig. 3.

Shell narrowly acuminate, pale brownish horn-colour, slightly malleated, and striated with lines of growth; whorls 5; aperture inversely auriform, about $\frac{2}{3}$ the whole height of the shell; columella slightly twisted, extending into a thin callosity which reaches the lip above; umbilicus very narrow; peristome simple above, slightly reflexed below. Alt. 12, diam. 6 mm.; height of aperture 8, breadth 3 mm.

Hab.—Near Chefoo, Shantung.

Plentifully in a disused canal.

23. *LIMNÆA CLESSINI*, Neumayr.

Liu Shi Tao, south-east promontory of Shantung. One or two specimens in a large fresh-water lagoon.

24. *LIMNÆA* (*GULNARIA*) *OVATA*, Drap., var. *ABERRANS*, Westerlund.

The island of Leu Kung Tao, or Wei Hai Wei Island, in a small stream which dried up during September, 1901, thereby causing the total destruction of the species living in it.

25. *LIMNÆA* (*GULNARIA*) *PLICATULA*, Bens.

Found sparingly in a fresh-water lagoon in Tao Hwan Island, one of the Chusan group, and apparently a favourite food of the many wild duck which resort thither in the Autumn.

26. *LIMNÆA* (*GULNARIA*) *SWINHOELI*, H. Ad.

Found plentifully at Plover Cove in the new territory on the mainland opposite to Hong Kong Island, and very sparingly on Double Island, a small island in the same vicinity, in both cases in paddy-fields through which run good fresh-water streams.

27. *PLANORBIS CHINENSIS*, Dunker.

A few specimens of this species occurred in a small marsh in Tao Hwan Island, in the Chusans.

28. *SIPHONARIA COCHLEARIFORMIS*, Rve.

A few specimens were obtained at Tao Hwan Island in the Chusans, where they are much appreciated by the Chinese as an article of diet.

29. *BULLA COLUMELLARIS*, Menke.

A few specimens were obtained at Hoi Ha, in the new territory, opposite to Hong Kong.

30. *BULLA AMPULLA*, Linn.

One specimen from British North Borneo.

31. *TEREBRA DIMIDIATA* (Linn.).

A few specimens from British North Borneo.

32. *CONUS* (*PUNCTICULIS*) *ARENATUS*, Brug.

33. *CONUS* (*CORONAXIS*) *HEBRÆUS*, Linn.

34. *CONUS* (*CORONAXIS*) *MILIARIS*, Hwass.

All these three species were obtained on a coral reef in British North Borneo.

35. *MITRA* (*TURRICULA*) *BALTEOLATA*, Reeve.

A few taken in Labuan.

36. *NASSA ARCLARIA*, Lamk.

A few specimens in British North Borneo.

37. *NASSA* (*ZEUXIS*) *OLIVACEA*, Brug.

One specimen in Sebutik Island, in Dutch Borneo, on the east coast of the island.

38. *COLUMBELLA* *FULGURANS* (Linn.).39. *COLUMBELLA* *DISCORS* (Gmel.).

A few specimens from Tregannu, in British North Borneo.

40. *RAPANA* *BEZOAR* (Linn.).

A few specimens were obtained at Shawei Shan Island.

41. *PURPURA* (*THALESSA*) *HIPPOCASTANUM*, Lamk.

A common species on rocks on the shores of the Canton river estuary.

42. *SISTRUM* *MUSIVUM* (Kiener).

Not uncommon at Labuan.

43. *SISTRUM* *CONCATENATUM* (Lamk.).

A few in British North Borneo.

44. *CASSIS* *STRIGATA* (Gmel.), var.

Not uncommon on the coast of Shantung, where it is dug up with a pointed stick from the tidal margin and is an article of diet.

45. *CYPRÆA* *FIMBRIATA*, Gmel.46. *CYPRÆA* (*ARICIA*) *ANNULUS*, Linn.47. *CYPRÆA* (*LUPONIA*) *APELLUS*, Linn.48. *CYPRÆA* (*LUPONIA*) *ERRONES*, Linn.49. *CYPRÆA* (*TRIVIA*) *SCABRIUSCULA*, Gray.50. *CYPRÆA* (*PUSTULARIA*) *NUCLEUS*, Linn.51. *CYPRÆA* (*EONA*) *CICERCULA*, Linn.52. *CYPRÆA* *ARABICA*, Linn.

All the above *Cyprææ*, with the exception of *C. arabica*, were obtained in Labuan and British North Borneo. *C. arabica* was collected at Fung Bay on the mainland, opposite to Hong Kong Island.

53. *CERITHIUM* *PATULUM*, Sowb.

Found in profusion on the rocks at Kuhto, in the new territory, adjoining the island of Hong Kong.

54. *CERITHIUM* *MORUS*, Lamk.

Plentifully in the estuary of the Canton River.

55. *TEREBRALIA* *SULCATA* (Born).

At Pakerang, in British North Borneo; a few specimens of large size. In the neighbourhood of Hong Kong the species is plentiful in suitable localities, and apparently quite indifferent to hot sunshine and cold winds, when exposed by a falling tide.

56. *TELESCOPIUM FUSCUM*, Schum.

Sebatik Island, Dutch Borneo. Very commonly to be found on the edges of the mangrove swamps, buried in the sand or mud.

57. *CERITHIDEA RHIZOPORARUM*, A. Ad.

At Hong Kong. More plentiful than the preceding, but like it in habitat and behaviour.

58. *PLANAXIS SULCATUS* (Born).

Not uncommon at Crooked Island, off the mainland, adjoining Hong Kong.

59. *MELANIA*.

Two species of *Melania* were obtained in Borneo—one at Lahad Datu, Darvel Bay, which lived in fresh water, and was not very common, and one which lived in the salt water of a mangrove swamp, at Labuan, in great profusion. The first was *M. episcopalis*, Lea, and the second *M. Labuanensis*, Brot. The neighbourhood of Hong Kong produced two species, of which one, *M. Hainanensis*, Brot, was only discovered in two localities, many miles apart, but plentifully in both places. The habitat of this species appeared to be clear, rapidly running, rocky streams. The other species, *M. costellaris*, Lea, was obtained from the stagnant water of the paddy-fields, and was very much restricted in its distribution.

60. *LITTORINA* (*MELARAPHE*) *MELANOSTOMA*, Gray.

A common species, both in British North Borneo and in the neighbourhood of Hong Kong.

61. *LITTORINA CARINIFERA*, Menke.

Taken commonly at Pakerang in British North Borneo and in Labuan.

62. *LITTORINA UNDULATA*, Gray.

Found abundantly with the last-named species.

63. *LITTORINA SCABRA* (Linn.).

Found in moderate numbers at Shawei Shan Island, where, during the ebb tide, it must have lived in perfectly fresh water.

64. *LITTORINA ARBORICOLA*, Rve.

Not uncommon at Labuan.

65. *LITTORINA BREVICULA*, Phil.

The species occurred abundantly at Shawei Shan Island, where, like *Littorina scabra*, it passes half its life in fresh and half in salt water.

66. *TORINIA PERSPECTIVIUNCULUS* (Chemnitz).

A few specimens were obtained in British North Borneo.

67. *BYTHINIA STRIATULA*, Bens.

This species occurred sparingly in a small marsh at Tao Hwan, an island of the Chusan group, where it was associated with *Limnaea plicatula* and *Planorbis Chinensis*.

68. *VIVIPARA HAMILTONI* (Metcalf).

Specimens which, though not typical, we felt constrained to relegate to this species, were taken at Lahad Datu, Darvel Bay, on the east coast of Borneo, where they occurred sparingly in a small jungle puddle.

It is rather curious that all the *Vivipara* referred to in this paper as being found in China were observed about the stems of growing rice in the paddy-fields.

In winter-time, after the rice crop has been gathered in, the surface of the paddy-fields becomes as hard, dry, and dusty as a highway, and yet the *Vivipara* never seem to seek shelter in the streams which almost invariably run through or by the sides of the fields. It appeared probable that the molluscs buried themselves for the Winter months. With the object of ascertaining whether this was the case, a particular paddy-field, some fifteen yards square, and one of about half a dozen, in a small valley isolated by half a mile from any other cultivation, were carefully watched. About ten days after the field had been flooded, *Vivipara Chinensis* began to appear, and as all the specimens were thickly encrusted with hard mud, which they never are later in the season, it seemed only possible that they had made their way up from below, and, indeed, some were noted which had only half extricated themselves from the sodden earth. These molluscs must have been deeply buried, as the soil is subjected to a very thorough ploughing before the water is run over it. Curiously, all the specimens contained young.

All the *Vivipara* appear to be greatly relished by the Chinese as articles of diet, and are sold by measure in the native markets.

69. *VIVIPARA ANGULARIS* (Müll.).

Found in great numbers at Lin Chao, in the vicinity of Shanghai.

70. *VIVIPARA QUADRATA*, Bens.

This species was obtained in the paddy-fields at Tao Hwan Island, in the Chusans, and also purchased in the market at Shanghai.

71. *VIVIPARA CHINENSIS*, Gray.

This species was found to be fairly common in the vicinity of Hong Kong, and also at Tao Hwan Island in the Chusans. The specimens varied greatly both in colour and in size.

72. *AMPULLARIA EXPANSA*, Nevill.

A few specimens which were obtained in a jungle ditch at Lahad Datu, Darvel Bay, British North Borneo, were assigned to this species.

73. *ASSIMINEA LATERICEA*, Bens.

This species was found plentifully at Lin Chao on the northern mouth of the Yangtze Kiang, and sparingly at Tao Hwan in the Chusan Archipelago.

74. *ASSIMINEA NORBURYI*, n.sp.

Shell conical, perforate, polished, of a rich chestnut colour; whorls 6-7; suture impressed; peristome simple; aperture oval. Operculum paucispiral, horny, thin, and transparent, the nucleus being situated on the side adjacent to the columella. Alt. 3.5, diam. 2 mm.



This species occurred in great plenty at Lin Chao, in company with *A. latericea*, Bens., and *Vivipara angularis*, and many thousands were found left stranded on the rapidly drying paddy-fields, exposed to the full glare of a September sun.

75. *CYCLOPHORUS (GLOSSOSTYLUS) BORNEENSIS*, Metcalfe.

This species was plentiful in the old jungle of Doat Island, near Labuan.

76. *CYCLOPHORUS (EUCYCLOPHORUS) PUNCTATUS*, Grateloup.

This species was plentiful with *Camæna cicatricosa* in the garden of the British Yamen, in Canton native city, and less so at Hoi Ha, on the mainland, opposite to Hong Kong Island.

77. *NATICA GUALTERIANA*, Petit.

A few specimens were obtained in British North Borneo.

78. *SCALARIA SCALARIS* (Linn.).

One dead specimen was obtained at Tolo Harbour, on the mainland opposite to Hong Kong.

79. *NERITA LINEATA*, Chem.

Obtained in British North Borneo, and also at Double Haven in the new territory adjacent to Hong Kong.

80. *NERITA POLITA*, Linn., var.

A curiously striated variety of this species was obtained in the estuary of the Canton River.

81. *NERITA (PELORONTA) CHRYSOSTOMA*, Récluz.

Obtained near Hong Kong.

82. *NERITA* (*THELICOSTYLA*) *ORYZARUM*, Récluz.

Obtained in the estuary of the Canton River.

83. *NERITA* *CHAMELEON*, Linn.

A few specimens not exactly typical were obtained at Shawei Shan Island, at the mouth of the Yangtze Kiang.

84. *NERITA* *ALBICILLA*, Linn.

A few specimens were obtained at Labuan.

85. *NERITINA*.

Of *Neritina* four species were obtained, and of these three were observed in the neighbourhood of Hong Kong and one at Labuan.

Of those at Hong Kong, *Neritina variegata*, Rve., lives always in clear, rapidly running, rocky streams, and is generally distributed on the mainland adjoining Hong Kong. *N. (Clithon) meleagris*, Lamk., was only found in one very limited area, in a deep pool at a spot where a small mountain stream debouched into the sea; and *N. pulchella*, Rve., like *N. variegata*, is most widely distributed about Hong Kong, but, unlike it, never appears to venture above high-water mark, so that practically it lives, all its life, among the sea-washed pebbles of the shore.

One specimen of *Neritina crepidularia*, Lamk., was taken in a mangrove swamp at Labuan.

86. *NERITOPSIS* *RADULA* (Linn.).

A few specimens at Labuan.

87. *TURBO* (*MARMOROSTOMA*) *PORPHYRITES*, Martyn.

One or two specimens were taken at Labuan.

88. *MONODONTA* *LABIO* (Linn.).

Plentifully on rocks at Crooked Island, in the new territory adjoining Hong Kong.

89. *CHRYSOSTOMA* *PARADOXA* (Born).

A few specimens were obtained in British North Borneo.

90. *GIBBULA* *CUMINGI*, A. Ad.

A few specimens from British North Borneo.

91. *ACMÆA* *STRIATA*, var. *BORNEENSIS* (Rve.).

Not uncommon on rocks at low tide in British North Borneo.

92. *ACMÆA* *SACCHARINA* (Linn.).

Commonly on rocks at low tide at Labuan.

93. *ACANTHOPLEURA* *SPINIGER* (Sowb.).

One specimen was taken at Labuan on a rock at low tide.

94. *OSTREA* *TALIENWANENSIS*, Crosse.

One specimen picked up dead at Shi Tao, in Shantung.

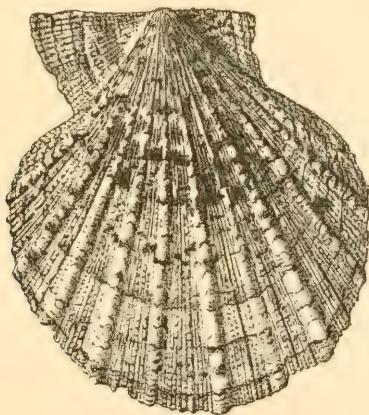
95. *OSTREA (LOPHA) FRONS*, Linn.

A few specimens at Hoi Ha, in the vicinity of Hong Kong.

96. *PECTEN (CHLAMYS) FARRERI*, n.sp.

Shell orbicular, equilateral, scaly, the left valve somewhat more convex than the right, the former bearing 10 coarse costæ, the latter about 25, between which, on both valves, appear numerous finer riblets; auriculæ very unequal, the anterior large, descending in a curve, the posterior comparatively small, forming approximately an obtuse-angled triangle, both sculptured with scaly riblets; colour dirty white, banded and mottled, especially on the left valve, with rich purple brown. Long. 81, lat. 75 mm.

Hab.—Shi Tao, Shantung.



The nearest ally of this handsome species appears to be *Pecten latus* from Japan, from which, however, it differs in being somewhat more orbicular, in the greater number of the costæ in both valves, on which the scales are much smaller and further apart, and in the shape of the auriculæ, the anterior being considerably more curved, while the posterior descends more abruptly and without the curve noticeable in *P. latus*.

97. *MYTILUS SMARAGDINUS*, Chem.

A few specimens picked up on an island in the Canton estuary, washed up after the great typhoon of November, 1900.

98. *MODIOLA METCALFEI*, Hanley.

A common species about Hong Kong.

99. *BARBATIA SINENSIS* (Phil.).

Plentifully in the Canton estuary, buried in crevices of submerged rocks.

100. *ANODONTA GIBBA*, Bens.

A common mollusc at Tao Hwan, where it inhabits certain deep dykes which are used for purposes of irrigation. It is a favourite article of diet with the Chinese, and by every homestead was invariably a large pile of its empty shells. Apparently these molluscs are at times obtained by diving, as I saw men thus engaged.

101. *HEMICARDIUM (FRAGUM) FRAGUM* (Linn.).

A few specimens were obtained in British North Borneo.

102. *CHAMA NIVALIS* (Rve.).

Labuan. One specimen only obtained.

103. *MERETRIX ZONARIA*, Lamk.

Common, and often very fine, on the Shantung coast.

104. *CIRCE DIVARICATA*, Sowb.

Not uncommon about Hong Kong.

105. *DOSINIA PUBESCENS*, Phil.

Labuan. A few dead specimens only were obtained.

106. *CYCLINA CHINENSIS* (Chem.).

Not uncommon about Hong Kong and on the adjoining mainland.

107. *TAPES (AMYGDALA) VARIEGATA*, Sowb.

Obtained in the neighbourhood of Hong Kong.

108. *TAPES (HEMITAPES) STRIATUS* (Chem.).

Obtained in the same parts of China as the last-named.

109. *CYRENA SOLIDA*, Desh.

A common species in the mangrove swamps at Labuan.

110. *CORBICULA LARGILLIERTI* (Phil.).

Occasionally found in paddy-fields on the mainland opposite to Hong Kong, and, like many other fresh-water molluscs, a favourite article of diet with the Chinese.

111. *CORBICULA FLUMINEA* (Müll.).

Occasionally obtained in paddy-fields near Hong Kong.

112. *SOLETELLINA (PSAMMOTÆA) CHINENSIS*, Desh.

In the vicinity of Hong Kong not uncommonly.

113. *SOLETELLINA (CAPSELLA) VIOLACEA* (Lamk.).

A common species about Hong Kong, and much used as food by the Chinese.

114. *ASAPHIS DEFLORATA* (Linn.).

Hong Kong. A few specimens only were obtained.

115. *SOLENOCURTUS CONSTRICTUS* (Lamk.).

Not uncommon in the Chusan Islands, where it is an article of diet.

116. *SOLENO MALACCENSIS*, Wkr.

Not uncommon at Shi Tao, in Shantung.

117. *MARTESIA STRIATA* (Linn.).

Not uncommonly in Sebatik Island, Dutch Borneo.

In conclusion, it only remains to pay a slight tribute to Mr. J. H. Ponsonby for his continued courtesy and kindness as a correspondent during the three years which were spent by Surgeon K. H. Jones in Chinese waters.

NOTES ON THE GENUS *ANOMA*, ALBERS.

By E. R. SYKES, B.A.

Read 13th May, 1904.

PLATE IX.

RECENTLY Mr. Pilsbry has written¹ an exceedingly interesting monograph of the many puzzling forms usually grouped in collections under the specific names of *A. Maugeri* and *A. striata*. Included in his work, however, are a number of names representing forms unknown to him, and, having recently worked through, with his review, the collection formed by Chitty, now in the British Museum, and also a good series brought from Jamaica by Mr. G. Nutt, I have thought it might be of interest to supply a few critical notes, and to figure a few forms that Mr. Pilsbry was unable to see.

In the first place, Mr. Pilsbry, when diagnosing the genus, states "apex unknown" There are several young specimens in Chitty's collection showing the protoconch, and I now figure (Pl. IX, Fig. 1) an adult shell of *A. splendens*, the only specimen that I have seen in which the upper whorls remain when the shell is fully grown. The specimen has 16 whorls, the first three white, then about five are horn-colour, finally the colouring shades into the usual dark brown, and the white zone appears below the suture. The actual protoconch is glassy, rather bulbous, blunt, and smooth, and appears as if intorted.

It must be understood that, in the case of species not mentioned, I have no remarks to offer, and am in accord with Mr. Pilsbry; also, that these notes are confined to Jamaican forms.

ANOMA GOSSEI (Pfr.).

The type of this species is in the British Museum.

ANOMA TRICOLOR (Pfr.).

Chitty's *raphanina* is an absolute synonym. There are in his collection young specimens with the protoconch. This latter feature agrees in general with the description given above, as do also the protoconchs of *A. sinuata* and *A. solida*, var. *valida*.

ANOMA GRACILIS (Adams).

I now figure (Pl. IX, Figs. 2, 2a), from Chitty's collection, both this shell and its 'var. *integra*' (Figs. 3, 3a), which latter I regard as

¹ Man. Conch., ser. II, vol. xvi, pp. 1-40.

a distinct species. They appear to be Adams' actual 'types,' as it may be inferred from the original description (cf. Contrib. Conch., p. 153) that these were in Chitty's collection. *A. integra* is much more conspicuously, closely, finely striate, the sculpture showing well all over the shell, and the columellar margin is not so sinuous.

ANOMA TESSELLATA (Adams).

From the British Museum specimens, labelled *A. zebrina* (Pfr.)—this latter form having been described from Cuming's collection—I can confirm Mr. Pilsbry's remarks as to their identity. The var. *cinerea*, Adams, is correctly identified by Mr. Pilsbry, but may prove worthy of specific rank.

ANOMA NITENS (Chitty); *A. PRUNICOLOR* (Chitty).

In my view these are one species. Comparing the shells from Negril Spots, one of which is figured by Mr. Pilsbry under the name *nitens*, with Chitty's own shells from New Hope, they agree; these latter I cannot sever from *prunicolor*, which is now figured (Pl. IX, Figs. 4, 4a). Save that the upper remaining whorl is a dark brown, there are in Chitty's collection shells from New Hope agreeing well with Mr. Pilsbry's variety *Simpsoni*.

ANOMA FUSCOLABRIS (Chitty); *A. RADIATA* (Chitty).

Both correctly identified.

The following form appears to be worth characterization as

A. FUSCOLABRIS, var. *PILSBRYI*, n.var. Pl. IX, Figs. 10, 10a.

Shell in form resembling *A. fuscolabris*, but not quite so bulbous, more solid, with a thicker lip. Colour dark brown. Shell smooth, except for well-marked striae on the later two-thirds of the last whorl.

ANOMA FLEXUOSA (Pfr.).

I, also, have been unable to identify this shell.

ANOMA LEVIS (Adams).

I quite agree with the identification of this species and its varieties, as also that the form *concinna* is probably a good species. In Chitty's specimens of the form *unicincta* the lip is pink.

ANOMA SPLENDENS (Menke), Pfr.

I have the variety *roseolabris* from Manchester.

ANOMA ALBOANFRACTUS (Chitty).

The form *bicolor* seems to be hardly worthy even of varietal rank. Pfeiffer's *pairana* is unknown to me except from figure and description; from these latter I should also place it as a synonym.

ANOMA DOHRNIANA (Pfr.).

Unknown to me.

ANOMA PULCHELLA (Chitty).

I quite agree with Mr. Pilsbry's identification of the typical form, but his figures of the var. *pulla* seem to be erroneous. I regard *pulla* (now figured, Pl. IX, Figs. 5, 5a, from Chitty's specimens) as quite a distinct species.

It has a marked umbilical chink, and is a horn-brown shell, with the ends a little darker, and a very pale yellowish lip. There are well-marked striæ at the back of the last whorl and behind the lip. Compared with *A. pulchella*, the whorls are a very little more inflated, and the upper ones are not so pyramidal. There are only three specimens, and none in very good condition.

ANOMA STRIATA (Adams).

Both the forms *fusca* (Pl. IX, Figs. 6, 6a) and *corpulenta* (Figs. 7, 7a), placed by Mr. Pilsbry under *A. solida*, appear to me really to belong here.

ANOMA SOLIDA (Adams).

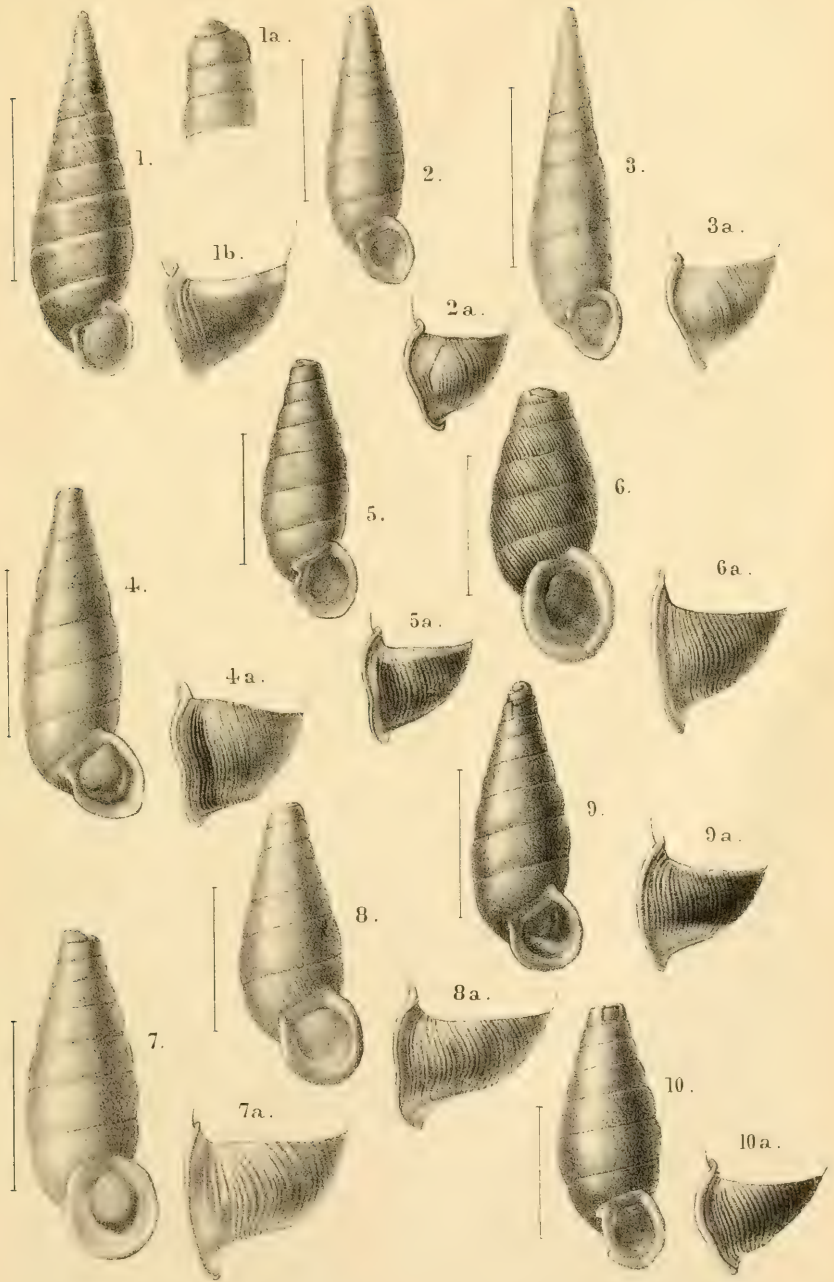
Specimens of the subspecies *striatula* are in Chitty's collection as from St. Elizabeth. I now figure (Figs. 8, 8a) the var. *conica*. A tablet mounted in Chitty's collection under the name *unicolor* seems to be rather in confusion, and includes a specimen that I refer to *alboanfractus*.

ANOMA NIGRESCENS (Adams).

The var. *crassa* (Figs. 9, 9a) seems to be a broader shell of the typical form.

EXPLANATION OF PLATE IX.

| | |
|------------------|--|
| Figs. 1, 1a, 1b. | <i>Anoma splendens</i> , Menke. |
| „ 2, 2a. | „ <i>gracilis</i> (Adams). |
| „ 3, 3a. | „ „ var. <i>integra</i> . |
| „ 4, 4a. | „ <i>prunicolor</i> (Chitty). |
| „ 5, 5a. | „ <i>pulla</i> (Chitty). |
| „ 6, 6a. | „ <i>striata</i> , var. <i>fusca</i> , Adams |
| „ 7, 7a. | „ „ var. <i>corpulenta</i> , Adams. |
| „ 8, 8a. | „ <i>solida</i> , var. <i>conica</i> , Adams. |
| „ 9, 9a. | „ <i>nigrescens</i> , var. <i>crassa</i> , Adams. |
| „ 10, 10a. | „ <i>fuscolabris</i> , var. <i>Pilsbryi</i> , Sykes. |



A.H. Searle del. et lith.

Mintern. Bros. imp.

SPECIES OF ANOMA.

NEW LAND-SHELLS FROM NEW ZEALAND.

By HENRY SUTER.

Read 13th May, 1904.

RHYTIDA DUPLICATA, n.sp.

SHELL convexly depressed, umbilicated, carinated, with a ridge above the keel. Sculpture: The surface of the shell is rather irregularly and rugosely plicated, the plicæ, by anastomosing, forming a partial network, and inclined backward in the same direction as the incremental lines, which are at intervals more or less conspicuous on the last whorl. Colour: My specimens being all so-called 'dead shells,' and having lost the epidermis, it is impossible to describe the colour. To judge from analogy, I suppose it to be about the same as in *R. Greenwoodi*. The spire is depressed conoidal, slightly convex, obtuse. The apex is slightly raised, obtuse, of $1\frac{1}{2}$ whorls, and finely obliquely plaited. The embryonic shell is subglobose, having the upper side flat



and the umbilicus shallow. Diam. 3.5, height 2.5 mm. Whorls $4\frac{1}{2}$, rapidly increasing, the first ones convex, the last bluntly keeled at the periphery, above which, at a distance of about 2 mm., is a revolving rib, separated from the keel by a shallow groove, and from the slightly raised ridge below the suture by a broad depression; this ridge disappears gradually on the penultimate whorl. Base flatly convex. Suture sharply impressed, near the aperture subcanaliculate. Aperture obliquely transverse, subtriangular, the margins slightly approximating and united by a callus on the penultimate whorl. Outer lip sharp, slightly depressed and advancing above, angled at the periphery and

receding below. Inner lip oblique, slightly thickened and reflected. Umbilicus deep, funnel-shaped, patulous, margined by a slightly elevated ridge, occupying about one-third of the greater diameter of the shell. Diam. maj. 24, min. 20 mm.; height 12 mm.

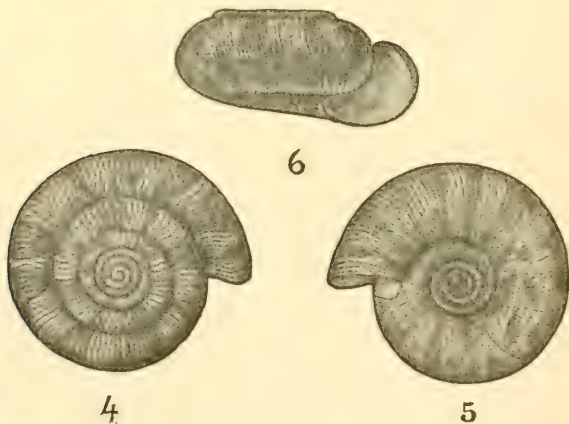
Type in my collection.

Hab.—Cape Maria van Diemen.

The former lighthouse-keeper, Mr. McGahey, very kindly collected some of these shells for me. So far no fresh or living specimens have been obtained, and both the colour of the shell and the animal remain unknown for the present. This species is so distinct from all the other New Zealand species of *Rhytida* that I thought it well worth describing and figuring, notwithstanding the poor material at my disposal. It may be considered as an intermediate form between *R. Greenwoodi* and *R. Dunnie*.

ENDODONTA (CHAROPA) TRANSENNA, n.sp.

Shell small, whitish with irregular streaks of chestnut, finely ribbed, with distinct revolving threads on base, umbilicated. Sculpture: All the whorls, except the protoconch, are finely ribbed, the riblets being low and undulating, and about 18 in number per millim., and the interstices microscopically decussate; under the lens a number of revolving liræ are visible on the base. Colour nearly white, with irregular streaks



and blotches of chestnut on the upper surface. From the periphery down to the base there is a change in colour pattern, smaller and zigzag lines predominating. Spire flat and very little raised above the last whorl. The apex consists of $1\frac{1}{2}$ whorls, the first of which is smooth, the following half microscopically decussate. Whorls 5, at first very slowly, then more rapidly and regularly increasing, convex; periphery and base also convex. Suture well impressed.

Aperture vertical, lunate. Outer lip regularly arched, sharp, the inner lip arcuate, very little thickened, and not reflexed. Umbilicus broad, perspective, showing all the whorls, in width about 1.2 mm., or somewhat less than one-third of the greater diameter of the shell. Diam. maj. 3.2, min. 2.9 mm.; height 1.4 mm.

Type in my collection.

Hab.—In native bush, Waitakerei Range, about 6 miles from Henderson, Province of Auckland (H. S.).

Unless closely examined this species may easily be taken for *E. anguiculus* or *E. corniculum*, subsp. *maculata*, but it can at once be separated from both of them by the spiral threads on the base.

LAOMA (PHRIXGNATHUS) MOELLENDORFFI, Suter.

Exemplum sinistrorsum.

The occurrence of a normally sinistral species of this genus in Tasmania, *Laoma Weldii*, T.-Woods, is a well-known fact, but from New Zealand up to this time no sinistral *Laoma* has been known; my surprise, therefore, was great indeed when, in January last, I found a beautifully developed sinistral specimen of *L. Moellendorffi*. The shell has all the characters of the species described by me in 1896, except that it is sinistral, the incremental striæ much more oblique, the circumference slightly oval, and the last whorl descending; it is also somewhat larger, the greater diameter being 3.25 mm., though there are only four whorls, as in the type.

Type in my collection.

Hab.—In native bush near Cowes Bay, Waiheke Island, Hauraki Gulf (H. S.).

REALIA TURRICULATA, Pfr., n. subsp. LEPIDA.

A most graceful small variety, of a much lighter colour and smaller dimensions than the typical form. The chestnut zigzag bands are narrower and less numerous, the spire is more elongate and more acute, not convex, but straight; the whorls, $7\frac{1}{3}$ –8 in number, are more convex, and the suture is deeper. Diam. 4, height 7.5 mm.

Extreme specimens vary from 3×6.5 to 4×8 mm.

R. turriculata (specimens in my collection) varies from 4×8.5 to 5×11 mm.

Type in my collection.

Hab.—Forty Mile Bush, North Island (H. S.). More plentiful on limestone formation.

In the same locality also occurs an albino form (mut. *albina*), in which the shell is of a cream tint and the zigzag markings devoid of colour, being light horny and pellucid.

DESCRIPTIONS OF TWENTY-EIGHT SPECIES OF GASTROPODA
FROM THE PERSIAN GULF, GULF OF OMAN, AND ARABIAN
SEA, DREDGED BY MR. F. W. TOWNSEND, OF THE INDO-
EUROPEAN TELEGRAPH SERVICE, 1900-1904.

By J. COSMO MELVILL, M.A., F.L.S.

Read 10th June, 1904.

PLATE X.

IN offering another contribution towards the elucidation of the molluscan fauna of the Persian Gulf and contiguous seas, I would point out that, as was the case in my last paper on the subject,¹ nine-tenths of the following small and abyssal species were extracted from sifted sand, dredged at one prolific station. Already nearly one hundred species, new to science, have resulted from this gathering, and the quota is not, even yet, exhausted. A good many dubious specimens and imperfect, broken examples of strange forms, as might be expected, also occur, which are, naturally, not considered, but this fact only serves to emphasize the more than probability of the supposition that these explorations have so far only touched the threshold of benthic life, and that these hitherto scarcely known seas possess within their profounder recesses many wonderful forms, waiting to be revealed some day.

We have not had time as yet thoroughly to diagnose the Pelecypoda of this region, but Mr. R. Standen and I hope to complete the catalogue before very long, and likewise, at the same time, to give emended lists of some of the leading Gastropod families.

Except where otherwise stated, all the species are from the Gulf of Oman, lat. 24° 58' N., long. 56° 54' E., 156 fathoms.

CYCLOSTREMA EUMARES,² n.sp. Pl. X, Figs. 1, 1a.

C. testa minuta, umbilicata, tenui, alba, nitida, lævi, anfractibus 3-4, quorum duo apicales, læves, globulosi, cæteris ad suturas paululum excavatis, tumidis, ultimo permagno, supra lævi, versus basim longitudinaliter sub lente scalpto-striato, regione umbilicari, spiraliter trilirata, excavata, crenulata, liris longitudinalibus decussata, apertura rotunda, peristomate tenui, continuo. Alt. 1, diam. 1.75 mm.

Very small, and perhaps not full-grown. Several examples occurred, one possessing a linguiform appendage to the peristome, slightly

¹ Proc. Mal. Soc., vol. vi, pt. 1, pp. 51-60, pl. v.

² εὐμαρής, well-adapted, gentle.

covering the umbilical region, which is excavate, thrice spirally lirate, decussate and crenulate at the points of junction of the longitudinal liræ, beyond these spiral lirations the base is scratched with what may be incremental lines of growth, the rest of the surface is white, smooth, and shining. Allied to *C. sulcatum*, Watson,¹ from Pernambuco, 675 fathoms.

CYCLOSTREMA EUPOIETUM,² n.sp. Pl. X, Fig. 2.

C. testa parva, compacta, alba, solidula, obtecte umbilicata, parum nitente, anfractibus 4, apicali parvo, simplice, subhyalino, cæteris, præcipue penultimo atque ultimo spiraliter arcissime lirato-sulcatis, penultimi liris sub lente fortiter punctatis, ultimo ad basim circa umbilicum crenellifero, crenellis magnis, paucis, apertura rotunda, peristomate tenui, continuo, umbilicum fere obtegente. Alt. 1, diam. 1.2 mm., sp. min.; alt. 1.5, diam. 2 mm., sp. max.

Several examples of a small, narrowly umbilicate shell, four-whorled, the two last being very closely spirally lirately furrowed, the penultimate minutely puncto-striate. The crenellations round the half-covered umbilicus are large in proportion to the size of the shell. Mouth round, peristome continuous, hardly thickened, a tongue-shaped process, lirato-sulcate as is the rest of the surface, extending over the umbilical region. In the absence of the operculum and soft parts this species seems best included in *Cyclostrema*, Marryat, a genus that badly needs revision, but, speaking on conchological grounds alone, it appears allied to certain *Leptothyreæ* in several particulars.

ETHALIA JUCUNDA, n.sp. Pl. X, Figs. 3, 3a.

E. testa minuta, depressa, alba, nitida, imprimis perforata, deinde callifero, callo magnopere umbilicum obtegente, anfractibus 4, apicali parvo, vitreo, ultimo rapide accrescente, ad peripheriam rotundato, omnibus nitidis, lævissimis, apertura ovato-rotunda, peristomate intus maxime incrassato.

Var. *carinulata*, n.var.

Testa ut supra, sed undique spiraliter ante striatula, ad peripheriam sæpius subangulato, basi circa umbilicum paullum excavata. Alt. .75, diam. 1.75 mm., sp. maj.

An exceedingly small, but particularly interesting *Ethalia*, its nearest allies being *E. reclusa*, Dall, *E. diaphana* (D'Orb.), and perhaps *E. suppressa*, Dall,³ the first and the last of these having been obtained during the "Blake" Expedition. It is not among the common species in the above locality; I have, indeed, only seen about a dozen examples, and amongst them the var. *carinulata* predominated. The smooth form, which I have considered most typical, however, is slightly larger, and decidedly adult. Here no striation is perceptible with aid of the very

¹ Cf. Report "Challenger" Expedition, vol. xv, p. 121, pl. viii, figs. 11a-c.

² εὐποίητος, well-formed.

³ Bull. Mus. Comp. Zool. Harvard Coll., xxix, pt. 2, pp. 361, 362, pl. xxviii, figs. 7, 8.

strongest power. It is possible I am joining two species, but, until a larger series is obtained, I am persuaded this is the wiser course. The basal sculpture of the var. *carinulata*, below the somewhat carinate periphery, is very distinct in some examples, but others show a more marked columellar callus, and a consequent transition towards the typical form. I am under much obligation to Dr. W. H. Dall for his opinion as to the location of this species. He wrote me as follows:—"This belongs to the section or subgenus of *Ethalia* or *Teinostoma* which Conrad named *Solariorbis*. In the 'Blake' report I included some species under *Ethalia*, but they are closely related to *Teinostoma* also, and, until we know something about the operculum and animals, it is impossible to make a final classification of these curious little shells."

BASILISSA (*ANCISTROBASIS*) *COMPESA*,¹ n.sp. Pl. X, Fig. 4.

B. testa parva, conica, anguste umbilicata, albida, delicata, anfractibus 6, apicali vitreo, globulari, cæteris ad suturas impressis, simul ac ad peripheriam, et profunde alveatis, supernis binis, penultimo tribus, ultimo supra peripheriam quatuor liris spiralibus præditis, undique longitudinaliter arcuissime et suboblique decussato-liratis, interstitiis quadratis, ultimo ad peripheriam bicarinulato, crenellifero, simul ac circa umbilicum, basi planato, trochiformi, liris concentricis 8-9 decorato, interstitiis spiraliter minutissime punctatis vel alveolatis, apertura subquadrata, labro tenui, concavo, columella ad medium et ad basim sinuata, excavata, utrinque incrassata, prominula. Alt. 2.25, diam. 2 mm.

The smallest of the few described species of this abyssal genus. Its chief affinity would seem to lie with *B. alta*, var. *oxytoma*, Watson, from the Gulf of Mexico, as regards size and form, but the sculpture is quite different, and the grooved excavate callosity of the columellar and basal regions shows it really belongs to the section *Ancistrobasis*, Dall. All the original material for this genus, described by the Rev. R. Boog Watson² in 1879, consisted of specimens not quite adult, and accordingly an emended diagnosis was found necessary by Dr. Dall³ a few years later (1889).

SCISSURELLA JACKSONI, n.sp. Pl. X, Fig. 5.

S. testa parva, profunde umbilicata, oblongo-ovata, undique alba, tenuissime delicata, anfractibus 5, quorum apicalis parvus, globularis, hyalinus, cæteris ad medium bicarinatis, suturis compressis, arcuissime omnino longitudinaliter liratis, liris supra carinas curvatis, infra rectis, ultimo anfractu infra, usque ad basim, obscure spiraliter striato, inter carinas sinu angusto, sed longo, apertura rotunda, labro ad sinum paullum incrassato, margine columellari supra umbilicum in specimenibus quibusdam extenso. Alt. 1.75, diam. 1.75 mm.

¹ κόμπος, elegant.

² Rep. "Challenger" Exped., vol. xv, p. 100.

³ Bull. Mus. Comp. Zool. Harvard, xxix, p. 383.

The most frequent of the three species found together in the above locality. It seems almost intermediate between *S. alta* and *aëdonia*, both of Watson,¹ from the Azores and Pernambuco respectively; but is quite distinct from either. The rarer species associated with it are *S. aetheria*, M. & S., and what seems to be *S. coronata*, Watson,² the type of which came from Tahiti. I have especial pleasure in naming this beautiful little mollusk after Mr. John Wilfrid Jackson, who has given much needed assistance in sorting the dredged material, and was the first to extract this species therefrom.

CERITHIUM ANEMBATUM,³ n.sp. Pl. X, Fig. 6.

C. testa parva, fusiformi, solidula, pallide albo-fusca, anfractibus 12, quorum apicales 4, vitrei, nitidi, læte ochracei, sub lente spiraliter unicarinati, cæteris apud suturas impressis, quatuor supernis spiraliter tri-, tribus his proximis quadri-liratis, liris papillois, ultimo anfractu 8-10 lirato, apertura ovato-rotunda, labro tenui, canali brevi. Long. 5, lat. 1.50 mm.

A very small species, but I think quite adult. The apical whorls are shining, ochraceous, once spirally keeled, the remainder being papilloso transversely lirata. It is not very frequent in siftings from the above dredging.

CERITHIUM PERVICAX, n.sp. Pl. X, Fig. 7.

C. testa minuta, albida, interdum pallide fusca, delicata, anfractibus 9-10, quorum 3-4 apicales, ochraceo-fusci, nitidi, læves, sub lente forte ad medium unicarinati, cæteris ad suturas multum impressis, gradatulis, nequaquam varicosis, supernis spiraliter bi-, ultimis triseriatis, gemmulatis, ultimo infra peripheriam unicarinato, apertura subrotunda, labro tenui, marginem apud columellarem nitido, crassiusculo, canali brevissimo. Long. 3, lat. 1 mm.

My coadjutor (Mr. R. Standen) and I, in describing *Cerithium verecundum*,⁴ mentioned this as but a form of that shell. A closer research has satisfied me as to its specific difference. Much smaller than *C. verecundum*, long. 3 as against 4.20 mm., it is broader in proportion, and no trace of varices is to be seen. The mouth is rounder, not prolonged towards the base, the canal remarkably short. It is as abundant in shell-sand from the above locality as its nearly allied species is scarce. Of the true *C. verecundum* I have not noticed more than twelve examples, as against two hundred or more of *C. pervicax*.

BITTIUM CAUDATUM, n.sp. Pl. X, Fig. 8.

B. testa minutissima, cylindrica, solidula, pallide brunnea, apud apicem multum attenuata, anfractibus 10, quorum apicales 4 nunc

¹ Rep. "Challenger" Exped., vol. xv, pp. 114, 115, pl. viii, figs. 1, 3.

² L.c., p. 114, pl. viii, fig. 4.

³ ἀνέμβατος, inaccessible.

⁴ Ann. & Mag. Nat. Hist., ser. VII, vol. xii, p. 300.

caudati, perlæves, fusco-vitrei, nunc subdistorti, delicate striati, cæteris cylindraceis, spiraliter triliratis, liris papilloso-gemmatis, ultimo anfractu quadrilirato, apertura subrotunda, labro tenui, canali brevi. Long. 2, lat. 1 mm.

One of the smallest of mollusks, peculiar for its very attenuate, caudate apex; the sculpture of the shell is normal; the nearest approaches to it seem to be *Cerithiopsis ridicula* and *turrigera*,¹ Watson. From the first of these it differs in its coloured apical whorls, those of *ridicula* being white, with only seven whorls in all, as against nine in the present species. *C. turrigera* is more remotely allied, its ornamentation consisting of only two spiral rows of gemmate liræ. It is often hard to know where *Bittium* begins and *Cerithiopsis* ends; *C. ridicula*, especially, looks like one of the former genus, and as such I, for my part, would classify it.

TRIFORA CONCATENATA, n.sp. Pl. X, Fig. 9.

T. testa pergracili, multum attenuata, albescente, albo-fusca, anfractibus ad 18, quorum apicales 4, ochracei, spiraliter unicarinati, arcte et pulcherrime sub lente longitudinaliter lirati, liris sinuosis, cæteris rectis, suturis indistinctis, tribus gemmularum ordinibus concatenatis præditis, gemmulis rotundis, nitentibus, ultimo anfractu quatuor ordinibus, circa basim angulato, apertura rotundo-ovata, labro simplice, canali brevi. Long. 5, lat. 1 mm., sp. max.

A small, very gracefully attenuate species, white or whitish-drab, with ochreous apical whorls, these being once keeled spirally, the usual pattern being present on the remaining whorls of three rows of round, shining gemmæ—four on the body-whorl, the lowest row being the largest; these spiral rows are more or less concatenate, leaving clear spaces between.

TURBONILLA INÆQUALIS, n.sp. Pl. X, Fig. 10.

T. testa pergracili, nitida, albida, lævissima, anfractibus 9, quorum apicales duo magnopere heterostrophi, vitrei, pellucetes, globosi, cæteris gradatulis, nitidis, interdum inæqualibus et quasi-varicosis, costulis longitudinalibus lævibus, rectis, præditis, ultimo anfractu fere recto, costulis versus basim evanidis, apertura ovali, labro tenui, margine columellari paululum incrassato. Long. 5, lat. 1.15 mm.

Peculiar for its often exhibiting pseudo-varices, these being simply unequally effuse longitudinal ribs. The surface of the shell is remarkably smooth, white, and shining, the mouth a perfect oval, and the heterostrophe apex glassy, globular, and completely reversed. *T. Peronii*, Vélain, from St. Paul's Island, Indian Ocean, seems akin.

TURBONILLA MICROPERONE,² n.sp. Pl. X, Fig. 11.

T. testa fusiformi, curta, albescente, paullum incrassata, anfractibus 9, ventricosis, undique arcte costulatis, costis crassis, obliquis, numero

¹ Rep. Challenger Exped., vol. xv, pp. 528, 529, pl. xxxviii, figs. 1, 2.

² μικρός, small; πέρωνη, a pin.

anfractum apud ultimum circa 18, ultimo curto, compressulo, apertura subrotunda, labro tenui. Long. 4, lat. 1 mm.

A well-marked, but hardly common form. There are several other species of this difficult genus and its immediate allies from the same locality, many of which we have elected, at present, to consider forms of such common *Turbonilla* as *T. sororia*, *terebrina*, or *basilica*, Melv. It is indeed a thankless and almost hopeless task to thoroughly sort out even, much less attempt to classify, a large gathering of such a genus as this; especially as the fact should not be lost sight of that very probably there are sexual differences to be considered, affecting both form and texture of shell.

TURBONILLA RECTICOSTATA, n.sp. Pl. X, Fig. 12.

T. testa eleganter fusiformi, gracili, alba, parum nitente, tenui, anfractibus (inclusis apicalibus 2 reversis, globulosis, heterostrophis, subvitreis) 11-12, apud suturas impressis, paullum gradatulis, undique longitudinaliter costatis, costis rectis, paullum incrassatis, interstitiis omnino lævibus, ad basim anfractus ultimi evanidis, numero circa 16, apertura ovata, labro tenui, fere continuo, columella obscure plicata. Long. 6, lat. 1.50 mm.

I think this *Turbonilla* quite distinct from the larger and coarser *T. candida*, H. & A. Adams, which occurs in the Persian Gulf likewise. The apical whorls are more conspicuously reversedly coils in *T. recticostata*, the whorls are more gradate, the ribs perfectly straight throughout; on the upper whorls of *candida* they are closer and suboblique, and likewise fewer in number. It is one of the less frequent forms; seven or eight examples alone have yet come to light.

MUCRONALIA OXYTENES,¹ n.sp. Pl. X, Fig. 13.

M. testa oblonga, parva, albo-vitrea, nitidissima, polita, anfractibus 7, quorum apicales 3, contracti, angusti, mucronati, semipellucetes, cæteris latoribus, cylindricis, infra, juxta suturas, spiraliter interne pellucido-zonatis, apertura anguste ovata, labro simplice, tenui, columella obliqua. Long. 3.75, lat. 2 mm.

The nearest approach I have seen to this species, of which but three or four specimens alone have so far occurred in the above locality, is *M. cylindrica*, Sowb.,² from Cebu, Philippines, a shell twice the length, more pellucid, and with more arched and flexuose lip.

Another *Mucronalia* has been noticed to occur with the foregoing, but in too imperfect a condition to diagnose.

MITRA TOWNSENDI, n.sp. Pl. X, Fig. 14.

M. testa oblongo-fusiformi, solida, læte castaneo-brunnea, anfractibus 8, quorum apicales duo, cæteris apud suturas paullum impressis, fere rectis, undique spiraliter arcte punctatis, punctis minutis, apertura oblonga, intus nitida, brunneo-livescente, labro paullum effuso, columella albo-livida, 5 plicata. Long. 30, lat. 10 mm.

¹ ὀξυτένης, sharply drawn to a point, in allusion to the three apical whorls.

² Proc. Mal. Soc., vol. iv (1900), p. 127, pl. xi, fig. 6.

Hab.—Persian Gulf, Muskat, 7–30 fathoms.

This *Mitra*, of a warm chestnut colour, plain in form, belongs to the same group of the genus as the West American *M. caliginosa*, Reeve, *maura*, Swains., *Ide*, Melv., etc. There is likewise some affinity to *M. picta*, Reeve. It was very uncommon in the above locality, and it affords me much pleasure to suggest for it the name of its discoverer, Mr. Frederick W. Townsend.

PLEUROTOMA (OLIGOTOMA) PATRICIA, n.sp. Pl. X, Fig. 15.

Pl. testa oblongo-fusiformi, alba, solidula, anfractibus 9, quorum apicales 2 parvi, apice ipso acuminato, huic duobus vel tribus proximis tumidis, longitudinaliter costulatis, costulis prominulis, albis, margaritaceis, nitidulis, cæteris anfractibus apud suturas, simul ac apud medium, arcissime carinatis, carinis interdum irregularibus, superficie longitudinaliter incurvistrata, ultimo anfractu supra medium carinato, dein usque ad basim 8–10 conspicue spiraliter lirato, liris lævibus, nitidulis, superficie interstitiali arcte striata, apertura oblonga, labro tenui, sinu lato sed non profundo, canali brevi. Long. 5, lat. 2 mm.

Ten or twelve examples of a very beautiful, acutely spirally carinate little *Pleurotoma*, the third and fourth whorls being curiously swollen and conspicuously ribbed, the lower whorls acutely keeled, the body-whorl, below the carination, many-lirate. It is evidently of the same alliance as *P. violaceus*, Hinds, *P. makemonos*, Jous., and *P. Pouloensis*, Jous., all from the Persian Gulf region, and I have likewise compared it with description and figure of two unique and obscure species of the latter author, viz., *P. Clevei* and *Bellardi*, Jous. These are both evidently very nearly allied both to each other and to our species, which differs, however, not only as regards the tumid upper whorls, as above mentioned, but likewise in size, being only half the dimensions of the other species mentioned. Some affinity likewise exists with *P. fusca*, Hombr. & Jacq. (= *gemmata*, Hinds), also found in the same dredging in abundance, but this species is also larger, and conspicuously moniliform. *P. tiara*, Watson,¹ is also a near congener. This is a New World deep-sea form. *Drillia* (or ? *Mangilia*) *subsida*, Dall,² from the West Indies, has also many points in common.

PLEUROTOMA (SURCULA) HALICYRIA,³ n.sp. Pl. X, Fig. 16.

P. testa fusiformi, tenui, sordide alba, subhyalina, anfractibus 9, quorum 1½ apicales, globulosi, læves, vitrei, apice ipso fere immerso, cæteris ad suturas maxime impressis, nitidis, fere lævibus, ad medium fortiter angulatis, longitudinaliter obliqui-costatis, costis nitidis, crassiusculis, supra, juxta suturas fere evanidis, simul ac anfractu ultimo infra peripheriam versus basim, numero circa 15, ultimo et penultimo infra spiraliter liratis, liris obscuris, inconspicuis; apertura oblonga, infra contracta, labro tenuissimo, sinu rotundo, lato, sed non

¹ Rep. Challenger Exped., vol. xv, p. 347, pl. xxi, fig. 7.

² Bull. Mus. Comp. Zool. Harvard, xviii, p. 118, pl. xii, fig. 3.

³ ἄλς, κυρία, a mistress of the sea.

profundo, columella tenuiter callosa, alba, nitente, canali producto, lato. Long. 32, lat. 10 mm.

Hab.—Gulf of Oman, lat. $24^{\circ} 49' N.$, long. $56^{\circ} 56' E.$, 225 fathoms, mud bottom, October 26th, 1900.

Only one example occurred of a *Surecula*, delicate in texture, possessing all the attributes of an abyssal species, but with some resemblance to *P. (Surecula) undatiruga*, Bivona (= *tenuis*, Gray), from the Mediterranean. That species, however, is nodulous on the angles, with far more frequent and very sinuous thin longitudinal ribs. Some similarity to *P. (Surecula) symbiotes*, Wood-Mason & Alcock, may likewise be traced. This species came from South Indian seas, lat. $7^{\circ} 04' N.$, long. $76^{\circ} 34' 15'' E.$, in 1043 fathoms,¹ and is a larger shell, 57 mm. in length, and a great deal broader in proportion, say 19 diam., the canal being not so produced, and the whorls far more compressed suturally.

CLATHURELLA POLYHYMNIA,² n.sp. Pl. X, Fig. 17.

Cl. testa oblongo-fusiformi, tenui, pallide ochracea vel alba, anfractibus 8, quorum apicales 2 vitrei, bulbosi, cæteris ventricosi quadrato-decussatis, ad juncturas lirarum gemmatis, gemmis nitentibus, interstitiis alveolatis, apertura oblonga, labro incrassato, intus tridenticulato, sinu lato, conspicuo, columella quasi-plicifera. Long. 8, lat. 3 mm.

A very pretty little species, with thickened longitudinal and spiral liræ, beaded at the points of junction.

MANGILIA ADAMANTINA, n.sp. Pl. X, Fig. 18.

M. testa fusiformi, semitragona, solidula, alba, anfractibus 6-7, duobus apicalibus albo-lacteis, vitreis, perlævibus, his proximo lævi, arete longitudinaliter gemmato-costulato, cæteris crassicostatis (numero costarum anfractus ultimi circa 11), simul ac spiraliter arete multiliratis, supra medium unicarinatis, apertura oblongo-ovata, labro crassiusculo, intus interdum ochro-marginato, columella fere recta, canali brevi. Long. 4, lat. 1.50 mm.

A minute, somewhat diamond-shaped form, white, once spirally keeled, moderately longitudinally ribbed, and crossed with numerous spiral liræ, somewhat resembling *M. apollinea*, described in this paper, but that species is quite smooth.

MANGILIA AGLAIA, n.sp. Pl. X, Fig. 19.

M. testa gracillima, fusiformi, delicata, anfractibus 11-12, quorum apicales 3-4 ochracei, sub lente pulcherrime decussati, cæteris apud suturas impressis, ventricosi, spiraliter tri- vel quatuor-liratis, liris crassis, undique longitudinaliter costatis, costis anfractuum superiorum rudioribus, ultimi numero circa 14, apertura oblonga, labro incrassato, fimbriato, sinu lato sed non profundo, canali producto. Long. 10, lat. 3 mm., spec. maj.; long. 8, lat. 2 mm., spec. min.

¹ Ann. & Mag. Nat. Hist., ser. vi, vol. xiv, p. 161, pl. iii, figs. 7; 8.

² Polyhymnia, the Muse of song.

Hab.—Persian Gulf, Mussandam, 50 fathoms.

A graceful, attenuate species, of the same alliance as *M. obtusicostata*, Smith, *Polynesiensis*, Reeve, or *Alicia*, M. & Stand., these being all of more abbreviate form. The apex is ochraceous, and beautifully microscopically decussate. Of the two specimens selected as types, the larger is not adult, while its fellow has all the labial characteristics well developed.

MANGILIA APOLLINEA, n.sp. Pl. X, Fig. 20.

M. testa parva, ovato-fusiformi, albida, subnitente, nequaquam striata, anfractibus 5, apicales læves, parvi, cæteris gradatis, lævissimis, undique longitudinaliter costatis, costis crassis, super medium anfractuum conspicue et acute unicarinated, carina ad juncturam costarum gemmata, apertura oblonga, ad basim angustiore, labro incrassato, extus, supra medium, unigemmato, margine columellari fere recto. Long. 5, lat. 1.75 mm.

A scalate *Mangilia*, white, principally conspicuous for its thickened longitudinal ribs, 9–10 in number on the body-whorl, the interstices quite smooth, one spiral keel alone, a little below the sutures, crossing the ribs at right angles, and at the point of junction bearing a beaded point.

MANGILIA BARBITON,¹ n.sp. Pl. X, Fig. 21.

M. testa gracili, utrinque attenuata, alba, parum nitida, anfractibus 8, apicalibus tribus tumidis, vitreis, cæteris ad suturas multum impressis, supernis parvis, ultimo permagno, undique longitudinaliter costulatis, costulis ad juncturam lirarum spiraliū arete gemmulatis, apertura anguste oblonga, labro incrassato, albo, sinu inconspicuo, columella recta, canali paullum producto. Long. 8.50, lat. 3 mm.

A most elegantly formed *Mangilia*, which perhaps might with equal propriety be termed a *Cythara*, very abundant in shell-sand; all dead, but the examples are hardly bleached, and are probably white in life. Slight traces of a yellow peripheral zone are to be noted in some instances.

MANGILIA CALLISTEPHANA, n.sp. Pl. X, Fig. 22.

M. testa angusta, fusiformi, solida, albo-ochracea, anfractibus ad 8, quorum apicales duo nitidi, vitrei, globulosi, cæteris ad suturas impressis, supernis bi-, ultimo tricarinalato, carinula superiore præsertim gemmato, gemmis conspicuis, ultimi anfractus circa 12, ultimo infra peripheriam ad basim spiraliter octolirato, apertura oblonga, labro incrassato, sinu lato sed non profundo, columella fere recta, canali brevi. Long. 6, lat. 2 mm., sp. max.; long. 3, lat. 1 mm., sp. min.

One of the most locally abundant *Pleurotome* in the dredged shell-sand; also found in live condition, when it is seen to be pale ochreous white, with a semi-transparent appearance. The specific name is

¹ Barbiton, a stringed instrument.

suggested by the beautiful spiral row of shining gemmæ more particularly decorating the upper of the spiral keels so prominent on the whorls.

MANGILIA KOWEITENSIS, n.sp. Pl. X, Fig. 23.

M. testa anguste fusiformi, minuta, solida, pallide straminea, anfractibus 6, quorum apicales duo albo-vitrei, læves, tertio longitudinaliter multilirato, aliter lævi, nitido, cæteris longitudinaliter costatis, costis rectis, ultimum apud anfractum circa 12, apud basim evanidis, undique spiraliter pauciliratis, liris crassis, ad juncturas costarum gemmatis, apertura anguste oblonga, labro percrasso, albo, supra obscure unidenticulato, columella fere recta, canali brevi. Long. 4·15, lat. 2 mm.

Hab.—Koweit, Persian Gulf, 10 fathoms.

A Cytharoid little species, elegantly formed. Some slight analogy with *M. Fairbanki*, Nevill, or *obeliscus*, Reeve, exists, but our specimens are in every way adult, and much smaller. *Daphnella arcta*, E. A. Sm., from the same locality, is also to some extent comparable.

DAPHNELLA DEA, n.sp. Pl. X, Fig. 24.

D. testa delicata, tenui, albida, ventricosa, fusiformi, anfractibus 8-9, quorum apicales 4 ochracei, pulchre decussati, apice ipso vitreo, lævi, cæteris inflatis, undique pulcherrime et arctissime decussatis, liris longitudinalibus tenuissimis, obliquis, apertura oblonga, labro effuso, tenui, sinu obscuro, canali brevi. Long. 11, lat. 4 mm., sp. max.

Most exquisite in decussating sculpture of the finest character; a thin, almost colourless, and inflated shell, its outer lip hardly exhibiting any sinus. This species is finer-grained than the nearly allied *D. thia*, M. & S., from the same locality, and of different form to the also closely akin *D. buccinulum*, M. & S.

DAPHNELLA LUCASII, n.sp. Pl. X, Fig. 25.

D. testa inflata, fusiformi, tenui, parum nitida, obscure brunneo-maculata, anfractibus 9, quorum apicales 4, apice ipso parvo, tribus huic proximis sub lente pulcherrime decussatulis, cæteris valde ventricosis, spiraliter distincte acutiliratis, liris apud penultimum 7, ultimi anfractus 18, intervallis imparibus, undique irregulariter longitudinaliter lirato-costatis, costulis ad ultimum persæpe evanidis, apertura rotundo-ovata, labro tenuissimo, effuso, canali paullum recurvo, paullum producto. Long. 10, lat. 4·50 mm.

The conspicuous spiral liræ extending at unequal intervals over the whole surface of the lower whorls, almost unbroken on the ventricose body-whorl, while crossed frequently above by irregular liral riblets on the upper whorls, distinguish this little *Daphnella* from its congeners. It is slightly like *D. teres*, Forbes, in general form, or *D. marmorata*, Hinds. I have pleasure in connecting with it the

name of Mr. B. R. Lucas, who first found it, with some other interesting forms, in shell-sand from the station given above.

ACTEON PULCHRIOR, n.sp. Pl. X, Fig. 26.

M. testa rotundo-ovata, vel oblonga, dolioliformi, tenui, delicata, albo-lactea, vel pallide fusca, subcrystallina, anfractibus 5, apice obtuso, globulari, apud suturas compressis, ventricosulis, undique arcte spiraliter sulcatis, sub lente forti longitudinaliter tenuissime et oblique striatulis, apertura ovata, labro tenui, columella paullum incrassata, nitida, vix plicata. Long. 3.50, lat. 1.75 mm.

Hab.—Persian Gulf, off Bahrein, 6 fathoms, coral sand.

Variable in form, one specimen being almost round, the majority, however, are oblong, tun-shaped, with remarkably blunt, vitreous, globular apex, the substance subpellucet, milky-white, or suffused with fuscous, whorls five, closely spirally furrowed, and microscopically longitudinally obliquely striolate. The very narrow umbilicus is half concealed by the columellar margin; it is but slightly plaited. Several examples. Allied to *Acteon austrinus*, Watson,¹ from Culebra Island, south West Indies, at 390 fathoms.

RETUSA BYSMA,² n.sp. Pl. X, Fig. 27.

R. testa parva, conico-cylindrica, alba, supra truncatula, longitudinaliter artissime sulcata, versus apicem sulcis minus conspicuis, lineis scalptis spiraliter superficiem totam circumcingentibus, anfr. 3-4, apertura oblonga, versus basin cochleariformi, labro tenui, fere recto, columella paullum oblique convexa. Alt. 4, diam. 2 mm.

Utriculus famelicus, Watson, seems the nearest ally to this little species, which is basally broader in proportion, that being a most attenuate shell. The longitudinal lines of growth and deeply seated crown are similar in both.

CYLICHNA PITHISCUS,³ n.sp. Pl. X, Fig. 28.

C. testa parva, ovata, compressa, alba, nitida, undique spiraliter arcte tenuiter striatula, apertura oblonga, supra angustiore, infra paululum effusa, labro tenui, columella versus basim effusa, simplice. Alt. 2.75, diam. 1.30 mm.

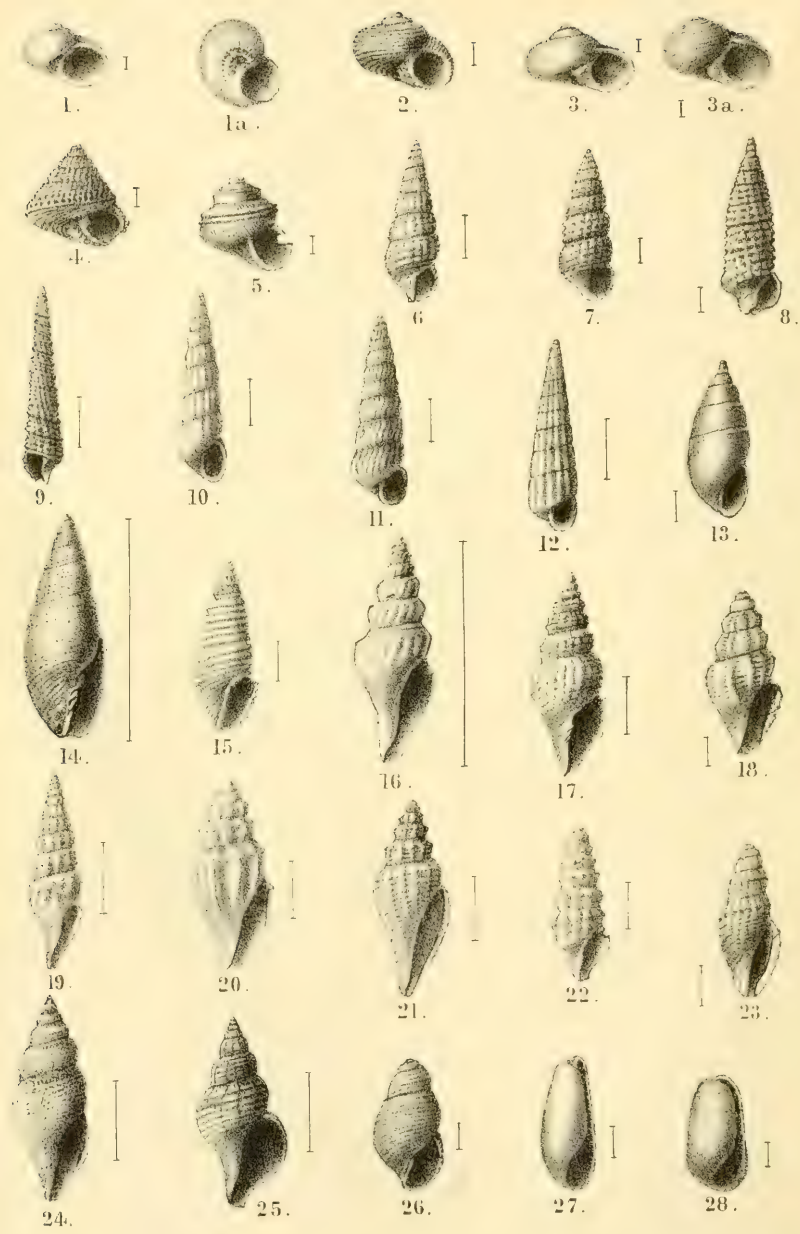
A good many examples of a small, white little species, slightly compressed laterally, oval in form, regularly spirally very minutely striolate, there being no pitting or delicate punctuation, as exists in the nearly allied *C. crenilabris*, M. & S.,⁴ from the same locality, but irregular longitudinal striæ cross the spiral lines.

¹ Rep. Challenger Exped., vol. xv, p. 628, pl. xlvi, fig. 2.

² *βύσμα*, a bung, or cork, from the form.

³ *πίθισκος*, a small barrel.

⁴ Proc. Zool. Soc., 1901, pt. ii, p. 455.



A. T. Hollick del. et lith.

Mintern Bros. imp.

NEW SPECIES OF GASTROPODA FROM THE PERSIAN GULF, GULF OF OMAN, AND ARABIAN SEA.

EXPLANATION OF PLATE X.

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|---|---|
| FIGS. 1, 1a. <i>Cyclostrema eumares</i> , n.sp. | FIG. 15. <i>Pleurotoma (Oligotoma) patricia</i> , n.sp. |
| ,, 2. ,, <i>eupoietum</i> , n.sp. | ,, 16. ,, (<i>Surcula</i>) <i>halicyria</i> , n.sp. |
| ,, 3, 3a. <i>Ethalia jucunda</i> , n.sp. | ,, 17. <i>Clathurella Polyhymnia</i> , n.sp. |
| ,, 4. <i>Basilissa compsa</i> , n.sp. | ,, 18. <i>Mangilia adamantina</i> , n.sp. |
| ,, 5. <i>Scissurella Jacksoni</i> , n.sp. | ,, 19. ,, <i>Aglaia</i> , n.sp. |
| ,, 6. <i>Cerithium anembatum</i> , n.sp. | ,, 20. ,, <i>apollinea</i> , n.sp. |
| ,, 7. ,, <i>pervicax</i> , n.sp. | ,, 21. ,, <i>barbiton</i> , n.sp. |
| ,, 8. <i>Bittium caudatum</i> , n.sp. | ,, 22. ,, <i>callistephana</i> , n.sp. |
| ,, 9. <i>Trifora concatenata</i> , n.sp. | ,, 23. ,, <i>Koweitensis</i> , n.sp. |
| ,, 10. <i>Turbonilla inæqualis</i> , n.sp. | ,, 24. <i>Daphnella dea</i> , n.sp. |
| ,, 11. ,, <i>microperone</i> , n.sp. | ,, 25. ,, <i>Lucasii</i> , n.sp. |
| ,, 12. ,, <i>recticostata</i> , n.sp. | ,, 26. <i>Actæon pulchrior</i> , n.sp. |
| ,, 13. <i>Mucronalia oxytenes</i> , n.sp. | ,, 27. <i>Retusa bysma</i> , n.sp. |
| ,, 14. <i>Mitra Townsendi</i> , n.sp. | ,, 28. <i>Cylichna pithiscus</i> , n.sp. |
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CONUS COROMANDELICUS, SMITH, ITS PROBABLE AFFINITIES,
AND SYSTEMATIC POSITION IN THE FAMILY CONIDÆ.

By J. COSMO MELVILL, M.A., F.L.S.

Read 10th June, 1904.

IN September, 1894, the description of a most notable abyssal Cone was published,¹ a species obtained during one of the cruises of H.M. Indian Survey steamship "Investigator," with which the names of Dr. A. Alcock, F.R.S., and the late Professor Wood-Mason are so closely associated. Its locality was "off the coast of Coromandel, lat. $14^{\circ} 18' 15''$ N., long. $80^{\circ} 18' 30''$ E., in 80-110 fathoms, and also lat. $15^{\circ} 4' 7''$ N., long. $80^{\circ} 25' 7''$ E., in 128 fathoms."

The author, in naming it *Conus Coromandelicus*, adds:—"It belongs to that section of the genus which includes *C. D'Orbigny*, *cancellatus*, etc., and which have the surface ornamented with transverse grooves and ridges. It is not sufficiently similar to any known species to suggest a comparison."

In 1903 Mr. Frederick W. Townsend was fortunate enough to obtain from two contiguous soundings in the Gulf of Oman, viz., lat. $25^{\circ} 10'$ N., long. $59^{\circ} 12'$ E., at 180 fathoms, and lat. $25^{\circ} 19'$ N., long. $58^{\circ} 10'$ E., at 205 fathoms, a few finer examples than those dredged off the coast of Coromandel; these were associated with *Rostellaria delicatula*, Nevill, also found in the deep waters of the Bay of Bengal, and a fine new *Pleurotoma*, *P. navarchus*, M. & S.

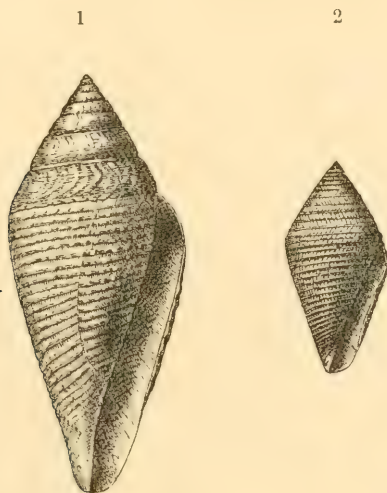
One of the largest of these specimens, evidently adult and quite perfect, and in live condition, measures long. 48, lat. 18, aperture 33×6 mm. This is as compared with long. 37, lat. 14, aperture $25 \times 3\frac{1}{2}$ mm. in the type.

Recently, when collecting Tertiary fossils in the Barton Beds, between Highelife and Hordle, South Hants, I found some good examples of *Conorbis dormitor* (Solander), and a comparison of these with *Conus Coromandelicus* reveals to my mind an alliance of the closest nature possible. We seem, indeed, to possess in these profound depths of the Arabian Sea and North Indian Ocean the direct descendant of a genus (or section of a genus) hitherto deemed extinct, the living analogue, so to speak, of the Barton Eocene *Conorbis* of prehistoric days.

The main differences seem to consist in (a) size: *C. dormitor* does not usually exceed 15 to 20 mm. longitudinally, by 7 in latitude; aperture 10×2 mm. (b) Greater length in proportion to length of

¹ Ann. & Mag. Nat. Hist., ser. VI, vol. xiv, p. 159, pl. iv, figs. 1, 2.

spire in the body-whorl of the recent form, *C. dormitor* being an exact double cone. In all other vital points the closest similitude prevails: both possessing smooth apical whorls, number of these identical, say 7-9, sculpture very akin, allowing for a certain intensification of the surface-pattern, sulcation, and ribbing of the Eocene species, while the live *C. Coromandelicus*, in prime condition, has its costæ and ornamentation of the upper whorls of a more mellowed pronouncement. In form, save for the particular mentioned above under (*b*), they are very similar, the effuse thin outer lip receding at the sinus, and almost indicating Pleurotomid characters to both species, the cone-like aperture being wider in the recent form, which is, in some examples, slightly more produced at the base.



1. *Conus (Conorbis) Coromandelicus* (Smith).
 2. „ „ „ *dormitor* (Solander).

Conorbis, a genus instituted by Swainson¹ in 1840, was formed to receive the old *Conus dormitor*,² Solander, 1766, and consists of but few species, only one other, *C. alatus*, Edwards, existing in the Barton Beds. Three species, *C. marginatus* (Lam.), *subangulatus* (Desh.), and *æquipartitus* (Cossmann), occur, however, in the Middle Eocene (Calcaire Grossier) of the Paris Basin.³ *Conorbis dormitor* is well figured by Sowerby, Min. Conch., 1821, pl. 301, fig. 2 ;

¹ Malacology, pp. 149, 312.

² Brander's Foss. Hant., p. 23, pl. i, fig. 24. Also Brit. Oligocene and Eocene Moll., by R. Bullen Newton, p. 130.

³ Cf. "The Eocene and Oligocene Beds of the Paris Basin," by George F. Harris and Henry W. Burrows.

Woodward, Recent and Fossil Shells, pl. vii, fig. 2; also Mon. Pal. Soc., 1856, p. 200, pl. xxiv, figs. 11a, 11c.

Conorbis, judging by the only test that can be applied to it, viz. the conchological, almost runs into certain species that have been assigned to the genus (or subgenus of *Pleurotoma*) *Genota*, H. & A. Adams.

The type, *G. mitraformis* (Wood), a recent species from East Indian seas, is not so akin as others more recently described by Watson and Dall under the names *Pleurotoma (Genota) attractoides*,¹ Watson, from the Philippines, and *P. viabrunnea*, Dall, collected in the New World tropics during the "Blake" expedition. With these should be associated *Pleurotoma amphiconus*, J. de C. Sowb., a fossil shell of the closest relation to both the species chiefly now under discussion. Here the aperture is narrow and conoid, and it would not be a matter of surprise to see some future palæontologist placing this species in the same genus that was formed to include *C. dormitor*.

It may not, indeed, be out of place to give two quotations by the late Dr. Searles V. Wood & F. E. Edwards,² in speaking of the analogies and appearance of this species: "In the elevated conical spire, the almost semicircular form of the outer lip, and the produced base of the whorls, it presents the closest analogies with that section of the *Pleurotomæ* formed of *P. prisca*, *amphiconus*, *linearis*, and similar species. Indeed, so closely does it approach to some of them that, judging from external characters only, it is difficult to decide to which genus it should be referred. The straight, narrow aperture, however, is entirely that of a Cone, and indicates a necessity that the animal, in order that it might withdraw into the inner whorls, should be enabled to enlarge the space within the shell, a necessity which was met by the power of absorption possessed by the animal. The curvature of the outer lip is all quite distinct in its character from the sinus in the outer lip of the *Pleurotomidæ*."

And again: "In the well-known Eocene species,³ *C. dormitor*, Sol., for instance, the shell outwardly possesses quite as much of the character of a *Pleurotoma* as that of a Cone; and Mr. Swainson has, in fact, taken it as the type for a genus which he has named *Conorbis*, and which, in his circle of affinities of the *Conidæ*, he regards as the representative of the *Pleurotomidæ*. This division depends entirely on the external characters of the shell; no living representative has, I believe, been found, and the animal is therefore unknown. It is certain, however, that it was a true Cone, for, on breaking a specimen, the inner whorls will be found reduced by absorption to a membrane-like thinness, and the capability to effect this is not, I believe, possessed by the animal of *Pleurotoma*. The proposed genus, *Conorbis*, is not well defined by its author, and is not generally received, although it may be adopted as a section of *Conus*. The characters appear to be

¹ Rep. Challenger Exped., Zoology, vol. xv, p. 301, pl. xx, fig. 8.

² Mon. Pal. Soc., 1856, p. 301.

³ L.c., p. 118.

the elevated conical apex, produced base representing the canal which distinguishes the *Pleurotomæ*, the condition of the outer lip, which is not thickened within, and so strongly arched as to be almost semi-circular in form, the deep wide sinus, which divides the posterior extremity of the outer lip from the suture, and exactly resembles the notch by which the *Pseudotomæ* (a section proposed by Bellardi) are distinguished, and the elevated, reflected anterior margin of the columellar lip, forming the right wall of the anterior canal."

To sum up, I would venture to propose that the Swainsonian name *Conorbis* be applied to *C. Coromandelicus*, Smith, subgenerically, as an isolated recent form, its place being between the subgenus *Hermes*, Montfort (in which *C. tendineus*, Hwass., is one of its nearest allies), and the section *Genota*, H. & A. Ad., of *Pleurotoma*

I have mentioned that Mr. Townsend dredged these Cones alive; but the soft parts were not, unfortunately, retained. It is much to be hoped that the next examples procured will be able to be fully anatomically examined and reported on, as especially to be compared with the animal of *Genota*. Indeed, in no assemblage of Gastropoda are our attempts at classification and demarcation of genera or subgenera so apt to become futile as in the wonderful wealth of forms exhibited by the Pleurotomidæ, both recent and fossil. What is wanted for this family is a specialist to concentrate the whole of his lifework upon it, and it alone. The number of new forms, mostly abyssal, increases yearly, and very likely there exist further links to bind the two groups we have been discussing, *Conus* and *Pleurotoma*, together in more than one way.

DESCRIPTIONS OF SIX NEW SPECIES OF MARINE MOLLUSCA
FROM THE COLLECTION OF THE LATE ADMIRAL KEPPEL.

By G. B. SOWERBY, F.L.S.

Read 10th June, 1904.

TRIPHORA PRINCEPS,¹ n.sp.

Testa perelongata, sinistrorsa, straminea, postice fusco-tincta, lineis rufo-fuscis numerosis longitudinalibus parum obliquis picta; anfractus circa 40, planulati, sulcis longitudinalibus parum obliquis hic illic foveolatis insculpti, cingulis 4 interruptis pseudo-nodulosis, aliquanto irregularibus, inæqualibus, duo inferioribus majoribus, instructi; anfractus ultimus infra sub-acute angulatus, ad angulum bicarinatus,



infra angulum subconceavo-constrictus, carinis 2 aliquanto robustis munitus; rostrum longiusculum, contorto-reflexum; apertura subquadrata; labrum tenue. Long. 57, diam. maj. 7 mm.

Hab.—?

This is by far the largest known species of the genus. Unfortunately, with the unique specimen there is no indication of its habitat, but it is not improbable it may have been dredged off Ascension Island, as it was found in Admiral Keppel's cabinet in close proximity to shells so labelled. Besides its remarkable size, the shell is very distinct in character. The longitudinal brown pitted grooves intersect the spiral

¹ *Triphora*, Blainville (1828) = *Triforis*, Deshayes (1834). See Hedley, "Studies on Australian Mollusca": Proc. Linn. Soc. New South Wales, 1902, pp. 606-8.

ridges, causing the most prominent ones to assume the form of transversely oblong nodules.

There is a very small young shell of this species in the British Museum, from the Cuming Collection.

TRIPHORA SMITHI, n.sp.

Testa elongato-acuminata, pallide straminea, anfractus circiter 35, planulati, cingulis spiralibus 2-4 acutiusculis lævibus instructi, aliter læviuseculi; anfractus ultimus obtuse angulatus, ad angulum bicarinatus, infra angulum leviter convexus, triliratus; rostrum breviuseculum, leviter contortum; apertura subquadrata; labrum tenue. Long. 33, diam. maj. 5 mm.



Hab.—?

Although much smaller than *T. princeps*, this shell is larger than any other known species of the genus. It is broader in proportion to its length than *T. princeps*, and both the spiral ridges and the interstices between them are remarkably smooth, showing only irregular growth-lines. The specimen is at present unique.

MARGINELLA (CRYPTOSPIRA) ROBUSTA, n.sp.

Testa ovata, solida, fulvo-carneola; spira occulta; apertura angustiuscula, arcuata; margo columellaris albo-callosus, multiplicatus, plicis



crassiusculis, acutis, super basim testæ partim productis; labrum incrassatum, intus minute dentatum, extus anguste marginatum. Long. 21, diam. maj. 14½ mm.

Hab.—Ascension Island (Keppel).

This shell differs from *M. cornea*, Lamk., in its short ovate robust form, and in the prominence and length of the numerous columellar plicæ, which cover almost the whole length of the aperture, and extend partly across the base of the shell.

MUREX (PTERONOTUS) EXQUISITUS, n.sp.

Testa elongato-trigona, albida, fusco late balteata; spira acute conica; anfractus 7, primi 2 (apicales) oblique papillares, fere læves, sequentes 2 convexi, costis 8-10 eximie squamosis instructi, cæteri angulariter trivariicosi, undique squamis minutis copiosis undulatis et imbricatis ornati, spiraliter lirati; anfractus ultimus supra angulatus, infra attenuatus, rostratus, varicibus tenuiter expansis, leviter reflexis,



acute angulatis, breviter spinosis; rostrum mediocriter productum, rectiusculum; apertura parva, rotunde ovata. Operculum corneum, lamellosum. Long. 26, diam. maj. $9\frac{1}{2}$ mm.

Hab.—?

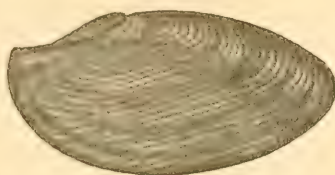
This lovely little *Murex* has somewhat the form of *Eupleura caudata*, Say. It is exquisitely laminated and sealed all over. There were three specimens of it in the collection of Admiral Keppel, without any indication of habitat.

YOLDIA KEPPELIANA, n.sp.

Testa oblonga, subovalis, tenuis, compressa, olivacea, nitida, oblique lirata, liris irregularibus, antice subdistantibus, postice coarctatis; margo dorsalis anticus longus, mediocriter declivis, levissime arcuatus, posticus brevis, truncatus, vix rostratus; margo ventralis postice convexus et multum aelivis, ad extremitatem acute angulatus, in medio leviter arcuatus, antice rotundatus; cardo normalis. Long. 43, alt. 31, crass. 8 mm.

Hab.—?

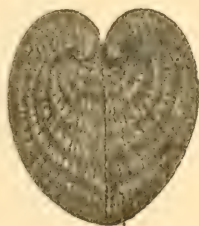
This species differs from *Y. lanceolata*, Sowerby, in being more compressed, more shortly truncated, and sharply angled at the posterior end, and in the oblique ridges being less waved, and extending almost to the posterior extremity.



end, and in the oblique ridges being less waved, and extending almost to the posterior extremity.

CARDITA UMBONATA, n.sp.

Testa rotundato-cordiformis, tumida, crassa, aurantiaca, rufo-fusco suffusa, costis 20 crassis, rotundatis, nodulosis, instructa; umbones prominentes, valde convexi, antice incurvati; lunula brevis, profunda; margo dorsalis postice arcuatus, declivis, antice brevissimus; cardo normalis. Alt. 30, lat. 30, crass. 26 mm.



Hab.—Off Sierra Leone (Admiral Keppel).

A robust shell of a peculiarly tumid form, with very broadly rounded umbones. Perhaps the nearest approach to it in form is *C. Cuvieri*, Broderip.

NOTE ON *VOLUTA BRAZIERI*, COX.

By EDGAR A. SMITH, I.S.O.

Read 10th June, 1904.

THE British Museum has recently acquired the unique type of this species which hitherto formed part of the collection of Dr. J. Cox, of Sydney. On comparing it with the figure and description (Proc. Zool. Soc., 1873, p. 568, pl. xlvi, fig. 8), it was found that the former was almost a caricature, giving but a slight idea of the form of the shell, and ridiculous as regards coloration. On the plate it is stated that the figures were partly drawn by Helena Forde and lithographed by the late Mr. Sowerby. I have little doubt, therefore, but that a badly coloured drawing of the type was sent from Australia for reproduction. Of one thing, however, I feel quite certain, that Mr. Sowerby was not responsible for such a miserable production. Knowing the accuracy of his drawing and his characteristic colouring, it is quite certain that he could not have produced



such a misleading figure. I am afraid, therefore, that the above-mentioned lady must be held responsible. The copies of this figure by Tryon in the Manual of Conchology and by Sowerby in the Thesaurus Conchyliorum are even more grotesque. Dr. Cox thus described the colour of this shell: "Indistinctly banded about the centre with dark chestnut, ornamented with irregular buff-coloured markings." I should rather describe the shell as of a light-brown colour, mottled irregularly with white, exhibiting upon the

body-whorl three bands of a darker brown, two being near the middle and one just below the shoulder. Some dark-brown streaks, starting from the suture, extend more or less over the shell. A close scrutiny also reveals the presence of transverse thread-like reddish lines, which are most conspicuous behind the edge of the labrum. The apex is pale purplish rose, and the aperture purple also. The apex is described by Dr. Cox as "granular." The specimen, in its present condition, has lost the extreme protoconch, and the spire consists of five whorls, which are distinctly longitudinally costate, especially the three uppermost ones.

Both Cox and Tryon have placed this species in the section *Callipara*, probably on account of the general resemblance in form to *V. bullata*, Swainson, from South Africa, and Tryon even ventured the opinion that perhaps it might be "only a color-variety of that species." An examination of the apices at once shows the absolute distinctness of these two forms. In *V. bullata* it is enormous for the size of the shell and globose, whereas in the present species it is minute. In this respect it agrees with some of the forms of *Lyria*, as well as in the character of the columellar folds, which in the typical forms (*V. nucleus*, etc.) consist of two or three small plications anteriorly. Another feature common to this species and nearly all the forms of *Lyria* is the presence of transverse hair-like colour-lines.

This interesting specimen evidently is not adult, and has an abnormal aspect; indeed, I am of opinion that it is merely a monstrous growth of *V. deliciosa*, Montrouzier. The plication and rosy colour of the spire, the smooth body-whorl, and its style of coloration are the same, the columellar folds are exactly similar, and the very fine liræ above the three basal plicæ are also faintly indicated, and finally, the localities, New South Wales and New Caledonia, do not present any difficulty in respect of this proposition.

ON THE *DORIS PLANATA* OF ALDER & HANCOCK.

By Sir C. N. E. ELIOT, K.C.M.G.

Read 10th June, 1904.

GEITODORIS PLANATA (A. & H.).

Doris planata, A. & H. : Brit. Nudibranch. Moll., pl. viii.*Geitodoris complanata*, Bergh : Bull. Mus. Comp. Zool. Harvard, 1894, vol. xxv, p. 163, pl. iv, figs. 13-18; pl. v, figs. 1-5.*Platydorid planata*, Garstang : Journ. Marine Biol. Assoc., vol. i, No. 4 (1890), pp. 445-6.

Alder & Hancock's *Doris planata* has been attributed to the genus *Platydorid*, but, in so doing, authors seem to have attended only to the description given opposite the plate (No. viii), and to have neglected the definition of the characters as given in the synopsis at the end of the work (i.e., pt. vii, p. 42). *D. planata* there comes under the heading—

“** ORAL TENTACLES LINEAR.

Lingual spines of two kinds, various : no central spine. Occasionally with a spinous buccal collar.”

From this it follows that the animal has a radula with differentiated teeth of two kinds, and possibly a labial armature, two characters which do not belong to the genus *Platydorid*.

Through the kindness of Mr. Allen, of the Plymouth Laboratory, I have received five specimens of the animal known there as *Platydorid planata*. They present striking differences in appearance, but agree in structure, and are no doubt correctly referred to the same species. Three are greenish grey, soft in texture, and flat in shape. The mantle edge is ample; the back slightly arched, and covered with soft tubercles of various shapes and sizes. The largest is 16 mm. long, 11.5 broad, and 5.5 high. The two remaining specimens are white, and much bent in shape, but apparently more stoutly built than the others. The skin seems, at first sight, smooth, but is really finely granulate. The measurements of the larger specimen are—length 12.5 mm. (probably representing at least 20, if straightened), breadth 8.5, height 6. Unless the contrary is stated, the following notes apply to both classes of specimens. The foot is deeply grooved and notched in front, fairly broad, and does not project behind the mantle. The tentacles are distinct and conical. The dorsal integuments are full of strong spindle-shaped spicules. The pockets of the rhinophores and branchiæ are slightly raised, tuberculate and crenulate, but not lobed. The rhinophores have about 25 perfoliations. Of the branchiæ Mr. Garstang (i.e.) says that they are six, but that in one specimen the third on each side was deeply bifurcated, and in the

other distinctly trifold.¹ This divisibility of the posterior plume no doubt explains the apparent variations in number. The largest flat grey specimen has seven, of which two might also be considered as a single but divided plume. In the other two specimens eight tips are visible, the plumes being retracted. In the larger white specimen there are six or eight plumes, according as the posterior one on each side is counted as bifid or as two; in the smaller example, there appear to be nine, quite separate. In both white specimens the branchial apparatus is entirely everted, and the anal papilla unusually large. In all specimens the plumes are small and scanty, apparently tripinnate.

The buccal mass is greenish, small, and contains a labial armature of short, closely packed brown rods, arranged in an almost complete ring. The radula is fragile and not large. There are about 18 rows of colourless teeth, and the formula varies from $9 + 12-0-12 + 9$ to $10 + 14-0-14 + 10$. I could not find any row which was wider than this, but such may have existed and been broken up. The 12 or 14 teeth nearest the rhachis are of the ordinary hamate type, and strongly built. The 9 or 10 outermost are extremely thin, and closely crowded together. Bergh's plates (l.c.) give a good idea of both kinds of teeth. The other internal organs appear to be as in the genus *Geitodoris*, but in one of the white specimens the seminal duct and glans penis appear to bear minute hexagonal scales.

These forms cannot be referred to *Platydoris*, for not only do they differ decisively in the mouth parts, but they have not the characteristic stiff, leathery consistency and feeling. On the other hand, they have all the essential characters of *Geitodoris*, and Verrill, who discovered *Geitodoris complanata*, thought it might be allied to *D. planata*, A. & H.

I regard the form here examined as being certainly identical with *D. planata*, and as belonging to the genus *Geitodoris*. The only question is whether it should be specifically distinguished from *Geitodoris complanata* found on the north-east coast of America. The colour of the two is similar, and the chief differences seem to be that the specimens from Plymouth are (1) smaller, (2) have a smaller radula, (3) have varying branchiæ, which appear to be typically six, with a tendency to division in the posterior plumes, whereas in *G. complanata* there are definitely ten plumes. All these differences could be explained by the hypothesis of growth, but further examination may prove that there are two species, or well-marked varieties, from the east and west coasts of the Northern Atlantic respectively. The specific name *planata* (A. & H., 1855) has clearly priority, and must be borne by the American form unless it is shown to be distinct.

In view of Garstang's description of the buccal parts of his *Platydoris planata* it is possible that it may be really distinct from the specimens sent me. Both Verrill's *G. complanata* and the form here examined were obtained by dredging, and seem to frequent fairly deep water.

¹ He also adds that the branchiæ of each side are retractile separately from those of the other side.

DESCRIPTION OF A HELICOID LAND-SHELL (*XANTHOMELON
BEDNALLI*) FROM CENTRAL AUSTRALIA.

By J. H. PONSONBY, F.Z.S.

Read 10th June, 1904.

XANTHOMELON BEDNALLI, n.sp.

Testa umbilicata, turbinata, solidula, fusco-olivacea; spira modice exserta, coniformis; anfr. 5 tumiduli, sutura valde impressa discreti; primus fere lævis, cæteri lineis incrementi conspicuis oblique curvatis ornati et striis spiralibus irregularibus decussati, ita ut seriebus granulorum sculpti videantur, ultimus inflatus magnus, antice sensim descendens; apertura fere circularis, oblique disposita. Marginibus intus cæruleo-albidis, sat distantibus, callo tenuissimo nitido junctis, dextro expanso et leviter reflexo, columellari valde incrassato, umbilicum latum pervium partim obtegente. Diam. maj. 22·5 mm., min. 17·5 mm.; alt. 18 mm.

Hab.—MacDonnell Range, Central Australia.

This species was kindly sent by Mr. Bednall, of Adelaide, whose name it has been a pleasure to associate with it. The shells, two adult

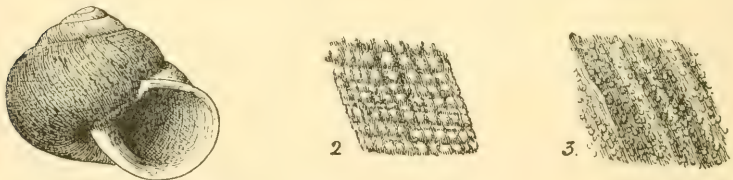


FIG. 1. *Xanthomelon Bednalli*.
 ,, 2. Sculpture of same, highly magnified.
 ,, 3. Sculpture of *X. grandituberculatus*, similarly magnified.

and several young, are related to *Thersites* (*Hadra*) *grandituberculata*, Tate.¹ From it, however, *X. Bednalli* is readily distinguished by its non-continuous peristome, the absence of any flatness of the whorls below the suture, and more especially by the sculpture, which, as will be seen by reference to the accompanying magnified drawing, is quite different to that of Professor Tate's species.

It is understood that the type will be deposited by Mr. Bednall in the South Australian Museum.

As the result of Mr. Hedley's² investigations it appears that the present and similar species should be included in *Xanthomelon*.

¹ Report of the Horn Expedition, pt. ii, Zoology, p. 200, pl. xviii, fig. 11 (1896).

² Op. cit., p. 224.

ORDINARY MEETING.

FRIDAY, 11TH NOVEMBER, 1904.

E. R. SYKES, B.A., President, in the Chair.

Charles Michael Hall was elected a member of the Society.

The following communications were read:—

1. "Descriptions of three new species of *Opisthostoma* from Sarawak, North Borneo." By E. A. Smith, I.S.O.
2. "On a new variety of *Planispira zebra*, from the Island of Gisser, and a new species of *Chloritis* from Java." By the Rev. R. Ashington Bullen, F.L.S.
3. "On the Anatomy of certain species of *Siliqua* and *Ensis*." By H. Howard Bloomer.
4. "On the genus *Tomigerus*, Spix, with descriptions of new species." By Dr. H. von Ihering.
5. "Notes on some New Zealand Pleurotomidæ." By Henry Suter.
6. "Notes on some species of *Chione* from New Zealand." By Henry Suter.
7. "Note on Mr. Suter's paper on species of *Chione* from New Zealand." By E. A. Smith, I.S.O.
8. "On *Oliva tigridella*, Duclos." By F. G. Bridgman. (See *Notes*.)

The following specimens were exhibited:—

By F. G. Bridgman: Specimens of *Oliva tigridella*, Duclos, and *O. ispidula*, Lamk.; also sections of Gastropod shells showing the great differences in thickness and texture.

By Rev. R. Ashington Bullen: Specimens of *Borus oblongus* from the River Corentyn, between British and Dutch Guiana; also a beautiful series of *Xesta citrina* from the Island of Gisser. (See Plate XI.)

By A. S. Kennard: A sinistral example of *Helicigona arbustorum*, probably the first recorded instance of this abnormality in the species.

By G. K. Gude: A rare work on the Argentine Molluscan fauna by Pellegrino Strobel.

By E. R. Sykes: Specimens of the genus *Miratesta*, Sarasin.

ORDINARY MEETING.

FRIDAY, 9TH DECEMBER, 1904.

E. R. SYKES, B.A., President, in the Chair.

Mrs. Alice L. Williams and Miss Marie Victoire Lebour, B.Sc., were elected members of the Society.

The following communications were read:—

1. "Description of a new species of *Trachiopsis* from British New Guinea." By H. B. Preston, F.Z.S.

2. "An arrangement of the American Cyclostomatidæ, with a revision of the nomenclature." By Prof. W. H. Dall, D.Sc.

3. "A Correction in Nomenclature." By E. A. Smith, I.S.O. (See *Notes*.)

4. "Note on the Dates of Publication of the various parts of Moquin-Tandon's 'Hist. Moll. terr. fluv. de France.'" By J. W. Taylor, F.L.S. (See *Notes*.)

The following specimens were exhibited:—

By Rev. R. Ashington Bullen: A collection of land and fresh-water shells from Huntingdonshire. Forty species were shown, including twenty-two hitherto unrecorded from the county; also some striking colour varieties of *Xesta citrina*, Linn., and *Amphidromus palaceus*, Mousson.

By G. B. Pritchard: Tertiary shells from Australia, including an example (the second discovered) of *Cypræa gastroplax*, M'Coy, with a broad flange projecting from the shell horizontally above the mouth. The specimen came from the clay of Mornington. Other species were *Solutofusus carinatus*, Pritchard, *Concholepas antiquatus*, Tate, and *Pseudovaricia mirabilis*, Tate.

By E. R. Sykes: A collection of West Indian Cyclostomatidæ.

ORDINARY MEETING.

FRIDAY, 13TH JANUARY, 1905.

E. R. SYKES, B.A., President, in the Chair.

John Ritchie, jun., was elected a member of the Society.

Dr. Henry Woodward, F.R.S., and Mr. Wilfred Bendall were appointed to audit the accounts of the Society for 1904.

The following communications were read:—

1. "A review of the Genera of the Family Mytilidæ." By A. J. Jukes-Browne, F.G.S.

2. "Note on the Type of *Geomelania*, with the description of a new species." By E. R. Sykes, B.A.

3. "On three species of *Dyakia* from Western Sumatra." By E. R. Sykes, B.A.

4. "On some Nudibranchs from the Pacific, including a new genus, *Chromodoridella*." By Sir C. N. E. Eliot, K.C.M.G.

5. "Notes on two rare British Nudibranchs, *Hero formosa*, var. *arborescens*, and *Staurodoris maculata*." By Sir C. N. E. Eliot, K.C.M.G.

6. "Description of a new *Achatina* from the Zambesi." By H. B. Preston, F.Z.S.

7. "Note on *Geitodoris planata* (Alder & Hancock)." By Sir C. N. E. Eliot, K.C.M.G. (See *Notes*.)

8. "Note on some Holocene Non-Marine Mollusca from Walton Heath, Surrey." By Raymond H. Chandler. (See *Notes*.)

9. "Note on *Oliva oryza*, Lamarek." By F. G. Bridgman. (See *Notes*.)

The following specimens were exhibited:—

By B. B. Woodward (on behalf of Raymond H. Chandler): Holocene shells from a pipe in the Chalk at Walton Heath. Some eighteen species were shown, including the shells of *Limax maximus* and *Vitrea Rogersi*.

By G. B. Pritchard: Older Tertiary shells from Victoria, comprising examples of Cephalopods, Gastropods, and Peleceypods.

By F. G. Bridgman: Varieties of *Olivella oryza*, Lamk. Attention was particularly drawn to a small white variety (not figured by Duclos or Reeve) used by the natives of the West Indies in the construction of shell-baskets. An exceedingly beautiful example of this work was shown; also specimens of *Oliva intertineta*, Cpr., *O. punctata*, Marrat, and *O. nitidula*, Duclos.

By E. R. Sykes: Types of shells lately described by him from the Indo-Malayan region; also a malformed specimen of the common cockle (*Cardium edule*).

NOTES.

A CORRECTION IN NOMENCLATURE. (Read 9th December, 1904.)—In the Proc. Malac. Soc., vol. v, p. 345, a note was published by Messrs. G. B. Sowerby & H. C. Fulton upon "a specimen of *Fistulana clava*, Lamk., perforating a shell of *Mitra intertirata*, Reeve." This very interesting object having been acquired by the British Museum, it became necessary to prepare a label for exhibition, and it was found that neither the name of the bivalve nor of the *Mitra* appeared to be quite correct, but that they should respectively be *Fistulana mumia* (Spengler), and *Mitra circulata*, Kiener, var.

It is a most difficult and complicated question as to which generic name should be employed for the bivalve, but after considerable investigation I am inclined to adopt *Fistulana*,¹ Bruguière (1789), for this shell, in agreement with Dr. Paul Fischer, who has discussed this point at some length in the Journ. de Conch., 1866, pp. 322-326. One important reference he overlooked at the time, namely, Lamarck's "Prodrome d'une nouvelle classification des Coquilles" in the Mém. Soc. Hist. nat. Paris, an. vii (1799). On p. 90 he gave a brief diagnosis of *Fistulana*, and quoted but one species, namely, *F. clava*. In this Prodrome, however, he made no reference to *Gastrochaena* or the species (*cuneiformis*, *mytiloides*, and *modiolina*) which he subsequently, in 1818 (Anim. sans Vert., vol. v, p. 447), placed in it. Fischer, in his Man. de Conch., p. 1130, observes that Lamarck limited *Fistulana* in an exact manner in 1799, showing that he had subsequently referred to Lamarck's Prodrome, which appears to have escaped his attention previously. With regard to the specific name, that given by Spengler (*mumia*) has undoubted priority over Lamarck's *clava*.

¹ *Fistulana*, Fabricius (1780), is evidently merely a misprint of *Fistularia*, Müller (1776).

A careful examination of the *Mitra* shows that it is certainly distinct from *M. interlirata*, and that it possesses all the features of *M. circulata* of Kiener. The distant spirals and the intervening sculpture are precisely similar, and the number of the columellar folds is the same, namely, three and a very faint anterior fourth, whilst in *interlirata* there are five with the indication of a sixth.

As this remarkable instance of boring is likely to be referred to in future works, it seemed to me advisable to make the above corrections as soon as possible.

E. A. SMITH.

NOTE ON THE DATES OF PUBLICATION OF THE VARIOUS PARTS OF MOQUIN-TANDON'S "HISTOIRE NATURELLE DES MOLLUSQUES TERRESTRES ET FLUVIATILES DE FRANCE." (Read 9th December, 1904.)—In the Proceedings of the Malacological Society, vol. v, p. 261, Mr. B. B. Woodward, on the authority of the "Bibliographie de la France," gives the dates upon which the various component parts of this important work were published. The particulars there given would appear to be inaccurate, as MM. Letourneux & Bourguignat (Prodr. Malac. Tunisie, 1887, p. 1, note), who investigated the subject, give earlier dates for every individual part. According to these authors the true dates of publication were:—

| | | | |
|----------|--------|-----------------|-------|
| Livr. I, | issued | April 12th, | 1855. |
| " II | " | May 4th, | 1855. |
| " III | " | August 1st, | 1855. |
| " IV | " | September 10th, | 1855. |
| " V | " | January 2nd, | 1856. |
| " VI | " | April 9th, | 1856. |

J. W. TAYLOR.

NOTE ON *GEITODORIS PLANATA* (ALDER & HANCOCK). (Read 13th January, 1905.)—Since I wrote my paper in this journal (vol. vi, p. 180) to prove that Alder & Hancock's *Doris planata* should bear this name, my attention has been called to the account of the species in Jeffrey's British Conchology, vol. v, p. 85, written by Alder, as stated on p. 27. It says: "The examination of further specimens of different sizes, from the Clyde district, proves that the *D. planata* of the 'British Nudibranchiate Mollusca' is the young of *D. testudinaria*. In its young state it is extremely flat, and the gills imperfectly developed." Alder's authority on such a point must naturally carry great weight, but it is noticeable that, whereas he says he had seen further specimens from the Clyde, he does not say that he had seen any from the Mediterranean, and merely refers to Risso (Hist. Nat. l'Eur. MÉR., vol. iv, p. 33, fig. 15). It is therefore probable that he identified the specimens with *D. testudinaria* merely on the strength of Risso's description, and, if that is so, I do not think the identification can be considered certain, for he can have had no means of comparing the buccal parts, of which Risso makes no mention. But these organs, which are clearly referred to by Alder & Hancock (Brit. Nud. Moll., pt. vii, p. 42), are the most important characters of *D. planata*, and distinguish it from all other recorded British forms. Until it is shown that the *D. testudinaria* of the Mediterranean possesses them, I think the specific name *planata* should be maintained for the British form, and the genus seems to me undoubtedly *Geitodoris*. Risso's *D. testudinaria* has been identified by Bergh and others with *Platydoris argo*, but this identification also is not certain, as Risso's description and figure are unsatisfactory and inadequate. The external characters are not in any way remarkable, and might apply to many Dorids, except that the animal is described and depicted as having

five simply pinnate branchiæ. As early as 1844 Philippi (Enum. Moll. Siciliæ, vol. ii, p. 78) pointed out that this is probably an error, but if it be correct, the animal is neither *D. planata* nor *D. argo*.

It is, of course, possible that *D. testudinaria* may be rediscovered in the Mediterranean and prove to be a *Geitodoris*, in which case its identity with the British form is highly probable. C. N. E. ELIOT.

NOTE ON *OLIVA TIGRIDELLA*, DUCLOS. (Read 11th November, 1904.)—This species was figured, but not described, by Duclos in his monograph of the genus (Hist. nat. Coquilles, *Oliva*, pl. viii, figs. 13–16). Figs. 13, 15, and 16 have been reproduced by Tryon (Man. Conch., vol. v, pl. xxxiii, figs. 28, 29, 42).

It has been hitherto considered by Reeve, Weinkauff, Tryon, etc., a variety of *Oliva ispidula*, Lamarck, but if a careful comparison be made it will be seen that the two forms are very distinct. *Oliva ispidula* is more cylindrical, in length nearly $2\frac{1}{2}$ times its breadth, and as a rule much larger than *O. tigridella*, which is more fusiform and quite different in its proportions. It is also to be observed that in *O. ispidula* the markings often take the form of transverse bands, whilst if any lines are observable in *O. tigridella* they are invariably longitudinal. Many specimens of *O. ispidula* have a single band round the upper part of the body-whorl.

O. tigridella more nearly resembles *O. Duclosi*, Reeve (*Jaspidea*, Duclos), than any other species, both in size and form, whereas *O. ispidula* is most like *O. litterata*, Lam., in form, although different in size.

It may thus be characterised:—Shell fusiform-cylindrical; length usually slightly less than 1 inch, width rather less than half the length, being greatest near the shoulder, and gradually narrowing towards the base; spire about $\frac{1}{3}$ of the entire length; columellar plicæ rather fine and numerous in young specimens; colour and markings very variable; ground-colour generally yellow or yellowish-brown or red; markings, when forming lines, taking a longitudinal direction, but generally irregularly spotted or blotched. Aperture dusky. F. G. BRIDGMAN.

NOTE ON *OLIVA ORYZA*, LAMARCK. (Read 13th January, 1905.)—This very common species has not, I think, been satisfactorily determined by Duclos, Reeve, or Marrat in their monographs. The commonest form, which is probably that originally described by Lamarck, is uniformly white. It is so abundant that it is used by the natives of the West Indies in the manufacture of shell-baskets, etc. This plain white variety has been figured neither in Duclos' nor Reeve's monograph, but a figure of it is given by Marrat (Thesaurus Conch., pl. xxii, fig. 391). This figure, however, hardly illustrates what I regard as the typical form, which is more correctly represented by fig. 387 on the same plate. An orange-tipped specimen is figured in Reeve's monograph (pl. xxvii, fig. 81b), with the remark that "the colouring of the apex seems to be a characteristic feature in this species." Duclos (pl. i, fig. 10) figures a somewhat similar shell, but this is more pink than orange at the apex. I believe these are all varieties of the same species. F. G. BRIDGMAN.

NOTE ON SOME HOLOCENE NON-MARINE MOLLUSCA FROM WALTON HEATH, SURREY. (Read 13th January, 1905.)—At Walton Heath, which lies just to the north of Reigate, there is a chalk quarry showing several 'pipes' in section. Pipes in the Chalk are generally barren, but three of these contained some non-marine mollusca, which are referable to the following species:—

| | |
|--------------------------------------|--------------------------------------|
| <i>Limax maximus</i> , Linn. | <i>Acanthinula aculeata</i> (Müll.). |
| <i>Agriolimax agrestis</i> (Linn.). | <i>Helicigona lapicida</i> (Linn.). |
| <i>Vitrea crystallina</i> (Müll.). | " <i>arbustorum</i> (Linn.). |
| " <i>cellaria</i> (Müll.). | <i>Helix nemoralis</i> , Linn. |
| " <i>Rogersi</i> , B. B. Woodw. | <i>Ena obscura</i> (Müll.). |
| " <i>alliaris</i> (Miller). | <i>Cochlicopa lubrica</i> (Müll.). |
| " <i>nitidula</i> (Drap.). | <i>Cæcilioides acicula</i> (Müll.). |
| <i>Zonitoides excavatus</i> (Bean). | <i>Vertigo pusilla</i> , Müll. |
| <i>Arion ater</i> (Linn.). | <i>Clausilia laminata</i> (Montagu). |
| <i>Punctum pygmaeum</i> (Drap.). | " <i>biplicata</i> (Montagu). |
| <i>Pyramidula rotundata</i> (Müll.). | <i>Carychium minimum</i> , Müll. |
| <i>Hygromia hispida</i> (Linn.). | <i>Pomatias elegans</i> (Müll.). |
| " <i>rufescens</i> (Penn.). | <i>Acicula lineata</i> (Drap.). |

Of these the most interesting are :—

The single specimen of *Zonitoides excavatus*, the species not having been found in the fossil state south of the Thames, although it occurs in the Holocene of Chignal and the Pleistocenes of Copford and Clacton in Essex.

Vitrea Rogersi, also represented by a single example, because it confirms the existence of this species in Holocene times. Some examples were found in the Ightham fissure, but there being at the time some doubt whether they might not have been introduced accidentally from above, attention was not specially drawn to them.

Clausilia biplicata is also noteworthy, it having hitherto only been met with in Holocene deposits at Blackfriars and at Reigate. The striation on this specimen is less marked than on recent examples, an unusual condition, since sculpturing is usually more conspicuous on fossil than on recent shells of the same species.

A small snail's egg which was found is probably that of a *Clausilia*; while the fragment of a larger one may be put down to *Helix nemoralis*.

The specimens have now been deposited in the British Museum.

I am indebted to Mr. B. B. Woodward and Mr. A. S. Kennard for their kindness in determining and describing these specimens, also for the information as to former finds, etc.

RAYMOND H. CHANDLER.

DESCRIPTIONS OF THREE NEW SPECIES OF *OPISTHOSTOMA*
FROM SARAWAK, NORTH BORNEO.

By EDGAR A. SMITH, I.S.O.

Read 11th November, 1904.

THE three species about to be described were collected by Mr. Sydney Beddome at Piesing, Upper Sadong, Sarawak. Including these, the number of distinct forms now recognized from Borneo amounts to twenty-three.

OPISTHOSTOMA SHELFORDI, n.sp. Fig. 3.

Testa dextrorsa, minima, conica, rufescens; anfractus 5 convexi, primus lævis, cæteri liris obliquis, tenuibus, arcuatis, instructi, ultimus primo peculiariter contractus et contortus, deinde arcuatim retrorsus, usque ad apicem spiræ ascendens, lamellis fortioribus ornatus; apertura circularis; peristoma duplex, pallidum, margine interno anguste expanso, externo angusto, spiræ contiguo. Long. 2, diam. 1.6 mm.

Hab.—Piesing, Upper Sadong, Sarawak.

Remarkable on account of the way in which the last whorl is curved up the spire, so that the upper edge of the peristome is slightly above the apex. Under the microscope the surface is seen to be minutely spirally striated.



OPISTHOSTOMA SADONGENSE, n.sp. Fig. 2.

Testa dextrorsa, rimata, conica, rufescens; anfractus 6 perconvexi, lamellis numerosis, tenuibus, obliquis, ornati, ultimus constrictus, retrorsus contortus et ascendens, lamellis versus labrum validioribus et magis distantibus; apertura angulatim ovalis, antice leviter canaliculata; peristoma duplex, margine interno continuo, porrecto, leviter incrassato, externo anguste expanso, spiram versus interrupto. Longit. 2.25, diam. 2.5 mm.

Hab.—Picsing, Upper Sadong, Sarawak.

Characterised by the peculiar shape of the aperture, which is distinctly channelled at the lower part.

OPISTHOSTOMA PICSINGENSE, n.sp. Fig. 1.

Testa conica, rimata, rufescens, dextrorsa; anfractus 6 convexi, regulariter accrescentes, lamellis numerosis, tenuissimis, contortis, obliquis, ornati, ultimus ad peripheriam obtuse subangulatus, antice contortus et retrorsus ascendens, infra cristatus; apertura rotundata, campanulata; peristoma duplex, pallidum, margine interno continuo, leviter expanso, externo versus spiram fere interrupto, anfract. penultimo contiguo. Longit. 2·3, diam. 2·6 mm.

Hab.—Picsing, Upper Sadong, Sarawak.

In this species the last whorl ascends so that the top of the peristome is on a level with the top of the third whorl. There does not appear to be any spiral sculpture.

ON A NEW VARIETY OF *PLANISPIRA ZEBRA*, PFR., FROM THE ISLAND OF GISSER, AND A NEW SPECIES OF *CHLORITIS* FROM JAVA.

By the Rev. R. ASHINGTON BULLEN, F.L.S., F.G.S.

Read 11th November, 1904.

PLATE XI.

My friend Lieutenant V. Brooke Webb, R.N., who was engaged in charting parts of the Eastern seas about 1892-3, informs me that the Isle of Gisser is a low sandy atoll-formed island, about one-third of a mile in diameter, and surrounded by a reef, situated five miles from the south-east point of Ceram, and close to Ceram Laut, in lat. $3^{\circ} 53' S.$, long. $130^{\circ} 52' E.$

From this island some very beautiful varieties of *Xesta citrina* (Pl. XI, Figs. 3-11) were obtained, also the interesting variety of *Planispira zebra*.

PLANISPIRA ZEBRA, var. *KOLLERI*, n.var. Pl. XI, Fig. 1.

Testa orbicularis, perspective medioeriter umbilicata, subtenuis, translucens, albido-fulva, fasciis angustis brunneis 4-5 radiisque obscuris fuscis inferne ornata, et flammulis brunneis supra picta, periostraco molli induta, striis sat distinctis, haud vero magnopere notatis sculpta; spira concave depressa; anfractus $4\frac{1}{2}$ convexi, sensim accrescentes, sutura subprofunda discreti, primus subnitidus; apertura oblique lunata; peristoma album, nitidum, expansum, reflexum, praesertim ad latus externum, supra umbilicem aliquantulum reflexum. Diam. maj. 21.5, min. 18 mm.; alt. 10 mm.

Var. *b.* Testa fasciis angustioribus, radiis lateris inferioris bene notatis.

Var. *c.* Testa fasciis paene obsoletis, radiis lateris inferioris magnopere distinctis.

Var. *d.* Testa fasciis coalescentibus; latus inferum brunneum, fasciis albido-fuscis aliquando submoniliformibus.

It was a matter of difficulty to settle upon the most typical form of this variety, as the distinctive characters of the shell, with regard to the colour-markings, are so variable, the shape and size, however, being fairly constant.

I have, therefore, regarded as typical, a specimen that distinctly shows the greatest number of general characteristics, and I have been compelled to treat the other specimens as variants. This, I fear, may appear somewhat arbitrary, but it seemed the best way to secure a base-line for comparison.

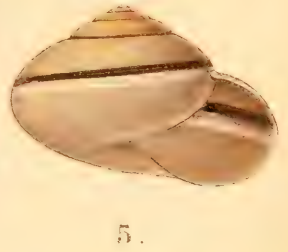
Planispira zebra, Pfr., from the Island of Ceram, has somewhat the same zigzag flame-like markings, and probably is only another form of that under consideration. The stripes in *P. zebra* extend over the whole height of the shell, whereas, in the forms from Gisser, the zigzags are confined to the upper half of the shell; the species from Ceram is also slightly larger, and has a denticle-like projection, caused by the pinching in of the aperture near the upper part, which characteristic is quite absent from the specimens from Gisser; also the constriction behind the peristome in *P. zebra* is absent in var. *Kolleri*.

CHLORITIS MALANGENSIS, n.sp. Pl. XI, Fig. 2.

Testa profunde sed haud late umbilicata, orbicularis, omnino brunnea, lineis incrementi leviter striata, undique minute granulata, periostraco setis aduncis recurvis dense sato induta; spira concave depressa; anfractus $4\frac{1}{2}$ convexi, ultimus parum irregularis, antice oblique descendens, pone labrum subconstrictus, infra prope aperturam serobiculatus; apertura pallide rufo-brunnea, sublunata, denticulo transverso sat longo prope marginem inferiorem instructa; peristoma pallide caeruleo-rufescens, nitidum, anguste expansum et reflexum, marginibus conniventibus, callo conspicuo junctis. Diam. maj. 17, min. 15 mm.; alt. 9 mm.

Hab.—Malang, Java.

In conclusion, my best thanks are due to Lieut. V. Brooke Webb, R.N., for his geographical information, to Mr. E. A. Smith for access to the British Museum collections, and to Mr. E. R. Sykes for bibliographical references.



ON THE ANATOMY OF CERTAIN SPECIES OF *SILIQUA* AND *ENSIS*.

By H. H. BLOOMER.

Read 11th November, 1904.

PLATE XII.

I WISH, first of all, to express my indebtedness to Professor W. H. Dall, of the United States National Museum, for his kindness in permitting me to examine the following specimens.

1. *SILIQUA PATULA* (Dixon).*External Characters.*

The animal is straight along the dorsal surface, with the exception of a slight ventral deflection about one-third of the distance from the anterior end. The length from the anterior side of the anterior adductor muscle to the posterior side of the proximal portion of the siphon is 60 mm., and the depth at the anterior and posterior ends 27 mm.

The mantle-lobes commence at the postero-dorsal surface of the anterior adductor muscle, and, in passing anteriorly over it, are quite separate from each other. Then they take a deep curve, and proceed posteriorly about half-way along the ventral surface, when they become constricted, so that the pedal aperture is a large opening extending from the anterior adductor muscle to the point of constriction. Further, near the centre of the ventral surface, the mantle-lobes have the appearance of being abruptly pressed in, and of gradually resuming their normal condition as they pass anteriorly. Around the whole of the edge of each mantle-lobe is a curious foliated fringe. At the anterior end of the pedal aperture it is inconspicuous, but, proceeding along the ventral surface, it increases in size, and, near the centre, assumes a larger and more complicated arrangement. At the posterior end it is again very small, and becomes larger as it traverses anteriorly the dorsal surface. The muscular flaps bordering the pedal aperture are weak.

The siphon is deep and comparatively short. The proximal portion is very muscular, while the anterior part of each lateral side terminates in a powerful siphonal retractor muscle. The free portion of the siphon is in one piece, the exhalent being separated from the inhalent chamber by a very muscular wall. This divisional wall extends to the anterior end of the proximal portion of the siphon. The distal end of each siphonal chamber is bordered by a tentacular fringe, with the tentacles more numerous at the dorsal and ventral edges of the siphon, and the remaining portion of the siphon is covered with a papillose integument. There is no fourth aperture.

The gills are relatively short and deep. They lie well dorsally, and reach as far as the wall dividing the siphonal chambers. The outer

demi-branches begin more posteriorly than the inner ones. The exterior edges at the bases of the gills are connected with the siphonal wall, and the interior ones are joined together. The labial palps are short at the base, and form a long taper to the distal ends.

Musculature.

1. *Pallial Muscles.*—The muscles of each mantle-lobe commence over the anterior adductor muscle as a shallow band, and deepen as they proceed to the ventral surface, along which they form a band of considerable yet varying depth.

The muscles of the proximal portion of the siphon are very strongly developed, and terminate anteriorly in extremely powerful siphonal retractor muscles. Inside each mantle-lobe, a short distance dorsal to the line of concrescence, is a muscular ridge (Fig. 1, *P.R.*). This ridge continues along the proximal portion of the siphon as far as the siphonal retractor muscle. Its function is not apparent.

The anterior adductor muscle (Fig. 1, *A.A.*) is a narrow and deep muscular plate, widening towards the ventral surface. Posteriorly it rests against the clavicle or rib of the shell. Dorsally and anteriorly it is connected with the mantle-lobes, and posteriorly with the dorsal and ventral integuments.

The posterior adductor muscle (Fig. 1, *P.A.*) is an oval plate of muscles. On the antero-dorsal surface rest the distal parts of the bifurcations of the retractor posterior muscle. Dorsally the muscle is connected with the dorsal integument, and ventrally with the ventral integument.

2. *Pedal Muscles.*—Though a portion of the distal end (Fig. 1, *R.F.*) is missing, the general structure of the foot appears to be very similar to that of *Solen*.

The muscles apparently coinciding with the protractor pedis anterior muscles are short and powerful. They pass anteriorly alongside the viscera. Laterally they are attached to the valves of the shell, while anteriorly they are joined to the dorsal and ventral integuments. The fibres pass over the longitudinal muscles of the foot (that is, they are exposed to the pedal cavity), and spread out as they proceed ventrally.

The retractor pedis posterior muscle (Fig. 1, *P.R.P.*) is of medium length, the distal end is bifurcated, and the bifurcations rest on the posterior adductor muscle. The fibres of the muscle pass anteriorly along the foot as longitudinal muscles.

The retractor pedis anterior muscles are situated at the antero-dorsal part of the foot. The free portions run dorsally close to the liver, and are attached to the shell. The fibres on reaching the foot pass partly into the pedal integument, and partly along the fibres of the retractor pedis anterior muscles.

Alimentary Canal.

The lips (Figs. 2 and 3, *A.L.* and *P.L.*) are broad and thick. The œsophagus (Figs. 2 and 3, *Oe.*) is long, and proceeds with a curve in a dorso-posterior direction to the œsophageal division of the stomach

(Figs. 2 and 3, *Oe.St.*). The latter is neither deep nor long, but very wide. The central division (Fig. 2, *C.D.*) is deep, and bordered by a muscular ridge. Dorsally the œsophageal and central divisions are completely separated from the cardiac division (Figs. 2 and 3, *C.St.*) by a muscular wall (Figs. 2 and 3, *Oe.C.R.*) stretching laterally across the stomach. The posterior portion of this divisional wall, which also forms the dorsal limit of the central division, is very strongly developed. The cardiac division projects anteriorly a little over the œsophagus and extends posteriorly to the pyloric division (Figs. 2 and 3, *P.St.*), from which it is likewise separated by a muscular ridge (Fig. 2, *M.R.C.*). The pyloric division (Figs. 2 and 3, *P.St.*) is large, and irregular in shape. On the ventral side, at the posterior end, it continues as the cæcum of the crystalline style (Figs. 1, 2, and 3, *C.C.*). The latter is also large, of considerable length, and passes with a curve towards the dorsal surface of the pedal cavity.

The intestine (Fig. 1, *In.*) leaves the stomach anteriorly to the cæcum of the crystalline style. After forming, in and on the liver, a number of loops, it passes to the distal end of the cæcum and returns some distance along its ventral surface, when, becoming free, it proceeds to the dorsal surface of the pyloric division. Turning posteriorly, it continues as the rectum, is soon encircled by the ventricle, and, passing over the posterior adductor muscle to the exhalant chamber, terminates at the bilobed anus.

The liver is large, and covers the stomach, with the exception of the posterior end. The mass of it, however, lies ventrally to the stomach.

Nervous System.

The cerebro-pleural ganglia are wide apart, anterior, although near to the retractor pedis anterior muscles, and are joined by a commissure passing in front of the mouth. Each ganglion apparently gives rise anteriorly to only one nerve, which innervates the anterior adductor muscle and the mantle-lobes. Posteriorly each ganglion is connected with a pedal ganglion, but it is not possible to locate the exact position of the latter in the specimen examined. Each cerebro-pleural ganglion is also joined with one of the visceroparietal ganglia by a connective running between the viscera and lateral integument, then underneath the bifurcated parts of the retractor pedis posterior muscle to the ganglion.

The visceroparietal ganglia are situated between the bifurcations of the retractor pedis posterior muscle. Each ganglion gives off laterally a branchial nerve, and only one posterior nerve, viz. the posterior pallial nerve. It innervates the posterior adductor muscle, the siphon, and the mantle-lobes.

Gills.

A transverse section, cut horizontally to the axis of the demi-branch (Fig. 4), shows it to belong to the type homorhabdic, also to be non-plicate, and consequently not presenting any differentiation of the filaments. The interlamellar junctions are not regularly situated, the number of filaments between them varying considerably and ranging from 10 to 24.

2. SILIQUA COSTATA (Say).

Siliqua costata is very similar to *S. patula*, the chief differences discernible being: (1) the groove in which rests the clavicle or rib of the shell runs a little more antero-ventrally than in *S. patula*, so that the anterior adductor muscle of *S. costata* is forced a little antero-dorsally; (2) the large pallial fringe at the middle of the ventral surface is proportionately longer and narrower, and has a dendritic appearance; (3) the free portion of the siphon is smaller, while the exterior border between it and proximal portion of the siphon is more pronounced, this being particularly so at the dorsal and ventral surfaces. It may, however, be partly due to contraction. No material difference is noticeable in the internal structure.

3. ENSIS DIRECTUS (Conrad).

Ensis directus closely resembles *E. ensis*, but is more massive and decur. Both sides of the posterior end of the proximal portion of the siphon curve outwards instead of inwards. The free portions of the siphon are more prominent, and carry a denser mass of tentacular fringe. The fourth aperture is more central, that is, it is nearer the anterior end. It is also longer, and bordered by several rows of tentacles.

There is no appreciable difference in the internal structure.

4. ENSIS MINOR, Dall.

Ensis minor also closely resembles *E. ensis*, but is very much smaller and more attenuated. It curves more dorsally, and the fourth aperture is situated at the centre of the ventral surface.

There is no marked difference in the internal structure.

EXPLANATION OF PLATE XII.

Siliqua patula (Dixon).

- FIG. 1.—View from the right side, showing the alimentary canal, etc. Natural size.
 ,, 2.—Longitudinal section of the stomach, showing internal structure of the left side. $\times 1\frac{1}{2}$.
 ,, 3.—Longitudinal section of the stomach, showing internal structure of the right side. $\times 1\frac{1}{2}$.
 ,, 4.—Transverse section of the gill, cut horizontally to the axis of the demi-branch. $\times 60$.

REFERENCE LETTERS.

A. anus; *A.A.* anterior adductor muscle; *A.L.* anterior or upper lip; *B.V.* blood-vessel; *C.* chitin in interfilamentar junction; *C.C.* cæcum of the crystalline style; *C.S.* crystalline style; *C.St.* cardiac division of the stomach; *C.D.* central division of the stomach; *Ex.S.* proximal portion of the exhalant siphonal chamber; *Ex.S'* free portion of the exhalant siphonal chamber; *F.* foot; *I.J.* interlamellar junction; *In.* intestine; *In.S.* proximal portion of the inhalant siphonal chamber; *In.S'* free portion of the inhalant siphonal chamber; *I.S.* interlamellar septum; *L.* liver; *M.* mouth; *M.R.C.* muscular ridge separating the cardiac from the pyloric division of the stomach; *M.R.P.* muscular ridge separating the central from the pyloric division of the stomach; *Oe.* œsophagus; *Oe.C.R.* ridge dividing the œsophageal from the cardiac division of the stomach; *Oe.St.* œsophageal division of the stomach; *P.A.* posterior adductor muscle; *P.L.* posterior or lower lip; *P.R.* pallial ridge; *P.R.P.* retractor pedis posterior muscle; *P.St.* pyloric division of the stomach; *R.* rectum; *R.F.* restored portion of the foot; *S.R.* ridge dividing the inhalant from the exhalant chamber of the proximal portion of the siphon; *St.* stomach; *T.P.M.* transverse pedal muscles; *V.* ventricle.

Ex.S¹ A. PA. PPP CC St. L. Oc. AA
 Ex.S. R. V.

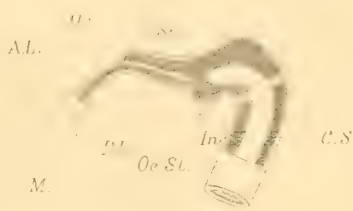


In.S. SR TPM. In.
 In.S¹ PR 1. F. R.F.

Oe.CP.
 P.St. M.R.C. C.St. Oe.CR. P.St.



2.



3.

Fig. 1. 2. 3.



I.J. 4.

ON THE GENUS *TOMIGERUS*, SPIX, WITH DESCRIPTIONS OF
NEW SPECIES.

By Dr. H. VON IHERING.

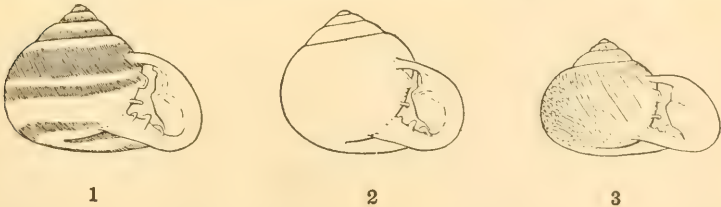
Read 11th November, 1904.

DURING last year I received some small but interesting collections of land and fresh-water shells found by Mr. Francisco Dias da Rocha at Fortaleza, Ceará. As I propose to deal more fully with the matter again in another place, I have here only given descriptions of the new species and added some remarks on the subdivision of the genus *Tomigerus*.

I. SPECIES COLLECTED BY MR. DIAS DA ROCHA.

TOMIGERUS LÆVIS, n.sp. Fig. 2.

Shell subglobose, not much distorted, with a straightened umbilical suture, which is bordered with yellowish-brown, the rest of the shell being white, shining, and somewhat transparent. Surface smooth, sculptured only with faint growth-striae. Spire shortly conical; whorls $4\frac{1}{2}$, convex, separated by a deep suture, the last distorted, excavated behind the columellar lip, and having an oblique groove



behind the outer lip. Aperture vertical, subtriangular, with three small parietal lamellæ, of which the uppermost is bifid, and the middle one very minute, almost obsolete. The baso-columellar margin has three lamellæ, and the outer lip a large obliquely-entering plate-like fold within the outer margin, its upper end being bifid. Peristome expanded, white. Alt. 10 mm.; greater diam. 13, lesser diam. 9 mm.

TOMIGERUS ROCHAI, n.sp. Fig. 1.

Shell compressed-ovate, distorted as if by pressure on the apertural side, imperforate, with a long straightened umbilical suture. Surface sculptured with faint spiral impressed lines and with somewhat irregular riblets, except on the last half-whorl, which is strongly corrugated. Spire conic; apex white; whorls 5, nearly flat, the last distorted, excavated behind the columellar lip, and having an

oblique groove behind the outer lip. Aperture vertical, somewhat triangular, with three lamellæ on the parietal wall, three on the baso-columellar margin, and a large obliquely-entering plate-like fold within the outer lip, its upper end being bifid. Peristome broadly expanded, white. Body-whorl whitish, with three broad blackish-brown uninterrupted bands, the upper one broadest. The upper whorls are dark brown, with a white subsutural band. Alt. 11.5 mm.; greater diam. 15.5, lesser diam. 10 mm.

Collected by Mr. Francisco Dias da Rocha, to whom the species is dedicated.

The four specimens examined are quite similar, but in two of them the dark colour of the last whorl is divided in four bands, and another example is very pale, the bands nearly completely disappearing, except on the base, where the umbilical rimation is bordered with dark-brown, as in the other examples. The aperture, in all specimens, is white on the lip and darkish around the folds.

This species is allied to *T. clausus*, but is larger, with a more elevated spire, and a much broader aperture. The uppermost parietal fold is united above to the peristome in *T. clausus*, whereas in *T. Rochai* it is a little remote.

TOMIGERUS CORRUGATUS, n.sp. Fig. 3.

This species is closely allied to *T. Rochai*, but larger and with a shorter spire. The bands are the same, but in one of the two examples they appear only at the base. As the differences in the spire coincide with those of the dimensions, I have no doubt that the two species are really different. Alt. 13 mm.; greater diam. 21, lesser diam. 12 mm.

TOMIGERUS CLAUSUS, Spix.

Tomigerus clausus, Pilsbry: Manual of Conchology, ser. II, vol. xiv, p. 106, pl. vii, figs. 67-70.

The examples collected by Mr. Dias da Rocha correspond with the description given by different authors. The coloration varies from white to pale-brownish, the dark bands always being well developed. The largest specimen has the following dimensions: alt. 11.5 mm.; greater diam. 17, lesser diam. 11 mm.

T. clausus seems to be the most common species of *Tomigerus* in Ceará.

The species described above are of interest in various respects. A new type is represented by *T. levis*, remarkable for its smooth, very white, and somewhat transparent shell, but the brown band of the umbilical suture shows that this species is related to the banded forms. It is a rule in the species of *Tomigerus*, if the bands are disappearing, that they are retained longest on the under side and principally along the umbilical suture. Likewise the two other species, which are closely allied, exhibit a feature not yet found in the genus. On them the anastomosing branched riblets or wrinkles, which only feebly exist in *T. clausus*, are very strongly developed.

By the collection of Mr. Rocha the number of the known species of *Tomigerus* is raised from four to seven, that is to say, almost doubled. Mr. Rocha has commenced the malacological exploration of his native State with great ability, and it is to be hoped that he will continue it with success, and also that it will be possible for him to furnish us also with the animals preserved in alcohol, in order that we may determine exactly, by anatomical examination, the systematic position of the genera *Tomigerus* and *Anostoma*. Of the latter genus he collected *A. octodentatum*, F. de Waldh.

II. NOTES ON *TOMIGERUS*.

On this genus we already have a good monograph by Pilsbry, in his excellent Manual of Conchology, ser. II, Pulmonata, vol. xiv, pp. 105-109, 1902. In considering this genus I have not dealt in detail with the synonymy of the known species. In one respect only it seems to me desirable to propose an arrangement different to that adopted by Pilsbry. With regard to the lamellæ of the outer lip, *T. gibberulus*, with two folds, differs from all the other species, which have only one. Moreover, as its parietal lamellæ are also different in form from those in the other species, it is quite evident that *T. gibberulus* represents a distinct section. As *T. gibberulus* is the oldest species of the genus it becomes necessary to retain for it the name *Tomigerus*, s.str., and to form a new subgenus for all the remaining species characterised by a single lamella on the outer lip, for which I propose the name *Pilsbryella*.

The following is a key to the natural arrangement of the species of the genus *Tomigerus* :—

- a. Outer lip with two lamellæ ; subgenus *Tomigerus*, s.str. *T. gibberulus*.
- b. Outer lip with one lamella only ; subgenus *Pilsbryella*.
- c. Shell brown or corneous, not banded ; spire elevated conic, whorls smooth or with slight growth-wrinkles.
- cc. Shell whitish with brown bands, spire shortly conical.
- d. Umbilical suture straight in the middle ; whorls 5, diam. about 12 mm. *T. turbinatus*.
- dd. Umbilical suture short, arcuate, whorls 4-4½ ; diam. 5.75-7.5 mm. *T. Cumingi*.
- e. Surface smooth, shining, white, with a brown umbilical band only. *T. lævis*.
- ee. Surface strongly sculptured, with dark bands.
- f. Back of the last whorl corrugated.
- g. Aperture higher than large ; bands narrow, yellowish. *T. clausus*.
- gg. Aperture as high as broad ; bands broad, dark.
- h. Spire short, lesser diam. 12 mm. *T. corrugatus*.
- hh. Spire more elevated, lesser diam. 10 mm. *T. Rochai*.

NOTES ON SOME NEW ZEALAND PLEUROTOMIDÆ.

By HENRY SUTER.

Read 11th November, 1904.

THERE has been considerable confusion about three species, viz.: *Pleurotoma Buchananani*, Hutton, 1873; *Pleurotoma Trailli*, Hutton, 1873; and *Drillia* (?) *Maorum*, E. A. Smith, 1877. I have lately been studying these forms, and propose the following towards an elucidation of the complication:—

1. SURCULA BUCHANANI, Hutton, subsp. MAORUM, E. A. Smith.

Drillia (?) *Maorum*, E. A. Smith: Ann. Mag. Nat. Hist. (4), vol. xix (1877), p. 497.

Drillia Buchananani, Hutton: Journ. de Conch., vol. xxvi (1878), p. 16 (not of Cat. Tert. Moll.).

Pleurotoma Buchananani, Hutton: Man. N. Zeal. Moll., 1880, p. 42 (not of Cat. Tert. Moll.).

Drillia Maorum, Hutton: l.c., p. 44.

Pleurotoma Buchananani, Tryon: Man. Conch. (1), vol. vi, p. 208 (not of Cat. Tert. Moll.).

Drillia (?) *Maorum*, Hutton: Proc. Linn. Soc. N.S. Wales (1), vol. x (1886), p. 116.

Surcula Trailli, Suter: Trans. N. Zeal. Inst., vol. xxxi (1899), p. 90; l.c., vol. xxxiv (1902), p. 211; Index Faunæ Nov. Zeal., 1904, p. 71.

There can be no doubt that E. A. Smith's *D. Maorum* is very much like *P. Buchananani*, Hutton, of the Cat. Tert. Moll., but it is not absolutely the same. The former is more slender, the whorls in consequence appear rather higher, the width of the body-whorl is less, and the canal is shorter. The margination of the suture is generally, but not always, slighter. The special sculpture and the number of longitudinal costæ are somewhat variable in both species. The angle of the spire I found on an average to be 29° in *Maorum*, and 32° in the Pliocene *Buchanani*. Carefully taken measurements of the two species gave the following result:—

| | <i>Maorum.</i> | <i>Buchanani.</i> |
|--|----------------|-------------------|
| Total length | 21 mm. ... | 21 mm. |
| Length from base to middle of first suture ... | 12·5 ,, ... | 13 ,, |
| Length of aperture | 10 ,, ... | 10 ,, |
| Length of spire | 12 ,, ... | 12 ,, |
| Width of body-whorl | 6·5 ,, ... | 7·5 ,, |

The differences between the two are too slight to separate them as different species, and I therefore propose to make *Maorum* a subspecies of *Buchanani*.

Tryon and Hutton made *P. Trailli*, Hutton, a synonym of *D. Maorum*, and I followed them in 1899 and later publications. This, however, was a mistake, as will be seen presently.

Type in the British Museum.

2. SURCULA TRAILLI (Hutton).

Pleurotoma Trailli, Hutton: Cat. Mar. Moll. New Zeal., 1873, p. 11.

Drillia amula, Angas: Proc. Zool. Soc., 1877, p. 36, pl. v, fig. 9.

Drillia bætica, Hutton: Journ. de Conch., vol. xxvi (1878), p. 16 (not of Reeve).

Pleurotoma Trailli, Hutton: Man. N. Zeal. Moll., 1880, p. 42.

Drillia Trailli, Tryon: Man. Conch. (1), vol. vi, p. 206.

Drillia (?) *Maorum*, Hutton: Proc. Linn. Soc. N.S. Wales (1), vol. x (1886), p. 116 (not of Smith).

Surcula Trailli, Suter: Trans. N. Zeal. Inst., vol. xxxi (1899), p. 90; l.c., vol. xxxiv (1902), p. 211; Index Faunæ Nov. Zeal., 1904, p. 71.

Although the sculpture of the shell is generally the same as in *Buchanani* and *Maorum*, yet the dimensions are very different:—

| | | <i>Trailli</i> . | | <i>Buchanani</i> . | | <i>Maorum</i> . |
|---------|-----|------------------|-----|--------------------|-----|-----------------|
| Length | ... | 28 mm. | ... | 21 mm. | ... | 21 mm. |
| Breadth | ... | 10·5 „ | ... | 7·5 „ | ... | 6·5 „ |

The angle of the spire is 30°.

Some months ago I saw for the first time the type-specimen of Hutton's *P. Trailli*, and I at once saw that I was greatly mistaken in judging this species to be synonymous with *D. Maorum*, E. A. Smith.

Comparing the description of *Drillia amula*, Angas, of which specimens from New Zealand are in the British Museum, I come to the conclusion that it is beyond a doubt the same species as *P. Trailli*, Hutton. If the figure represents the natural size of the shell, then it also agrees in its dimensions with Hutton's species, for it has length 27, breadth 10 mm. The diagnosis gives the length as 27, the breadth as 8·5 mm., but the latter can hardly be correct.

Hab.—Stewart Island.

Type in the Colonial Museum, Wellington, New Zealand.

NOTES ON SOME SPECIES OF *CHIONE* FROM NEW ZEALAND.

By HENRY SUTER.

Read 11th November, 1904.

SINCE 1873 three species of *Venus* from New Zealand, described by Quoy & Gaimard in the Voyage of the "Astrolabe," have been lumped together, viz.: *V. crassa*, *mesodesma*, and *violacea*. As if this had not been enough, *V. denticulata*, Q. & G.,¹ was added, though its habitat is said by Q. & G. to be "Nouvelle Hollande ou Van Diémen." In Hutton's Cat. Mar. Moll. N. Zeal., 1873, p. 70, we find *V. crassa*, *denticulata*, *violacea*, Quoy, *spissa*, Desh., and *spurca*, Sby., as synonyms of *Chione mesodesma*, Quoy. E. von Martens, in the Crit. List Moll. N. Zeal., 1873, p. 45, adopts the same synonymy, adding *V. scansilis*, Römer. In the "Révision des coq. de la N. Zél. et des îles Chatham"² Hutton cites *Chione mesodesma*, Q. & G., no synonyms being given. The same synonyms contained in the Catalogue of 1873 are repeated by Hutton in his Manual of 1880, p. 148, and all the synonyms given by Von Martens are also accepted in the "Revision of the Recent Lamellibranchiata."³ Admitting the above synonymy as correct as far as Quoy & Gaimard's species are concerned, I substituted the specific name *crassa*, Q. & G., for *mesodesma*, Q. & G., as it has priority of seven pages.⁴

Coming quite recently across the descriptions and figures of the above species in the Voyage of the "Astrolabe," I began to have grave doubts whether they were really extreme forms of one species, and I decided to follow up the question. I wish to point out that with regard to *V. spurca*, Sby., *spissa*, Desh., and *scansilis*, Römer, I am unable to decide if they are synonyms of *mesodesma*, Q. & G., or not, and I quote them on the authority of E. von Martens.

The reason for lumping together three species, considered distinct by Quoy & Gaimard, is to be found in the insufficiency of the material available in our collections, a species being usually represented from one or two localities only. Now, when nearly allied species are to be separated, as in the present instance, it is very

¹ Hedley is inclined to consider this species as a synonym of *Chione gallinula*, Lamk. (Proc. Linn. Soc. N.S. Wales, 1904, p. 195).

² Journ. de Conch., vol. xxvi (1878), p. 49.

³ Proc. Linn. Soc. N.S. Wales (1), vol. ix, p. 523.

⁴ Trans. New Zeal. Inst., vol. xxxiv, p. 221; Index Faunæ Novæ Zealandiæ, 1904, p. 89.

probable, that in the collection used for study, only one of the species is represented, and this may be very variable, as is the case with *C. mesodesma*, and so one easily comes to the conclusion that the different species have been established on extreme forms which should be considered as one species only.

Besides this, New Zealand conchologists are greatly handicapped in their work by the want of the necessary literature and type-specimens for comparison. For a number of years I have tried to get specimens from various localities in New Zealand, and to a certain extent have been successful. I have thus been enabled to study carefully these nearly allied forms of *Chione*, and I now venture to publish the result of my investigations.

CHIONE CRASSA (Quoy & Gaimard).

Venus crassa, Q. & G.: Voy. Astrolabe, Zool., vol. iii (1834), p. 525, pl. lxxxiv, figs. 7-8.

Venus crassa, Gray: in Dieffenbach's Travels in N. Zeal., vol. ii (1843), p. 250.

Chione gibbosa, Hutton: Cat. Mar. Moll. N. Zeal., 1873, p. 71; Journ. de Conch., vol. xxvi (1878), p. 49; Man. N. Zeal. Moll., 1880, p. 148.

Venus gibbosa, Hutton: Macleay Memor. Vol., Linn. Soc. N.S. Wales, 1893, p. 81, pl. ix, fig. 88.

Chione gibbosa, Suter: Trans. N. Zeal. Inst., vol. xxxiv (1902), p. 222.

Shell globose, orbicular, subequilateral, very thick, umbones hooked, heart-shaped, lunule large and well marked, escutcheon deep. Valves concentrically striated, the costæ partly united and forming bundles of ribs. Colour whitish or yellowish, with two light-reddish bands converging towards the umbo; this number is fairly constant. Interior white, bordered by dark violet. The muscular impressions have pale-reddish striations; the margin is denticulated the whole length, the ventral margin slightly inflexed posteriorly. The three cardinal teeth are strong. Length 27, height 24.75, diam. 18 mm. (Q. & G.).

The lunule is very distinct, rather large, heart-shaped.

I have specimens from Preservation Inlet and Stewart Island. One of the latter has exactly the measurements given above, the others are smaller. The concentric ribs are separated by narrow, deep grooves; they are slightly convex, with a sharp edge above. The pallial sinus is short, regularly triangular, pointing to the anterior adductor muscle.

Chione gibbosa was founded on a single right valve only. In the "Revision of the Recent Lamellibranchiata" Hutton omitted the species as "found fossil only." The Pliocene specimens I possess are less gibbous and smaller, but so is also the recent specimen I have from Preservation Inlet. The fossil specimens agree with the diagnosis and figures of *V. crassa*, Q. & G., fairly well, and Hutton's name therefore becomes a synonym.

C. crassa is a rather rare species now.

CHIONE MESODESMA (Quoy & Gaimard).

- Venus mesodesma*, Q. & G.: Voy. Astrolabe, Zool., vol. iii (1834), p. 532, pl. lxxxiv, figs. 17-18.
- Venus spurca*, Sowerby: Proc. Zool. Soc., 1835, p. 23; Thesaurus Conch., vol. ii, figs. 92-97; Reeve, Conch. Icon., figs. 90a-b.
- Venus spissa*, Deshayes: in Lamarek's Anim. s. Vert., 2nd ed., vol. vi (1840), p. 373.
- Venus mesodesma*, Gray: in Dieffenbach's Travels in N. Zeal., vol. ii (1843), p. 251.
- Murcia scansilis*, Römer: Mal. Blätter, vol. vii (1860), p. 161.
- Chione mesodesma*, Hutton: Cat. Mar. Moll. N. Zeal., 1873, p. 70; Journ. de Conch., vol. xxvi (1878), p. 49; Man. N. Zeal. Moll., 1880, p. 148.
- Venus mesodesma*, Hutton: Proc. Linn. Soc. N.S. Wales (1), vol. ix, p. 523.
- Venus crassa*, Suter: Trans. N. Zeal. Inst., vol. xxxiv (1902), p. 221 (not Q. & G.).
- Chione crassa*, Suter: Index Faunæ Novæ Zealandiæ, 1904, p. 39 (not Q. & G.).

The diagnosis is to be found in Hutton's Manual, etc. Quoy & Gaimard remark: "A small species, a little resembling *Mesodesma striata* in form, and the regular longitudinal striæ. The shell is oval, nearly equilateral, light yellowish, with some transverse triangular flames of a pale reddish colour. The interior of the valves is bright violet. The lunule, of the same colour, is elongated oval. The beaks are white; the margin of the valves denticulated on the inner side. There is no anterior lateral tooth. Length 20·25, height 15·75, diam. 9 mm."

This species is easily distinguished from *C. crassa* by its much less gibbous form, the lanceolate lunule, and the less prominent concentric ribs. In colour-markings this species is exceedingly variable, and it is very often beautifully ornamented with zigzag lines. It is the most abundant bivalve on the east coast of the North Island, and especially on Tiri-Tiri Island in the Hauraki Gulf, where I have seen tons of this species piled up on the beach. By dredging in depths from five to thirty fathoms in Hauraki Gulf great quantities of valves are always met with.

CHIONE MESODESMA (Q. & G.), subsp. VIOLACEA (Q. & G.).

- Venus violacea*, Q. & G.: Voy. Astrolabe, Zool., vol. iii (1834), p. 533, pl. lxxxiv, figs. 19-20.

A small orbicular subspecies with cutting margins, denticulated interiorly; subequilateral, slightly gibbous near the apex, regularly longitudinally grooved, lamellæ flat, directed upwards. The beaks are rounded, directed forwards, heart-shaped, also the lunule, which is short, sharply defined. The escutcheon is elongated and well marked. Colour reddish-violet with a few white spots and two rays of greenish colour descending from the umbones. Interior white, broadly bordered with violet. No anterior lateral tooth. Length 15·75, height 12·25, diam. 6·75 mm. (Q. & G.).

I cannot consider this more than a subspecies. It differs from the species chiefly in its colour and markings, and especially in the cordate, short lunule, which is much more like that of *crassa*.

CHIONE SUBSULCATA, n.sp.

Venus sulcata, Hutton: Proc. Linn. Soc. N.S. Wales (2), vol. i (1887), p. 226 (Wanganui System).

Venus sulcata, Hutton: Pliocene Moll. of N. Zeal., p. 81, pl. ix, fig. 87, in Macleay Memorial Vol., 1893.

Some months back, when arranging the New Zealand shells in the Colonial Museum, Wellington, I came across some recent valves of a *Chione* I had never seen before. They were collected by the late Mr. Traill near Stewart Island. I soon found out, however, that they are closely allied to Hutton's *Venus sulcata*.¹ In the Macleay Memorial Vol. Capt. Hutton seems to be rather doubtful whether the Pliocene form is identical with the Miocene. I have not seen Miocene specimens, but I have good examples from the Pliocene of Wanganui and Waikopiro, and these, as well as the recent specimens, show a character which was not mentioned by Capt. Hutton; they are all finely and closely radiately striated, the striæ running over the broad concentric ribs. This radiate striation is visible in some specimens to the naked eye, in others it can only be seen by the aid of a good lens. I have asked Professor W. B. Benham, curator of the Otago Museum, to kindly examine the type-specimen, which is from the Miocene of Napier, with regard to this radiate striation, and he informs me "that the concentric ridges are perfectly smooth; there are no striations visible even with a hand lens." Therefore the Pliocene and recent forms may be considered a distinct species, and require a new specific name.

The specimens I have seen show some variation in the proportion of the height to the length, viz. :—

| | | |
|--|--------------|----------------|
| The Pliocene type, according to Hutton, is | 35 × 41 mm., | ratio 1 : 1.17 |
| My Pliocene specimen from Waikopiro is | 31 × 36 ,, | ,, 1 : 1.16 |
| One recent valve from Stewart Island is | 34 × 41 ,, | ,, 1 : 1.2 |
| Another | 41 × 47 ,, | ,, 1 : 1.15 |

The lunule in Pliocene and recent specimens is oblong cordate, striated, and well defined; the escutcheon long and narrow. The pallial sinus is short, pointing to the middle of the anterior adductor muscle. The margins of the valves are finely crenulated.

This is another example of one of our Pliocene molluscs having its existence down to the present time.

Type.—*Venus sulcata*, Hutton, of the Pliocene (1887), nec *V. sulcata*, Hutton, 1875.

¹ Trans. N. Zeal. Inst., vol. vii (1875), p. 458, pl. xxi.

NOTE ON MR. SUTER'S PAPER ON SPECIES OF *CHIONE* FROM
NEW ZEALAND.

By EDGAR A. SMITH, I.S.O.

Read 11th November, 1904.

IN the first place I would point out that the synonymy quoted by Mr. Suter at the commencement of his paper dates back as far as 1853, for both Sowerby, in the "Thesaurus Conchyliorum," and Deshayes (Cat. Conchifera Brit. Mus.) regarded *Venus crassa*, *mesodesma*, *violacea*, and *denticulata* as belonging to one species. In the next place I would note that it is not quite correct to say that the habitat of *V. denticulata* was "said by Quoy & Gaimard to be Nouvelle Holland ou Van Diémen." Their words are: "Nous ignorons sa localité positive; nous la supposons de la Nouvelle Hollande ou de Van Diémen."

With regard to *Venus spissa*, Deshayes, I would point out that *spissa* was merely a misprint of *crassa*. This will at once be evident by referring to the Hist. nat. Anim. sans Vert., 2nd ed., vol. vi, p. 373. *Venus spurca*, Sowerby, may be regarded as an uncertain species, as it was said to be from Valparaiso. The shells under this name in the Cuming Collection are undoubtedly *V. crassa*, but it is impossible to say that they are the actual specimens described by Sowerby in the Proc. Zool. Soc., 1835, p. 23. The shells subsequently figured by Sowerby (Thesaurus Conch., vol. ii, pl. clvi, figs. 92-97) and by Reeve (Conch. Icon., vol. xvi, pl. xx, figs. 90a-b) are certainly *V. crassa* and varieties.

In my opinion *V. crassa* was founded on old and much thickened shells, and *V. denticulata*, *V. mesodesma*, and *V. violacea* are younger stages of the same species. I agree with the late Dr. E. von Martens that *Murcia scansilis* of Römer¹ is also a synonym.

The species appears to be common in some parts of New Zealand. The localities Valparaiso and Philippines require confirmation. Mr. Suter has failed to note that I have recorded this species from the Auckland Islands in 10 fathoms, and also from Tristan da Cunha in 1,000 fathoms.

¹ Mal. Blätt., vol. vii (1860), p. 161.

DESCRIPTION OF A NEW SPECIES OF *TRACHIOPSIS* FROM
BRITISH NEW GUINEA.

By H. B. PRESTON, F.Z.S.

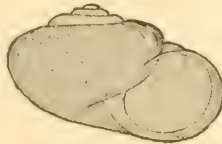
Read 9th December, 1904.

PLANISPIRA (*TRACHIOPSIS*) *BLACKIANA*, n.sp.

Shell depressed, fulvous brown, the peristome slightly tinged with pinkish purple. Whorls 5, convex, well marked with coarse striæ which almost appear as riblets, especially on the later whorls, possibly indicating periods of rest, and with finer lines of growth between them. Suture well-impressed. Aperture suboval. Peristome reflexed and descending above, the extremities united by a slight callosity. Columellar margin rather broadly expanded, whitish. Umbilicus deep and rather narrow, though rapidly broadening towards the base of the shell.

Diam. maj. 21 mm.; alt. 10 mm. Aperture (inside measurement), diam. 7 mm., alt. 7.5 mm.

Hab.—Port Moresby District, British New Guinea.



A very striking shell, whose nearest ally appears to be *T. Delessertiana*, Le Guil. From this, however, it differs in its more solid appearance, in its rather deeper suture and somewhat more circular aperture, and in the purplish tinge on the outer lip, which is absent in *T. Delessertiana*; moreover, the riblets appear to be quite peculiar.

I have received several specimens through the kindness of Mr. P. G. Black, with whose name I have much pleasure in associating the species. Although there appears to be some variation in size, all the other characters are absolutely constant.

AN ARRANGEMENT OF THE AMERICAN CYCLOSTOMATIDÆ,
WITH A REVISION OF THE NOMENCLATURE.

By Prof. WILLIAM H. DALL, D.Sc.

Read 9th December, 1904.

THE following arrangement shows in outline the results of a somewhat extended investigation into the nomenclatorial history and diagnostic characters of the American members of this family.

Genus ANNULARIA, Schumacher, 1817.

Rhachidian tooth of the radula, narrow, unicuspidate.

Type: *Turbo lincina*, Linn.

This is *Annularia*, Schumacher, after the deduction of *Cyclophorus*, which dates from 1810.

Subgenus ANNULARIA, s.s.

Operculum horny, multispiral, circular, with a depressed central nucleus, and an elevated, calcareous, continuous, spirally gyrate lamina externally, which is obliquely striate, with the coils separated by a narrow channel at the suture, and with the opercular periphery sulcate.

Section *Jamaicia*, C. B. Adams, 1850.

Type: *J. anomala*, Adams. Jamaica.

Operculum externally very convex, internally concave; few-whorled, with subcentral nucleus, and gyrate calcareous lamina.

Section *Diplopoma*, Pfeiffer, 1859.

Type: *D. architectonicum* (Gundlach). Cuba.

Operculum paucispiral, with a lamina as in *Annularia*, s.s., but with the peripheral sulcus exceptionally deep.

Section *Adamsiella*, Pfeiffer, 1851.

Type: *A. mirabilis* (Wood). Jamaica.

Operculum circular, thin, paucispiral, with a central nucleus, and very delicate, gyrate, calcareous lamina, of which the coils are separated by deep channels; the shell pupiform, small.

Genus RHYTIDOPOMA, Sykes, 1901.

Type: *Ctenopoma rugulosum*, Pfeiffer.

Operculum flat, circular, with subcentral nucleus, and rather rapidly enlarging whorls; calcareous layer rising in low, regularly spaced lamellæ, in harmony with the incremental lines; calcareous

layer with the coils separated from the suture by a channel showing the horny basis of the operculum; a peripheral sulcus present. The radula as in *Annularia*.

This is *Ctenopoma* (Shuttlew.), Pfr., 1856, not of Peters, 1844.

Genus COLOBOSTYLUS, Crosse & Fischer, 1888.

Type: *Cyclostoma Jayanum*, C. B. Ad. Jamaica.

Radula as in *Annularia*. Habit of the shell resembling that of *Cyclostoma*, auct. (= *Ericia*). Operculum flat, double-edged, circular or subcircular, few-whorled, slightly concave externally, nucleus subcentral, depressed; calcareous layer smooth or incrementally striate, with no channel at the suture or elevated lamella.

Genus CHONDROPOMA, Pfeiffer, 1847.

Radula with the rhachidian tooth tricuspid.

Subgenus CHONDROPOMA, s.s.

Type: *Cyclostoma semilabris*, Lamarck. Haiti.

Operculum thin, flat, smooth, with no peripheral sulcus, paucispiral, with very excentric nucleus, and whorls rapidly enlarging; the calcareous layer reduced to a very thin layer of minute superficial granules, or absent entirely. *C. pictum*, Pfr., is similar.

Subgenus TUDORA, Gray, 1850.

Type: *T. megacheila* (Pot. & Mich.). Curaçao.

Operculum few-whorled, with an excentric nucleus and duplex periphery, the calcareous layer flat, with incremental striæ, not channelled at the suture.

Subgenus nov. PARACHONDRIA, Dall.

Type: *Turbo fascia*, Wood. Jamaica.

Operculum flat, thin, with no peripheral sulcus, with a subcentral nucleus, and few, rapidly enlarging whorls; calcareous layer appressed, thin, obliquely striate, with a narrow smooth channel at the suture.

This is *Cistula* (Humphrey, MS.), Sowerby, 1847, not of Say, 1825.



Genus nov. OPISTHOSIPHON, Dall.

Type: *Chondropoma Bahamense*, Sh. (Figs. 1, 2.) Bahamas.

Shell with the habit of *Chondropoma dentatum*, Say, but in the adult with a tubular projection behind and distinct from the outer lip and the posterior angle of the aperture, but communicating with the lumen of the whorl. Operculum as in *Rhytidopoma*, but thinner.

Chondropoma Bahamense, Shuttleworth, and *C. Rawsoni*, Pfeiffer, of the Bahamas, *Tudora Moreletiana*, Petit, Isle of Pines, and *T. excurrens*, Gundlach, Cuba, belong to this group. The tube communicates with the whorl, so that air is admitted when the aperture is hermetically sealed by the operculum. In senile specimens it is sometimes closed by shelly matter deposited within the whorl. The end of the short, bulb-shaped tube has the aperture turned toward and very close to the surface of the preceding whorl, which is probably the reason why the arrangement has not attracted more attention. The tube is complete before the outer lip or its expanded portion is begun, and thus differs from the sulcus or channel at the posterior angle of the aperture and indenting the lip itself, which occurs in some American members of this family.

It is hardly necessary to add that in the above diagnoses account has been taken only of the distinctive and diagnostic characters. I have depended on the identifications of species made by Bland and Gundlach of specimens in the National Museum.

A REVIEW OF THE GENERA OF THE FAMILY MYTILIDÆ.

By A. J. JUKES-BROWNE, B.A., F.G.S.

Read 13th January, 1905.

THE shells of the genus *Mytilus* have not been favourites among conchologists, because few of them display any elegance of shape or any beauty of colour. Their dentition has been dismissed as variable, the so-called cardinal teeth being described as small or obsolete, and the crenulations, which often occur on the anterior border and sometimes on the dorsal border, have not been regarded as true teeth.

The recent researches of M. Félix Bernard¹ into the development of their hinge-teeth have, however, invested the Mytilidæ with a much greater interest for all those who concern themselves with the phylogenetic classification of the Pelecypoda and with their palæontological history.

The observations of Neumayer and Bernard have shown that in some genera of Lamellibranchs the embryonic shell (prodissoconch) does not show any crenulations along the hinge-line (e.g. *Cytherea*, *Lucina*, etc.); while in others this hinge-line is slightly thickened and crenulated, forming a slender and primitive hinge-plate, which Dr. Dall has called the *provinculum*. In the centre of this provinculum there is a small ligamental pit separating the crenulated band into two series, an anterior and a posterior.

The crenulations of the provinculum seldom persist into the adult stage, other teeth being subsequently developed which take their place, and a more solid hinge-plate being formed in connection with these later teeth. These secondary teeth are known as dysodont teeth in the Mytilidæ and as taxodont teeth in the Arcidæ and their allies, but Bernard has shown that both kinds have the same origin, and that they spring from the terminations of internal ribs.

Bernard remarks that the study of the hinge-teeth should commence with the Mytilidæ, because the genera of this family "furnish the key of all the problems which present themselves in this period of their evolution. It is, in fact, in this family that the development [of the hinge] is slowest, and consequently the plainest, the stages being clearly separated from one another; in it, also, the dental products exhibit a primitive character and a minimum of differentiation,

¹ "Notes sur le développement et la morphologie de la coquille chez les Lamellibranches": Bull. Soc. Géol. Fr., 1895 and 1896, vols. xxiii, xxiv. "Sur le développement des dents de la charnière chez les Lamellibranches": C.R. Acad. Sci. Paris, 1897, vol. cxxiv, p. 1165. "Recherches sur la coquille des Lamellibranches": Ann. des Sci. Nat., 1898, vol. viii, pp. 1-208, pls. i-xii.

without any possibility of these facts being attributable to retrogression."¹

Further, he observes that the Mytilidæ are remarkable for the important part taken by the provinculum, and for the manner in which the permanent ligament is developed. At the close of the embryonic stage there is in this, as in all the allied families, a sudden change in the growth of the shell, a *dissoconch* being formed, which is gradually enlarged into the adult shell. In this process Jackson has recognised two transitory stages, which he has called the *nepionic* and the *nealagic*. In the Mytilidæ that which becomes the permanent ligament is developed separately in the nepionic stage, a second small ligamental pit appearing on the hinge-line or provinculum, behind the central ligament-pit of the prodissoconch.

From the time when this second ligamental pit makes its appearance, the crenulations on the posterior part of the provinculum are greatly modified; those which lie between the two ligamental pits become pinched up, while those behind the second pit increase in number, and the ligament extends itself posteriorly below the crenulations as the provinculum grows and extends in that direction.

With the commencement of the succeeding nealagic stage, the growth of the crenulated band or plate is stopped, and teeth of another kind begin to form at each end of it. These are traceable to the primitive riblets of the shell, and for them Bernard adopts Neumayer's name of *dysodont* teeth. The hinge-line is thus continued and extended by a series of dysodont teeth, and, at the same time, the posterior ligament increases in length until it passes beyond the limit of the provinculum and reaches the posterior dysodont teeth, sometimes remaining below these teeth, as in *Crenella*, but generally spreading upward, and erasing all the provincular teeth and sometimes all of the dysodont teeth as well.

On the anterior side of the shell other changes are in progress during this nealagic stage. This side is bent gradually inward, or, as Bernard expresses it, rotated on an axis, so that it encroaches more and more on the anterior part of the primitive crenulated hinge-plate. This process is continued till, in *Mytilus*, all the anterior part of the original crenulated band is obliterated by the incurved border with its dysodont teeth, the earlier dysodont teeth being thus brought beneath the umbo, while later teeth appear on the border below and in front of it.

The final result in a typical *Mytilus* is that the primitive central ligament-pit is obliterated by the incurvature of the anterior border, and the posterior teeth are generally obliterated by the growth and extension of the permanent posterior ligament, so that in most cases the hinge consists entirely of the anterior dysodont teeth, a few of which generally persist beneath the umbones of the adult. Sometimes, however, even these disappear as separate teeth, and the hinge becomes almost edentulous.

¹ Ann. des Sci. Nat., Zool., tom. viii, p. 67 (1898).

There are, however, many exceptions to this obliteration of the posterior denticulations; in one group of shells (hitherto included in the genus *Mytilus*) all these posterior teeth persist in the adult, the ligament remaining entirely internal; in others many of the dysodont teeth are effaced by the upward growth of the ligament, but some still remain beyond its termination.

M. exustus (Linn.) is a species in which all the posterior teeth thus persist. The hinge of a young specimen of this species was figured by Bernard, but he does not seem to have been aware that the stage which he figures persists in the adult. He makes it clear, however, that these posterior crenulations are of exactly the same nature as the anterior denticles, the position of the latter below the hinge and umbo being due entirely to the incurvature of the shell during the dissoconch stage.

It would appear, therefore, that Bernard's work makes it necessary for conchologists to reconsider the generic values of the characters presented by the shells of the Mytilidæ, and to revise the genera and subgenera, so as to establish these groups on a sounder and more satisfactory basis.

In the first place it seems to me that those species of *Mytilus* which possess posterior denticulations on the hinge-line of the adult shell should be separated from the species which do not present this character, and should be grouped in a distinct genus. There is a better reason for such separation than at present exists for separating *Mytilus* from *Modiola*, for a typical *Modiola* differs from an edentulous *Mytilus* only by a less amount of rotation and incurvature of its anterior side, whereas a denticulate *Mytilus* retains an important embryonic character of the hinge-line; and it is generally admitted that a hinge-character is of more importance than one which merely affects the shape of the shell.

Again, there are some species, at present included in the genus *Modiola*, which possess a similar row of posterior denticulations. Of this group *Modiola citrina* (Chemn.) is the type, and if this be compared with *Mytilus exustus* and *M. Domingensis* it will, I think, be apparent to everyone that there is a much closer resemblance between all three than there is between *Modiola citrina* and *Modiola modiolus*. There are many species of *Mytilus* in which the umbones are by no means terminal, and some of these have sometimes been referred to *Mytilus* and sometimes to *Modiola*.

The union of the two groups typified by *M. citrinus* and *M. Domingensis* has been advocated by Dr. H. von Ihering, and on this point I quite agree with him, only I lay more stress on the denticulation of the hinge-line than he does, and less on the surface-structure of the shell. I would therefore raise the assemblage to the rank of a genus, and should include in it the group for which the name *Mytilaster* was proposed by the Marquis de Monterosato in 1884.

In this connection I would remark that the sculpture of the external surface of the shell does not seem to be a character of much importance in the Mytilidæ. If it were always correlated with other differential characters it might be so regarded, but this is not the

case. The true *Mytilus* is generally smooth, but there are a few striated and ribbed species which can hardly be excluded from the genus. In the case of *Modiola*, even when all the species which have a denticulate hinge are removed, there still remains at least one species, *M. demissus*, better known as *M. plicatula*, which is a true edentulous *Modiola*, and yet is strongly ribbed. Lastly, in the *Mytilaster* group, there is every gradation from a smooth shell to divaricate striation.

In studying the shells of Mytilidæ, therefore, the position of the umbones and the surface sculpturing of the shell may be regarded as features of secondary importance. If, on the other hand, we look to the characters of the hinge, and to the number and position of the muscular impressions, we shall find that these afford a much more satisfactory means of distinguishing genera and subgenera from one another.

I have studied the hinge of a considerable number of species of *Mytilus*, and have found that, though in some species the number of teeth varies, yet it does so within narrow limits, while in other species there is little or no variation. Further, I find that there are few, if any, species of *Mytilus* which are really edentulous, and that the dental characters are more or less correlated with the other special characters which have been mentioned, so that the teeth are really as useful a basis for diagnosis as they are in any other family.

In the common *Mytilus edulis*, and in all the closely allied species, such as *Galloprovincialis*, *borealis*, *Dunkeri*, *latissimus*, and *planulatus*, the teeth are connected with a series of small riblets on the anterior side of the shell. These riblets descend from the extreme border of the shell, which is incurved against the hinge-line beneath the umbo; this border is thickened so as to form a kind of hinge-plate, and the teeth arise from the plate opposite the grooves which separate the riblets. All these details can be clearly seen on any half-grown British *M. edulis* from 37 to 50 millimetres long ($1\frac{1}{2}$ to 2 inches). The position of the teeth thus accords with the origin attributed to them by Bernard; they represent the ends of the primitive internal ribs, corresponding with the grooves or depressions between the external ribs, which were developed in the neologic stage of the shell. There is no trace of such riblets on the posterior side even of very young shells, and, if teeth were ever formed on this side of the hinge, they have all been obliterated by the elongation and upward growth of the ligament.

The number of these anterior teeth in this group of shells varies even in the same species. In *M. edulis* it varies from 3 to 6 in each valve, but so far as my experience goes 4 is the usual number, and, when 6 occur, three of them are generally very small, and are placed close together, so that they only occupy the space of two in a more normal specimen. In *M. Galloprovincialis* the normal number appears to be 3, though occasionally there are as many as 5. In what I take to be *M. angulatus*, of which I have seen specimens from the Falkland Islands and from Vancouver, the number of teeth varies from 2 to 4 or 5, and seems largely to depend on the extent to which the anterior side is inflexed beneath the umbo, the degree of inflexion

varying greatly in this species. In *M. Dunkeri* and *M. crassitesta* (both from Japan) this inflexion is extreme, the umbones are terminal, and the teeth of the adult shell are reduced to 2 in each valve.

In the group typified by *M. afer*, *M. perna*, *M. smaragdinus*, and *M. latus*, the anterior side is always more inflexed than in *M. edulis* and *M. Galloprovincialis*; the riblets are fewer, and the teeth are never more than 2 in number, frequently appearing as 2 in one valve and 1 in the other. The two teeth do not always occur in the same valve, some species having them in the left (*M. smaragdinus*), others in the right valve (*M. latus* and *M. perna*). The single tooth of one valve always fits into the space between the two of the other valve. The final stage of the suppression of these anterior teeth seems to be reached in *M. Magellanicus*, *M. crenatus*, and their allies. In these species the anterior margin is so inflexed and twisted under the hinge-line that the teeth of one valve seem to have been compressed into a single tooth or ridge which fits into a hollow or groove in the other valve, the teeth of the latter having become entirely obsolete. In these species the umbones are more than terminal, for in most cases they project beyond the anterior side.

To sum up, therefore, out of those species of the genus *Mytilus* which do not possess denticulations behind the ligament, three groups can be based on the differences of the anterior teeth. In the first group the umbones are seldom terminal, there being generally a small anterior inflation which bears from 2 to 6 small teeth. In the second group the umbones are terminal, the dental area is compressed, and there are never more than 2 teeth, generally 1 opposed to 2. In the third the umbones project beyond the anterior side, and the dental formula is 1 opposed to 0.

Passing now to the differences in the number and position of the adductor and retractor scars, we find that they are important, because they are correlated with other differences both in the shell and in the animal. So far as I can ascertain, the first detailed account of the anatomy of a mussel of the *M. latus* type was that by Mr. A. Purdie, published in 1887 by the New Zealand Government as one of the Studies in Biology at the Colonial Museum.

Mr. Purdie compared the anatomy of *M. latus*, *M. edulis*, and *M. Magellanicus* from New Zealand material, and the following are his conclusions:—"While *M. edulis* and *M. Magellanicus* agree so closely as to leave no question of their being members of one genus, there is a very considerable interval between them and *M. latus*. To pronounce definitely upon the above question [are *M. latus* and *edulis* congeneric?] would require an intimate knowledge of a great number of species of Mytilinæ, when it is possible that all intermediate stages between the above distinct forms might be found. My study of the internal structure has extended only to the three species mentioned in this paper, but so far as this serves to decide, there seems to be occasion for separating *M. latus* from the others, if not as a genus, at any rate as a subgenus." He gives a complete tabular view of the differences between *M. latus* and *M. edulis*, of which the following are the most important:—

M. edulis.

Muscles.—Anterior adductor present.
 Anterior retractor attached to the foot.
 Posterior retractors of the byssus united in one bundle.
Cavitè des flancs.—Of considerable size.
Plaited organs.—Large.
Circulatory system.—Arterial system double and equilateral.
 Mantle supplied from anterior aorta; posterior aorta small.
 Marginal artery absent.
 Oblique vein anterior to the combined posterior retractors.
Organ of Bojanus.—Communicates with the pericardium by a large passage.
Gills.—Ascending lamellæ quite free at their upper edge.
Mantle-lobes.—Broadly joined at the posterior end.

M. latus.

No anterior adductor.
 Anterior retractor attached to byssus.
 Posterior retractors of the byssus separated into two portions.
 No trace of such a cavity.
 Rudimentary.
 Arterial system single and median.
 Mantle in part supplied from posterior aorta, which is large.
 Marginal artery present.
 Oblique vein between middle and posterior retractors.
 Has no communication with the pericardium.
 Ascending lamellæ attached by their upper edge.
 Lobes joined only by a short transverse bar.

The differences in the arrangement of the muscles are, naturally, indicated on the shell; that of *M. latus* showing the scars of three retractor muscles, a small anterior one below the ligament, a large rounded middle one, and a posterior scar united to that of the posterior adductor. There is, of course, no anterior adductor scar, so that, in respect of adductor muscles, the mollusc is monomyarian, not dimyarian.

In *M. edulis*, on the other hand, there is a small but well-marked anterior adductor and an anterior retractor, while the scars of the middle and posterior retractors are united to one another and to the posterior adductor, the combination forming a scar which has somewhat the shape of the figure 6.

Now there are many species which present the same arrangement of muscular scars as in *M. latus*; they include *M. afer*, *M. variegatus*, *M. perna*, and *M. smaragdinus*, and they are the same group which has been separated by the 2-1 arrangement of teeth mentioned on p. 215. Presumably, therefore, the anatomical structure of these species is more or less similar to that of *M. latus*. It is, however, very desirable that other species should be examined, in order to determine this, for the relative distance between the scars of the middle and posterior retractors differs in different species, and some of them (as Mr. Purdie has suggested) may be intermediate in structure between *M. latus* and *M. edulis*. It is, in fact, stated by Dr. von Ihering, that, in the case of *M. chorus*, the separation of the retractors is sometimes incomplete, "and then the impression of the [central] byssal muscle is contiguous to the rest of the posterior retractor scar."¹ *M. meridionalis* seems also to be a connecting link in this and other respects between the two groups.

Dr. H. von Ihering was, I believe, the first to recognise that this isolation of the middle byssal retractor and the absence of an anterior

¹ Proc. Malac. Soc., vol. iv, p. 85.

adductor were characters that marked off a certain group of species,¹ and that this assemblage included the species which had been separated by Möreh in 1853, as a subgenus of *Mytilus*, under the name of *Chloromya*.² Möreh gave no diagnosis, merely enumerating the species *perna*, Linn., *Africanus*, Chemn., *variegatus*, Chemn., *smaragdinus*, Chemn., and *latus*, Lamk. Von Ihering established the subgenus on the characters above mentioned, and made *M. perna* the type, but did not notice the teeth, which, as I have shown, are also distinctive of this group.

There is another group of *Mytilus* which is also generally monomyarian by the absence of the anterior adductor, though the arrangement of the byssal muscles is the same as in *M. edulis*. This is the strongly ribbed section typified by *M. Magellanicus*, and separated by Möreh under the name of *Aulacomya*. As von Ihering remarks, the want of an anterior adductor is not in itself a very important character, and he states that this muscle is really always present in young *M. Magellanicus*, though it disappears in older specimens.³ Nevertheless, when its loss is associated with other characters such as those of the hinge (see p. 218) and the ribbing of the shell, it becomes useful as a means of diagnosis.

From the observations above recorded we can now distinguish more clearly the several groups into which the genera *Mytilus* and *Modiola* may be divided, and shall be able to form some idea of their generic or subgeneric value.

Genus MYTILUS, Linnæus.

Umbones generally subterminal, but sometimes terminal; anterior expansion of the shell very small or obsolete. Hinge with a variable number of small teeth on the anterior side, these teeth being connected with an equal number of small short riblets which curve inwards from beneath the umbones. Outer surface of shell smooth, except in the subgenus *Aulacomya*. Anterior muscular scar small, and in some cases absent.

Subgenera.

Eumytilus, Ihering. Anterior side with a small ribbed expansion under the umbo, the margin of which bears several small teeth, generally from 3 to 5, but sometimes only 2; these teeth vary in size and number, even in the same species. Anterior adductor scar always present, the median and posterior byssal scar united to one another and to that of the posterior adductor. Type, *M. edulis*, Linn.

To this group belong the following species:—

¹ Op. cit., pp. 85, 87.

² "Catalogus Conchyliorum quæ reliquit Comes de Yoldi, Hafniæ," 1853, pt. ii, p. 52.

³ Mr. Purdie seems to have found that an anterior adductor was always present in the New Zealand form of *M. Magellanicus*. I have not been able to ascertain whether it differs in any other respects from that species.

- M. Galloprovincialis*, Lamk.
M. ungulatus, Linn. (non Lamk.).
M. Grunerianus, Dunker.
M. Dunkeri, Reeve (= *Grayanus*, Dunker).
M. latissimus, Clessin.
M. planulatus, Lamk.
M. Californicus, Conrad.
M. borealis, Lamk.
M. crassitesta, Lischke.
M. Patagonicus, d'Orb.

Chloromya, Mörch. Umbones more completely terminal, and the anterior side inflexed so as to form a small hinge-plate below the umbo. Shell always smooth. Riblets of anterior side short, and sharply inflexed beneath umbo. Teeth 1-2 or 2-2; most frequently the former, but the single tooth is sometimes in the right, sometimes in the left valve. No anterior adductor scar, byssal scars three, an anterior, a median, and a posterior, the latter united to the posterior adductor. Type, *M. perna*, Linn.

To this group belong the following species:—

- M. pictus*, Born (= *M. afer*, Gmel.).
M. latus, Chemn.
M. variegatus, Chemn. (= *M. achatinus*, Lamk.).
M. smaragdinus, Chemn.
M. meridionalis, Krauss.
M. Taprobanicus, Blanf.
M. palliopunctatus, Dunker.
M. chorus, Molina.

Aulacomya, Mörch. Shell always ribbed or furrowed. Umbones terminal, elongated, and often projecting beyond and in front of the anterior side, which has only a single riblet twisted in under the umbo. Ligament long and carried in a channel beneath the umbones. Hinge without definite teeth, but having a tooth-like ridge in one valve which fits into a groove or depression in the other valve. Anterior adductor often absent, but other scars as in *Eumytilus*. Type, *M. Magellanicus*, Chemn.

The only other species that I have seen which can be included in this section are: *M. decussatus*, Lamk., *M. crenatus*, Chemn., and perhaps the rare *M. oblongus*, Clessin.

It will be convenient to consider the genus *Modiola* next, before passing on to the other species which possess posterior crenulations as well as anterior teeth. I have elsewhere¹ given my reasons for holding to the Lamarekian name of *Modiola* (or *Modiolus*), and for rejecting that of *Tolsella* of Scopoli. The following will serve as a definition of the *Modiola* shell.

Genus MODIOLA, Lamarek.

Shell oblong or elongate, oblique, generally inflated toward the

¹ Journ. Conch., vol. xi, p. 101 (1904).

anterior side, and often compressed on the posterior side. Smooth or concentrically striated, seldom ribbed,¹ but in some species feebly striated on the posterior slope. Umbones obtuse, anterior, but seldom terminal. Anterior margin expanded in front of the umbones, but quite smooth. Hinge-line without teeth or crenulations. Anterior adductor scar larger than in *Mytilus*; posterior scars united, the byssal portion long and narrow, the adductor part rounded and not bulging upwards as in *Mytilus*.

According to Bernard the development of the hinge-line in *Modiola* differs in several respects from that of *Mytilus* (see references on p. 211). In the nepionic stage, the crenulations of the provinculum are finer and closer than in *Mytilus*; in the nealagic stage, dysodont teeth appear on the posterior extension of the hinge-line, but are long, slender, and oblique, not short and vertical as in *Mytilus*. Moreover, the extension of the ligament is more rapid than the growth of these teeth, so that it quickly covers those that are first formed, and then prevents the formation of others.

As regards the anterior side, the few dysodont teeth that are here developed are obliterated by the backward inflexion of that side, and no fresh teeth are developed on the margin below them, as in the case of *Mytilus*, so that both sides of the hinge-line remain toothless.

The development of the hinge of *Lithodomus* is in all respects similar to that of *Modiola*.

There are several shells which have been described as belonging to the genus *Mytilus* which seem to me more properly referable to *Modiola*, because they all have a smooth, toothless, expanded margin, below or in front of the umbones. One of these is the large *Mytilus tortus*, for which Gray created the subgenus *Stavelia*. It certainly will not come under any of the subgenera of *Mytilus* which I have defined above, but I cannot see that it differs in any particular from the diagnosis of *Modiola*, and it has much resemblance in form to the well-known *M. barbata* of the British coast. The peculiar twist of the anterior side does not seem to me a sufficient character for establishing a subgenus, especially as no other species with a similar twist has yet been found, so that there is no group of twisted shells. Moreover, it is generally admitted that the nearest ally of *M. tortus* is *M. horridus*, and the alliance is indeed so close that Mr. E. A. Smith informs me that the former may be regarded as a twisted form of the latter. I am glad to say also that he agrees with me in referring both species to the genus *Modiola*.

H. von Ihering, in the paper before mentioned, not only failed to recognise the true affinities of these two species, but actually grouped them with *M. hirsutus*, and made the latter the type of a new subgenus of *Mytilus* for which he proposed the name *Trichomya*. In my opinion *M. hirsutus* differs so greatly in all essential characters that it does not even belong to the same genus as the shell which should be called *Modiola torta*. It has a crenulated hinge-line, and is

¹ *M. demissus* (= *M. plicatula*, Lamk.) is a true *Modiola*, though ribbed.

consequently referable to the same group as *M. exustus*, a group which has been separated by Mörch as the subgenus *Hormomya*. I cannot therefore recognise the subgenus *Trichomya* as having any value whatever.

Other species, generally called *Mytilus*, which I would transfer to *Modiola* are: *M. confusus*, Angas, *M. ater*, Frauenfeld, and *M. atratus*, Lischke.

With regard to the subdivisions of *Modiola*, I cannot, of course, accept the sections and subgenera adopted by Dr. Dall in 1898,¹ because he includes those with a crenulated hinge-line, like *Brachydontes* and *Gregariella*, which I transfer to another genus.

A few species of *Modiola* have smooth, polished shells, and these have been grouped under the name *Amygdalum*; it may be convenient to recognise this group as a natural section of the general assemblage, but the character on which it is based does not seem to me of much importance. There are other forms, such as *M. auriculata*, Krauss, *M. lignea*, Reeve, and *M. flavida*, Dunker, which differ from the type and from one another, and may be separable as subgenera, but the whole assemblage of toothless Mytilidæ requires further investigation, not only as regards the shells, but the animals themselves.

Myrina has been placed by Fischer as a subgenus of *Modiola*, and may perhaps be so retained, for though its course of hinge-development, as described by Bernard, is slightly different, it practically becomes a *Modiola* when adult. *Adula* is another group which may be placed here, but is certainly a link between *Modiola* and *Lithodomus*.

Lithodomus itself next claims attention, and if I were classifying the Mytilidæ for the first time, I should not think it worthy of generic separation, but should regard it as a subgeneric group, obviously derived from *Modiola*, and modified only in consequence of having taken to excavating holes in hard substances. The longer siphons of the animal and the cylindrical form of the shell are the most obvious points in which *Lithodomus* differs from *Modiola*; and in *Botula*, as well as *Adula*, there are certainly connecting links.

I find, however, from a perusal of Dr. Th. List's excellent monograph² of the Mediterranean *L. lithophagus* that the muscular system does differ to some extent from that of *Modiola*. The anterior adductor is relatively stronger, and the posterior smaller, so that the two adductor scars are nearly equal in size; the posterior retractor byssi forms a small oval scar directly above the adductor, and there is no separate pedal scar, the muscle being rudimentary, and its terminal surface united with that of the retractor byssi. Thus the shells which retain a definite anterior expansion of the shell, with a smooth interior margin, and present a hinge-line entirely destitute of teeth or crenulations, may be grouped in the two genera *Modiola* and *Lithodomus*. Their sections and subgenera may be tabulated as below.

¹ Trans. Wagner Free Inst. Sci. Philadelphia, vol. iii, pt. 4, p. 791.

² "Fauna und Flora des Goltes von Neapel": Zool. Stat. zu Neapel, Mon. 27, Die Mytiliden, von Dr. Th. List, 1902.

Genus MODIOLA, Lamk.

Section *Eumodiola* (von Ihering). Shell obliquely oblong, more or less expanded on the posterior side, and inflated along a central oblique line from the umbo to the posterior side of the ventral border. Ex. *M. modiolus*, (Linn.).

Section *Amygdalum* (Megerle). Shell elongate, narrow, not inflated, smooth, and polished. Ex. *M. arborescens*, (Chemn.).

Subgenus *Adula* (H. & A. Adams). Shell elongate, transverse, straight, and subcylindrical; umbones between centre and the anterior end. Ex. *A. soleniformis*, (d'Orb.).

Subgenus *Myrina* (H. & A. Adams). Shell oblong, transverse, not oblique, and nearly equilateral. Ex. *M. pelagica*, (Forbes).

Genus LITHODOMUS, Cuvier.

Shell long, narrow, and subcylindrical. Umbones at or near the anterior end, which is rounded and inflated. Posterior end generally wedge-shaped, but sometimes cylindrical and tapering. Shell surface smooth or wrinkled. Hinge-line straight, without crenulations. Margins of shell quite smooth. Adductor scars oval and nearly equal; byssal scars oval and small. Ex. *L. lithophagus*, (Linn.).

Subgenus *Botula* (Mörch). Shell oblong, subrhomboid, umbones terminal, prominent, and spirally curved. Ex. *B. cinnamomea*, (Lamk.).

We now come to the species which possess denticles or crenulations on the hinge-line *behind* the ligament, and these I propose to group in a separate genus, because I regard this character of generic importance, and of much greater value than the relative position of the umbones, which has hitherto been regarded as the only real distinction between *Mytilus* and *Modiola*.

I agree with von Ihering in grouping together the shells with subterminal umbones, which Mörch made a subgenus of *Mytilus*, under the name of *Hormomya*, and the shells for which Swainson proposed the name of '*Brachidontes*,' generally regarded as a subgenus of *Modiola*; but I cannot follow him in transferring the typical species of *Brachidontes* to *Hormomya*, and in retaining the former name for *Modiola demissa*.

The name '*Brachidontes*' (Swainson, 1840) has priority over that of *Hormomya* (Mörch, 1853), and Swainson's type is *Modiola sulcata*, Lamk.; hence Swainson's name, or some amended form of it, must be taken as the name of the new genus, though *Hormomya* can be used as a subgeneric name for the striated mytiloid forms like *M. exustus*, Linn., and *M. Domingensis*, Lamk. From these latter the little group for which the Marquis di Monterosato proposed the name *Mytilaster* in 1884, differs only in the character of the external markings, but it may be convenient to retain his name and to regard the assemblage as a second subgenus.

The construction of the name *Brachidontes* is obviously very bad; one supposes that Swainson meant to convey the meaning of short teeth; and Fischer altered it to *Brachydontes*, but that is little better,

for the σ of *ὄσους* cannot be omitted, and if emendation of any kind is permitted, the name must be converted into *Brachyodontes*. Personally I should like to replace it by *Brachyodon*, which would more correctly convey the meaning of a 'short-toothed shell,' but as the plural form has been allowed to stand in *Macrodon* and *Polydon* (properly *Polyodontes*) I do not alter it in this case.

There is another small group of mytiloid shells which differ very little from those which form the subgenus *Hormomya*, but has been regarded by some authors as having generic rank. This is the *Septifer* group, in which the anterior adductor muscle is attached to a myophoric plate instead of to the inner surface of the shell. In all other respects, so far as I can learn, both shell and animal agree with *Hormomya*, and the existence of a myophoric septum does not seem of sufficient structural importance to form the basis of a separate genus.

It is true that most species of *Septifer* are stout, strongly ribbed shells, but in these respects they resemble *B. (H.) hirsutus* and *B. purpuratus*; they also compare with these species in the length and strength of the ligament, and in the small number of posterior crenulations on the hinge-line, which have been left unobliterated by its extension. It seems natural, therefore, to place *Septifer* as a subgenus under *Brachyodontes*. All the species with a crenulated hinge-line will come under these four groups except *M. hamatus* (Say), which is exceptional and interesting in several particulars. In the first place, the ligament is very long, is completely marginal, and seems to have almost obliterated all the posterior crenulations of the hinge-line, for, though the shell-margin is crenulated by the ribs, these crenulations become oblique and faint near the ligament, instead of becoming stronger and transverse. It is a fact, however, that this is sometimes the case with that variable species *Brach. purpuratus*, Lamk., and its var. *ovalis*. *M. hamatus*, however, has other peculiarities: there is no anterior adductor, and the united posterior byssal and adductor muscles leave a scar of unusual shape, the adductor end of which is little broader than the byssal end.

As all these peculiarities are not combined in any other species with which I am acquainted, I consider that *M. hamatus* stands by itself, and should form a separate subgenus of *Brachyodontes*, for which I propose the name of *Ischadium*, thinking that in shape and colour the shell has a sufficient resemblance to a 'dried fig' to justify the appellation.

The genus and subgenera can then be defined as follows:—

Genus BRACHYDONTES, Swainson.

Shell generally finely ribbed, but sometimes wrinkled, or even smooth. Anterior development of the shell, and consequently the position of the umbones, variable. Hinge-line generally straight, and terminating in an angle posteriorly. Ligament rather short, marginal or infra-marginal. Anterior margin with several close-set teeth; posterior border crenulated, sometimes throughout its length, above and behind the ligament, sometimes only behind the ligament.

Muscular scars similar to those of *Eumytilus* or *Modiola*. Type, *C. sulcatus*, Lamk. (= *citrinus*, Chemn.).¹

Subgenera.

Hormomya (Möreh). Shell finely ribbed; umbones subterminal; anterior side straight or incurved. Type, *B.* (*Hormomya*) *exustus*, (Linn.).

Mytilaster, Monterosato. Shell mytiloid, with nearly terminal umbones, either with a superficially crinkled surface or marked only by concentric lines of growth. Type, *M. lineatus*, (Gmelin).

Septifer, Récluz. Shell similar to that of *Hormomya*, except that the anterior adductor is fixed to a plate which forms a triangular septum at the anterior end of each valve. Type, *S. bilocularis*, (Linn.).

Ischadium, subgen. nov. Shell oblong or pyriform in outline, sculptured all over with strong raised divaricating ribs. Umbones slightly divergent; anterior riblets well-marked, and corresponding with a variable number of dysodont teeth. Ligament long, without crenulations behind it. Anterior adductor scar absent, and anterior byssal scar small. Posterior byssal scar large and broadly united to that of the posterior adductor. Type, *I. hamatum* (Say).

It may be useful to enumerate some of the species which may be referred to each of the first four groups. To *Brachyodontes*, s.s., the following are referable:—

| | |
|----------------------------------|--------------------------------|
| <i>B. sulcatus</i> , Lamk. | <i>B. ustulatus</i> , Lamk. |
| <i>B. Menkeanus</i> , Reeve. | <i>B. Capensis</i> , Krauss. |
| <i>B. purpuratus</i> , Lamk., | <i>B. striatulus</i> , Hanley. |
| and ? var. <i>ovalis</i> , Lamk. | <i>B. Senhausi</i> , Reeve. |

To *Hormomya* the following species are referable:—

| | |
|-------------------------------------|---|
| <i>B. (H.) hirsutus</i> , Lamk. | <i>B. (H.) subramosus</i> , Hanley. |
| <i>B. (H.) exustus</i> , Linn. | <i>B. (H.) rostratus</i> , Dkr. (in Rve.). |
| <i>B. (H.) Domingensis</i> , Lamk. | <i>B. (H.) tenuistriatus</i> , Dkr. (Rve.). |
| <i>B. (H.) cubitus</i> , Say. | <i>B. (H.) curvatus</i> , Dkr. |
| <i>B. (H.) Adamsianus</i> , Dunker. | <i>B. (H.) granulatus</i> , Hanley. |
| <i>B. (H.) Lavalleanus</i> , d'Orb. | <i>B. (H.) crebristriatus</i> , Say. |
| <i>B. (H.) Darwinianus</i> , d'Orb. | <i>B. (H.) Charpentieri</i> , Dkr. |

To *Mytilaster* the following species belong:—

| | |
|------------------------------|-----------------------------------|
| <i>M. lineatus</i> , Gmel. | <i>M. hybridus</i> , Monterosato. |
| <i>M. minimus</i> , Poli. | <i>M. Marioni</i> , Locard. |
| <i>M. crispus</i> , Cantr. | <i>M. Solisianus</i> , d'Orb. |
| <i>M. lacustris</i> , Costa. | (= ? <i>M. exiguus</i> , Dkr.). |

Genus MODIOLARIA, Beck.

I have not paid any special attention to the genus *Modiolaria*, which is in many respects very similar to *Modiola*, but the animal

¹ It is a question whether this species will not now have to be called *Brachyodontes modiolus*, as it is certainly the *Arca modiolus* of Linnæus (1767).

has a long anal siphon and a long vermiform foot. As regards the shell, I do not consider the surface sculpturing to be of much importance, but the hinge-line is almost always crenulated behind the ligament. From Dr. List's monograph, above quoted, we learn that the arrangement of the muscles in *Modiolaria* is very different from those of other genera. In *M. marmorata* the posterior adductor is much smaller than the anterior; the byssal retractors consist of three separate muscles, viz., anterior and posterior retractors of small size and a middle group of muscle-cords which are inserted high up, below the ligament in an uninterrupted line. This division into a median byssal retractor recalls that in *Chloromya*, but the scar is very different in shape.

Modiolaria therefore may well retain the generic rank which has been given it. I think Fischer was right in placing *Gregariella* under it as a subgenus. The shell originally described as *Modiola opifex* is also a *Modiolaria*; for this shell Dr. Dall proposed the subgenus *Botulina*, but he has since admitted that this is a synonym of *Gregariella*, so that *opifex* may be included with *G. Petagnaë*.

Rhomboidella. Monterosato, 1884, only differs from *Modiolaria* in being striated all over, and cannot rank as more than a subgenus.

Other recognised genera of Mytilidæ are:—*Idas*, Jeffreys, *Dacrydium*, Torell, and *Crenella*, Brown.

In conclusion, I desire to tender my sincere thanks to all those who have assisted me by imparting information or by the loan of specimens, viz., to Messrs. R. H. Burne, J. E. Cooper, A. Hartley, Rev. A. H. Cooke, Dr. W. E. Hoyle, Mr. J. C. Melvill, Mr. J. MacAndrew, and Mr. E. A. Smith.

NOTE ON THE TYPE OF *GEOMELANIA*, PFEIFFER, WITH THE
DESCRIPTION OF A NEW SPECIES.

By E. R. SYKES, B.A.

Read 13th January, 1905.

THE genus *Geomelania* was founded by Pfeiffer (Proc. Zool. Soc., 1845, p. 45) for *G. Jamaicensis*, which he then described from Cuming's collection. In an endeavour some little while ago to identify some species of this group, it was brought to my notice that there was some confusion as to the actual form described by Pfeiffer, and the object of these notes is to clear up this difficulty.

Pfeiffer's description is brief: he gave no figure, but states that the shell is 12 mm. long.

Cuming had apparently two or more species, as they would now be called, which he placed together and distributed as *G. Jamaicensis* to various correspondents. After a careful examination I have, I think, traced the actual types of the species (Fig. 2), labelled as from the locality that Pfeiffer gave, and which agree well with the figures given by Pfeiffer himself (Conch. Cab., Cyclostomacea, pl. xxx, figs. 19, 20).

C. B. Adams received from Cuming a different shell of larger size, and consequently the description of *G. Jamaicensis* given by him

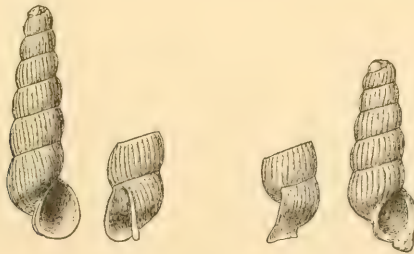


FIG. 1.

FIG. 2.

(Contrib. Conch., p. 18) must not be relied upon as referring to the present species, and probably the shells he had, require a name: I forbear to suggest one, however, as I am at present not sufficiently acquainted with the group.

In 1851 Petit (J. Conchyl., vol. ii, p. 82, pl. ii, fig. 4) gave a figure, purporting to represent the species, "d'après un individu qui nous a été donné par M. Cuming." This, again, was not the true *G. Jamaicensis*, and was probably the same form as was sent to Adams.

One naturally turns to Adams' species to see what name he utilised for the true *G. Jamaicensis*: I think his *G. affinis* is the same species, and so that name becomes a synonym.

The shells I now describe were collected by Mr. Jarvis and Mr. Nutt, and the species is separable, when adult, from all the forms of *Geomelania* known to me, by the fact that it forms a second lip and peristome, within and beyond the earlier one. This seems to be a constant, though remarkable, character. There is a series of the present form in Chitty's collection, now in the British Museum, marked by him "n.s.," but only one or two of those show the duplication. Another noteworthy feature is the absence of any spiral sculpture; there is also a lack of any denticle or projection on the outer margin of the peristome.

I append a diagnosis.

GEOMELANIA JARVISI, n.sp. Fig. 1.

Shell much elongated, almost cylindrical, but tapering very slowly towards the apex; colour almost transparent white, becoming chalky in appearance when dead; sculpture, numerous well-marked ribs, the latter being slightly arcuate and extending over the whole of the shell; apex truncate; whorls, seven remaining, very convex, separated by a deep suture; aperture ovate, the outer margin being well expanded and reflexed, a trifle 'squared' at the base, and without any trace of denticle or projection; a well-marked callosity joins the margins; the adult shell has a second lip formed in and beyond the first, very similar in character. Alt. 10, diam. (penultimate whorl) 2 mm.

Hab.—Near Albert Town, Trelawney, Jamaica.

Type in my collection.

ON THREE SPECIES OF *DYAKIA* FROM WESTERN SUMATRA.

By E. R. SYKES, B.A.

Read 13th January, 1905.

THE shells now discussed form part of an interesting collection which has recently been sent to me for determination.

DYAKIA GRANARIA (Bock).

Helix (*Nanina*) *granaria*, Bock: Proc. Zool. Soc., 1881, p. 628, pl. lxx, fig. 1.

This species was described by Bock from a single specimen, which is now in the British Museum. My specimen is a trifle larger (46 mm. in diameter, the type being 40 mm.), and slightly more depressed in form, thus giving the aperture the appearance of being more drawn out to one side. The sculpture is similar to that of Bock's specimen, including the striking elevated ridge on the last whorl, but entirely lacks the wrinkling or malleation to which he refers and which is very conspicuous on the last whorl of the type.

DYAKIA PERSTRIATA, n.sp. Fig. 2.

Shell sinistral, depressed trochiform, narrowly but deeply umbilicated, somewhat thin, brown horn colour, being paler above and also

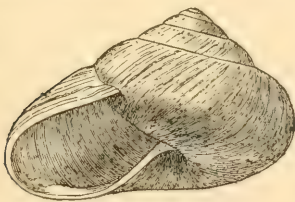


FIG. 1.

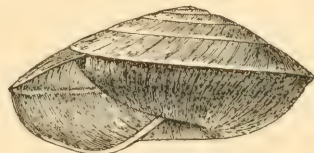


FIG. 2.

near the umbilicus; the protoconch is almost smooth, then subgranulose wrinkling appears, becoming from the third whorl onwards well marked radiating rib-striae, these rib-striae are cut on the third whorl by spirals, which gradually become less conspicuous, until the last whorls appear only to bear strong rib-striae, which are subgranular; below, the shell is lightly marked by irregular wrinkled lines of growth, with, under a lens, indications of closely-set spirals; whorls $6\frac{1}{2}$, flattened, slowly but regularly increasing; suture not much impressed;

the last whorl is very acutely carinate, not descending; aperture sublunate, the peristome being somewhat thickened, very pale horn colour, and slightly reflexed over the umbilicus. Diam. max. 39·5, alt. 19·5 mm.

Related to *D. Maarseeveni* (Bock), but the present shell is larger, darker in colour, the sculpture is stronger, and the rib-striae are subgranular.

DYAKIA EUCONUS, n.sp. Fig. 1.

Shell sinistral, well elevated, trochiform, very narrowly umbilicated, somewhat thin, the earlier whorls brown horn colour, and the later whitish beneath a horn-coloured periostracum, slightly paler below; the first two whorls are smooth save for traces of radiate wrinkling at the sutures, then a large number of closely-set fine spirals appear, cutting irregular and obscure lines of growth, these lines of growth gradually become stronger and the spirals less conspicuous; the sculpture below is spirals cutting irregular lines of growth; a few specimens show traces of a ridge at the periphery such as is to be seen in *D. granaria*; whorls 6, regularly and moderately increasing, somewhat convex, with a well-marked suture, the last whorl rounded at the periphery in adult shells; aperture subquadrate, the peristome somewhat thickened and slightly reflexed over the umbilicus. Diam. max. 36, alt. 24 mm.

Noteworthy for its trochiform shape, with somewhat convex whorls; the sculpture is not striking until viewed under a lens. I have seen three specimens, constant in their characters, and all appear to have sustained slight injuries during life.

ON SOME NUDIBRANCHS FROM THE PACIFIC, INCLUDING
A NEW GENUS, *CHROMODORIDELLA*.

By Sir C. N. E. ELIOT, K.C.M.G.

Read 13th January, 1905.

THE Nudibranchs described in this paper have been derived from various sources, and consist of (1) *Dictyodoris tessellata* from Madagascar, (2) *Rizzolia modesta* and *Chromodoris petechialis* from Japan, (3) Abraham's *Doris Wellingtonensis* from New Zealand, which has been referred to *Doridopsis*, but is here shown to be an *Archidoris* or *Anisodoris*, (4) a small collection sent by Mr. Burnup from Scotsburg, Natal, about 30° S., consisting of *Chromodoris runcinata*, *lineata*, and *annulata*, *Chromodoridella mirabilis*, gen. et sp. nov., and *Hexabranchus* (?) *Adamsii*. Considering the latitude of the locality, this last-named collection is remarkably equatorial in character. Of the other species, *Dictyodoris tessellata* has hitherto been recorded from the Palm Islands and *Ch. petechialis* from Hawaii, so that, as usual, the forms appear to be widely distributed over the Indo-African-Pacific area.

Dictyodoris tessellata, Bergh.

Dictyodoris tessellata, Bergh: Semper's Reisen Archipel. Philippin., Theil iv, Heft 1, pp. 75-78, pl. C, figs. 11-12; pl. F, figs. 22-23.

Two specimens from Madagascar were kindly given me by Professor Völzkw. The label bears the inscription "Bai v. Tulear, S.W. Madagask. Riff am Steinen." They are clearly of the same species, but one is nearly twice as large as the other. The measurements of the larger are: length 22.5 mm., breadth 18, height 9. The mantle-edge is ample, being 7 mm. wide at the sides and 5 over the head and tail.

The texture is like a hard clear jelly. On the back is an elaborate reticulate or stellate pattern, which is much more developed in the larger than in the smaller specimen. Its genesis seems to be that there are three dorsal ridges bearing three or four tubercles each. These tubercles are then connected by secondary ridges. Tertiary ridges extend towards the middle of the figures thus formed, and towards the mantle-edge, but are little developed in the smaller specimen. The ridges are white in the smaller, pale purple in the larger specimen. In both the colour between the ridges is brownish purple, with numerous round white dots. Round the mantle runs a purplish-white border. The foot is bluish white. There are purple spots on the under side of the mantle, and a purple band at the junction of the foot and body. The foot shows no sign of an anterior groove or notch, but is much contracted.

The rhinophore openings are closed, as is also the branchial pocket in the larger specimen. In the smaller it is open and roundish, without teeth or lobes. The branchiæ are four, two on each side, the rachis thick, the branches few and bipinnate, white, but deep red at the tips.

The formula of the radula is at its maximum about $54 \times 40 : 0 : 40$. The teeth are simply hamate, crowded, and smaller in the middle. The four or five outermost are somewhat degraded in shape, with fine hair-like denticles on the apex. A trace of the hook sometimes remains in a larger denticle.

The coloration, dorsal pattern, radula, and branchiæ leave no doubt that this is *D. tessellata*, but I think the genus should be united with *Halgerda*, Bergh, which appears to have priority as a name, though it is difficult to be sure, as both genera were created in 1880. I cannot find any material difference in his description of the two genera. If they are united the list of species will be as follows:—

1. *H. formosa*, Bergh: Verhandl. zool.-botan. Gesell. Wien., vol. xxx, pp. 190–195, pl. iv, figs. 15–20; pl. v, figs. 10–12 (1880).
2. *H. tessellata* (Bergh): Semper's Reisen, Suppl., Heft i, p. 75, pl. C, figs. 11–12; pl. F, figs. 22–23.
3. *H. maculata*, Eliot: Gardiner's Fauna and Geog. Maldive and Laccadive Archipel., p. 556: small, and perhaps an immature specimen of *H. Wasinensis*.
4. *H. Willeyi*, Eliot: Proc. Zool. Soc., 1904, vol. ii, p. 372.
5. *H. Wasinensis*, Eliot: l.c., p. 373.

RIZZOLIA MODESTA (?), Bergh.

Rizzolia modesta, Bergh: Verh. z.-b. Wien., vol. xxx, pp. 156–160, pl. i, figs. 1–11 (1880).

One specimen from the Inland Sea, Japan, dredged by Mr. Gordon Smith in 85 fathoms. As preserved, it is of a uniform yellow and stoutly built, being 32 mm. long, 9 mm. broad across the pericardium, and 11 mm. high to the top of the pericardium, which is large and prominent. The left side of the head has apparently been bitten off, and only the right oral tentacle remains. It is large and stout, 9 mm. long. The rhinophores are much smaller, being 5.5 mm. long, stout, and set close together, slightly wrinkled, but not perfoliate.

The cerata are set in eight groups on each side, but the last three or four groups are close together, so that superficially the number seems less. Each group consists of two rows of papillæ arranged in a horse-shoe (v. Bergh's figures, l.c., pl. i, fig. 1). The first two groups are set on very distinctly projecting prominences; the remainder are only slightly raised above the level of the back. The first group contains about 14 cerata, none of which are very long. The number of cerata in the living animal is rather greater than is given here, for though they are not very caducous, a good many have fallen off. There is a considerable interval between this group and the second, which contains 19 cerata, in the midst of which is the anal papilla. The third and fourth groups contain respectively 16 and 14 moderately

long cerata; the fifth and sixth also 14, but rather shorter; the seventh and eighth 10 each, shorter still.

The cerata are longer towards the middle, and shorter towards the ends of the horse-shoe. The largest are in the second group, and measure 11 mm. They are all cylindrical, rather thin, and contain yellow liver-branches, which nearly fill the small ones, though they form only a comparatively narrow centre in the larger. These branches are not ramified, but are constricted here and there, and have an irregular lumpy surface. The cnido-sacs at the tip of the cerata are paler than the rest of these organs. The genital papilla is between the first and second groups of cerata.

The foot is broad, with expanded lateral margins; the anterior margin is produced into moderately long tentacular expansions, grooved and bilobed in the upper lip. The mouth is a large, round opening. The jaws are large, yellow, with a single row of short, blunt denticles. The radula consists of a single row of 28 yellow teeth, of horse-shoe shape, with a strong central cusp, and five rather long and slightly curved lateral denticles, as in Bergh's plates (i.e., pl. i, figs. 7-8). A few teeth have only four denticles, but I did not see any which had more than five.

This is perhaps a large specimen of *R. modesta*, recorded from Eno-sima, Japan. But it is proportionately stouter, and with longer tentacles; also the colour in life was possibly different. On the other hand, the arrangement of cerata seems the same, and the teeth agree with Bergh's plates, though none have more than five denticles. Perhaps a description of the colour and appearance of the living animal would enable one to formulate characters justifying specific rank.

It may be doubted whether the genus *Rizzolia* is really distinct from *Hervia*. The characters, as formulated by Bergh, are almost identical. If the two genera are to be regarded as separate, it would appear that the chief peculiarity of *Rizzolia* is that the groups of cerata are set on low but still quite distinct projections of the body.

CHROMODORIS PETECHIALIS (Gould).

Doris petechialis, Gould: United States Exploring Expedition, 1838-42, vol. xii, p. 296, Atlas, figs. 391, 391a (1852).

One specimen obtained by Mr. Gordon Smith in the Inland Sea, Japan.

The animal, as preserved, is soft in texture, almost gelatinous; thick and stout; length 30 mm., breadth 21.5, height 15. The ground-colour is a semitransparent white, showing the viscera. The mantle completely covers the head and foot, and is bordered with orange, as is also the foot, but less distinctly. On the inside the mantle-border looks as if the colouring-matter had dissolved and slightly tinged the adjacent parts. On the back are scattered purplish spots, not at all raised, and about 2×1.5 mm. in size. They are thickest behind the branchiæ. Similar spots are found at the sides of the foot.

The pockets of the rhinophores and branchiæ are not raised. The

rhinophores are large and bright orange. The branchiæ are white below and orange above. They are 18 in number. The three at each side are larger than the rest; the anterior plumes are very small, and the hindermost turn inwards in a spiral.

The foot is broad, grooved, but not notched in front. The mouth-parts are everted. On each side is a thick, strong tentacle.

The labial armature consists of two yellowish plates, composed of thick-set, bifid rods. The colourless radula has a formula of about $91 \times 85 : 0 : 85$ at its greatest width. The teeth are as usual in the genus, the innermost denticulate on both sides, the laterals on the outer side only, and the two or three outermost on the top. The laterals are tall, erect, hamate, but not much bent until quite the top, and bearing 7-10 minute denticles below the main hook.

I think this animal may be identified with Gould's *Doris petechialis*, described as follows:—"Animal rounded, oval, depressed, pale, a little slate-coloured each side, and with a marginal orange-coloured line and a submarginal lemon-coloured shading; over the whole surface are small, regularly disposed, rose-red blotches, like petechiæ. Cervical tentacles tapering, vermilion-coloured, with only a minute portion laminated. Branchial star of six narrow, tapering, pinnate plumules. Head very small; lateral tentacles short, conical; foot narrow, shorter than the body; beneath colourless, the mantle and foot bordered with pale orange." Length $2\frac{1}{2}$ inches, breadth $1\frac{1}{4}$. Habitat, Honolulu.

The above description corresponds almost exactly with the external characters of the present specimen, the only important point of difference being that the branchiæ are given as 6, not 18. But of the 18 branchiæ 6 are larger than the others, and no doubt in life they project conspicuously from the pocket, whereas the smaller plumes remain hidden.

Collingwood's *Ch. tumulifera* (Trans. Linn. Soc., Zool., vol. ii, 1881, p. 130) is probably identical with *D. petechialis*, but is smaller and has raised tuberculate spots which possibly disappear with age. *Ch. pallescens*, Bergh, and *Ch. inornata*, Pease, are closely allied forms, but present slight differences, particularly in the shape of the teeth, which render identification with the present specimen difficult, though they may assume its characters with further growth, as they are small and perhaps young forms.

The name *petechialis* has undoubted priority, and must be borne by any species which can be identified with Gould's animal.

Ch. picta (Pease), (Proc. Zool. Soc., 1860, p. 29), is not improbably a colour variety of the same species.

CHROMODORIS RUNCINATA, Bergh.

Chromodoris runcinata, Bergh: Semper's Reisen, Heft xi, pp. 479-481, pl. li, figs. 32-33; pl. liii, figs. 5-12 (1877); Eliot, Proc. Zool. Soc., 1904, vol. i, pp. 393-4.

Two specimens, both about 25 mm. long and 7 broad. They are bluish white, with markings of orange and dark blue, both of which colours form a sort of reticulate mottling as well as isolated dots. Branchiæ in one specimen 12, and grey; in the other, 13, and red.

One specimen has 10 very small conical protuberances under the posterior edge of the mantle; the other only 5, but much larger. Neither has any protuberances on the anterior mantle-edge. Their absence appears characteristic of the African specimens.

CHROMODORIS (?) LINEATA (Souleyet).

Chromodoris (?) *lineata* (Souleyet): Eliot, Proc. Zool. Soc., 1904, vol. i, pp. 396-7, pl. xxiv, fig. 7.

One specimen 20 mm. long, 5 broad, and 5 high; bluish white, with 5 raised lines down the centre of the back. Rhinophores large; branchiæ 11. Both organs show traces of having been red. The labial armature and radula, as described. The teeth are bifid, with 4-5 smaller denticles.

It does not appear to be recorded that the stripes of *Ch. lineata* are raised, but otherwise the present specimen corresponds fairly well with the forms described under that name, and it seems hazardous to create a new species.

CHROMODORIS ANNULATA, Eliot.

Chromodoris annulata, Eliot: Proc. Zool. Soc., 1904, vol. i, pp. 389-390.

One specimen, 24 mm. long and 10 broad.

The texture is flabby, and the mantle ample. The general colour is dirty grey, with white spots, but a large purple blotch occupies nearly the whole region of the back, behind the rhinophores. The branchiæ are 16, arranged in a spiral, and have a dark stripe down the inner and outer edge. The labial armature consists of minute hooked rods. The radula is as described; the teeth bear about 10 denticles.

Ch. annulata has the perplexing peculiarity of losing, when preserved, the pattern which is characteristic of it in life. The present specimen appears to coincide in structure with those which I found at Zanzibar and to have lost its colour in much the same way.

CHROMODORIDELLA MIRABILIS, gen. et sp. nov.

This remarkable animal may be succinctly described as a *Chromodoris* with the branchial pocket situated, not on the dorsal surface, but on the under side of the body, and pointing downwards. I confess to considerable doubt as to whether it is a normal form or a monstrosity, but Mr. E. A. Smith and Mr. F. Jeffrey Bell, who have examined it, agree with me in thinking that it shows no signs of distortion or irregularity. The proportions are symmetrical, and both the external and internal characters appear perfectly natural. It must therefore, I think, be accepted as a valid generic type, unless reason can be shown for treating it as a *lusus naturæ*.

The chief reason for suspecting that it is not a normal form is that, although the position of the branchiæ is so unusual, it is otherwise not only a typical *Chromodoris* but closely allied to, if not identifiable with, *Ch. Semperi*. The shape, the colour, the radula, and the labial armature all recall those of this species (see Bergh, Semper's Reisen, Heft xi, p. 482), though there are differences of detail.

It may be observed that the alteration in the position of the branchial pocket, though striking, is not morphologically of much importance, and does not imply any considerable modification of the organism. In a flat Dorid the branchiæ could hardly be placed under the mantle-edge without undergoing some alteration of structure, but, in a form like the present, where there is space to allow of their being freely suspended, a very slight change in the direction of the intestine and the vascular system is sufficient to account for the difference.

In any case the present specimen appears to be a special modification of *Chromodoris*, and not to represent an order parallel to the Cryptobranchiata, as *Corambe* may be supposed to do. The branchiæ, though abnormal in position, have otherwise the characters of the genus *Chromodoris*, whereas *Corambe* has merely a few lamellæ at the posterior end of the body under the mantle-margin.

It is also probable that this specimen is not referable to the genus *Hypobranchiæa*, A. Adams, and it certainly is not his *H. fusca* (Gen. Rec. Moll., vol. ii, p. 46, and Proc. Zool. Soc., 1847, pp. 23-4), which is a flat brownish animal six inches long. It is very inadequately described by Adams, but as he places it under the Phyllidiidæ, this position, taken in conjunction with his description of the family characters, ought to mean that it has no jaws or radula. He does not, however, say that he examined the buccal parts. In Proc. Zool. Soc. (loc. cit.) he says that *Hypobranchiæa* "differs from all the other genera of the Dorididæ in having the vent, and the gills which are extruded from it, situated beneath the edge of the mantle." This language is probably not accurate, but it sounds like an incorrect description of a branchial pocket with pendent extruded plumes like that of *Chromodoridella mirabilis*.

The single specimen is superficially not unlike those of *Chromodoris runcinata* which were sent with it, but is somewhat slenderer and higher, and resembles *Ceratosoma* in shape, as the body slopes upwards from the head, and the end of the back is continued above the tail for some distance. The total length from the head to the tip of the tail is 21 mm., from the head to the end of the dorsal surface 16 mm., of the tail 9 mm., of the dorsal process 7 mm. The height at the head is 4.5 mm., at the middle of the back 6 mm., at the end of the back 6.5 mm. The breadth is 6.5 mm. at the head, and 4.5 mm. across the dorsal process. The mantle-edge measures 1 mm. at the sides, and 2 mm. over the head. The texture is soft and flabby. The ground-colour is dirty white, with numerous deep yellow spots and fewer scattered greenish-blue spots. Both kinds are arranged quite irregularly, but they are most numerous on the back, and fewer at the sides. The sole of the foot is colourless. The foot is long and expanded in front, both laterally and anteriorly, so that it projects a considerable distance before the mouth. The anterior margin is thickened, but not grooved. The mantle-margin is thin, quite distinct, and expanded into a small veil over the head. The rhinophores are yellow, stout, and mace-like, with about 15 perfoliations. They are retractile into pockets with hardly raised edges.

On the under side of the dorsal process, about 1 mm. from its end and 4 mm. from the body, is the branchial pocket, from which project 12 simply pinnate branchiæ, surrounding a large anal papilla. They are all united at the base, and completely extruded in a bunch from the pocket, which has a simple round rim, not at all raised. It is not clear that the branchiæ could be entirely retracted into it.

The mouth, on each side of which is a distinct conical tentacle, opens into a wide, much puckered, and laminated cavity. The labial armature consists of two yellowish plates. Under the microscope they have the appearance of a tessellated pavement, and are seen to be composed of small rods with thick bent heads, as in Bergh's plates of *Ch. Semperi* (Semper's Reisen, Heft x, pl. li, fig. 34). The radula also resembles that of *Ch. Semperi*. The teeth are bifid, but the two prongs are rather longer and more curved. The innermost teeth have an accessory denticle, and the outermost, which are fairly tall and straight, have two or three. There are 58 rows, and the maximum number of teeth on each side is about 80. There is no stomach outside the liver, which is purplish, and rounded before and behind. On issuing from the liver the intestine runs along the top of it on the right-hand side, and then turns downwards.

No armature was found in the reproductive organs. The central nervous system is as usual; the eyes large and black: A small flocculent mass above it is probably the blood-gland.

HEXABRANCHUS (?) ADAMSI, Gray.

Hexabranclus Adamsii, Gray: H. & A. Adams, Gen. Rec. Moll., vol. ii, p. 59, pl. lxiii, fig. 9; Gray, Guide Syst. Dist. Moll. Brit. Mus., p. 210; M. E. Gray, Figures of Molluscous Animals, pl. ccxix, fig. 1.

One specimen, with a length of 21 mm. and a breadth of 5 mm., and therefore unusually long and narrow. The colour is whitish, with a narrow, bright light-red border, inside which, but hardly connected with it, are a row of similarly coloured blotches, each having, in the centre, a deep bright-red dot. Then follows a clear white zone; then, down the centre of the back, two rows of similar blotches, with dots, growing larger towards the branchiæ. There are two rows of bright-red dots, without blotches, on the under side, one at the junction of the mantle and the foot, the other lower. The sole is colourless, and allows the intestines to be seen through it. The mantle-edge is folded against the sides of the body, but, when stretched out, measures 3 mm. at most. The rhinophores are large and straight, with tall stalks. The laminated part is bright red. The margins of the pockets are not raised. The branchiæ are as usual in the genus, eight in number, whitish, with remains of bright-red lines.

The tentacles are large, flat, folded in two, the edges indented, but not very deeply. The labial armature consists of two greyish plates composed of minute rods, somewhat bent, and of rather varying shape. The radula consists of 30 rows, containing 35 or 40 large hamate teeth on each side of the bare rhachis. They are yellowish,

with strongly built bases. The innermost and two or three outermost are smaller, but not denticulate or degraded. The other internal organs appear to be as usual in the genus. The verge is long (11 mm.) and greenish.

The references given above contain practically no information about *H. Adamsii*, except that afforded by the figures, which represent a rather elongated animal having blotches and dots on the back, and dots round the foot, much as described above. The original was probably a specimen resembling the present one.

The so-called species of *Hexabranhus* are of very doubtful validity, and are perhaps merely colour varieties. The present specimen shows no variation in structure from the ordinary type, but the pattern of blotches with central dots is distinct and remarkable, as is also the extreme narrowness compared to the length. These two characters, if found in other individuals, constitute a better species than most of those described.

ARCHIDORIS WELLINGTONENSIS (Abraham).

Doris Wellingtonensis, Abraham: Proc. Zool. Soc., 1877, pp. 211, 259, pl. xxix, figs. 27-28.

On p. 1121 of his "System der Nudibranchiaten Gasteropoden" (Semper's Reisen, Heft xviii, 1892) Bergh gives, in his list of the species of *Doridopsis*, "40. *D. lacera* (Cuv.), *Doris wellingtonensis*, Abraham. M. Pacific (Nov. Zel.)." I have not found any explanation of this entry, but an examination of the type-specimen in the British Museum leaves no doubt that Abraham's *D. Wellingtonensis* is not a *Doridopsis*, but belongs to the Archidorididæ. I think also that Cuvier's *Doris lacera* is not a *Doridopsis*, but a *Hexabranhus*.

This latter view seemed to be adopted by Professor Bergh in treating of *Doridopsis* in Journ. Mus. Godefroy, Heft viii (1875), p. 85, where he says, "Wenn die Darstellung der Tentakel bei Cuvier richtig ist, gehört diese Form absolut nicht den Doriopsen an." Even in his Syst. Nud. Gast., p. 1091, under *Hexabranhus*, we find *D. lacera*, Cuvier, as a synonym of *H. flammulatus*, and in his account of the Opisthobranchiata collected by Schauinsland (p. 225) he adheres to this opinion. Cuvier's *Doris lacera* (Ann. Mus. Hist. nat., 1804, p. 452, etc.) was brought by M. Péron from La mer des Indes. It would seem to be undoubtedly a *Hexabranhus*, and not a *Doridopsis*, on account of the characters presented by the tentacles, the branchiæ, and the radula. It is true that Cuvier says on p. 459, "Les *Doris* diffèrent éminemment des Tritonies par la bouche en trompe et sans dents dans les premières, courte et armée de mâchoires tranchantes dans les secondes." But he says later (p. 460), "Au fond de la trompe est une fente verticale . . . derrière est la langue qui ressemble à celle de la Tritonie et de l'Aplysie." We have become familiar with the idea that the radula is a set of teeth, but Cuvier evidently thought of it as a tongue, which is equally natural, and when he said that his *Doris* had no teeth he did not mean that it had no radula.

Through the kindness of Mr. E. A. Smith I have been allowed to examine both the type-specimen of Abraham's *Doris Wellingtonensis* in the British Museum, and also a very fine specimen from Otago.

The type-specimen is not well preserved, but agrees with Abraham's description of its external characters. There are whitish tubercular spots between the large flat pustules, and the oral tentacles have a distinct pit at the apex. It would appear, however, from a comparison with the other specimen, that this curious feature is due to distortion by the preserving fluid. Abraham says there is no groove on the anterior margin of the foot. I think there is one, but there are so many lines and wrinkles in this part of the animal that it is hard to say which are natural and which are due to distortion. The branchiæ are seven, bushy, tripinnate. It looks as if there were a few separate plumes rising from the floor of the cavity here and there, near their bases. The radula was extracted. It consists of 48 rows with about 50 teeth, at most, on each side of the rhachis, which is broad, without a central tooth, but with several irregular longitudinal folds. The first lateral projects almost at right angles into the rhachis. It has a short, low hook, and a long thick base. The other teeth are hamate, of the same type, but the hook is longer, and the base shorter. The outermost teeth are smaller, but not degraded. There is a very strong labial cuticle, but no labial armature.

The second specimen is a magnificent example of the animal. It is 137 mm. long, 84.5 broad, and 42.5 high. The mantle-margin is about 20 mm. wide and 7 thick. The foot is long and broad (76 mm.), and just covered by the mantle. The colour, above and below, is a uniform orange yellow. The under parts are very soft and flaccid. The anterior margin of the foot is distinctly grooved. There is a rent in the middle, and it is impossible to say whether there was a natural notch or not. The dorsal surface is much harder, with an almost scaly feeling. The back is moderately arched, and covered with large flat warts, of which the biggest are circular and measure about 9 mm. across. They are arranged in five rather irregular rows. Between them are smaller and lower warts. Outside these large warts are others, very numerous, extending right down to the mantle-edge, and decreasing gradually in size outwards. They are softer than the central warts, but higher, and sometimes quite pointed. Possibly the back has been flattened by accidental pressure. The edge of the mantle is undulated. The openings of the rhinophores and branchiæ are only slightly prominent, crenulate, but not tuberculate or stellate.

The branchiæ are seven, tripinnate, and sometimes quadripinnate, not very large, considering the size of the animal, but much ramified. The anal papilla is subcentral.

The internal organs are not very well preserved, and have been severely injured by two glass skewers which have been driven through the animal, apparently to preserve its form.

The blood-gland is large and much branched. In the central nervous system the common commissure is remarkably large and thick, but, considering the size of the animal, the eyes, which are

black, are very small. The ganglia are injured, but appear to be as in *Archidoris*.

There is a very strong labial cuticle covering a hard muscular ring, but not containing any trace of a labial armature. The hinder part of the radula has been injured. The portion remaining is 14.5 mm. long and 15.5 broad. It consists of 44 rows, containing about 75 teeth on either side of the bare rhachis. The front rows are of a dark mahogany colour, those behind somewhat lighter. As in the type-specimen, the rhachis has two or three longitudinal folds, but is proportionally not so wide. The inner and outer teeth of each row are smaller than those in the middle. The innermost tooth of each row projects almost at right angles into the rhachis; it is low, often irregularly shaped, but not denticulate. The teeth are simply hamate; the outermost smaller, but not degraded.

The salivary glands are large, 40 mm. long when stretched out, and 5 mm. wide at the thickest part. They are tapering, simple, and not at all ramified. The liver has a deep cleft in front, in which lies the stomach. It is laminated internally, and full of what appear to be fragments of a grass-like seaweed.

The reproductive organs are very much injured. The verge and vagina appear to be as in *Archidoris*, and not armed. The vas deferens is much convoluted. Lying with the other organs, but detached from them, is a long greyish gland, which may be a prostate. If so, the animal is referable to Bergh's genus *Anisodoris*. I am not, however, myself of opinion that the mere presence or absence of a prostate is sufficient to divide otherwise similar forms into separate genera.

NOTES ON TWO RARE BRITISH NUDIBRANCHS, *HERO FORMOSA*,
VAR. *ARBORESCENS*, AND *STAURODORIS MACULATA*.

By Sir C. N. E. ELIOT, K.C.M.G.

Read 13th January, 1905.

I. *HERO FORMOSA*, VAR. *ARBORESCENS*, VAR. NOV.

Hero formosa, Lovén, G. O. Sars : Moll. regionis arcticæ Norvegiæ, p. 316, pl. xxviii, figs. 3a-3d; Bergh, Semper's Reisen, Heft vii, p. 310; Verhandl. zool.-botan. Gesell. Wien., vol. xxxviii, p. 699, pl. xix, figs. 9-11; pl. xx, figs. 1, 2 (1888); Vayssière, Ann. Mus. Marseille, vol. iii, p. 88 (1888).

Hero is a somewhat aberrant genus of the Æolidiidae, differing from all the others in having branched cerata, one pair of which is situated on the frontal margin before the rhinophores. The radula is triseriate. The known species are confined to the North Atlantic and Mediterranean. Bergh (Syst. Nud. Gast., Semper's Reisen, Heft xviii, p. 1037) gives four, but of these *H. Mediterranea* (Costa) appears to be founded on a misprint. Costa, in the Ann. del Mus. Zool. della R. Univ. di Napoli, 1866, p. 41, gives, in a list of fauna, "*Cloelia* (a synonym of *Hero*) *Mediterranea*, Nob. Golfo di Napoli, I.," but on p. 90 of the same publication, under the heading "Alcune correzioni ed aggiunzioni," we read, "pag. 41, verso 12, *Cloelia*, leggi *Tenellia*." The species, therefore, is not a *Hero* at all, but the *Tenellia Mediterranea* described by Costa in the same paper, which is perhaps an *Embletonia*. *Hero fimbriata* is the *Doris fimbriata* of Vahl (Müller, Zoologia Danica, 1788, vol. iv, p. 22), described as "*Doris flavescens, pedicellis dorsi apice fimbriatis*," and depicted on pl. cxxxviii, fig. 2, which represents a yellow and pinkish animal, with slightly branched processes on the sides of the back and frontal veil. It seems to me to be a *Tritonia* or *Marionia*.

Two valid species are known—*H. formosa*, Lovén, from the Northern Atlantic, and *H. Blanchardi*, Vayssière, from the Mediterranean. The former is yellowish white, with opaque white lines and spots; both the frontal and the lateral papillæ are ramose, and the central tooth of the radula has three or four denticles on each side. *H. Blanchardi* is yellowish, with red papillæ; the frontal papillæ are ramose, but those at the sides of the body are small, and either entire or simply bifid; the central tooth of the radula has five denticles.

I have received from St. Andrews three specimens which seem to constitute a well-marked variety of *H. formosa*, possibly meriting

specific rank. The colour is a uniform dirty but semitransparent white, with no trace of opaque white lines or spots, though they may have been destroyed by alcohol.

The hepatic diverticula are yellowish. The general appearance suggests a nearly circular piece of white, branched seaweed. Including the cerata, the largest specimen is 9 mm. long and 8 broad. The largest cerata are 4.5 mm. high and 3 wide at the top. The body is an isosceles triangle, 7.5 mm. long and 4.3 broad at the widest part in front. Besides the two frontal appendages, one specimen has six papillæ behind the rhinophores on each side of the body, and two have five. The genital opening is under the first of these papillæ, and the vent under the second. The largest and most elaborately developed papilla is the second or third. Its main trunk is divided into four branches, each of which is subdivided four times, and on the tip of each subdivision are four points, which, however, are not completely developed in all instances. The hepatic ramifications correspond with all these ramifications of the papillæ. The other papillæ are arranged on much the same plan, but are less complete, and the primary divisions are only two or three. The hindermost papillæ are small and rudimentary. The frontal appendages are like the papillæ, but simpler; the main axis is bifid; next come three or four subdivisions, and then three or four points. Like the papillæ, they contain ramifications of the liver.

The rhinophores are much contracted, and seem to me perfoliate. Bergh gives, as a generic characteristic, *rhinophoria simplicia*, but in describing *H. formosa* (Semper's Reisen, Heft vii, p. 311) calls them "stark kreisförmig gerunzelt." Really simple rhinophores, however, sometimes simulate perfoliation, when contracted by the preserving fluid. The oral tentacles are large, flat, and curved backwards. The foot is straight in front, with ample but not tentaculiform corners. The side-margins are expanded so that the ventral surface is broader than the back, which is flat.

The jaws are large, but thin and transparent. The cutting edge bears a line of very irregular denticles, which show some traces of being arranged in two rows. In the single specimen dissected the radula consisted of 62 triseriate rows. The laterals are as depicted in Bergh's plates, consisting of a moderately broad basal part, from which rises a pointed but hardly hooked spine. The central plates are of the horse-shoe shape, with a longish median cusp, and, on each side, three very strong denticles, the first pair of which are nearly as large as the central cusp.

I have compared with these specimens two others from Plymouth which I believe to represent the typical *H. formosa*. They have a general resemblance to *Tritonia* in shape, and the papillæ are of moderate size. They appear to be formed by a process of repeated bifurcation, but, as the secondary branches are close to the primary, the arrangement might be described in some cases as quadrifid. The frontal papillæ are similar to those at the sides of the body. The colour is a beautiful transparent white. Along each side runs an opaque white line, with a few opaque white spots, and a similar

line runs down the centre of the back, also accompanied by spots and sending off rather irregular branches to the lateral papillæ. There are six of these papillæ, besides the frontal pair. The rhinophores are quite smooth.

The largest specimen is bent, and measures 12 mm. from head to tail, equivalent to at least 15 mm. if it were straightened out. The largest papillæ are 6 mm. high, and the width, measured across from the outermost tips on one side to the other, only 5 mm. The radula consists of 50 rows. The central teeth bear four denticles, on each side of which the fourth is smaller but rarely absent.

The other characters are as in the St. Andrews specimen. These latter differ from the typical form in having a different coloration (as preserved), larger and more elaborately ramified cerata, and only three denticles on the central tooth. Provisionally I describe them as merely a variety, *arborescens*, as it is impossible to be certain of the colour in the living animal; the development of the cerata is merely a matter of degree, and the number of denticles may prove not to be constant. Bergh describes them as varying from two to four. But if the three characters given above are found to be constant and concomitant, they warrant the creation of a new species.

II. STAURODORIS MACULATA (Garstang).

Doris maculata, Garstang: J. Mar. Biol. Assoc., vol. iv, p. 167 (1896).

? = *Staurodoris pseudoverrucosa*, v. Ihering: Jahrb. deutsch. Malac. Gesell., 1886, p. 233.

? = *Doris eubalia*, Fischer: Journ. de Conch., 1872, p. 10.

Through the kindness of Mr. Allen, Director of the Marine Laboratory at Plymouth, I have been allowed to examine two fine specimens of this interesting form, dredged north of the New Ground buoy in June last. The measurements are as follows in millimetres:—

| | Length. | | Breadth. | | Height. |
|-----|---------|-----|----------|-----|---------|
| (1) | 35 | ... | 19 | ... | 16 |
| (2) | 34 | ... | 20·5 | ... | 17·5 |

The texture is rather stiff, and the colour uniform pale yellow. There is no note as to the appearance of the living animals, but they were presumably as described by Garstang, bright yellow with purple tubercles and ridges.

The body is high and arched; the mantle descends to the ground all round, touching the edges of the foot. The back is covered with a reticulate pattern formed of tubercles and ridges. The tubercles are large knobs, sometimes rising into a kind of peak, but not clavate or constricted at the base. They are connected, in all possible directions, by ridges of varying elevation and distinctness, and the rectangular fields thus formed are traversed by lower irregular ridges, some of which show signs of developing incipient tubercles. The arrangement of the main ridges and tubercles is not very regular, but there are three fairly distinct rows down the middle of the back, and at the sides two others less distinct. Outside all these rows are

a quantity of smaller tubercles on the mantle-margin, not clearly connected by ridges, and specially numerous and crowded over the head. In both specimens there are three large tubercles between the rhinophores. The dorsal integuments are full of small spicules, which are not, however, visible to the naked eye, as in some allied forms.

The rhinophores are yellowish, large, thick, and closely perfoliate. The pockets are protected by two large tubercles, one on each side.

In both specimens the branchial pocket is entirely closed by about eight tubercles which meet over it, and, in both, the branchiæ are five in number, stout, bipinnate, and in some parts imperfectly tripinnate. There is no doubt about this character, although Garstang describes them as simple pinnate plumes, but it is quite possible that they may vary in different specimens, and that this variation may take the form of increased ramification, as the size of the whole animal increases. The anal papilla has a crenulate edge, and rises a little behind the centre of the branchiæ.

The foot is nearly as broad as the body, and has expanded lateral margins. It is grooved in front, with a slight notch in the upper lip. The mouth is small, and on each side of it is a flattish tentacle.

On the labial cuticle are two small patches of white rods, not combined into a plate, not bifid, straight or slightly curved in the centre. These patches are much more distinct in one specimen than in the other. Vayssière (Ann. Mus. Hist. nat. Marseille, vol. vi, p. 20) mentions that *St. verrucosa* has "deux taches brunâtres" on the cuticle, representing the rudiments of jaws.

The radula consists in one specimen of 37, in the other of 40 rows, with fragmentary remains of three or four others in front. In both there are at most 75–80 teeth on each side of the rachis. The teeth are simply hamate, with rather blunt tips. They show no trace of serrulation. Those at the inside and outside are smaller than the others, and the two or three outermost are irregular and rudimentary. There are two large, reddish-yellow salivary glands. The stomach lies wholly outside the large, yellowish hepatic mass, and its interior is strongly laminated. The gall-bladder is large.

The blood-gland is white, distinct, and in two divisions, of which the posterior is larger. The central nervous system is as in Bergh's plates of *St. ocelligera* (Semper's Reisen, Suppl., Heft ii, 1881). The eyes are large and black.

The reproductive system is much as in *St. verrucosa*. The retracted, muscular verge bears some reddish spots, which do not, however, appear to be thorn or scale-like growths. The larger spermatheca measures 5.5×4 mm., and is yellow; the smaller 2×1.5 mm., and is reddish. The mucous gland is large and yellowish white; the albumen gland smaller and deep yellow.

I think this form can be safely referred to *Staurodoris*. This genus is well characterized in its typical forms, but passes on the one hand into *Archidoris*, and on the other becomes very similar to *Halgerda* and *Dietyodoris*. The present specimens are not unlike the animal described by me as *Halgerda Wasinensis* (Proc. Zool. Soc., 1903, vol. ii, p. 373), but the pockets of both the rhinophores and branchiæ are

protected by tubercles, and the foot is broad. In fact, they differ from the typical *Staurodoris* only in having bipinnate branchiæ, and Garstang describes these organs as being simply pinnate in the smaller individuals. The ridges connecting the dorsal tubercles are found in *St. pseudoverrucosa*, von Iher., *St. d'Orbigny* (Gray), and sporadically in *St. verrucosa*.

It is possible that the *Doris eubalia* of Fischer (l.c.), from Arcachon, is the young of this species. It has the same striking coloration and simply pinnate branchiæ, like the small specimens, but no ridges connecting the tubercles are mentioned. They may perhaps be developed later. Bergh refers *D. eubalia* to *Lamellidoris*, no doubt because Fischer says it has no oral tentacles, but wide rounded buccal lobes. But, though Fischer's description is inadequate, he expressly says that the branchiæ are retractile.

It is also possible that *St. maculata* may be von Ihering's *St. pseudoverrucosa*, from Naples, which has conical dorsal tubercles connected by ridges, five bipinnate branchiæ, but no tubercles on the branchial pocket. The absence of the latter in von Ihering's specimen might be explained as an individual anomaly, but his remark "Das Thier gleicht äusserlich der *St. verrucosa*" is unfavourable to the identification, as the specimens sent me from Plymouth are not at all like those of *St. verrucosa* from Naples.

DESCRIPTION OF A NEW SPECIES OF *ACHATINA* FROM THE ZAMBESI.

By H. B. PRESTON, F.Z.S.

*Read 13th January, 1905.**ACHATINA MORRELLI*, n.sp.

Shell elongate, yellowish white, irregularly painted with broad reddish-brown flame-markings and blotches, a thin white line appearing below the suture; transversely sculptured with closely-set ridges, crossed by spiral striae, presenting a cancellated appearance, except on the lower half of the body-whorl, where the sculpture becomes obsolete; whorls 9-10; spire somewhat slender; suture impressed; aperture inversely auriform; peristome simple, a dark band about 2 mm. broad extending into the interior of the shell;



columella slightly curved outwards, extending into a slight callosity which reaches the lip above. Alt. 63.5, diam. maj. 25 mm.; aperture, alt. 26, diam. 10 mm.

Hab.—Changa Changa, Lusempha Valley, about 100 miles north of Zumbo on the Zambesi River.

This species appears most nearly to approach *A. glaucina* (Ancy), Smith,¹ from Zomba on the Shiré River, but differs from that species in possessing an additional whorl, in its more slender spire, the whorls being less convex, and in the shape of the aperture, the parietal side of the whorl bulging further into the opening; moreover, the distinct flame-markings readily distinguish it from *A. glaucina*.

¹ Proc. Zool. Soc., 1899, p. 590, pl. xxxiv, figs. 2, 3.

MALACOLOGICAL SOCIETY OF LONDON.

INCOME AND EXPENDITURE FOR THE YEAR ENDED 31st DECEMBER, 1904.

| Dr. | £ s. d. | Cr. | £ s. d. |
|---|-----------|------------------------------------|-----------|
| To Balance from last year | 35 2 0 | By Cost of "Proceedings"— | |
| Annual Subscriptions— | | Printing and Postage | £75 12 2 |
| Ordinary Members | £41 9 6 | Illustrations | 42 9 2 |
| Corresponding Members | 19 16 2 | | 118 1 4 |
| Annual Subscriptions in arrear— | 61 5 8 | Printing Circulars, etc. | 2 13 6 |
| Corresponding Members | 1 17 6 | Postage | |
| Annual Subscriptions in advance— | | Linnean Society— | |
| Ordinary Members | £2 2 0 | Electric Lighting | £1 1 0 |
| Corresponding Members | 2 11 0 | Gratuities to Attendants | 2 10 0 |
| Entrance Fees | 4 13 0 | | 3 11 0 |
| Sale of "Proceedings" | 2 12 6 | Lantern Operator | |
| Dividends on £50 Metropolitan 2½% Stock | 16 0 7 | Sundry Expenses— | |
| Donations for Illustrations | 25 16 6 | Secretary | £2 12 9 |
| Advertisement Receipts | 5 5 0 | Amounts refunded | 1 12 6 |
| | £153 17 9 | Balance in hand | |
| | | | £153 17 9 |

We have this day examined the accounts of the Treasurer of the Malacological Society of London, and we find the above statement to be correct.

JOHN H. PONSONBY, Hon. Treasurer.
January 20th, 1905.

Auditors { HENRY WOODWARD.
 WILFRED BENDALL.

ANNUAL GENERAL MEETING.

FRIDAY, 10TH FEBRUARY, 1905.

E. R. SYKES, B.A., President, in the Chair.

The President referred to the recent death of Professor George Bond Howes, F.R.S., a past President of the Society, and it was resolved that a message of condolence should be sent to Mrs. Howes, in which the Society might give expression to its sense of the deep loss suffered by Biology.

Mr. H. Fulton and Mr. F. G. Bridgman were appointed scrutineers.

The following report was read:—

“Your Council, in presenting their twelfth Annual Report, are able once more to record a year of satisfactory progress.

During the past twelve months four new members have been elected. On the other hand, seven have been lost to the Society—two by death, Dr. C. E. Beecher and Professor E. von Martens, two by retirement, and three by the action of Rule X.

The membership of the Society on December 31st, 1904, stood as follows:—

| | | | | | | | |
|-----------------------|-------|-------|-------|-------|-------|-------|-----|
| Ordinary members | ..... | ..... | ..... | ..... | ..... | ..... | 88 |
| Corresponding members | ..... | ..... | ..... | ..... | ..... | ..... | 75 |
| | | | | | | Total | 163 |

At the end of the year 1903 the total membership was 165, and of 1902, 168.

The finances of the Society are in a thoroughly sound condition. After payment of all liabilities there is a balance of £24 2s. 2d. in the Treasurer's hands, whilst the sum of £50 still remains invested in Metropolitan 2½ per cent. Stock.

Since the last Annual Meeting the first three numbers of Vol. VI of the ‘Proceedings’ have been issued, consisting of 182 pages and illustrated with 10 plates and 80 figures in the text.

The thanks of the Society are due to the following members, who have defrayed part of the cost of illustration, or have gratuitously furnished drawings for reproduction:—Rev. R. Ashington Bullen, R. H. Burne, S. I. Da Costa, Lieut.-Colonel H. H. Godwin-Austen, G. K. Gude, J. C. Melvill, J. H. Ponsoby, H. B. Preston, E. A. Smith, I.S.O., G. B. Sowerby, H. Suter, and E. R. Sykes. Without this generous assistance the Society would not be in a position to issue such a fully illustrated publication.

Further, the thanks of the Society are specially due to the Council of the Linnean Society, through whose kindness it has been permitted, as in previous years, to hold its meetings in Burlington House."

On the motion of Mr. S. I. Da Costa, seconded by Capt. Peile, the above was adopted as the Annual Report of the Society.

The Treasurer presented the statement of income and expenditure for the past year. This was passed on the motion of Mr. Da Costa, seconded by Capt. Peile.

The following were elected as Officers and Council for the year 1905 :

President.—E. R. Sykes, B.A., F.L.S.

Vice-Presidents.—Sir C. N. E. Eliot, K.C.M.G. ; Professor W. A. Herdman, F.R.S. ; B. B. Woodward, F.L.S. ; Henry Woodward, LL.D., F.R.S.

Treasurer.—J. H. Ponsonby, F.Z.S.

Secretary.—R. H. Burne, B.A., F.Z.S.

Editor.—E. A. Smith, I.S.O.

Other Members of Council.—W. T. Blanford, C.I.E., LL.D., F.R.S. ; S. I. Da Costa ; J. Cosmo Melvill, M.A., F.L.S. ; R. Bullen Newton, F.G.S. ; Rev. Canon Merle Norman, D.C.L., F.R.S. ; W. G. Ridewood, D.Sc., F.L.S.

The President delivered an address upon "Variation (including Teratology) among Recent Mollusca." On the motion of Dr. Henry Woodward, seconded by Mr. J. Cosmo Melvill, a vote of thanks was passed to the President for his address.

On the motion of Mr. G. K. Gude, seconded by Mr. H. Burnup, a vote of thanks was passed to the Retiring Members of Council, and to the Auditors and Scrutineers.

During the meeting the following specimens bearing on the subject of the Presidential Address were shown :—

By the President, on behalf of Mr. R. Welch : A series of specimens of *Helix nemoralis*, illustrating variation and left-handedness, and two reversed specimens of *Helicella Itala* from Bundoran ; also other varieties of British land and fresh-water shells.

On behalf of Mr. A. G. Stubbs : A very remarkable series of deformations of *Planorbis spirorbis* and other fresh-water species, all collected in the same ditch, near Tenby.

On behalf of Mr. J. R. Le B. Tomlin : Three reversed specimens of *Helicella Itala* from Bundoran, and a long series of shells of *Helix nemoralis* (over two hundred) from the same locality, illustrating variation ; also two specimens of *Helix aspersa* grown together.

On behalf of Mr. Dautzenberg : A series of reversed specimens of land and fresh-water shells, including twelve species of *Helix* and examples of several other genera.

On behalf of Mr. E. A. Smith, I.S.O. : Dextral and sinistral specimens of *Littorina litorea*.

On behalf of Mr. R. Standen : Reversed specimens of *Helix Pisana*, *H. pomatia*, *H. aspersa*, *H. nemoralis*, *H. hortensis*, *Helicella virgata*,

Helicigona arbustorum, and *Limnaea stagnalis*, together with distortions of other land-shells.

By the President: A series of *Buccinum undatum* illustrating variation in size, shape, and sculpture, left-handedness, and duplication of the operculum, sinistral specimens of *Marginella*, *Gibbus*, and *Helix*, as well as distorted examples of *Littorina litorea* and colour varieties of *Helix picta*.

By Mr. G. K. Gude: Varieties of *Helix aspersa* from various parts of the world. Specimens of *Euhadra peliomphala*, *E. Luchuana*, and *E. quesita*. Sinistral forms of *Helicella virgata*, *H. Cantiana*, and *Helix pomatia*. Specimens of *Helicigona arbustorum* with corroded peristome.

By Mr. F. G. Bridgman: Specimens of the genus *Oliva*, showing colour variation.

By Rev. R. Ashington Bullen: An abnormal example of *Neritina pupa*.

By Mr. S. I. Da Costa: A coloured variety of *Pecten niveus*. A specimen of *Burtoa Arnoldi*, with eggs, from the Zambesi, and of *Burtoa Nilotica*, var. *crassa*, from Mashonaland.

By Mr. R. Bullen Newton: Specimens of *Distorsio* from the Upper Tertiary of Italy. Shells of this genus show constant irregularities in the form of the spire.

By Capt. Peile: Distorted specimens of *Euchelus*. Varieties of *Purpura carinifera* and of *Ariophanta laxipes*, *Cypræa pallida*, and other genera.

By Mr. A. S. Kennard: A sinistral example of *Helicigona arbustorum* from Uxbridge. Fossil and recent specimens of *Pisidium amnicum* showing mended fractures.

By Mr. J. Cosmo Melvill: A reversed variety of *Acavus hæmastoma*; a monstrous form of *Conus arenatus*, with conspicuously turreted spire; a distorted example of *Cypræa stolidus*; and a specimen of *Oliva gibbosa*, var. *mediocincta*, Melv.

ORDINARY MEETING.

FRIDAY, 10TH FEBRUARY, 1905.

E. R. SYKES, B.A., President, in the Chair.

ORDINARY MEETING.

FRIDAY, 10TH MARCH, 1905.

E. R. SYKES, B.A., President, in the Chair.

The following papers were read :—

1. "On a Dibranchiate Cephalopod, *Styracoteuthis orientalis*, from the Eocene of Arabia." By G. C. Crick, F.G.S.
2. "Note on the Horizon and Locality of the Type-specimen of *Pleuromutilus pulcher*." By G. C. Crick, F.G.S.
3. "Descriptions of seven new Marine Mollusca from the Collection of the late Admiral Keppel." By G. B. Sowerby, F.L.S.
4. "On the occurrence of Internal Septa in *Glyptostoma Newberryanum*." By G. K. Gude, F.Z.S.
5. "Note on a Dart found in the Body-cavity of *Helix aspersa*." By R. G. Barnes.

The following specimens were exhibited :—

By Miss Foster : A collection of shells from Warwickshire, including some extremely thin examples of *Anodonta*.

By Mr. E. A. Smith, I.S.O. : Living specimens of Littorinidæ from Cuba.

By Mr. E. R. Sykes : A series of Ormer shells (*Haliotis*) showing variation in the number of holes, including specimens with from four to eight holes.

By Mr. A. G. Stubbs : Drawings of the shells of British molluscs.

ORDINARY MEETING.

FRIDAY, 14TH APRIL, 1905.

E. R. SYKES, B.A., President, in the Chair.

The following papers were read :—

1. "Anatomical and Systematic Notes on *Dorcasia*, *Trigonephrus*, n.gen., *Corilla*, *Thersites*, and *Chloritis*." By Prof. Henry A. Pilsbry.
2. "Some account of the Anatomy of *Cassidaria rugosa*." By Alexander Reynell.
3. "Notes on a small collection of Shells from the Victoria Falls, Zambesi River, with descriptions of new species." By H. B. Preston, F.Z.S.
4. "Descriptions of six new species of Land Shells from South Africa." By Henry C. Burnup.

The following specimens were exhibited:—

By R. H. Burne: Tracks made by a snail (*Helix aspersa*) when feeding on a lichen-covered piece of wood.

By E. R. Sykes: A large series of varieties of *Nerita Rumphii*, Récluz.

By Mr. A. S. Kennard: Common land-shells (*Helix aspersa*, *H. arbustorum*) taken from crevices in the lower parts of a Roman wall. The specimens were found two feet below the surface of the ground.

OBITUARY NOTICES.

THOMAS GEORGE BOND HOWES, LL.D., D.Sc., F.R.S., who ably officiated as President of this Society during the years 1895 and 1896, died on February 4th last, at his residence at Chiswick, aged 57. Professor Howes, although not a specialist as a malacologist, had a considerable knowledge of the general anatomy of Mollusca, so that in this respect he was always of great service in the discussion of such anatomical subjects as came before the meetings of the Society. The able reviews of the current work on malacology which he delivered, as presidential addresses, will be well remembered by all those who were present on those two occasions, or who have since read them, as masterly compositions, teeming with information and instructive criticism, and which must have entailed enormous labour and research.

The greater part of Professor Howes' scientific career was passed at the Royal College of Science under his beloved master Huxley, after whose death he was appointed in 1895 Professor of Zoology. He also held many other scientific appointments. At one time he was Lecturer on Comparative Anatomy at St. George's Hospital Medical School. He was also a Vice-President and Member of the Council of the Zoological Society, honorary secretary of the zoological section of the Linnean Society, President of Section D of the British Association at Belfast in 1902, Examiner in Zoology to the University of London and other institutions, honorary member of the New Zealand Institute, corresponding member of the New York Academy of Science, etc. In 1897 he was elected Fellow of the Royal Society.

Professor Howes was essentially a teacher and lecturer. His mastery of detail was surprising, and a fault, if it could be regarded as such, was the enormous mass of facts which crowded his addresses, showing the vast amount of reading and study which he had devoted to their preparation. Nothing seemed too minute in detail to him to be passed over, and this completeness was a marked character of his researches. Perhaps the bulk of his writings may not be great, but many of his memoirs were important contributions to science, adding much to his repute as an accomplished and original investigator. Apart from his loss to the scientific world, his death must be deplored very deeply by all those who had the privilege of knowing him personally. He was exceptionally charming and kindly in disposition, and ever ready to assist anyone who was desirous of consulting him for advice and assistance.

E. A. S.

Professor Dr. CARL EDUARD VON MARTENS, a member of this Society since the year 1893, died last year, on August 14th, aged 73. He was born at Stuttgart in 1831, and studied both medicine and natural history. He was appointed assistant in the Zoological Museum of the Berlin University in 1855, with which institution he was connected for fifty years. In 1859 he became attached to the Museum für Naturkunde in Berlin, of which he eventually became second Director, and in recent years he was honoured with the rank of Privy Councillor.

In 1860 he accompanied the Prussian expedition to Eastern Asia in the "Thetis," visiting Japan, China, Siam, Java, and Celebes. He also explored the Sunda Islands. On his return to Europe he worked out the collections obtained during the expedition, and published the results in two volumes, constituting the Zoologischer Theil of the "Preussische Expedition nach Ost-Asien." Vol. ii, consisting of 447 pages and 22 plates, contained a very full account of the land molluses.

Other important works written by Martens are:—(1) his report on the land and fresh-water Mollusca in the "Biologia Centrali-Americana," occupying 706 pages and illustrated with 44 plates; (2) the molluscan portion in Möbius's "Beiträge zur Meeres Fauna der Insel Mauritius und der Seychellen," 168 pages and 4 plates (1880); (3) "Beschalte Weichthiere Deutsch-Ost-Afrikas," 308 pages and 7 plates (1897); (4) monographs of the genera *Nerita*, *Neritina*, and *Navicella*, in the Conchylien Cabinet, 506 pages and 48 plates; (5) "Conchologische Mittheilungen," 3 vols., 232 pages and 48 plates; (6) "Die Binnenmollusken Venezuela's," 68 pages and 2 plates (1873); (7) "Vorderasiatische Conchylien," 127 pages and 9 plates (1874); (8) Mollusca in Max Weber's "Zoologische Ergebnisse," vol. ii, 52 pages and 3 plates; vol. iv, 331 pages and 12 plates (1897); (9) Mollusca of the Deutschen Tiefsee Expedition, 1898-99, vol. vii, 146 pages and 5 plates.

In addition to these more extensive memoirs, Martens wrote over 200 separate papers in scientific publications, many of them being of the greatest utility to the systematist.

Besides his work on Mollusca, Martens wrote upon all branches of zoology, but especially upon Crustacea and Echinoderms. He was a most excellent correspondent and spared no trouble in giving information and answering difficult questions, and in this respect he will be a great loss to many. Although personally unknown to most English conchologists, we have been assured by those who had the pleasure of his acquaintance that he possessed a most kind and charming manner.

With regard to the merit of Martens' conchological work, its excellence is so universally admitted that no further comment or recognition of its value becomes necessary.

E. A. S.

PRESIDENTIAL ADDRESS.

VARIATION IN RECENT MOLLUSCA.

By E. R. SYKES, B.A.

Read 10th February, 1905.

VARIATION in Zoology consists of the differences seen in animals, and may be divided into two branches: the series under observation is called continuous, where we pass from one form to another by imperceptible gradations, or the term discontinuous is used, where there are marked gaps.

Too much stress cannot be laid upon the importance of the subject, and a true appreciation thereof is necessary both to the morphologist and the systematist, while to the student of evolution it is the foundation of his work. It is of special interest to the systematist, since, without some knowledge of it, he is unable to properly utilize the unit of his classification, a species; and, indeed, he is frequently in ignorance of what a species and its true limits may be. For instance, *Pisidium sinuatum*, Brgt., is only an ordinary species with a sinuous margin; *Calyptrea spirata* is said to be a variation of *C. Chinensis* which has taken its form owing to living in mud, where its sole attachment is to *Turritella*; *Ampullaria Brohardi* and *Voluta Brazieri* are probably only monstrosities; while those curious distortions found in *Planorbis* have had nearly a dozen unnecessary specific names. There is in the British Museum a specimen of *Nautilus* which, viewed from one side is *pompilius*, while if it be examined from the other side it appears to belong to *stenomphalus*.

Again, the student of evolution desires to know how far the forms seen to-day are constant, or in what manner they are affected by that ever-present law of Nature, variation, progressive or retrogressive, as it may be. It has been strongly urged that amongst the Achatinellidæ, for example, new species have been formed, and old ones have died out, even in recent years. Generations of molluscs succeed one another very quickly, and change of surroundings is liable to have a speedy effect. These changes are taking place very rapidly at the present day. In Saint Helena the bulk of the land fauna is extinct, owing to the destruction of the trees, and similar conditions threaten many other oceanic islands. In North America it has been noticed¹ that some of the woodland shells have been compelled to change their habits and live in the open country.

I would not suggest that every trifling variation be endowed with a separate name, since that course must prove the road to chaos, but

¹ Billups: *Nautilus*, vol. xvi, p. 112.

well-marked variations, especially such as are found isolated from the normal form, are worthy, not only of being placed on record, but also of figuring in nomenclature.

The desirability of these variations being noticed in our literature is well illustrated by a reference to the specimen of *Fistulana* piercing *Mitra*, recently described in our *Proceedings*. This was treated by us all as a hitherto unknown occurrence, but it may be mentioned that there is a specimen of *Fistulana* in the British Museum, collected so long ago as the days of Belcher, which has pierced in precisely the same manner through a valve of one of the *Veneridæ*.

The uses of the variations seen are but little known; but as an illustration of the utility of spines it may be stated that François¹ noticed that *Murex fortispina* could open, and did, in fact, open the valves of *Arca* by means of the tooth-like process on the outer lip.

Variation is as well-marked and as striking a fact in Palæontology as in Recent Zoology, but owing to the vastness of the subject I have confined myself to-night to a very brief outline of some facts presented by recent molluscs, and a few suggestions made relative thereto, one or two points being specially dwelt on.

I have not attempted, as I had at first proposed, to give full references for every fact mentioned, or the following pages would have in the main borne the aspect of a bookseller's catalogue; it must, however, be taken that the work is, as such work must be, a compilation from the labours of others.²

Hybridism in the Mollusca seems to have been but little studied. It has been noticed (in captivity) in *Limnea*. Hartman states³ that in *Partula* hybrids are common amongst some species and rare in others, those observed being usually the offspring of proximate species. He suggests that as *Partula* is hermaphrodite they may produce fertile hybrids, and throws out the conjecture that it is possible that some forms of the genus may have so arisen. The occurrence is also said to have been observed between several *Helices*, *Rumina decollata* and *Helix*, *Pyramidula rotundata* and *Vitrea lucida*, *Clausilia papillaris* and *Pupa cinerea*, *Littorina rudis* and *L. obtusata*, *L. rudis* and *L. litorea*. Furtado⁴ collected in the Azores ten specimens of *Vitrina*, and in every one the reproductive organs were lacking; from this and the appearance of the shell he suggested that they might be hybrids, and he cites similar suggestions which had been thrown out with regard to *Buliminus* and *Zonites* (*Hyalinia*) from those islands. In this connection we may also mention the statement⁵ that the interbreeding of French and Algerian races of *Rumina decollata* is said to have produced a new variety with a dentiform callosity in the aperture.

¹ Arch. Zool. Exper., vol. ix (1891), pp. 240-242.

² At the request of several members a number of references have now been added, but no attempt has been made to render them complete.

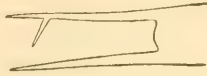
³ Bull. Mus. Comp. Zool., vol. ix, p. 173.

⁴ Ann. Nat. Hist., ser. v, vol. ix, p. 397.

⁵ Gassies: Journ. Conchyl., vol. ii, p. 356.

Abundant instances of discontinuous variation are found in studying the animal. For example, double and even quadruple monstrosities are found in the embryo in *Limax* and *Planorbis*; double also in *Philine*.¹

Deformation and variation of the eyes and tentacles are by no means uncommon. The tentacle and eye can be renewed, but this can only be done if the supra-pharyngeal ganglion is uninjured.² *Patella vulgata* has been seen with two tentacles and two eyes on the left side, the right being normal; *Nassa* with two eyes on the right-hand tentacle; *Littorina* and *Clausilia bidens* with a similar character; while in *Pecten* one eye has been observed imperfectly divided into two, the division being at right angles to the mantle-edge. Duplication of the extremity of the tentacle has been observed in *Helix lapicida*, the nerve being equally divided, and bifid tentacles have also been observed in *Nacella acnea*, *Littorina*, *Limnaea*, *Ancylus*, *Physa*, and *Helix*. *Triopa clariger*, again, has been examined with the upper tentacles, or rhinophores, abnormal owing to the right-hand one being divided into three branches. A specimen of *Submarginula* was found bearing upon



Cyclophorus, with bifurcate tentacle. (Sketch by Capt. A. J. Peile.)

each of the eye-projections two eyes in place of one, the tentacles being dwarfed. Adherent tentacles, attached throughout except for a slight cleft at the end, are noted in *Helix hispida*, and a somewhat similar case has been observed in *Limax agrestis*. *Limax levis* has been observed without any tentacles at all. Perhaps, however, the most interesting case is that recorded by Moquin-Tandon, namely, a double-headed *Limnaea auricularia*, one head being a third larger than the other. In the larger head the tentacles, eyes, mouth, etc., were normal, but in the smaller the left tentacle was dwarfed and had no eye.

Like the other organs, the radula is liable to vary.³ It has been shown that there is often an increase in the number and size of teeth and some variation in their form as the animal becomes older (*Hyalinia* and *Limax*). Age, however, affects many anatomical features as well as conchological; for example, the number of plicæ in the gills of Pelecypods is greater in the adult than in the young. Deformation of the teeth of the middle row of the radula has been noticed in *Helix*

¹ Lacaze Duthiers: Arch. Zool. Exper., vol. iv, p. 482.

² Cf. Fischer: Journ. Conchyl., 1864, p. 89; 1856, p. 230; 1888, p. 131. Forbes & Hanley: Brit. Moll., vol. iv, p. 288. Jeffreys: Brit. Conch., vol. iv, p. 350. Van den Broeck: Ann. Soc. Mal. Belg., vol. v, p. 29. Roberts: Sci. Gossip, vol. xxii, p. 259. Pelseneer: Res. Voy. Belgica, Mollusca.

³ See Binney: Bull. Mus. Comp. Zool., vol. v, p. 337. Jickeli: Nachrbl. Deutsch. Malak. Ges., 1873, p. 68. Sterki: tom. cit., p. 172. Esmark: Mag. Naturw., vol. xxvii, p. 92.

desertorum, and malformed teeth have been seen in *Leptaxis undata*, Lowe, whilst considerable variation has been noticed in *Aplysia*. Bateson¹ has collected several observations on the radula of *Buccinum*, showing that on the median plate the denticles may be as low as three in number, or as high as nine, whilst the laterals may have from three to five denticles, these latter again being sometimes unequal on both sides of the radula, i.e. four on one side and three on the other.

Of the generative organs, cases have been noticed² where the male generative organ, which should have existed, was entirely wanting (*Arion hortensis*, *Limax levis*), and in *Pupa muscorum* a specimen has been seen³ where the male organ was rudimentary and the female well developed. Whitfield⁴ noticed that the progeny of *Limnæa megasoma*, produced during confinement, exhibited changes in the soft parts, particularly diminution and disappearance of the hermaphrodite gland, which in the third generation was entirely lacking, while the female organ retained vitality, and he suggests that the atrophy of this caused the slenderer form which he noticed the earlier whorls took. The result has been also attributed to the want of sufficient and appropriate food. A case of the closing of the genital opening has been noticed⁵ in *Helix aspersa*, which has been attributed to a lack of full development. The generative apparatus of *Helix pomatia* has in one specimen been found to be divided into three entirely separate groups, and other interesting variations have been noticed.⁶ Parasitic castration in *Helix aspersa* has also been recorded.⁷

Mention should be made also of the curious specimen of *Helix nemoralis*, L., recorded by Fischer,⁸ which was furnished on the back of the foot with a fleshy cylindrical appendage, situated, when crawling, just behind the shell.

In the Pelecypods some variation has been observed in the position of the adductor muscles. Downing⁹ found in *Anodonta* that in specimens of varying ages the distance of the muscles from the umbo varied considerably in relation to their distance from the shell-margin, and suggested that perhaps the muscles moved less rapidly than the shell grew. The anterior muscle was found to move more rapidly than the posterior.

A curious specimen of *Mytilus edulis* was examined by Vayssière,¹⁰ in which the valves gaped at the far end and the mantle was largely developed, filling the cavity.

1 "Materials for the Study of Variation," p. 262.

2 Collinge, Journ. Malac., vol. xi, p. 15; and see S.B. Ges. Leipzig, 1883, p. 74.

3 Wiegmann: Jahrb. Malak. Ges., vol. v, p. 159.

4 Bull. Amer. Mus., vol. i, pp. 29-37; cf. Proc. Boston Soc., vol. xx, and Dall, Bull. Phil. Soc. Washington, vol. iii, p. 75.

5 Mangenot: Bull. Soc. Zool. France, vol. viii, p. 130.

6 Bietrix: Bull. Soc. Philom., ser. vii, vol. x, p. 74. Semper: Reisen Arch. Phil., vol. v, p. 247.

7 Garnault: Bull. Sci. Fr. Belg., vol. xx, p. 137.

8 Journ. Conchyl., vol. xxv, pp. 211-212, pl. iv, fig. 4.

9 Amer. Nat., vol. xxxvi, pp. 395-400.

10 Journ. Conchyl., ser. iii, vol. xxxix, p. 213.

Tellina incarnata has been observed with only one siphon and no labial palps.

Bloomer¹ found that in *Anodonta* the animal is able to repair even extensive damage to the mantle-lobes, but is not able to make good injuries to the gills, and that the mollusc can live and thrive with aborted respiratory organs.

Amongst Cephalopods, we may refer to a specimen of *Eledone cirrosa*, examined by Appellöf,² in which not only was the third left arm developed as hectocotylus as usual, but also the third right arm.

The operculum, we are all aware, may be present or absent in members of the same group, but it does not seem to be so generally known that it may be present or absent in the same species. Of a series of *Volutharpa ampullacea* examined by Dr. Dall, the majority were without opercula or any trace of the pad-like area from which the operculum is secreted, some had traces of this region, and others well-developed opercula. The bioperculate *Buccinum undatum* are well known, and a specimen has recently been taken off Unst.³ Clark found that every specimen of *Trochus lineatus* from one spot near Exmouth had distorted opercula, a fact which Jeffreys referred to some disease of the opercular lobe.

The epiphragm formed by many shells when aestivating deserves more consideration than it has received. It would be interesting to know how far the same form is constant in a genus, and what the explanation of those curious structures noticed in the specimens of *Thaumastus*, figured recently⁴ in our *Proceedings* by Mr. Smith, may be.

There seems to be but little relationship between the colour of the animal and that of the shell. Many colours are seen in the animals, Camerano⁵ stating that black is rare; brown, grey, yellow, white, and red, common; violet, fairly common; blue, not rare; while green is infrequent. His observations also led him to the belief that animals with strong shells were more highly coloured than those with fragile shells. All parasitic molluscs appear to be white. Age seems to have some effect, as also food, while conditions of temperature have been observed to be correlated with slug-coloration. In Germany it has been noticed that warmth either inhibits black or causes it to disappear, while exercising an opposite effect on red. *Limax arborum* has been noticed to be spotted with black on the plains and of normal coloration on the hills.⁶ In this connection a very interesting paper by Simroth⁷ should be studied. Collinge,⁸ studying the colour of the foot-fringe of *Arion empiricorum*, found extraordinary variation, which

¹ Journ. Malac., vol. vii, p. 138.

² Bergens Mus. Aarbog, 1893, p. 14.

³ Standen: Journ. Conch., vol. xi, p. 62.

⁴ *Ante*, p. 3.

⁵ Mem. Acc. Torino, vol. xxxvi, pp. 348-349.

⁶ Cockerell: Zoologist, ser. III, vol. x, p. 341.

⁷ Nachrbl. Malak. Ges., xviii, pp. 65-80.

⁸ Journ. Malac., x, p. 19.

in captivity proved inconstant. Temporary surroundings, again, affect the colour of slugs, a result which has been said to be due to slime secretion. Nudibranchs will vary with their habitat, and their brilliant colouring will become somewhat faded in captivity.

Planorbis corneus has been observed with a flesh-coloured or pink animal.

The shell is, as is well known, usually more brightly coloured in land molluscs, in warmer climates; this is also noticeable amongst marine shells, Arctic species, as also those from the deep sea, being usually inconspicuous in colour. In dry and arid regions the shell is often white and thick, the thickness hindering evaporation, and the whiteness being a protection from the sun's heat. Variation of food will alter the colour of the shell, and a curious brown-coloured race of *Helix hortensis* has been found¹ near tanneries, while yellowish forms of *H. nemoralis* are said² to prevail in dried grass, red or reddish-brown being most common at the edge of woods. In America it is stated³ that the colour of *Pyramidula alternata*, which lives in decaying wood, varies with the kind of tree in which it is found, and resembles that of the surroundings; this latter consideration, however, is foreign to my purpose at the moment. Similarly a damp season produces an effect.

Mr. Brindley⁴ recently found that of 639 *H. arbustorum* 465 were adult, and of these 15 were without any trace of banding, while of 261 *H. nemoralis* 21 were bandless, and these were mostly brownish in colour.

Rays of colour in the Unionidæ are most commonly found⁵ in specimens from running, not still water; while on the point of colour rays or bands in general I may remark that they are exceedingly inconstant, and may arise or cease suddenly.

The entire absence of any colouring in shells which normally are coloured is by no means rare. This is not, in general, correlated with any apparent change in the animal, and cases of albinism in the animal are very scarce. *Vivipara vivipara* has been seen⁶ in an isolated example to be absolutely lacking in black pigment, even in the eyes, and the same has been recorded in *Agriolimax*.

Shells may be white, or transparent and colourless. The causes may be various; food, a damp season, or some inherent defect in the secreting power of the animal have all been stated to cause it, and it may occur either in isolated specimens or in whole colonies. In France albinism is said to occur more in the north and in mountainous regions. White *Helix incarnata* are said to have had white descendants, but in other cases normal young have been bred. Gredler suggested that the white forms were perhaps hereditary, but somewhat morbid, and he

¹ Martens: Nachrbl. Deutsch. Malak. Ges., 1872, p. 44.

² Winkworth: Essex Nat., vol. xiii, p. 256.

³ Ormsbee: Nautilus, vol. x, p. 64.

⁴ Mollusca in Nat. Hist. Cambridgeshire, p. 122.

⁵ Jordan: Biol. Centralbl., vol. i, p. 392.

⁶ Simroth: Zool. Anz., vol. ix, p. 403.

stated that the albinos were often smaller than the coloured specimens, and found near the boundary of distribution. *Limnaea* and similar genera are sometimes found with white colour-bands.¹

In marine shells but little has been recorded, but I may perhaps refer² to a curious spot on Portland where, in a marine pond a few yards across, the fauna consisted of two white species, two species of which white varieties occurred without the normal coloured form, and two species where the normal form occurred with white varieties.

Ere passing from this branch of the subject, I would call your attention to a paper by Cooke³ in which he discusses the variation of *Achatinella multizonata* from a geographical standpoint. He states that while the actual specific distribution extends over some little area certain groups of colour-varieties are confined to certain portions of the range, and he concludes that isolation pays a greater part than environment.

Erosion has been noticed in many species; specimens of fresh-water bivalves are often eroded near the beaks, where the periostracum is thinnest, and Gastropods often show similar signs, generally on the earlier whorls. It has been attributed⁴ to emission of carbonic acid gas by plants, and also to a deficiency of calcium carbonate in the water; whilst in confinement, *Limnaea*, *Bithynia*, and *Planorbis* have been noticed⁵ to become eroded and of curious appearance, and the eroded spots have been seen to be occupied by *Micrococcus*. It has been stated that in a river in North America all the shells below the spot where a pollution by alkaline wastes entered the stream were eroded, while those above were not. In marine shells it has been said⁶ to be due to boring algæ; and many specimens have been noticed where the animal has thickened its shell internally for protection.

Decollation, the earlier whorls having been broken off and the cavity closed by a septum, is a normal occurrence in a number of Gastropods, e.g., *Truncatella*, some *Cylindrella*, etc. Many long-spined shells do not use the upper whorls, and this part loses vitality, becomes brittle, and breaks off. It may, however, occur abnormally owing to an accident to the spire. In confinement a scalariform *Helix aspersa* has been noticed,⁷ which on more than one occasion formed internal septa, the upper portion breaking off.

It must be remembered that Mollusca have the power of absorbing the upper whorls, so as to make room for themselves, and further, that they can secrete shelly matter to repair a hole broken in the shell. *Helix pomatia* can repair the upper whorls; and, in captivity, *Limnaea elodes* has been observed to repair a hole in the shell in six weeks.

¹ Overton: Journ. Malac., ix, p. 64.

² Journ. Conch., vol. vi, p. 166.

³ Pap. Bernice P. B. Mus., vol. ii, pp. 65-76.

⁴ Beauchamp: Conch. Exch., vol. i, p. 49. Shrubsole: Journ. Conch., vol. v, p. 66.

⁵ Noll: Zool. Garten, vol. xxiii, p. 157.

⁶ Hensman: Irish Nat., vol. iv, p. 137.

⁷ Lataste: Journ. Conchyl., vol. xxiv, p. 242.

External sculpture in the Gastropods is very variable, and the shell may be furnished within the mouth either with ridges or tubercles; the columella being often provided with accessory plates or folds: the wonderful armature of the Helicoids, Cyliindrellids, etc., at once comes to mind. Shells such as *Crepidula* and *Anomia* will form ridges, tubercles, etc., to match their site. While in many cases the internal armature is specifically constant, in others it shows considerable variation, such as the presence or absence of teeth in the Pupidæ. The crenulations on the margin in *Astarte*, again, have been recently¹ alleged to be sex characters, those with a crenulated margin being said to be female, those with a smooth edge male; and the point is one of considerable importance since these characters have been used for the separation of species. Dr. Dall states that in Alaska *Littorina*, where exposed to the full power of the surf, becomes shorter in the spire, the ridges become rounded nodules, and the axis of the shell broad and thick; an illustration of the principle that sculpture is largely due to the surroundings.

Our common *Purpura lapillus*, again, varies greatly in sculpture, some showing well-marked foliations in addition to the usual spirals, and it may be remarked that those in which the foliations were most noteworthy come from an old oyster bed in Rhoscollyn Bay, where lime would be abundant.

The variation of the ribbing in *Cardium* has been noticed² by Baker, and, on comparing three species, he found that they differed in the amount of variation, *C. magnificum* being the least variable, *C. muricatum* the most variable, while another form was intermediate. *Pecten* also has been carefully studied by Davenport,³ who found that the same species was more variable in some places than in others: he also states that the right valve has half a groove more than the left or upper one, and that the variability of the right valve is less than that of the left.

The Gräfin von Linden⁴ found on examination that the primary stage in sculpture was, in the forms seen, usually a thickening of the lines of growth to form transverse ridges; then, firstly, transverse and, secondly, longitudinal, tubercles appear, and finally longitudinal bands.

Beecher,⁵ studying spines, found that they only appear after the earlier stages, and he suggested that they may be formed by a special stimulus given to the secreting organs. Sometimes they are due to radiating lines being broken, and differentiated into spines, as in *Lima*. In such forms as the Murices and Spondyli he states that they are often formed by local repetition close to or on an ordinary spine. Further, he calls attention to the fact that in some of the Pliocene

¹ Ostroumoff: Zool. Anz., vol. xxiii, p. 499.

² Amer. Nat., vol. xxxvii, p. 481; cf. Dall, Tert. Fauna Florida, pt. v.

³ Proc. Amer. Ac., vol. xxxix, p. 123; Amer. Nat., vol. xxxiv, p. 863; Science, vol. xv, p. 531; Journ. Exper. Zool., vol. i, p. 607, etc.

⁴ Zeitsch. Wiss. Zool., vol. lxi, pp. 261-317.

⁵ Amer. Journ. Sci., ser. iv, vol. vi, pp. 1-20, etc.

beds the species in the lowest beds are smooth, higher up they become angular and carinated, and finally they are sub-spinose.

Sculpture, as is well known, is due to increased secretion at certain points, but how and why are these points determined?

In this connection two very interesting papers dealing with the Gastropods merit consideration. Dall¹ was led to consider the folds on the columella in the Volutidæ, and he pointed out that in the molluses with folds on the columella the adductor muscle was situated more deeply in the shell than in those in which the folds were absent. Further, he stated that when the mantle-cone was withdrawn within the shell, it must wrinkle longitudinally, and the more deeply-seated the adductor muscle was, the stronger would be the wrinkles, the deeper wrinkles coming on the columellar side, and the more numerous, smaller ones being opposite to the pillar. From this he was led to consider that the folds on the columella and the liræ or denticles within the mouth were formed by the repeated dragging in and out of the shell-secreting surface of the mantle, the folds or liræ forming in the wrinkles. This explains the folds in some forms of *Cypræa*, which are seen only in the adult shell, since in the young the mouth is more widely open, and the mantle not so wrinkled. It would be of interest to know how far the remarkable internal armature in *Plectopylis*, formed only at certain intervals in the shell, is due to such wrinkling of the mantle at rest periods, and whether their constancy in form is due to the mantle being folded naturally in a permanently similar manner, conformably to the internal organization of the animal.

A further development of the same theory was made by Stearns² in a paper on the remarkable series of variations of *Paludestrina protea*, Gould, in which he attributes spiral sculpture on the surface of the shell to puckering of the mantle-edge, while transverse sculpture he points out may be formed owing to a short period of rest when the edge of the lip is receiving the bulk of the secretions.

For further interesting details the student should consult these two papers.

There are giants and dwarfs in molluses as in all other animals. *Buccinum undatum*, L., for example, may measure as much as 6½ inches in length, while an apparently adult specimen in my collection reaches only 1½ inches. Size may depend upon surroundings, and those at the extreme limit of distribution of the species are often stunted in growth. *Neritina virginea* is dwarfed in very dense water, as also in fresh-water streams in Jamaica, from which the deduction has been drawn that while the animal can adapt itself the full development will only be reached if the surroundings be favourable. Similarly, Bateson³ has given an account of variation in form, etc., occurring in *Cardium*, where the water was very saline. In Guernsey there are two distinct races of *Ocenebra aciculata*, varying in size and colour, one

¹ "Tertiary Fauna of Florida," pt. i, pp. 58 et seq.; Amer. Nat., 1894, pp. 909-914.

² Proc. U.S. Mus., vol. xxiv, pp. 271-299.

³ Phil. Trans., 1889 B, pp. 297-330.

being found on the shore and the other dredged. *Helcion pellucidum*, when found on the leaves of *Laminaria* is thin, with bluish rays, but when it crawls down into the roots to live it becomes very thick, and usually loses the colour rays. Dwarf shells, again, thick and strongly formed, are often found on exposed coasts where the surf beats strongly; and some *Littorina*, which are confined to more or less brackish water, have thicker shells where the water becomes less salt. In South Australia two races of *Littorina unifasciata* are said¹ to occur: the first, living on rocks, moist during the ebb-tide, is long, slender, and bluish-white; the second, living on dried and higher places, is short, with a light and dark grey chequered pattern. *Arca tetragona*, as found dwelling in old shells in the Channel Islands, is much swollen, but where it inhabits crevices of rocks, as in the south-west of England, it is compressed and the surface is worn.

In rivers Unionidæ have usually heavier shells than in lakes, and where the stream is turbulent the teeth are stronger and the muscular impressions deeper. Some species seem better able to form shell than others; for example, in the granitic parts of South-East Bavaria, *Unio*, *Neritina*, and *Lithoglyphus* have² thick shells, while *Ancylus*, which lives with them, has a very thin shell.

Land-shells living in decayed leaves are usually thin, a result which has been attributed to the difficulty of obtaining lime. This presence or absence of lime has an effect on the size of the shell, and molluscs have been seen gnawing not only one another's shells but even their own³ in the endeavour to procure it.

Some molluscs have, naturally, flexuous shells, while in others this may occur abnormally, due, no doubt, to some failure in secretion.

Sexual dimorphism plays an important part in the size and shape of shells, notably in such forms as *Unio*, etc.

Temperature, again, must be considered, as, if it becomes too warm or too cold, the animal is much affected; several of the species found in thermal springs near Buda-Pesth were found⁴ to be dwarfed.

We may mention, as one of a number of similar cases, the deformities of *Limnæa*, etc., noticed by Folin in the Lake of Ossegor, where the sea had broken in, abnormal surroundings, with the usual result of abnormal shells, following.

Gibbosity of the body-whorl is well known in *Limnæa* and *Planorbis*, and has been ascribed to periodicity in growth.

The variations of *Limnæa peregra* are said⁵ to fall into natural groups, the long-spined being found in running water, the short-spined in lakes and ponds, while the strongly built forms dwell on the edges of large bodies of water or in turbulent streams, and those from hot or cold springs or great depths have generally a thin shell.

¹ Haacke: Zool. Anz., vol. viii, p. 504.

² Clessin: Nachrbl. Deutsch. Malak. Ges., 1874, p. 87.

³ Kobelt: Nachrbl. Deutsch. Malak. Ges., 1872, p. 44.

⁴ Hazay: Mal. Blätt., ser. II, vol. iii, p. 7.

⁵ Cf. Taylor: Journ. Conch., vol. vi, p. 284.

In confinement *Limnæa* is said¹ to vary in rate of growth, either with the nature of the water or the space the animals have in which to move; *L. megasoma* has been found to have narrower upper whorls in subsequent generations; the long and short spired races of *L. peregra* have been produced at will by changing the nature of the water; while it has even been asserted² that *L. involuta*, kept in confinement, has, in a few generations, lost its involute spire and become *L. peregra*.

Since the year 1767, when Geoffroy first noticed them, cases of remarkable distortion of the shell of *Planorbis* have been frequently recorded; sometimes isolated specimens were found, at others whole colonies appeared. Often other species occurring with them were found to be similarly distorted, but not invariably so. Similar variations have been observed in other species, but *Planorbis* has furnished the most striking instances and is here taken as a typical case. These forms exist in widely scattered localities, being described from England, France, Belgium, Germany, Switzerland, etc. This form of distortion is not confined to recent molluscs, a similar specimen of the Tertiary *Planorbis euomphalus*, J. Sby., having been observed. The appearance of these shells is very remarkable. They may be turreted, reversed, scalariform, and the direction of the whorl may vary from time to time. Piré³ described and figured a long series of *Planorbis complanatus* from a pond in which he notes the presence of abundance of *Lemna* and *Conferva*. Van den Broeck⁴ in discussing this paper suggested, and adduced experiments to prove, that scalariform shells moved more easily through the thick coating of weed than the normal ones; he further pointed out that being air-breathers they would desire to come to the surface, hinting also that we might be observing stages in the evolution or progress of *Planorbis*. Clessin, however, insisted⁵ that these variations were separately formed and not transmitted.

Rufford,⁶ noticing some abnormal specimens, found, on investigation, that in a number of them the worm *Chatogaster limnæi* was attached to the animal between the head and tentacles, and was inclined to attribute the results to its presence, though he very frankly stated that he had seen a normal specimen with a worm so attached.

Stubbs⁷ illustrated a long series of forms of *Planorbis spirorbis*, and stated that the other species found in the same ditch near Tenby were also occasionally distorted or abnormal, and cites as a possible cause, quoting Taylor,⁸ that the efforts to force their way through the mud in which they are sometimes left partially embedded, owing to

¹ Semper: "Animal Life." Hazay: Mal. Blätt., ser. II, vol. iv, p. 220. Varigny: Journ. Anat. Physiol., vol. xxx, p. 147.

² More, Zoologist, 1889, p. 154; cf. Williams, t.c., p. 235.

³ Ann. Soc. Mal. Belg., vol. vi, p. 23.

⁴ Ibid., vol. vii, pp. x-xx.

⁵ Mal. Blätt., vol. xx, p. 68.

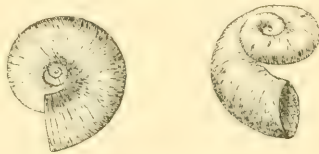
⁶ Zoologist, 1898, pp. 191-192.

⁷ Journ. Conch., vol. ix, pp. 106-108, pl. iv.

⁸ Monogr. Brit. Moll., vol. i, p. 118; cf. Journ. Conch., vol. viii, pp. 382-384.

the fact of the ditch in hot weather nearly drying up, might cause alteration in the direction of shell, if it be in process of formation. This idea was hinted at by Jeffreys many years ago. Fortunately, however, Standen¹ made a careful examination of these forms, keeping them in an aquarium, and he found that all the distorted shells were covered with a luxuriant growth of *Epistylis anastatica*, one of the rigid-stalked *Vorticelle*, whereas from the parts of the ditch lacking abnormalities the shells were clean and clear. This appears to be the probable cause, the animal shrinking when forming its shell from contact with the *Vorticelle*.

While on the subject of these distorted forms I may recall a very interesting series of *Littorina rudis*, var. *tenebrosa*, noticed by myself,² from the Fleet Backwater near Weymouth. They were picked up, dead shells only being found, in quantity on the shore, and were perhaps killed by a cold spell which had occurred. I doubtfully referred then to the possible cause as being attached weed which the animal was endeavouring to avoid, and in the light of Standen's investigation further enquiry there seems very desirable.



Aulopoma, scalariform, from Ceylon.

Akin to these forms of *Planorbis* is the elevation or depression of the spire. *Helix pomatia*, for example, has been seen so depressed as to be planorbiform,³ while the scalariform specimens are well known. Enquiry will probably show that this elevation or depression is correlated with some peculiarity of the animal. Baker⁴ has recently observed, after taking measurements of a large number, that in *Pyramidula alternata* the western specimens have a higher shell than the eastern, and vary more in spire elevation. In the Island of Syra⁵ it has been recorded that of *Pyramidula rupestris* more scalaroid than normal shells occur, and the theory has been put forward that, under some peculiar condition, a new race may be developing. Welch⁶ has illustrated some interesting scalariform and distorted specimens of *Helix nemoralis* from the sand-dunes of Bundoran, and suggests that the distortion may be due to "the intrusion of a grain of sand during the early life of the mollusk, and the consequent deviation of the whorl from its normal course of growth." It is needless to go

¹ Journ. Conch., vol. ix, p. 216.

² Proc. Dorset Club, vol. xiii (1892), pp. 191-198, one plate.

³ Bellevoye: Bull. Soc. Rheims, vol. viii, p. 89.

⁴ Amer. Nat., vol. xxxviii, p. 667.

⁵ Nachrbl. Deutsch. Malak. Ges., 1880, p. 67.

⁶ Journ. Conch., vol. x, p. 244.

through the list of genera or species in which scalariformity has been noticed, but it may be stated generally that, in most well-known land or fresh-water shells, it has been observed, while in marine shells it is less common. Indeed, all distortions are less common in marine shells, and where present they are chiefly recorded in those species living on the shore near high-water mark.

Mention may perhaps be made here of the remarkable specimen of *Bythinia tentaculata* recorded by Mr. Smith,¹ which had a very depressed spire and was almost 'Bulloid' in shape.

Sometimes the mollusc, after forming the lip in a normal manner, continues to grow and forms a second lip. This has been observed in *Helic*, *Clausilia*,² etc., while it should be remembered that a somewhat similar occurrence is usual in *Acroptychia*, *Leucoptychia*, etc. The suggestion has been made that a rainy season stimulated development and caused the growth to continue. Occasionally a second lip is formed in the mouth at an angle to the first, or irregular growth may continue after the mouth is formed.³

In *Clausilia* and *Cylindrella* specimens have been found with two apertures, sometimes at an angle to one another, sometimes back to back. Two explanations⁴ have been given: either the shell may be fractured and the animal may make use of the fracture and form a new mouth, or it may be that some obstacle becomes wedged in the old mouth and the animal gnaws its way out in another spot, and forms the new mouth there.

Rissoa, again, has been observed⁵ to form a new mouth if the old one be broken. Recently a specimen of *Helic pomatia* has been noticed with the mouth distorted and partly closed.⁶ The curious addendum to the shell of an aestivating *Ancylus* noticed by Nordenskiöld⁷ hardly comes within my scope at the moment.

Limnaea, also, may be deformed by notches in the edge of the mouth, and in some specimens I examined I found that several, which at first sight were normal, had really been so notched, but that subsequently the animal recovered itself and filled up the notch by degrees. The occurrence has been attributed to *Hydra*.⁸

Beyrich⁹ observed clefts in the columella of some species of recent and fossil *Natica*, and Martens¹⁰ has recorded the same in *Buccinum*,

¹ Journ. Conch., vol. v, p. 315.

² Westerlund: Nachrbl. Deutsch. Malak. Ges., 1875, p. 84. Clessin: Mal. Blatt., vol. xx, p. 58.

³ Baudon: Journ. Conchyl., vol. xxxii, p. 320. Nelson: Journ. Conch., vol. xv, p. 80.

⁴ Cf. Boettger: Nachrbl. Deutsch. Malak. Ges., vol. vi, p. 98. Gibbons: Quart. Journ. Conch., vol. i, p. 340.

⁵ Dautzenberg: Feuille Nat., vol. xxiii, p. 30.

⁶ Kobelt: Nachrbl. Deutsch. Malak. Ges., 1904, p. 125.

⁷ Zool. Anz., vol. xxvi, p. 59.

⁸ Cf. Brot: Ann. Soc. Mal. Belg., vol. xii, p. 48. Sykes: Journ. Malac., vol. iii, p. 34.

⁹ S.B. Ges. Naturf. Berlin, 1883, pp. 3, 45.

¹⁰ Ibid., 1889, p. 8.

and also in *Gibbula Richardi*, Payr., the latter author attributing the notches to the Cirripede *Aleippe*.

Buccinum undatum has been seen with a new canal formed at an angle to the old one,¹ and a specimen of *Fulgur canaliculatum* has been recorded by Johnson & Pilsbry² in which the basal canal was twisted to one side.

Pterocera varies occasionally in the number of labial digitations, Willey³ noticing a specimen of *P. limbis* which has an extra intercalated digitation; this note is of some interest with reference to the origin of species, since he identifies this extra digitation with one of those of *P. millepeda*, L. Variation in the number has also been seen in *P. delicatula*, Nevill.

Again, the presence or absence of the umbilicus is not constant. There occurs in Mauritius and the Seychelles a race of *Achatina fulica*, Fér., in which the umbilicus is open. Mr. Pilsbry⁴ states: "I am disposed to think the pathologic condition may be due to a disease of the left lobe of the mantle, possibly owing to some specific parasite of *A. fulica*."

Many species having spiral sculpture may be deprived of it by injury to the mantle; occasionally, again, species not normally carinate become so, the occurrence having been observed in *Helix*, *Placostylus*, *Limnæa*, *Buccinum*, *Rissoa*, etc.

The variation of *Cypræa* seems to deserve special notice. It will be a familiar fact to those who have studied the group, that there are found in New Caledonia,⁵ mainly off the Island of Nou, deformations of most of the species belonging to that fauna; these forms are elongate, beaked, and generally marked by melanism. Their coral habitat or a malady of the animal have been suggested, but the matter is at present an unsolved mystery. *Cypræa* is also liable to be marked by obtuse spiral ridges on the back; or the spire, which normally in the adult shell is flat, may be produced so as to give the specimen the form of *Marginella*. Some specimens have been seen with a curious protuberance on the back; this is due to a *Balanus* having attached itself to the shell, the animal having then covered it with a deposit of shelly matter.

Of *Haliotis tuberculata*, L., three or four specimens have been recorded⁶ in which the usual row of perforations is absent; and a specimen of *Haliotis Cracherodii* has been found, measuring nearly five inches in length, without any trace of perforations or indentations. On the other hand, Mr. Smith⁷ has given an account of a specimen of *Haliotis*, now in the British Museum, which was furnished with two

¹ Levett: Zoologist, ser. III, vol. viii, p. 490.

² Nautilus, vol. ix, p. 25.

³ Proc. Linn. Soc. N.S. Wales, vol. xxi, p. 110.

⁴ Man. Conch., ser. II, vol. xvii, p. 58.

⁵ Cf. Dautzenberg: Journ. Conchyl., vol. li, p. 291.

⁶ Jeffreys: Brit. Conch., vol. iii, p. 281. Smith: Conchologist, vol. ii, p. 75.

Marquand: Journ. Conch., vol. xi, p. 48. Kelsey: Nautilus, vol. xviii, p. 67.

⁷ Ann. Nat. Hist., ser. VI, vol. i, p. 419.

distinct rows of these perforations. He conjectured, as I understand it, that the edge of the mantle was notched either from birth or by accident; it seems to me that it may belong to a different category and may be due to duplication of the series of 'tentacles.'

The number of perforations is variable. In a series of *Haliotis tuberculata* sent from the Channel Islands, consisting of 97 specimens, all of 'merchantable' size, collected in February, I find the following variation:—

| | | | | | |
|-------------------------------|---|----|----|----|---|
| Number of completed holes ... | 4 | 5 | 6 | 7 | 8 |
| Number of specimens ... | 3 | 25 | 50 | 17 | 2 |

If we still further subdivide them, allowing one-half for all holes which are well in progress of formation but not completed, we get—

| | | | | | | | | |
|---------------------|----|----|----|----|----|----|----|---|
| Number of holes ... | 4½ | 5 | 5½ | 6 | 6½ | 7 | 7½ | 8 |
| Number of specimens | 3 | 10 | 15 | 35 | 15 | 16 | 1 | 2 |

The result is of interest, though the series examined was small.

Pelecypods are liable to various deformations. Sometimes one valve is flattened, the other being inflated; again, a situation in the margin will occur, marked by a groove running towards the beaks, and this notch has been occasionally noticed to be present in one valve only. A curious specimen of *Modiolaria discors* that I have, has apparently had one end broken off, and has formed a new shell inside the old broken portion, lacking the characteristic sculpture, and with the edges not properly opposed. *Pecten* has been seen with a notched shell edge, this being due to the growth of *Serpulæ*. An abnormal outgrowth has been seen on the edge in *Mactra*,¹ and various deformations of *Anodonta* have been recorded, notably one in which the edges of the valves on the lower margin are folded inwards.²

As to the sculpture, *Cardium* is sometimes found with the margin duplicated, the effect being as if one shell were placed inside another; it has also been seen with the ribs dislocated, probably by a former damage.³ The ribs in *Pecten* may divide late in life, or may arise then independently, and ridges may appear inside with no corresponding rib on the outside.

The internal colouring of the shell is liable to vary greatly, and *Anodonta* has been seen with the nacre of one valve white and the other of a salmon colour.

The hinge has been observed to be abnormal, and a case has been

¹ Leidy: Proc. Ac. Philad., 1879, p. 198.

² Sci. Gossip, vol. xxiv, p. 127.

³ Martens: S.B. Ges. Nat. Berlin, 1879, p. 74.

recorded in *Spatha* where the right valve overlapped the left.¹ The teeth in *Tapes* are liable to vary, one tooth being often aborted or lacking, and *Venus macrondon* has been noticed with only one tooth (not three) in one valve, and a corresponding cavity in the other.

One curious abnormality noticed² in the Polyplacophora is the reduction in number of the usual eight plates, either by suppression or union. Many years ago Montagu described a specimen as *Chiton septemvalvis*, and quite recently six-valved specimens of *Trachydermon ruber*, L., and *Ischnochiton conspicuus*, Cptr., have been noticed. Perhaps, however, the most remarkable is a three-valved specimen of *Ischnochiton contractus*, Rve., recorded by myself, in which the tail-valve occupied a greater space than the other two valves put together, being probably formed by union of two or more valves. This specimen is now preserved in alcohol in the British Museum.

Amongst Cephalopods we may refer to the interesting specimen of *Argonauta* recently figured³ in our *Proceedings*, which had a double sinuation on the left side; as also to that recorded by Adams,⁴ which had a portion broken out of the left side. He pointed out that this was repaired in the usual manner, but that the fragment which had been broken out, its loss having probably been prevented by the vela, now formed two-thirds of the repaired portion, while it had actually been reversed in position, the inside having become the outside.

One of the most interesting phenomena, perhaps, is when the coil of the shell in the Gastropods is reversed, accompanied by a corresponding deformation in the animal, or when a similar occurrence takes place in the Pelecypods. As is well known, the majority of the Gastropods have dextral shells, but a fair proportion are normally sinistral. In some groups the bulk of the known forms are constantly sinistral as in the Clausiliidae, whilst in such as the Helicidae a few species only have this character, or it may happen that certain sections of a family are reversed. In other groups, again, such as *Amphidromus*, *Partula*, and *Achatinella*, some of the species are normally found in both conditions; the proportion, however, of each kind will vary in each species, and it has been stated that *Partula otakeitana*, Brug., is generally reversed, while *P. vexillum*, Pease, has only one in fifty, and *P. affinis*, Pease, only one in several hundred sinistral. *Dyakia Lindstedti* is another illustration of the principle that a species may be normally both sinistral and dextral. We may also recall the well-known case of *Sipho antiquus*, of which a colony of sinistral specimens were found in Vigo Bay.

Whether these forms be in a strict sense hereditary, it is hard to say; in my view the cause that rendered the parent reversed may well, acting in conjunction with a predisposition to abnormality, give a greater probability of reversal in the descendants. Nylander has

¹ Jickeli: Nachrbl. Deutsch. Malak. Ges., vol. v, p. 69.

² Cf. Sykes: Journ. Malac., vol. vii, p. 164. Stearns: Nautilus, vol. xv, p. 53. Blaney: Proc. Boston Soc., vol. xxxii, p. 39.

³ *Ante*, vol. v, p. 310.

⁴ Amer. Journ. Sci., vol. vi, p. 138, 1848.

recorded the occurrence of four young sinistral shells from a normal dextral female of *Campeloma decisa*, Say; whilst Miss Hele noted the occurrence of dextral young from a sinistral *Helix aspersa*. On the other hand, sinistral *Limnæa stagnalis* have been bred from a sinistral parent, and in a pond in Belgium adult sinistral specimens of this species were found in one year, whilst in the following year similar young shells were taken, this leading to the suggestion that these latter were descendants of the former. I think the evidence amounts to this, that a sinistral parent shell is not unlikely to have sinistral young, but this result may not follow. It may be remarked, in passing, that in *Melantho* 15-25 per 1000 of the embryos are sinistral, but only 1 per 1000 survives. In slugs¹ *Limax schuabii*, Frauenfeld, has been recorded with the respiratory opening on the left side, and *Arion rufus*, L., with a similar character.

It may perhaps be of interest to give a list of the shells which I know of recorded as reversed. It is not proposed to deal with the vexed question of ultra-sinistral and ultra-dextral shells, and for the purpose of the moment *Planorbis* has been left as dextral. Owing to the scattered nature of the literature this list must be very incomplete, but may form a basis for other workers: no attempt has been made to verify the specific names.

SINISTRAL FORMS OF NORMALLY DEXTRAL SPECIES.

* All so marked have been seen by the writer.

- | | |
|--|--|
| * <i>Gibbus Lyonetianus</i> , Pallas. | * <i>Leucochroa candidissima</i> , Drap. |
| <i>Vitrina pellucida</i> , Müller. | <i>Helicella acuta</i> , Müll. |
| <i>Hyalinia nitida</i> , Müller. | <i>apicina</i> , Lam. |
| ,, <i>nitidula</i> , Drap. | * ,, <i>Cantiana</i> , Mont. |
| <i>Zonites Atyrus</i> , L. | ,, <i>Carthusiana</i> , Müll. |
| <i>Xesta duplocincta</i> , Bttg. | ,, <i>cespitum</i> , Drap. |
| * ,, <i>Javanica</i> , Fér. | ,, <i>conspurcata</i> , Drap. |
| <i>Laoma Moellendorffi</i> , Suter. | * ,, <i>ericetorum</i> , Müll. |
| * <i>Pyramidula alternata</i> , Say. | ,, <i>explanata</i> , Müll. |
| ,, <i>Cooperi</i> , Binn. | ,, <i>fasciolata</i> , Moq. |
| ,, <i>humilis</i> , Hutton. | ,, <i>neglecta</i> , Drap. |
| ,, <i>rotundata</i> , Müll. | ,, <i>oreta</i> , Brgt. |
| ,, <i>solitaria</i> , Say. | ,, <i>trepidula</i> , Serv. |
| ,, <i>strigosa</i> , var. | ,, <i>trochoides</i> , Poiret. |
| <i>Polygyra elevata</i> , Say. | ,, <i>unifasciata</i> , Poiret. |
| ,, <i>exoleta</i> , Binn. | ,, <i>variabilis</i> , Drap. |
| ,, <i>fallax</i> , Say. | * ,, <i>virgata</i> , Da Costa. |
| ,, <i>hirsuta</i> , Say. | <i>Hygromia hispida</i> , L. |
| ,, <i>inflecta</i> , Say. | ,, <i>limbata</i> , Drap. |
| ,, <i>Mitchelliana</i> , Lea. | <i>Vallonia pulchella</i> , Müll. |
| ,, <i>profunda</i> , Say. | * <i>Helicigona arbustorum</i> , L. |
| ,, <i>thyroides</i> , Say. | ,, <i>cornea</i> , Drap. |
| <i>Pleurodonte lychneuchus</i> , Müll. | ,, <i>lapicida</i> , L. |
| <i>Stylodonta unidentata</i> , Chemn. | ,, <i>Quimperiana</i> , Fér. |
| * <i>Acavus hæmastoma</i> , L. | * <i>Helix apatolena</i> , Brgt. |
| * ,, <i>phœnix</i> , Pfr. | ,, <i>aperta</i> , Born. |
| * <i>Dorcasia globulus</i> , Müll. | * ,, <i>aspersa</i> , L. |
| ,, <i>lucana</i> , Müll. | * ,, <i>hortensis</i> , Müll. |

¹ Cf. Baudon: Journ. Conchyl., vol. xxxii, p. 320. Seibert: Mal. Blätt., vol. xxi, p. 198.

- * *Helix lactea*, Müll.
 * „ *memoralis*, L.
 * „ *Pisana*, Müll.
 * „ *platycheila*, Menke.
 * „ *pomatia*, L.
 * „ *punctata*, Müll.
 „ *splendida*, Drap.
 „ *sylvatica*, Drap.
 „ *vermiculata*, Müll.
 * *Placostylus Aesopus*, Gass.
 * „ *fibratus*, Mart.
 „ *senilis*, Gass.
 „ *Ouveanus*, Mouss.
Orthalicus regina, Fér.
 „ *undatus*, Brug.
Rumina decollata, L.
Ena detrita, Müll.
Pupa avenacea, Brug.
 „ *Bigorriensis*, Charp.
 „ *Brauni*, Rossm.
 „ *muscorum*, L.
Achatina panthera, Fér.
 „ *virginea*, Brug.
Cochlicopa tridens, Pult.
Cionella lubrica, Müll.
 * *Succinea elegans*, Risso.
 * „ *Pfeifferi*, Rossm.
Limnaea limosa, L.
 „ *ovata*, Drap.
 „ *palustris*, Drap.
 * „ *peregra*, Müll.
 * „ *stagnalis*, L.
- Planorbis complanatus*, L.
 „ *spirorbis*, L.
Campeloma decisa, Say.
Valvata piscinalis, Müll.
Vivipara vivipara, L.
 * „ sp. indet. [in B.M., juv., from China].
Neritina fluviatilis, L.
Ericia elegans, Müll.
 * *Pomatias crassilabrum*, Drap.
 „ *obscurum*, Drap.
 „ *patulum*, Drap.
 * „ *septemspirale*, Raz.
Ditropis planorbis, Blanf.
 * *Diplommatina catathymia*, Sykes.
 * *Acme lineata*, Drap.
 * *Volva scapha*, Gmel.
 * *Marginella conoidalis*, Kien.
 * „ *curta*, Sby.
 * „ *limbata*, Lam.
 „ *miliacea*, Val.
 „ *nebulosa*.
 * „ sp. indet. [group of *avena*, Val.].
 * *Murex secundus*, Lam.
 „ *trunculus*, L.
 * *Buccinum undatum*, L.
Purpura lapillus, L.
 * *Sipho antiquus*, L.
 * *Turbinella rapa*, Gmel.
 * *Littorina litorea*, L.
 * „ *rudis*, Maton.
 * *Olivella oryza*, Lam. [Brit. Mus.].

DEXTRAL FORMS OF NORMALLY SINISTRAL SPECIES.

- Ena quadridens*, Müll.
Clausilia Almissana, Küster.
 „ *bidens*, Drap.
 „ *bidentata*, Ström.
 „ *biplicata*, Mont.
 „ *Duboisii*, Charp.
 „ *Macarana*, Zgl.
Clausilia perversa [? L. or Pfr.].
 * „ *plicata*, Drap.
 * „ *plicatula*, Drap.
 „ *Stentzi*, Rossm.
Pupa perversa [? author].
Physa fontinalis, L.

Amongst the Pelecy-pods a similar occurrence has been observed. *Chama* is said to be frequently reversed, and a reversed *Tellina plicata*, with the hinder fold of the shell bent to the left, has been recorded by Fischer.¹ Jeffreys states that *Astarte compressa* and *A. triangularis* sometimes have the hinge reversed, i.e., the right teeth being in the left valve, and *vice versa*.

The question naturally arises, what is the cause of this curious inversion? Dealing only with the Gastropoda two points are clear; firstly, that it must arise from a cause common to a very large number of species, and, secondly, that the cause takes effect in the early stages of development, ere the protoconch is formed. One explanation suggested has been the effect of the presence of abundant electricity in the air; another writer, stating that sinistral and dextral forms of

¹ Journ. Conchyl., vol. xxviii, p. 234.

a species of *Partula* are isolated from one another, has hinted at the effect of environment. Again, we have been told that "this abnormal growth probably is caused by disturbance of the relations of the embryo with its initial shell." Hartman,¹ when dealing with *Partula*, says as follows: "We can only conjecture as to the cause of this departure from the more usual conformation; but it may be owing to a reversal of the vital forces acting during the segmentation of the yolk of the egg in the early stages of the formation of the embryo. The eggs of the common garden slug (which are almost transparent and afford good material for observation), a short time after deposition, exhibit the germinal vesicle (which lies in the midst of the yolk) rising to the upper part, where a distinct rotation may be seen; after which it undergoes segmentation, and the germ appears. The rotary motion, which is probably due to ciliary or vital action, consists of two or three turns in one direction, and the same number in a reversed one; and in this reversed vital action, during segmentation of the yolk of the egg, may be the secret of sinistral or reversed shells."

Let us now turn to recent research in biology. In 1894 Crampton and Kofoid pointed out that in sinistral snails the cleavage of the egg from the second division onwards is typically spiral but reversed. Conklin, to whose papers² I am indebted for the facts here given, later found that in *Crepidula* this spiral character commenced with the first division of the egg; and in 1903 he summed up the matter of inverse symmetry, stating that, in such cases, the cleavage is inverse and must be preceded by inverse organization of the unsegmented egg, probably arising at the time of maturation or fertilization. Further, he suggests that there may be a reversal of polarity after the eggs are set free, which may perhaps be due to pressure on the egg-cell forcing the spindle through the egg and causing the polar bodies to be formed at the opposite pole to that which is usually the case.

Space fails me to give any details of Weldon's work from the statistical standpoint and to refer to other details, but I have now given some outline, brief and imperfect though it be, of variation in molluscs, and I would conclude by appealing to you to give your most serious attention to the subject, that the malacologist may bear his full share of the work, and receive his full share of the credit, in the solution of the many problems to which it is the key.

¹ Bull. Mus. Comp. Zool., vol. ix, pp. 176-177.

² Journ. Morphol., vol. xiii, pp. 1-226; Anat. Anz., vol. xxiii, pp. 577-588; Proc. Ac. Philad., 1903, p. 753.

NOTES.

NOTE ON THE HORIZON AND LOCALITY OF THE TYPE-SPECIMEN OF *PLEURONAUTILUS PULCHER*, G. C. CRICK. (Read 10th March, 1905.)—The species *Pleuronautilus pulcher*, described by the present writer in the Proceedings of the Malacological Society of London for March, 1904 (pp. 15-20, pl. ii), was founded upon four examples and a fragment, two of the specimens and the fragment being in the British Museum collection, the other examples forming part of the collection of Dr. Wheelton Hind, Stoke-on-Trent.

Dr. Hind's specimens were obtained from the 'Pendleside Series' (Carboniferous) at Hebden Bridge, Yorkshire. Of the British Museum examples only the fragment is localized; this is stated to be from the 'Millstone Grit' (i.e. the Pendleside Series) at Hebden Bridge. The smaller specimen in the national collection belonged to the Gilbertson Collection, but its locality is unrecorded. The larger specimen, which was selected as the type because it exhibited all the characters of the species, belonged to the collection of the late J. W. Davis, of Halifax, and though the precise locality whence it was obtained has not been recorded, the present writer pointed out the fact that its matrix agreed with that of the examples from Hebden Bridge.

The type-specimen was received among some specimens in a small box without a label; but according to an inventory of Mr. Davis's collection made by Dr. A. S. Woodward prior to the acquisition of the collection by the British Museum in 1895, this box of fossils was obtained from Hebden Bridge, about eight miles west of Halifax. This fact, then, enables us to fix the horizon and locality of the type-specimen of *Pleuronautilus pulcher* as the 'Pendleside Series' (Carboniferous), Hebden Bridge, Yorkshire. So far as is known to the present writer, this is the only locality which has yielded examples of this species.

G. C. CRICK.

NOTE ON THE VITALITY OF THREE SPECIES OF *LITTORINA*. (Read 10th March, 1905.)—It is a well-known fact that land and fresh-water Mollusca remain dormant for considerable periods, but instances among marine forms are much less common and therefore worthy of record. Recently Lieut.-Colonel L. W. Wilmer received from a relative some specimens of *Littorina* which had been collected at Havana on January 11th of the present year. On that day they were packed in a tin box, which was not opened until February 24th, a period of over six weeks. On being immersed in sea water they very soon showed signs of life, and began to crawl about the vessel in which they had been placed. The species are *Littorina muricata*, Linn., *carinata*, d'Orbigny, and *trochiformis*, Dillwyn. Some remarks on the great vitality of the first of these have

already been published by Dr. F. A. Hassler, who states that a considerable number of specimens were kept out of water for a whole year and then found to be alive!

The *Littorina* appear to be peculiarly adapted for living out of water; indeed, some species are known to live at a considerable distance from the sea. Mr. H. B. Preston informs me that he has seen great numbers of *L. arboricola* on trees fully a hundred yards from the backwaters of the harbour of Trincomalee, and it was quite evident to him that these *Littorina* never entered or were ever covered by the water. M. Récluz has stated that *L. neritoides*, occurring in the crevices of rocks on the French coast, are only covered by the sea at the highest tides, passing the rest of the time adhering to the surface by means of a glutinous mucus. Küster also observed the same species at Ragusa, 18 feet above the water, in the same position for four weeks, and he conjectured that possibly they remained inactive during the entire hot season of the year. Dr. E. von Martens also noticed some species in the Moluccas which pass the greater part of their life out of the water, being moistened only by the highest tides. Finally, attention may be called to the genus *Cremnoconchus*, which is practically a *Littorina*, both as regards its anatomy and radula, and is found living on rocks 30-50 miles from the sea.

E. A. SMITH.

ON A DIBRANCHIATE CEPHALOPOD, *STYRACOTEUTHIS*
ORIENTALIS, N.GEN. & N.SP., FROM THE EOCENE OF ARABIA.

By G. C. CRICK, F.G.S.

Read 10th March, 1905.

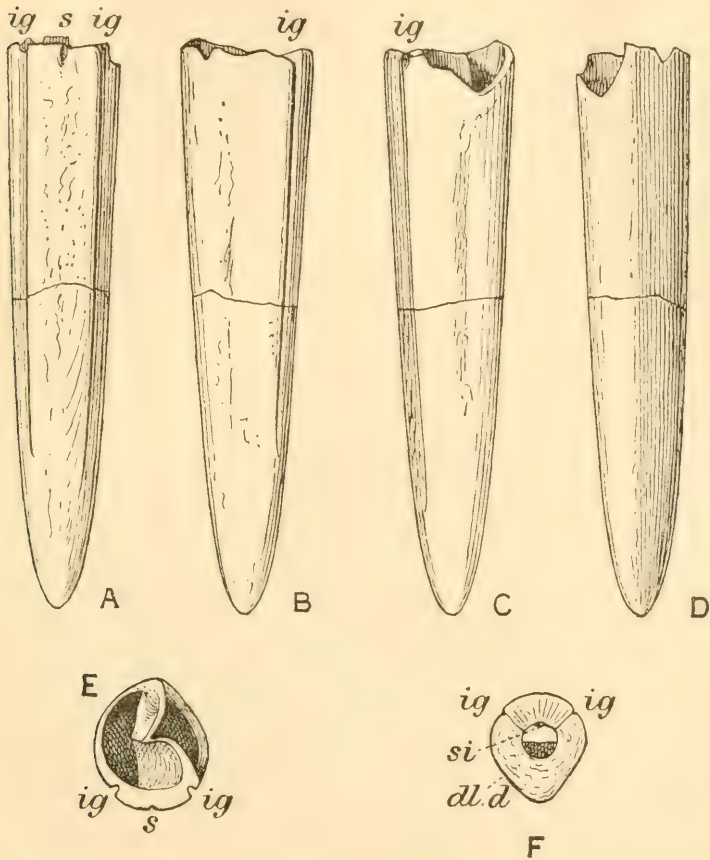
THE specimen described in the present paper formed part of a series of fossils,¹ consisting chiefly of the casts of Gastropoda, collected by Lieut.-Colonel Dr. A. S. G. Jayakar from the Eocene beds at Ras Ghissa and Sharkeeyab in Oman, Arabia, and presented by him to the British Museum. This fossil was obtained at Sharkeeyab, and is preserved in a fawn-coloured marly limestone. From the character of the fossils with which it was associated there seems to be no doubt as to its geological age.

The specimen is belemnitiform, 74 mm. long, conical, gradually tapering for about three-fourths of its length, the apical portion tapering rather more quickly, and terminating in a somewhat obtuse point. It is a little compressed, its ventro-dorsal and transverse diameters, at the anterior end, being 17 and 15 mm. respectively. Its transverse section is oval or subtriangular, the siphuncular or ventral side² corresponding to the base of the triangle. At the anterior end of the specimen the alveolar cavity is displayed, the guard being thickest on the ventral side. One side of the anterior part of the cavity is pushed inwards and broken (see Fig. E). On each side of the median portion of the dorsal area, the guard, for two-thirds of its length, is a little flattened, or even slightly concave. Symmetrically placed on the ventral surface, and 9 mm. apart, are two strong sharply-incised grooves, which pass backwards from the edge of the alveolus, where they are about 1 mm. wide, for a distance of 55 mm. and 47 mm. respectively, when each gradually dies away. In a ventral aspect of the guard, the one on the left, i.e. the longer of the two, turns towards the middle of the ventral surface as it is disappearing; that on the right gives off, throughout the lower half of its course, branches which also pass on to the ventral surface. A transverse section of the guard, at about its mid-length (see Fig. F), shows that a crack extends from the bottom of each groove to the boundary of the phragmocone, the crack being filled with a material of a dark reddish-brown colour. The internal portion of the guard between these two cracks is traversed by a number of small similarly coloured and radially disposed cracks, but these, excepting perhaps the median one, only extend part of the way between the

¹ This collection of fossils is mentioned by Mr. R. B. Newton, *Quart. Journ. Geol. Soc.*, vol. lxi (1905), p. 158. For details of the geology, see H. J. Carter, "Memoir on the Geology of the South-East Coast of Arabia" [reprinted with alterations and additions from the *Journ. Bombay R. Asiatic Soc.*, 1852, vol. iv], *Geological Papers on Western India*, etc. (1857), pp. 551-627.

² As in *Belemnites*, the side on which the siphuncle is situated is here called ventral.

phragmocone and the surface of the guard. At the anterior part of the specimen, and midway between the two longitudinal grooves, there is a small triangular indentation, which may be the posterior



Styracoteuthis orientalis. A, ventral aspect; B, right lateral aspect; C, left lateral aspect; D, dorsal aspect; E, anterior view of alveolar end; F, natural transverse section of guard, being the posterior view of the anterior half of the specimen. Eocene: Sharkeyab, Oman, Arabia. Drawn of the natural size from the type-specimen in the British Museum (Natural History). [C. 8010.]

ig. incised groove.

s. indentation at middle of anterior end of ventral surface.

si. siphuncle.

dl.d. dorso-lateral depression.

termination of another groove that was continued forwards over a portion of the alveolar cavity that is not now preserved. The surface of the specimen is roughened, having in places, especially at

the anterior part, quite the appearance of shagreen; it is also very foliaceous, as though the outer concentric layers of the guard were loosely superimposed. This is especially the case on the ventral surface between the two longitudinal grooves and on the dorsal surface. The internal structure of the guard is coarsely crystalline, and does not at all distinctly show the concentric lamellæ, such as are so conspicuous in the *Belemnite* rostrum. The phragmocone extends through about three-fourths of the length of the specimen; its section is almost circular; its sides are inclined to each other at an angle of 13° , the angle between the dorsal and ventral surfaces being 12° . The septa, as seen at a fracture at about the middle of the specimen, are oblique, their lowest part being on the siphuncular side, i.e., on the side adjacent to the two longitudinal grooves, and they have only a very slight ventral lobe.

The affinities of the fossil are quite clear. It is allied, on the one hand, to the genus *Bayanoteuthis* from the Eocene of Ronca and of the Paris Basin; and, on the other hand, to the genus *Vasseuria* from the Eocene of France.

The genus *Bayanoteuthis* was instituted by Munier-Chalmas¹ for a species (which he did not name) from the "sables de Beauchamp" (Upper Eocene) at Bremier, and for the species from the Eocene of Ronca that was described and figured by U. Schlönbach under the name *Belemnites rugifer*.² Munier-Chalmas did not give a detailed diagnosis of the genus, of which only a few fragments are known, but merely stated that it differed from true *Belemnites* by the possession of two sublateral grooves, and by the oval section of its narrower and more elongate phragmocone. But U. Schlönbach's figures and descriptions of his species, *B. rugifer*, are quite sufficient to indicate the characters of the genus. However, a diagnosis of the genus was subsequently given by M. Paul Fischer³ and afterwards by Zittel.⁴ In this genus the guard is elongated, subcylindrical, terminated posteriorly in a point, and bearing two longitudinal, broad, shallow, smooth, lateral grooves; the dorsal surface is ornamented with longitudinal coarse impressions; the alveolus is unusually deep; the phragmocone is narrow, very slender, long, and in cross-section oval; the siphuncle is ventral; and the septa, according to M. Fischer, possess a feeble siphonal lobe.

The present specimen differs from this genus in several important characters: firstly, by the more conical form of the guard; secondly, by the presence of the deeply incised groove on each side of the ventral surface; and thirdly, by the more nearly dorsal position of the broad shallow dorso-lateral grooves.

The genus *Vasseuria* was instituted in 1880 by Munier-Chalmas,⁵

¹ Bull. Soc. géol. France, sér. II, vol. xxix (1872), p. 530.

² Jahrb. d. k.k. geol. Reichsanst., Wien, Bd. xviii (1868), pp. 455-461, pl. xi, figs. 1a-h.

³ "Manuel de Conchyliologie," fasc. iv (1882), p. 360.

⁴ "Handbuch der Paläontologie," Bd. i, Abth. 2 (1884), p. 509.

⁵ Bull. Soc. géol. France, sér. III, vol. viii (1880), p. 291.

but he did not figure the genus. The type-, and the only known species (*V. occidentalis*, from the Eocene of Brittany) was subsequently figured by Vasseur¹ (pl. i, figs. 8-15) in an incomplete work issued in 1881,² by M. Paul Fischer in 1882,³ by M. Cossmann in 1895,⁴ and by MM. Cossmann & Pissaro in 1900.⁵ In this genus the guard is small, conical, narrow, having the form of *Dentalium*, and is straight, or very feebly curved; its external surface is ornamented with a number of longitudinal grooves; the phragmocone is more than one half the length of the guard and has an elliptical cross-section; the septa are oblique, directed backwards towards the siphuncular side, and provided with a subangular siphonal lobe; the septal necks extend from one septum to another. The type-species is described by Munier-Chalmas as having from 8 to 10 longitudinal grooves, with other secondary ones interpolated between them. Zittel, however, in his definition of the genus ("Handbuch der Paläontologie," Bd. i, Abth. 2, Lief. iii, 1884, p. 509) states that the shell was ornamented with *three* longitudinal furrows extending from the apex ("mit 3 von der Spitze ausgehenden Längsfurchen"), a statement which is repeated in the first (1895, p. 442) and second (1903, p. 476) editions of his "Grundzüge der Paläontologie." The statement is not borne out by any of the examples that the present writer has examined; they all possess considerably more than three rather deep grooves which extend from the apex and disappear towards the anterior part of the guard, whilst between these are interpolated finer grooves which anteriorly are entirely replaced by small irregular depressions, giving to the surface of the guard the appearance of shagreen.

The Arabian specimen is much larger than this genus; its two longitudinal grooves are deepest at the alveolar margin, and do not extend to the posterior extremity, whereas in *Vasseuria* the longitudinal grooves extend from the apex and die out on the alveolar region; *Vasseuria* also does not possess any dorso-lateral depressions.

While having affinities with both *Bayanoteuthis* and *Vasseuria*, the present specimen may also be compared with the Upper Cretaceous genus *Belemnitella*, d'Orbigny.⁶ Well-preserved examples of *Belemnitella mucronata*⁷ possess, on each side, a double dorso-lateral groove,

¹ "Recherches géologiques sur les terrains tertiaires de la France occidentale." Paléontologie par G. Vasseur. Atlas: pls. i-iii and v-xi. Cossmann states that he possesses also plates iv and xix.

² M. Cossmann: Bull. Soc. Sci. Nat. de l'ouest de la France, tom. v (1895), p. 159, footnote 2 (= "Mollusques éocéniques de la Loire-inférieure," tom. i, fasc. 1, p. 3, footnote 2).

³ "Manuel de Conchyliologie," fasc. iv (1882), p. 359, fig. 137.

⁴ Bull. Soc. Sci. Nat. de l'ouest de la France, tom. v (1895), p. 167, pl. v, figs. 10-13 (= "Mollusques éocéniques de la Loire-inférieure," tom. i, fasc. 1, 1895, p. 11, pl. i, figs. 10-13).

⁵ Bull. Soc. géol. Normandie, tom. xix (1898-1899), p. 21, pl. i, fig. 23 (1900).

⁶ D'Orbigny: Pal. Franç., Terr. créét., tom. i, Céph., 1840-42, p. 59.

⁷ See D'Orbigny, op. cit., pl. vii, figs. 1-3; C. Schlüter, Paläontographica, Bd. xxiv, pl. iv, figs. 1a, b, c; and D. Sharpe, Foss. Moll. Chalk (Mon. Pal. Soc.), pt. i (1853), pl. i, figs. 2a, b (the dorso-lateral grooves are indicated in these figures, but the vascular impressions are very imperfectly indicated in fig. 2b).

in which the groove adjacent to the dorsal area is much broader than the other, and anteriorly approaches its fellow on the opposite side, imparting to the alveolar region of the guard a subtriangular cross-section. The other groove on each side, i.e. the groove nearer the middle of the lateral area, is much narrower, and from it originate the vascular impressions which pass on to the ventral surface of the guard, where they form a very conspicuous character.

In the present specimen each dorso-lateral depression appears, then, to be comparable with the more dorsal member of each double dorso-lateral groove in the genus *Belemnitella*, whilst the incised grooves bounding the ventral surface appear to be comparable with the more nearly lateral component of each dorso-lateral groove in the same genus. The presence or absence of a ventral slit in this specimen is not determinable, owing to the imperfection of the anterior portion of the alveolar region; if a slit existed it was comparatively short, but the slight indentation (referred to above) in the middle of the ventral surface at the anterior end of the specimen the writer is disposed to regard as accidental.

The specimen appears, then, to be generically distinct, and, whilst being most nearly related to such Eocene forms as *Bayanoteuthis*, and especially to *Vasseuria*, forms a connecting link between these genera and the Cretaceous genus *Belemnitella*. Although only a single example is known, the form is so important that the writer proposes for it the name *Styracoteuthis*,¹ and, for its trivial designation, suggests the term *orientalis*.

¹ στύραξ, ακοσ, spike at lower end of spear.

DESCRIPTIONS OF SEVEN NEW SPECIES OF MARINE MOLLUSCA
FROM THE COLLECTION OF THE LATE ADMIRAL KEPPEL.

By G. B. SOWERBY, F.L.S.

Read 10th March, 1905.

PECTEN KEPPELIANUS.

Testa semiglobosa, æquilateralis, inæquivalvis; auriculis latiusculis, leviter inæqualibus, fere rectangularibus. Valva dextra valde rotundato-convexa, alba, maculis parviusculis, paucis, rosaceis, prope umbonem ornata, concentricè undulatim subrugose laminata; costis circ. 14, latiusculis, angulatis, longitudinaliter trisulcatis, interstitiis concavis. Valva sinistra concave depressa, aurantio-fusca, maculis fuscis et albidis lineisque undulatis variegata, concentricè subtilissime laminata; costis medioeriter latis, longitudinaliter liratis, interstitiis planulatis, lira angusta mediana interruptis.

Lat. 86, alt. 78 mm.

Hab.—Ascension Island (?).

The shell has just the form of the Californian *P. dentatus*, Sowerby, which it resembles also in the dentate character of the margin, but the difference, especially of the convex valve, is very apparent; the ribs are less numerous, and instead of being smooth and rounded, as in the last-named species, they are angular and strongly grooved.

My type is the only specimen of this species found in Admiral Keppel's collection, and it was labelled Ascension Island. It happens, as a rather curious coincidence, that just at this time two specimens have reached the British Museum from the Cape Verd Islands. The few labels with the late Admiral's shells were loose, and some of them may possibly have been misplaced. It is therefore quite possible that this *Pecten* may have been collected at Sierra Leone, which is much nearer to the Cape Verd Islands than Ascension. There were in the collection no shells from the Cape Verd Islands, but many from the other two localities mentioned.

TELLINA (PERONÆA) ASCENSIONIS. Fig. 1.

Testa oblonga, æquivalvis, fere æquilateralis, compressa, tenuis, alba, epidermide tenui luteo-virente induta, nitida, fere lævis, concentricè levissime striata, striis radiantibus vix conspicuis; latus anticum concentricè sulcatum, prope marginem subtilissime oblique striatum; latus posticum levissime angulatum, post angulum rugose plicatum. Umbones centrali, acuti, conjuncti, postice leviter inclinati. Margo dorsalis utrinque declivis, anticus leviter arcuatus, posticus superne rectus, deinde convexus, ad extremitatem obtuse angulatus; margo ventralis leviter arcuatus. Ligamentum crassum, longiusculum, nigro-fuscum. Dentes parvi, laterales nulli vel obsoleti. Pagina interna alba, roseo tineta.

Long. 65, alt. 36 mm.

Hab.—Ascension Island.

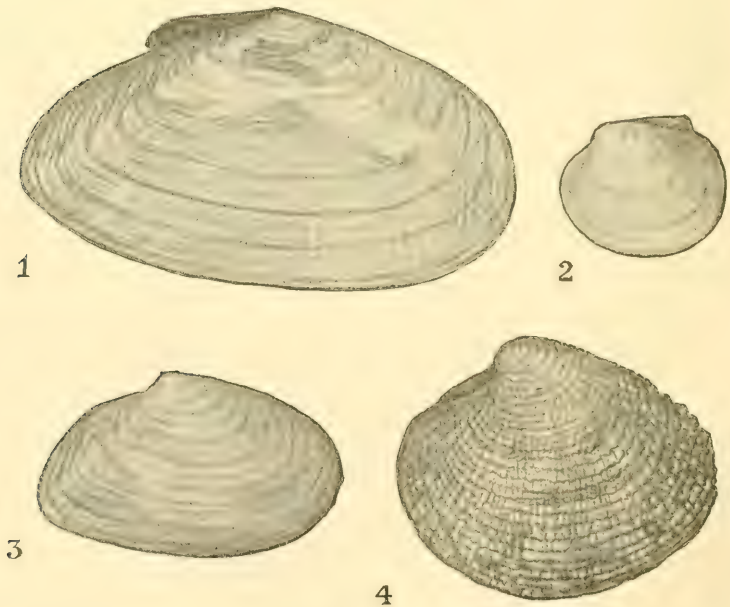
In form this species closely resembles the much smaller Mediterranean *T. nitida*, Poli. The greater part of the surface is almost smooth, exhibiting a few obscure growth-lines, and very faint radiating striæ. The posterior side is roughly plicately ridged, and the anterior concentrically grooved, while near the margin, on the anterior side, numerous fine oblique striæ are observable.

TELLINA (TELLINELLA) PRISMATICA. Fig. 3.

Testa oblongo-ovata, æquivalvis, inæquilateralis, compressa, tenuissima, alba, iridescens, concentricè confertim tenuissime striata, postice obscure angulata, leviter truncata, antice rotundata. Margo dorsalis anticus leviter arcuatus, posticus abbreviatus.

Long. 21, alt. 14 mm.

Hab.—Sierra Leone.



This little white shell, which shows beautiful prismatic colours in the light, is in form and substance somewhat like the European *T. tenuis*, Da Costa, but the ventral margin is rather straighter, and the posterior side more truncated.

VENUS (CHIONE) KEPPELIANA. Fig. 4.

Testa sub-ovata, solida, leviter inflata, fusca, maculis albidis conspersa, lamellis concentricis, numerosis, tenuissimis, fimbriatis, utrinque magis elevatis, instructa, radiatim confertissime lirata; liris medianis

angustis, rotundatis, posticis latioribus, anticis duplicatis, latiusculis. Umbones rotundati, incurvati, approximati; lunula elongato-cordiformis, distincta, nigro-fusca; ligamentum angustum, immersum; area ligamenti concave impressa. Margo dorsalis utrinque obtusissime angulatus; posticus longiusculus, subrecto-declivis; anticus abbreviatus, incurvus; margo ventralis rotunde arcuatus. Pagina interna lævis, alba, violaceo tineta, ad marginem subtiliter crenulata.

Lat. 42, alt. 36 mm.

Hab.—Off Sierra Leone.

In form this shell closely resembles *V. declivis*, Sowerby, which species Admiral Keppel dredged in the same locality. The concentric lamellæ are more numerous and less elevated, excepting at the sides. The species is further distinguished by its close radiating riblets, which are much narrower and closer than in the West Indian *V. cancellata*.

DIPLODONTA AURICULATA. Fig. 2.

Testa subquadrato-rotundata, æquivalvis, inæquilateralis, alba, lævigata, concentric sub-obsolete striata, postice late rotundata, antice leviter contracta. Margo dorsalis anticus breviter declivis, posticus rectus, auriculatus; margo ventralis valde arcuatus. Cardo normalis.

Lat. 21, alt. 19 mm.

Hab.—Sierra Leone.

This shell is distinguished by a well-defined posterior auricle; it is otherwise so like the British *D. rotundata* that it might have been taken for a monstrosity, were it not that two specimens, exactly alike, were taken at the above locality, and that there is a third in the British Museum.

PROTOMA PULCHRA. Fig. 5.

Testa elongato-turrita, albida, strigis maculisque fuscis ornata; anfractus 19, convexi, primi 2 minuti, læves, cæteri bicarinati, deinde



iris 2-4 angustis, hic illic albo et fusco articulatis, instructi; anfractus ultimus $\frac{1}{2}$ longitudinis testæ æquans, sex-liratus. Apertura subquadrata; columella tenuis, arcuata; labrum tenue, antice truncatum, late et profunde sinuatum.

Long. 37, diam. maj. $8\frac{1}{2}$ mm.

Hab.—Sierra Leone.

The only recent species hitherto known of this genus is *P. Knockeri*, Baird, to which the present shell has not much resemblance, excepting in one remarkable character, regarded as generic, viz., the strong sinus at the base of the aperture; the protoconch is also similar.

CONUS FUSCOLINEATUS. Fig. 6.

Testa ovato-turbinata, lævis, antice attenuata, postice rotundata, albida, epidermide lutea induta, lineis angustis, fuscis, transversis, plus minusve interruptis, ornata, ad apicem maculis grandibus, fuscis, irregularibus, picta. Spira brevissime obtusa; anfractus haud carinati. Apertura mediocriter lata, intus purpureo-fusco late trifasciata.

Long. 22, maj. diam. 12 mm.

Hab.—Sierra Leone.

In form this shell closely resembles *C. mercator*, a well-known and variable West African species, but the pattern, consisting of dark brown transverse lines, is entirely different from that of any of the numerous varieties of that species.

ON THE OCCURRENCE OF INTERNAL SEPTA IN *GLYPTOSTOMA*
NEWBERRYANUM.

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

Read 10th March, 1905.

It is well known that some mollusca, as they increase in size, withdraw from the upper or apical part of their shells. In some cases the empty space is at length filled with solid matter, as in *Magilus*, while in others septa are formed, completely closing the vacant portion, as in *Euomphalus*, *Triton*, etc. In elongated shells, such as *Cylindrella*, *Eucalodum*, and *Rumina decollata*, the vacated portion, becoming dead, breaks off and leaves the shell decollate.

Recently, while cutting a shell of *Glyptostoma Newberryanum* to show its internal structure, I noticed what I at first took to be an empty pupa-case of some insect, such as are frequently met with in the whorls of shells. Its substance, however, was found to be hard and solid, and a closer examination revealed it to be a saccate septum



composed of several layers of shelly matter and having its convex apex towards the protoconch (Fig. 1). On carefully breaking away some portions of the outer shell-wall higher up the spire, two additional septa were observed, each having been formed successively as the animal retreated further from the protoconch. The concave shape of each septum conforms to the shape of the liver-lobe, its apex is obliquely inclined; and while it closely invests the inner wall of the whorl a narrow space is left between it and the outer wall. The first septum occurs $1\frac{1}{2}$ whorls from the apex of the shell, the next $\frac{3}{4}$ whorl further down, while another $\frac{3}{4}$ whorl divides the second from the third septum (Fig. 2). A second specimen, upon being opened, yielded similar results.

As I have failed to trace any mention of such formations in the species under discussion, or in fact in any Helicoid, either in general textbooks or in special American faunal treatises, I have thought it of interest to place the facts on record.

NOTE ON A DART FOUND IN THE BODY-CAVITY OF *HELIX*
ASPERSA.

By R. G. BARNES.

Read 10th March, 1905.

AMONG the mollusca there are various calcareous or crystalline secretions, and these secretions may be used for diverse objects. There is found among some bivalves and a few Gastropods a crystalline style. As is well known, this lies in a blind sac, adjoining the intestine, and is probably used as an accessory digestive organ, though only present at certain seasons of the year. It has been observed also to vary in size with the amount of food ingested by the mollusc, suggesting that the structure may represent a reserve of food material with a special secretion, but a chemical modification of surplus food.



Different from both these organs, we find in certain Gastropods, especially the Helicidæ, an ergasidium, the special function of which is to stimulate sexual activity. These excitatory functions are not restricted to male or female, and it has even been thought that most molluscs are provided with some special excitatory, or else alluring, organ. Among some Gastropods, as *Agriolimax* and *Zua*, there is a special stimulatory organ which is a fleshy, linguiform, eversible process. This organ is either in the genital passage, near the outlet, or in a cleft at the base of the copulatory organs. Usually also this belongs to the masculine apparatus, though in *Amalia* it is in the feminine parts.

Another form of ergasidium is the dart of the Helicidæ, etc., variously known as the spiculum amoris, gyprobelum, and love dart. This dart appears to be formed in less than a week, and is a crystalline rod, which is slightly flexible, terminating in a fine point. The base is enlarged to fit upon a conical tubercle at the bottom of the dart-sac. A viscous secretion attaches it to the tubercle, and this also fills up the interior, which is partially hollow.

It used to be thought that it was hurled by one snail at another, being launched into the air and buried in the tissues of the other snail. It is thought now that, as the animals go round one another, previous to conjugation, this dart is pressed out, and is so used to stimulate the pair. In this way, owing to its loose attachment, it may become fixed in the flesh of the other individual and be drawn out.

On May 7th, 1904, in a specimen of *Helix aspersa* which had not previously been observed to conjugate, a dart was found in the body-cavity. It was attached to the interior of the body-wall, almost immediately above the muscle of the penis. This might be explained in two ways. It may have belonged to another individual, and have entered the body through the genital aperture, or it may have belonged to the same individual, and, not being used, have worked its way backwards, and have been replaced by the other dart, which was found fully formed in the dart-sac.

This second theory is supported by an observation made by Mr. W. M. Webb, when the dart was found in the body-cavity of three specimens of *Helix aspersa* which had been dormant for some months.

It would be of interest to know the fate of a dart which has entered the body-cavity, by whatever means it may have got there; but on this point I do not believe anything is at present known.

ANATOMICAL AND SYSTEMATIC NOTES ON *DORCASIA*, *TRIGONEPHRUS*, N.GEN., *CORILLA*, *THERSITES*, AND *CHLORITIS*.

By Prof. HENRY A. PILSBRY, Sc.D., etc.

Read 14th April, 1905.

(PLATES XIII AND XIV.)

I owe to Messrs. John Ponsonby and G. K. Gude the opportunity of dissecting a number of Helices not hitherto described anatomically. Two of them, '*Helix*' *globulus*, Müller, and *Corilla Humberti*, Brot, represent groups of such high interest that I need not apologise for discussing them at some length.

THE GENERA *DORCASIA*, GRAY, AND *TRIGONEPHRUS*, N.GEN.

Dorcasia was instituted by J. E. Gray (1838, p. 268) for the species *D. Alexandri*, Gray. Dr. Fleck collected a living specimen of *D. Alexandri* some years ago, and Simroth has given a short account of its anatomy (1894, p. 94). The same specimen—an immature one—furnished the notes and figures given by me (1895, p. 172). From these imperfect data it appears that *Helix globulus* differs from *D. Alexandri* in several important particulars, so that while the two are probably more nearly related to one another than either is to other known genera, yet it seems necessary to erect a new generic group for the species *globulus* and its immediate allies. The two groups will be distinguished as follows:—

| | |
|--|--|
| <i>DORCASIA</i> , type <i>Alexandri</i> . | <i>TRIGONEPHRUS</i> , type <i>globulus</i> . |
| Vas deferens free throughout. | Vas deferens closely bound to the penis and oviduct, nowhere free. |
| Duct of the spermatheca long, inserted upon a rather long vagina. | Duct of spermatheca short, inserted on the atrium. |
| Central and inner lateral teeth with mesocones only; outer lateral and marginal teeth with the ectocone developed. | All of the teeth tricuspid. |
| Shell depressed. | Shell globular. |

ANATOMY OF *TRIGONEPHRUS GLOBULUS*.

The foot is short and broad, the tail depressed, rounded posteriorly, evenly granulate.

The jaw is solid, moderately arched, and smooth.

The radula is large for the size of the snail, measuring about 8 mm. long, 4 wide. The teeth stand in nearly straight transverse rows, about 90 teeth in a row. The central and lateral teeth are so similar that the middle series can be found only with difficulty. These teeth (Pl. XIV, Fig. 15) are tricuspid, the mesocones being about as long as the basal plates, the side cusps distinctly overhanging, ectocone and entocone being nearly equal. The transition to the marginal type of

teeth is effected by suppression of the entocone first, and then diminution of the ectocone, which also is finally suppressed (Pl. XIV, Fig. 13, a group of transitional and marginal teeth).

The pharynx is disproportionately large, of the usual short form. The salivary glands are compact, and loosely united posteriorly below the œsophagus. There is an enormous crop, and a very small stomach (Pl. XIII, Fig. 8).

The pallial cavity (Pl. XIII, Fig. 7) is short and broad. The lung shows conspicuous venation on both sides of the pulmonary vein, the area on the cardiac side being particularly large and well supplied with veins. The pulmonary vein has numerous small, but no very large branches, except that a large pericardial vein is developed, bearing a large, ramose, first pericardial branch. Between this and the pulmonary vein a large median branch of the vena cava descends.

The venation is not very distinct unless viewed by transmitted light.

The kidney is large, subtriangular or rhombic, with a large cavity. There is no distinct ureter, the cavity opening by a subapical pore into the lung. There is no closed secondary ureter, but merely a narrow band along the intestine and overhung by it.

The genitalia of two individuals are figured (Pl. XIII, Figs. 6 and 9). The penis, very slender basally, is elsewhere stout, with a subterminal retractor. The vas deferens is closely bound to the penis throughout, and beyond it to the vagina, which is rather short. The duct of the spermatheca is inserted low, and is basally enlarged. It is not long, about the length of the penis, and terminates in an oblong spermatheca. In one individual (Fig. 9) the spermatheca was enormously swollen, and contained a large, oval, fleshy spermatophore, weakly corrugated externally. The oviduct has the usual sacculated structure. The albumen gland and ovotestis were not dissected out.

The retractor muscle of the penis inserts distally on the lung floor. The retractor of the right ommatophore lies between ♂ and ♀ branches of the genital system. The free retractor muscles were not further worked out.

THE RELATIONSHIPS OF *TRIGONEPHRUS*.

The morphology of the pallial organs gives at once an unmistakable clue to the affinities of this group. The rich venation of the cardiac side of the lung, the reflexed pericardial vein with its dominant first branch, separated from the ramifications of the pulmonary vein by a large branch of the vena cava, together with the short, bulky, sack-like kidney with deficient ureter, are structures eminently characteristic of a group composed of the genera *Helicophanta*, *Ampelita*, *Stylodonta*, *Acavus*, *Panda*, *Pedinogyra*, *Caryodes*, and *Anoglypta*. This group, the several members of which were brought together by the labours of Semper, Hedley, and the writer, was segregated from other Helices under the name *Macroogona* in my "Guide to the Study of Helices,"¹ and later was elevated to the rank of a family under the name

¹ Manual of Conchology, vol. ix, p. xxxii.

Acavidae. With the genera of the Acavidae *Trigonephrus* agrees, not only in the exceedingly characteristic structure of the lung, but also in having a strong smooth jaw and genitalia without accessory organs; but it differs from other known genera in the tricuspid teeth. All other forms known to belong to the family have unicuspid or nearly unicuspid teeth, by suppression of side cusps, which many lines of evidence show were present in the ancestral Vasopulmonata. The presence of side cusps in *T. globulus* indicates that it is a relatively primitive member of the stock. This conclusion is further emphasised by the fact that, so far as we can judge, the young undergo no such prolonged uterine or intra-oval existence as has been shown to prevail in the typical Acavidae. In this respect, *Trigonephrus* holds such a relation to *Helicophanta* and *Acavus* as typical *Achatina* bears towards the great West African *Metachatinas*.

When the pallial organs of *Dorcasia Alexandri* and its allies are examined, the relations of that genus to *Trigonephrus* may be intelligently discussed. It is likely that *Dorcasia* also belongs to the Acavidae. In this family the pattern of the lung venation is extremely constant and characteristic, being about the same in genera of Madagascar, Ceylon, and Australia.

CORILLA HUMBERTI (Brot).

Several specimens submitted by Mr. G. K. Gude, collected by the late Oliver Collett, enable me to confirm the anatomical data obtained by Semper in examining *C. erronea*, and to add a few further facts.

The jaw is stout and smooth, arcuate, without a median projection below.

The radula has teeth according to the formula 19 : 19 : 1 : 19 : 19. The transverse rows run slightly forward on each side of the middle tooth. All of the teeth are unicuspid, the cusps much shorter than the basal plates (Pl. XIV, Fig. 10, a group of central and lateral teeth, and Fig. 11, a group of lateral and marginal teeth). The marginal teeth differ from laterals by the shortening of the basal plates and the elongation of the cusps, which are oblique, broad, and obtuse. The outermost marginals (Pl. XIV, Fig. 12) are much shortened, without diminution in width.

The pallial tract (Pl. XIII, Fig. 3) is long and narrow, and densely pigmented. Scarcely any venation, aside from the pulmonary veins, is visible, even by transmitted light. So plain a lung as this I do not remember seeing in any Helicoid snail. The lung is about 28 mm. long. The kidney is 10 mm. long, about double the length of the pericardium. It is sack-like, with a very large cavity and thin walls, irregularly rugose within, there being a network of anastomosing rugæ and lamellæ. It excretes through a pore about the middle of the right side (the left side as the lung lies inverted in the figure), without any differentiated ureter. There is no enclosed secondary or gut ureter.

The genital system (Pl. XIII, Fig. 1) closely resembles that of *Corilla erronea* as figured by Semper. The penis is oblong, stout, and fleshy, contracting into an epiphallus more than three times its

length, the vas deferens terminal upon the epiphallus, as shown in the figure. The atrium and vagina are short. The uterus contained, in two individuals opened, two very large membranous egg-capsules, measuring about 10 by 5 and 7 by 5 mm. The embryos were in a very early stage of development. The albumen gland is well developed. The ovisperm duct is not convoluted and knotted as usual, but is coiled at its entrance into the side of the albumen gland. The ovotestis consists of several bundles of long cæca embedded in the digestive gland. The spermatheca is small and oval, on a very long, slender duct, which bears a long diverticulum. The total length of duct and diverticulum is 45 mm.; of the diverticulum 19 mm.

The free retractor muscles (Pl. XIII, Fig. 2) are united for about one-fourth of their length posteriorly. The right ocular retractor first branches off, then the pharyngeal retractor.

Corilla Humberti agrees very closely, it will be seen, with *C. erronea* (Semper, 1870) in internal structure; and the additional data obtained throw no light upon the affinities of the group with other Helicidæ. The plain lung, primitive type of kidney, and the diverticulum upon the spermatheca duct are all features foreign to those Helicid groups which share other structures. The suspicion I formerly entertained that *Corilla* might be related to the Macroogona is negatived by the knowledge we now have of the lungs of both groups; and we do not yet know enough of the anatomy of *Plectopyllis*, *Stegodera*, or *Traumatophora* to demonstrate any relationship between them and *Corilla*, though it is natural to suppose that these genera stand together. The genus, so far as we now know, stands by itself; and for it alone a subfamily Corillinæ must be erected. This might for the present be placed next to the Camæninæ (Epiphalloogona).

THERSITES MERIDIONALIS (BRAZIER).

In dealing with the molluscs of the Horn Expedition, Hedley has shown that the genus *Thersites*, as limited in the "Guide to the Study of Helices," contains two very distinct generic groups: *Thersites* proper, including chiefly species of Eastern Australia, with genitalia like *Chloritis*; and *Xanthomelon*, with a penis of highly specialized structure, comprising, besides the typical North Australian forms, a large series of South and West Australian species, composing the group of *X. bitaniata* and the group *Angasella*, formerly referred to *Planispira*. *T. meridionalis* has, as would be anticipated from the shell, the anatomy of *Thersites* proper.

The foot in *Thersites meridionalis* is blackish, finely granulose, with a pair of dorsal grooves, but no genital groove. The tail is rounded above. There is a right body-lobe on the thick mantle-edge, but the left lobe is merely vestigial.

The pallial organs (Pl. XIII, Fig. 5) have the structure usual in Epiphalloogona. The lung is copiously black-pigmented. The pulmonary vein is large, with numerous small branches.

The venation of the cardiac side is chiefly anterior, as usual. The pericardium is about 4 mm. long.

The kidney is very large—15 mm. long—about half the length of the whole pallial cavity, and four times that of the pericardium. The usual retrograde ureter is developed. The secondary or gut ureter is wholly open, merely a thickened band of tissue along the terminal course of the gut, upon which there is a low ridge, which in the natural position of the organs defines a gutter. A transverse section of the gut with this gutter spread open is shown to the left of Fig. 5.

So far as I know, the pallial organs of *Thersites* have not before been examined. Their structure confirms the very close relationship to *Chloritis* already predicated from the similar genitalia.

The penis (Pl. XIII, Fig. 4) is swollen distally, continued in an epiphallus of about the same length, which terminates in a short flagellum. The vagina is long, more than half the length of the penis. The duct of the spermatheca is long, as usual in the genus.

CHLORITIS FRAGILIS, GÜDE.

A specimen, not quite mature, of this species, sent by Mr. Hirase from Kyoto, Japan, was dissected to ascertain whether the far northern species really belong to the typically tropical genus *Chloritis*. This inquiry may now be answered affirmatively. No Japanese species of the genus has been examined anatomically heretofore.

The tail has a wide rounded welt above, but no longitudinal median groove there, such as occurs in *C. Porteri*.

The lung (Pl. XIV, Fig. 14) is rather short. The pulmonary vein bears a large branch on the cardiac side, which is more copiously supplied with veins than usual. The intestinal side is closely parallel-veined. The pericardium is one-fourth as long as the kidney. The kidney is very long, band-like, and reflexed in a long primary ureter as usual. The secondary or gut ureter is a narrow, open band.

The long kidney is a characteristic feature of the *Epiphallo-gona* or *Camæninæ*.

The genitalia of the specimen examined (Pl. XIV, Fig. 16) show immaturity. The penis is much swollen distally, containing a large papilla. The well-developed epiphallus terminates in a very short flagellum, and bears the penial retractor muscle near its base. There is a rather long vagina and a long duct of the spermatheca. It will be seen that these organs agree well with *Chloritis* except in the shortness of the flagellum, which is a characteristic of the subgenus *Tricho-chloritis*, Pils., to which group all species found north of the equator are probably referable.

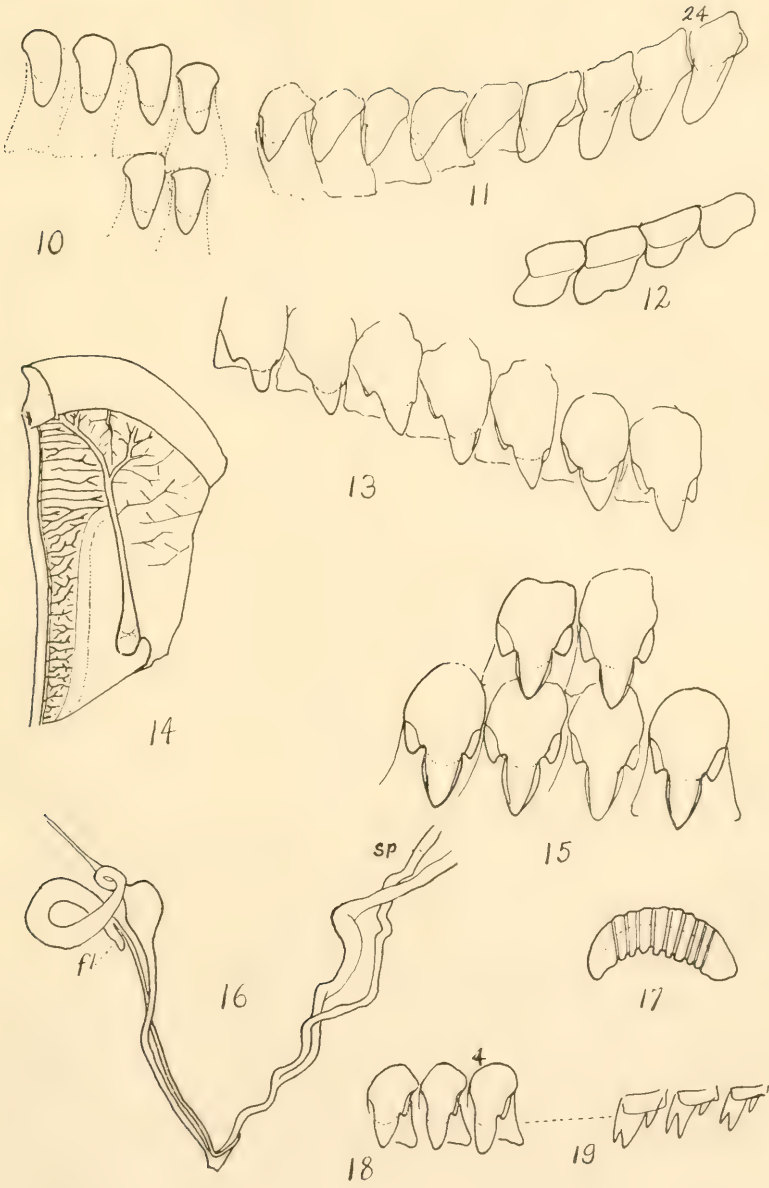
The jaw (Pl. XIV, Fig. 17) has 10 ribs, strongly projecting on the basal margin.

The central tooth has small ectocones. The laterals (Pl. XIV, Fig. 18) have also ectocones, and the marginal teeth (Pl. XIV, Fig. 19) are of the ordinary tricuspoid type. The teeth are throughout very similar to those of *Chloritis argillacea*, as figured by Wiegmann.



H. A. P. del.

PILSBRY ON CORILLA, THERSITES, TRIGONEPHRUS.



H. A. P. del.

PILSBRY ON CORILLA, TRIGONEPHRUS, CHLORITIS.

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EXPLANATION OF PLATES.

PLATE XIII.

- FIGS. 1-3.—Genitalia, muscles, and lung of *Corilla Humberti*.
 ,, 4, 5.—Genitalia and pallial organs of *Thersites meridionalis*.
 ,, 6-9.—Genitalia, pallial organs, and fore-gut of *Trigonephrus globulus*.

PLATE XIV.

- FIGS. 10, 11.—Teeth of *Corilla Humberti*.
 FIG. 12.—Outermost marginal teeth of same.
 FIGS. 13, 15.—Teeth of *Trigonephrus globulus*.
 ,, 14, 16-19.—Pallial organs, genitalia, jaw, and teeth of *Chloritis fragilis*.
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SOME ACCOUNT OF THE ANATOMY OF *CASSIDARIA*¹ *RUGOSA*
(LINN.).

By ALEXANDER REYNELL.

Read 14th April, 1905.

PLATE XV.

FOR the opportunity of examining the anatomy of this animal I am indebted to the kindness of Mr. Sykes, from whom I received it on the 14th June, 1904, it being trawled from a depth of 200 fathoms off the south-west coast of Ireland.

The animal, a full-grown male, was preserved in a solution of formaldehyde and much retracted in its shell. I was fortunate enough, however, in extracting it entire. The foot was rolled together, and the proboscis and tentacles partially retracted. I cannot find that the general anatomy of this species in its entirety has ever been described, though it must be pretty well known.

Kiener in his monograph of this genus gives some description of the animal and the anatomy of the pallial complex. I really cannot agree with his colouring of the animal, he making the colour of the foot and visible portion of the animal olive green, whereas, according to its captor, the colour of this specimen, when living, "was pale grey, much like the foot of a whelk," and, as preserved, the foot, head, and tentacles were of a pale yellowish pink colour, much like what is conventionally known as 'flesh colour,' the only pigmented portions being the proboscis and eyes.

Dr. N. Tiberi, in his paper "Sur les espèces du genre *Cassidaria* qui vivent dans la Méditerranée" (*Journal de Conchyliologie*, ser. III, vol. III, 1863), mentions this species, as figured by Kiener, and finds fault with his colouring.

Fischer gives some account and a figure of the liver of this species in his paper on the morphology of the liver of Gastropods. F. Bernard, in his beautifully illustrated paper, describing his researches on the pallial organs, minutely describes the osphradium and etenidium.

Perrier gives a full account of the anatomy and histology of the renal organs in his paper on these organs in Prosobranchs; this, again, is beautifully illustrated. Finally, there are some notes on the anatomy of this species to be found in part ii of Dr. Arnold Lang's "Textbook of Invertebrate Comparative Anatomy."

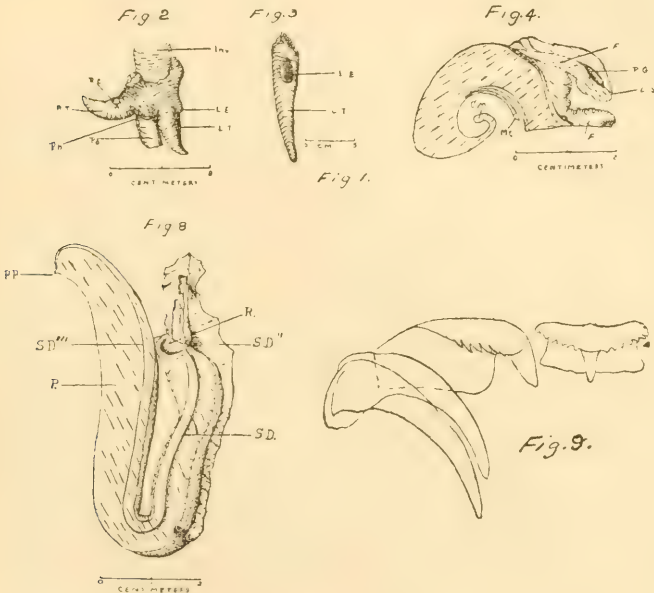
The *foot* (section, Fig. 4, *F'*). Solid and substantial, rounded posteriorly, notched anteriorly, and the edge divided into an upper and lower lip, between and in the centre of which the anterior pedal gland opens (*L.S.* and *P.G.*, Fig. 4). This gland takes the

¹ [*Morio*, Montfort, is an older name.—Ed.]

form of a straight tube about 8 mm. long. The whole of the foot, perhaps through contraction caused by the preserving fluid, is tuberculately reticulated and the margin crenulated. Kiener shows the foot with a broad untesselated margin, but I could trace no suggestion of this.

Operculum. Distinctly oval, and in texture and colour horny, semitransparent, subconcentrically striate, with the nucleus nearly marginal. It measures 32 by 14 mm.

Tentacles (Figs. 1, 2, 3, *L.T.*, *R.T.*) two in number, long and fairly thick, decreasing rapidly in size towards their free ends, but somewhat bluntly pointed. Corrugated and transversely striated through contraction.



Eyes (Figs. 1, 2, 3, *R.E.*, *L.E.*) two in number, placed on tubercles at the base and on the outside of the tentacles. They are pigmented with black, as are, to some extent, the tubercles.

The *rhynchostome* (Fig. 2, *Rh.*) is a plain, simple, rounded opening.

The *introvert* (Fig. 2, *Inv.*) is comparatively short, and conical in shape, with a bulbous swelling at the free end, flattened dorso-ventrally, transversely striate, thick-walled and muscular, especially towards the posterior, where it is attached by two more or less distinct bands of muscles (the introvert retractors, Fig. 1, *R.M.*) to the underside of the floor of the pallial chamber. It is pigmented with purple towards the free end, deepening in colour as the mouth is reached.

Alimentary Canal. The mouth appears as an apparently transverse slit at the free end of the proboscis or introvert.

On slitting open the proboscis (Fig. 2, *Pb.*) the buccal mass is revealed, and on making a longitudinal slit in this the mouth is seen to be provided with two hardened plates, an upper and a lower, of a brilliant orange colour, the margins being deep reddish purple. At the corners of the mouth are two small horseshoe-shaped areas tinged with purple, their use not being quite apparent to me, unless they act as gussets and allow the lips to open or form a disc or sucker, and so give the animal a firmer hold of its prey, and having drilled the shell, suck the contents to within reach of the radula.

Behind the hardened plates is the odontophore, bearing the radula, which is rather short, and distinctly visible on account of its bright purple colour.

The *buccal chamber* is elongated (Fig. 5, *A* and *D*, *Oe.*) and apparently extends the whole length of the introvert, and the hinder part is much sacculated internally. On leaving the buccal chamber the œsophagus is not folded on itself, but is constricted and dips downward, and here the nerve-collar is placed. The constriction continues for a short distance, when it suddenly enlarges, forming the crop (Figs. 1 and 5, *Oe'.*). This enlargement only affects the line of the upper portion of the tube, and is different in texture from the lower portion, its surface showing a cross hatching of fine muscular fibres. The crop continues, though slowly decreasing in size, till it passes underneath the division-wall at the far end of the pallial chamber, at which point it rather suddenly decreases and becomes the true œsophagus. The crop has a complicated internal structure, being pigmented from end to end with a number of transverse lamellæ pigmented with brown (Fig. 5, *B*, *C*, and *D*, *Oe'.*). They are cut through in the drawing and laid back. They spring from and are connected to a longitudinal fold shown to the left in the above figure. They may be secretory organs, as they have a spongy glandular appearance and give a distinctly alkaline reaction with red litmus, but I could get no reaction on testing for glycogen. This may have been destroyed by their long immersion in formaldehyde. Two raised folds run the length of the crop, and these, as far as I could make out, are not tubes. The one to the right is very distinct and much folded longitudinally, the one to the left being much less distinct. In life they may form a guide for the masticated food and also prevent its coming into actual contact with the lamellæ, though open to the action of their secretion, if any. On leaving the neighbourhood of the pallial chamber the walls of the œsophagus get much thinner, and it slowly enlarges till the stomach is reached. This organ is embedded in the liver and its walls are practically transparent, the openings of the hepatic ducts being distinctly visible.

The *stomach* is situated in the bight of the U described by the single turn of the alimentary canal, and is not easily separated from the small intestine, the size decreasing gradually. The intestine on leaving the stomach turns to the right, penetrating the kidney sac and traversing the nephridium. At its junction with the large intestine

or rectum (Fig. 1, *Re.*) there is an enlargement. The latter is thick-walled, muscular, and corrugated, supported throughout its whole length by folds of the inner membrane of the mantle, till the anus (Fig. 1, *An.*), which is free, is reached. The rectum lies to the right of the retracted penis, and the anus is some distance from the free edge of the mantle.

Salivary Glands (Figs. 1 and 5, *R.S.G.*, *L.S.G.*, *R.S.G'*, and *L.S.G'*). There are four of these, two on each duct. The primary glands (*R.S.G.* and *L.S.G.*) are much larger, semitransparent, membranaceous, and loose in texture. They are divided into lobes, of which I made out six in the right-hand gland and four in the left. These glands are situated at the ends of the ducts. The secondary glands (*R.S.G'* and *L.S.G'*) are considerably smaller, of very close texture, and irregular shape, and of an opaque, dead white appearance, that on the right-hand side being more or less embedded in the primary gland, while that on the left is situated some little distance along the duct, and is traversed by a nerve, *N'''*. The glands, as a whole, when *in situ*, lie behind one another, covering the crop. The duct of the posterior glands runs along the left-hand side, and that of the anterior along the right. The salivary ducts (*R.S.D.* and *L.S.D.*) open into the sacculate chamber of the hinder part of the buccal mass, just passing through the nerve-collar. They enlarge somewhat before entering, and apparently do not lead directly into the buccal chamber, but into the saccular folds, which are hollow.

Lang states, in his "Textbook of Comparative Anatomy," that the secretion of the salivary glands of *Cassidaria*, amongst other genera, contains an amount of free sulphuric acid from 2.18 to 4.25 per cent. ; this can only be when the glands are fresh, for on testing I found the secretions of both primary and secondary glands to have a distinct alkaline action on red litmus. This fact, though of interest, is perhaps not of much value, on account of the artificially preserved state of the animal. A. H. Cooke mentions that the acidity of this secretion was first noticed by Troschel in *Dolium galea*, the animal being alive at the time. Fischer states that it is the posterior gland which secretes sulphuric acid, and Coupin, mentioning this, refers the statement to Fischer, who also remarks that Panceri found the acid in the salivary glands of *Murex*, *Cassis*, *Tritonium*, *Pleurobranchus*, etc.

The *liver* is a large granular-looking organ, occupying, with the testes, the whole of the visceral sac behind the kidney, the latter occupying the upper part. In colour it is brownish green, and the cells are distinct ; it is divided into two lobes, each of which is provided with a duct opening into the upper side of the stomach (Fig. 6, *H.D'*, *H.D''*). The lobes of the liver are bound together with a very strong connective tissue, and in consequence is troublesome to dissect without destroying its texture and breaking the cells.

Pallial Complex. The free edge of the mantle is entire, simple, and not reflected, with a thin, sharp edge. The branchial chamber is extensive, and contains a highly developed bipectinate osphradium (Fig. 1, *Os.*) situated on the roof of the pallial chamber, quite to the left-hand side and running along the base of the etenidium. The folia

are deeply pigmented with green. With reference to this organ I feel I cannot add anything to the excellent account given by F. Bernard (5), and must admit I have been unable, from want of time and material, to give it very detailed attention as far as the histology is concerned. The large central nerve ganglion can be made out without difficulty on account of its being unpigmented.

The *ctenidium* (Fig. 1, *Ct.*) is of the usual monopectinate type, and is situated on the roof of the pallial chamber, to the left of and close to the osphradium. At its base runs the thin-walled vessel carrying the aerated blood to the heart. It is faintly pigmented with pink, and is attached to the mantle, from end to end, by more than half its under-surface. It finishes some little distance from the free edge of the mantle, and is so placed as to receive directly the inflowing stream of water from the syphon.

The *syphon* is short, and, as far as I could make out, has no appendages. It is formed by a fold in the mantle, which is much thicker on the left-hand side of the animal than on the right.

Hypobranchial Glands. These do not appear to be particularly well developed, though they cover a considerable area of the under-surface of the mantle in the neighbourhood of the *ctenidium*. They are formed by a number of folds of the inner membrane, very slightly pigmented with pink.

The pallial chamber was filled with a very tough mucous.

Nephridial Opening. This is placed at the back of the pallial chamber, in the wall separating the chamber from the nephridium.

Nephridium. Of large size, and rendered distinctly visible from the outside by a purplish tint when the animal is looked at after being taken out of the shell. It is in the form of a sac situated to the right hand of the pericardium, immediately behind the pallial chamber, from which it is separated by a thin and nearly transparent membrane, in which, as before mentioned, is situated the slit-like excretory orifice, surrounded by muscular fibres forming a sphincter. No part of the excretory tissue appears to be attached to this thin division-wall. The nephridium is traversed by the intestine, by which it is practically divided into two lobes. The internal structure of the organ is very complicated and has a more or less honeycombed appearance and a spongy texture, the divisions being formed by the ramifications which appear to be connected to two longitudinal axes, one on each side of and running parallel to the traversing intestine. The colour of the gland is brownish.

Reno-Pericardial Canal. Unfortunately the pericardium broke away owing to the weight of the visceral sac, and I could not trace the canal. Perrier states that it is very short, being only 2 mm. long and .5 mm. in diameter.

The *nephridial gland* is distinct both in colour and appearance from the nephridium, and occupies two sides of the sac, namely, those bordering the pericardium and the anterior border. Its canals ramify more or less under the general mass of the nephridium.

REPRODUCTIVE SYSTEM.

Penis (Fig. 8, *P.*). Very large and directed backwards when retracted, more or less oval in section, the free end curving downwards following the curve of the floor of the pallial cavity, blunt at the apex. At the right-hand side near the apex is a small pointed papilla (Fig. 8, *P.P.*).

Testis. Is a large whitish, somewhat granular-looking organ, which divides with the liver, as before mentioned, the visceral sac, and reaches quite to the apex.

The duct leading to the vas deferens is very short (Fig. 1, *S.D'*) where it has been cut through and the visceral sac turned back, joining the vas deferens at *S.D''*, Figs. 1 and 8.

Seminal Duct. Directly after entering, the duct enlarges very suddenly, forming a pear-shaped receptaculum (Fig. 8, *R.*), which contained a certain amount of a reddish-brown granular substance. The upper part of the walls of this receptaculum are rather thin, and it is attached on the underside to the floor of the pallial chamber.

On leaving the receptaculum the seminal duct or vas deferens (Fig. 8, *S.D.*) runs through a thick-walled tube which is formed by a thickening of the floor of the pallial chamber, semicircular in section; this becomes free as the base of the penis proper is reached.

The large penis is nearly solid (shown in section, Fig. 8), and in section the seminal duct shows as a vertical slit at the right-hand side (Fig. 8, *S.D'''*), and follows the contour of the organ right round the blunt extremity till it reaches the outlet at the papilla.

CIRCULATORY, NERVOUS, AND MUSCULAR SYSTEM.

Want of material has prevented my paying particular attention to these important parts of the anatomy of the animal.

The *heart* is of the usual monotocard type, and is provided with a very thin-walled auricle (Fig. 7, *Au.*) and a thick-walled and muscular ventricle enclosed in the pericardium. It is situated at the base of the kidney. The large thin-walled efferent vessel (Fig. 7, *Ef.V.*) carrying the aerated blood to the heart makes a U-shaped turn before entering the pericardium. The aortic trunk (Fig. 7, *Ao.*) swells on leaving the ventricle and then decreases in size. The aorta soon divides, the branches leading in opposite directions, one supplying the anterior and ventral parts of the body and the other the organs contained in the visceral sac.

Nervous System. I can say but little with regard to this. The nerve-collar, situated round the œsophagus close behind the buccal mass, is enveloped in a dense sheath of connective tissue, and the ganglia are not particularly distinct. The two cerebral ganglia above the œsophagus and the two pedal ganglia below it are to some extent distinct on account of their yellowish tint. The pleural ganglia are not so distinct and appear to be placed rather low, so that the cerebro-pleural connectives are longer than the pleuro-pedal. The right pleuro-visceral connective is a very distinct flat band, 2 mm. wide, which runs a little to the left-hand side of the crop after crossing over from the right pleural ganglion.

The *muscular system* is well developed, but I was unable to follow this out in detail. The columellar muscle is very strong, and has a glistening appearance where it clasps the columella. The introvert muscles have already been mentioned, and I regret not being able to give a definite account of the muscles actuating the radula.

The *radula* has a formula 2:1:1:1:2, and is tinted a fine red purple colour. The forms of the teeth are shown in Fig. 9, much enlarged. The central tooth is multicuspid, the central cusp being much the largest, and there appear to be about seven smaller cusps on each side. The laterals are multicuspid, the first being much the largest, and is directed inwards and downwards. The uncini are long, curved, and simple.

The forms of the radula teeth are not unlike those of *Cassia sulcosa*, Born, as given by Cooke, but in that species neither the middle cusp of the central tooth nor the first cusp of the laterals is so well developed. In *Cassia saburon*, Adanson, according to Woodward, the innermost of the uncini are cusped.

Not being familiar with the anatomy of forms allied to *Cassidaria rugosa*, I am unable to go into details of comparison, but hope at some future date to have the opportunity.

In conclusion, I must thank Mr. E. A. Smith, Mr. E. R. Sykes, and Mr. R. H. Burne for their kind assistance, and for the trouble they have taken in aiding me with suggestions and references.

BOOKS CONSULTED.

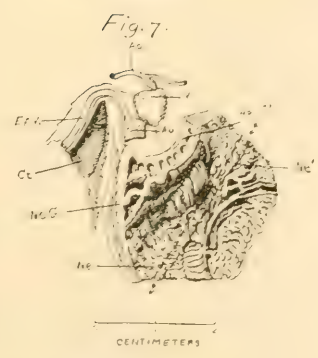
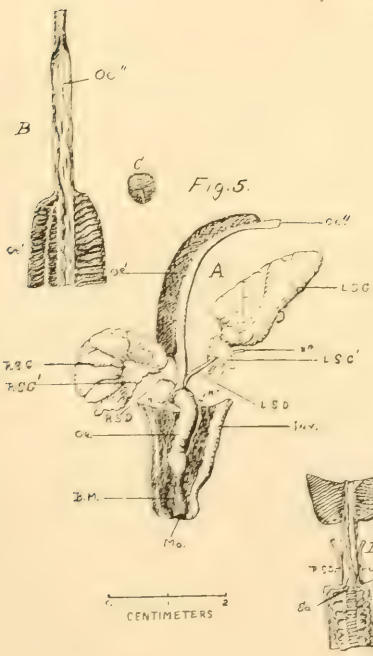
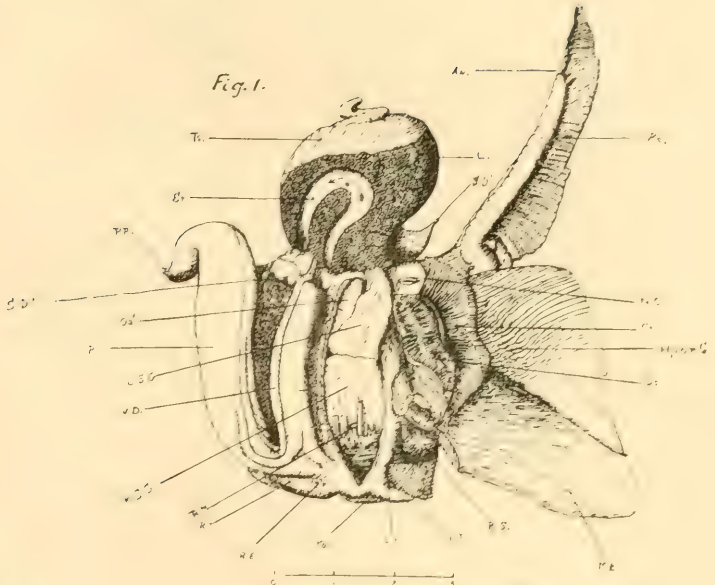
- (1) Kiener: Monograph on *Cassidaria*.
- (2) Dr. N. Tiberi. "Sur les espèces du genre *Cassidaria* qui vivent dans la Méditerranée": Journ. de Conch., ser. III, vol. iii, pp. 150-155.
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- (6) H. Coupin: "Les Mollusques," 1892.
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EXPLANATION OF PLATE XV.

FIG. 1.—Animal with the mantle cut away along the right side and folded back. The part carrying the rectum had to be divided from the rest to enable the folding back to be done without destroying various tissues. The penis has been pushed a little to one side, and the seminal duct cut through and turned away. The floor of the branchial cavity is cut away, in part exposing the salivary glands and a portion of the crop.

FIGS. 2-4.—In the text.

FIG. 5.—*A*, plan showing buccal mass, salivary glands, and crop; the introvert laid open. *B*, the posterior part of the crop laid open. *C*, transverse section of crop. *D*, anterior part of crop and posterior part of the buccal mass laid open, showing sacculation and entrance of salivary ducts.



A.R. del. ad nat

ANATOMY OF CASSIDARIA RUGOSA.

FIG. 6.—Liver, etc., showing entrance of hepatic ducts into stomach.

FIG. 7.—Nephridium, its relation to the heart and ctenidium. The arrows show the approximate course of the intestine.

FIGS. 8, 9.—In the text.

REFERENCE LETTERS.

An. anus; *Ao.* aorta; *Au.* auricle; *B.M.* front portion of buccal mass; *Ct.* ctenidium; *Ef.V.* efferent vessel; *Hpb.G.* hypobranchial glands; *H.D'*, *H.D''*. hepatic ducts; *Inv.* introvert; *L.* liver; *L.E.* left eye; *L.S.D.* left salivary duct; *L.S.G.* left primary salivary gland; *L.S.G'*. left secondary salivary gland; *L.T.* left tentacle; *Mo.* mouth; *Mt.* mantle; *N'*, *N''*, *N'''*. nerves; *Ne.*, *Ne'*. nephridium; *Ne.Gl.* nephridial gland; *N.O.* nephridial opening; *Oe.* posterior portion of buccal mass; *Oe'*. crop; *Oe''*. oesophagus; *Os.* osphradium; *P.* penis; *Pb.* proboscis; *P.P.* penis papilla; *R.* receptaculum; *Re.* rectum; *R.E.* right eye; *Rh.* rhynchostome; *R.M.* introvert retractor muscles; *R.S.* respiratory syphon; *R.S.D.* right salivary duct; *R.S.G.* right primary salivary gland; *R.S.G'*. right secondary salivary gland; *R.T.* right tentacle; *Sa.* entrance of salivary duct into the sacculations of posterior part of buccal mass; *S.D'*, *S.D''*. seminal duct; where seminal duct has been divided, in life these two points are joined; *S.D'''*. tract of seminal duct through penis; *St.* stomach; *Ts.* testis; *V.D.* vas deferens.

NOTES ON A SMALL COLLECTION OF SHELLS FROM THE
VICTORIA FALLS, ZAMBESI RIVER, WITH DESCRIPTIONS OF
NEW SPECIES.

By H. B. PRESTON, F.Z.S.

Read 14th April, 1905.

THE shells which form the subject-matter of the present paper are part of a small collection made by Mr. J. Morrell during a recent visit to the Victoria Falls.

MELANIA VICTORIÆ, Dohrn.

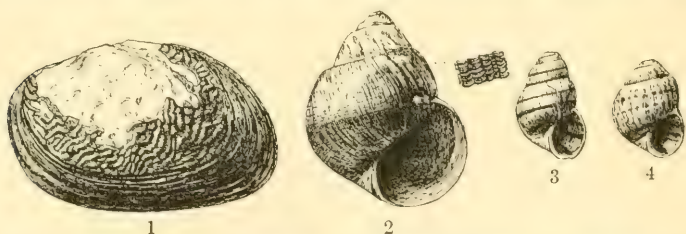
Collected in great quantity.

VIVIPARA CAPILLATA, Frfld.

A fair number taken.

VIVIPARA DENSESTRIATA, n.sp. Fig. 2.

Shell much eroded at the apex, perforate, conically turbinated, thin, rich brown; whorls 5, somewhat angulated, the body-whorl slightly keeled at the periphery, sculptured throughout with very fine wavy spiral striæ; suture deeply impressed, crenulated; peristome thin,



black; umbilicus very narrow; columella curved, extending into a thin callosity which reaches the lip above; aperture rotundly ovate; interior of shell pale brown, glossy.

Alt. 25.25 mm.; diam. maj. 20.5 mm. Aperture, alt. 15.5 mm.; diam. 10 mm.

Hab.—Just above Victoria Falls, Zambesi River.

CLEOPATRA MORRELLI, n.sp. Fig. 3.

Shell much eroded at the apex, pyramidally conical, thin, pale yellowish brown, encircled by one or more rich dark-brown bands, increasing to four on the body-whorl; whorls 5, finely transversely striated with lines of growth; suture impressed; umbilicus narrow; peristome thin, slightly expanded below; columella curved and somewhat reflexed over the umbilicus; aperture oval; operculum shallowly concave, horny.

Alt. 10.5 mm. ; diam. maj. 7 mm. Aperture, alt. 5 mm. ; diam. 3 mm.

Hab.—Just above Victoria Falls, Zambesi River.

Var. COSTATA. Fig. 4.

Shell more globular than the type; the upper whorls transversely ribbed; the dark bands increasing to five on the body-whorl.

Alt. 9.5 mm. ; diam. maj. 7.25 mm.

UNIO ZAMBESIENSIS, n.sp. Fig. 1.

Shell subtrapezoidal, deep rich brown, sculptured, especially above, with wavy zigzag ridges, and below with coarse irregular concentric lines of growth; anterior side obliquely rounded; posterior side somewhat squarely rounded.

Alt. 22.5 mm. ; length 35 mm.

Hab.—Just above Victoria Falls, Zambesi River.

All the species collected are much eroded at the apex, the erosion extending, notably in *Melania* and *Cleopatra*, down the whole of one side of the shell.

DESCRIPTIONS OF SIX NEW SPECIES OF LAND SHELLS FROM
SOUTH AFRICA.

By HENRY C. BURNUP.

Read 14th April, 1905.

PLATE XVI.

IN 1897 Messrs. Melvill & Ponsonby described the first *Curvella* found in South Africa under the name *Hapalus cataractæ*.¹ Since that date the same authors have differentiated three other species—*globosa*,² *sinuosa*,³ and *caloglypta*.⁴ In the present paper descriptions of four species of *Curvella*, one of *Ena*, and one of *Obeliscus* are given.

I am indebted to Mr. Ponsonby for kindly entrusting me with such of the specimens as were sent to him for determination, and for assisting me in their diagnosis.

ENA (PACHNODUS) McBEANIANA, n.sp. Pl. XVI, Figs. 1, 2.

Shell pyramidal, horn-coloured, opaque, deeply and rather widely umbilicate, thin, shining; with $6\frac{1}{2}$ whorls, rather ventricose, becoming flatter towards the apex, impressed at the sutures, all clearly, finely, obliquely striate, except the first $2\frac{1}{4}$, which are smooth; body-whorl half the length of the shell; aperture nearly round, slightly oblique, with thin simple peristome, the columella margin of which is thickened and triangularly reflexed over the umbilicus, which it partly hides; columella, and thin callus connecting the extremities of the peristome, pale, growing whitish in places.

Long. 15, lat. 12.5 mm.

Hab.—Pretoria, Transvaal (J. McBean). Several specimens.

The absence of a keel on the periphery will easily distinguish this species from some of its nearest allies; and the obliquity of its aperture, unaccompanied by any expansion of the labrum, will as readily prevent its being confounded with others. The tendency of the epidermis to peel off in patches is unusual in the group, as is also the opaque, light brownish gray shell exposed in those patches, most of its allies having semitranslucent shells.

CURVELLA CROSLYI, n.sp. Pl. XVI, Figs. 3, 4.

Shell imperforate, fusiform, white, thin, shining; with 6 whorls, the last 3 being more ventricose than the others, slightly impressed at the sutures, irregularly ornamented with curved, transverse striæ, which are crossed by a great number of regular, microscopic, spiral striæ, the last whorl being less than the spire; aperture ovate; labrum thin, simple, well arched forward in the middle, labium thickened and thrown back, quite covering and closing the umbilicus; columella slightly curved obliquely to the left; callus scar extending from the

¹ Ann. Nat. Hist., vol. xix (1897), p. 635, pl. xvii, fig. 4.

² Ibid., vol. ii (1898), p. 128, pl. vii, fig. 6.

³ Ibid., vol. iv (1899), p. 198, pl. iii, fig. 12.

⁴ Ibid., vol. viii (1901), p. 320, pl. ii, fig. 12.

suture well above the columella, and completely covering the umbilical region.

Long. 12, lat. 5.2 mm.

Hab.—Makowe, Zululand, Natal (J. Crosly).

This beautiful shell is much the largest of the South African *Curvella* yet discovered, and I have much pleasure in naming it after the discoverer, Mr. J. Crosly.

It is a thin, white, shining shell of six whorls, of which the three last are rather ventricose, and the three upper flatter. The irregular transverse sculpture, following the line of growth, which, like the outer lip, is well curved forward, is easily seen with a weak lens; while the fine spiral sculpture is only visible under a strong magnifier.

With the type are four 'dead' specimens, probably not quite mature, the largest measuring only 10.5 mm. in length, in which the umbilicus is open and the callus not well developed, but in other respects they agree with the type. I have also before me two of the calcareous eggs which were syringed from the shell; they are white, nearly spherical, and measure about 1.3 mm. in diameter.

CURVELLA STRAMINEA, n.sp. Pl. XVI, Figs. 5, 6.

Shell oblong-ovate, umbilicate, thin, shining, straw-coloured, sub-translucent; with $5\frac{1}{2}$ rather ventricose whorls, impressed at the sutures, ornamented with close, clear, fine, arched, transverse striae; aperture oval; peristome thin, simple, triangularly reflexed over the narrow umbilicus; columella and callus white, the former being slightly curved inwards at the base.

Long. 6.5, lat. 2.75 mm.

Hab.—Walmer, near Port Elizabeth, Cape Colony (Miss Hickey). Several specimens.

This pretty little species is more elongate and slender than its South African allies, and is conspicuous by its straw colour and distinct sculpture, which follows the arcuate contour of the outer lip.

CURVELLA SUCCINEA, n.sp. Pl. XVI, Figs. 7, 8.

Shell oblong-ovate, narrowly umbilicate, pale horn colour, thin, shining, translucent; with $5\frac{1}{2}$ slightly ventricose whorls; not much impressed at the sutures, nearly smooth, with faint, and very slightly curved, transverse sculpture crossed with very close, microscopic, spiral striae; apex rather blunt; aperture oval, about one-third of the length of the whole shell; peristome thin, simple, reflexed, and entire, covering, but not closing, the umbilicus; columella and callus pale straw colour.

Long. 5.75, lat. 2.5 mm.

Hab.—Maeström Forest, Bedford, Cape Colony (J. Farquhar).

This delicate little shell, though much resembling in general appearance the last species described (*C. straminea*), is easily distinguished from it by its smaller size, richer colour, smoother surface, less ventricose whorls, and shallower sutures, while the fine, microscopic, spiral striae, only to be seen with the aid of a strong lens, are not traceable in *C. straminea*, and the characteristic arch of the outer lip is not so pronounced in this as in the last-named species.

CURVELLA ELEVATA, n.sp. Pl. XVI, Figs. 10, 11.

Shell elongate-conic, umbilicate, pale ashy straw-colour, thin, shining, translucent; with 6 slightly ventricose whorls, not much impressed at the sutures, the apex being blunt, and the last whorl 2.5 mm. of the length of the shell, very finely, irregularly sculptured with curved, transverse striae, with traces of microscopic spiral lines; aperture oval, small; labrum thin, simple; labium triangularly reflexed over the umbilicus; columella paler, nearly straight, slightly bent to the left.

Long. 6.5, lat. 3 mm.

Hab.—Grahamstown, Cape Colony (J. Farquhar).

Broader at the periphery, which is situate lower on the body-whorl, and with straighter sides, and therefore of more pyramidal outline, this shell is more elegant in form than either of the preceding allied species, *C. straminea* and *C. succinea*, from which it is easily distinguished.

OBELISCUS NATALENSIS, n.sp. Pl. XVI, Fig. 9.

Shell elongate, attenuate above, very narrowly umbilicate, thin, yellowish white, shining, subtranslucent; with $9\frac{1}{2}$ rather ventricose whorls, the last being one-third of the whole length of the shell, and all, except the first two apical whorls, being ornamented with close, fine, sharp, curved, transverse liræ, the apical whorls being smooth, and the apex itself obtuse; aperture ovate; outer lip very thin, simple, arched forward rather above the middle, and receding towards the base; inner lip rolled closely back over the columella, which is arcuate.

Long. 21.5, lat. 6.75 mm.

Hab.—Umbogintwini, near Durban, Natal (Burnup).

The close lirate sculpture, which gives the whole shell a soft, silky appearance, readily distinguishes this species from *O. lanceolatus* (Pfr.), which is the nearest South African ally known. In the type, the exceedingly thin labrum is slightly broken away at the base, for which due allowance has been made in the measurements given. On the parietal wall the sculpture is almost obliterated by the beginning of the formation of a callus. A second example of this shell, found at Table Mountain (Natal), at a distance of about 50 miles from Umbogintwini, and at an altitude of fully 2,000 feet above the sea (while the last-named locality is little above sea-level), has the callus, which is almost pure white, in a more advanced state of development, and the labium more triangularly reflexed, and is 23 mm. long by 7 mm. broad. It also has the thin labrum slightly damaged.

EXPLANATION OF PLATE XVI.

FIGS. 1, 2. *Ena (Pachnodus) McBeaniana*, n.sp.

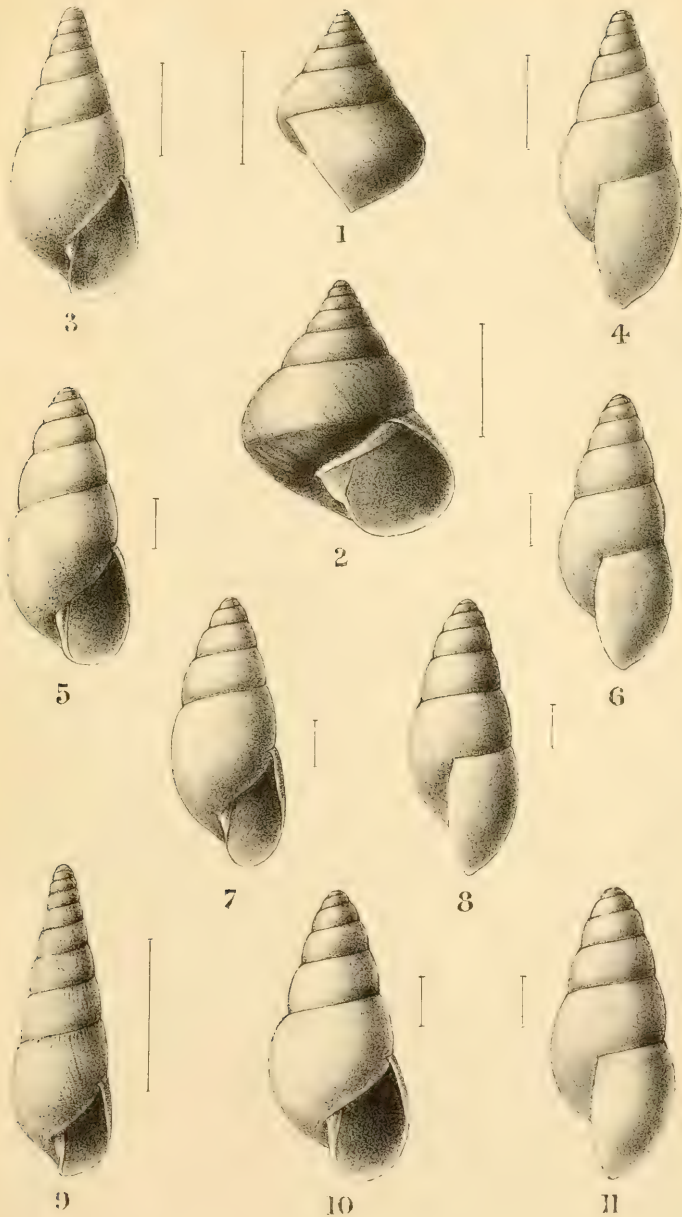
„ 3, 4. *Curvella Croslyi*, n.sp.

„ 5, 6. *Curvella straminea*, n.sp.

„ 7, 8. *Curvella succinea*, n.sp.

FIG. 9. *Obeliscus Natalensis*, n.sp.

FIGS. 10, 11. *Curvella elevata*, n.sp.



J. Green del. et lith.

Mintern Bras imp

NEW S. AFRICAN LAND SHELLS.

ORDINARY MEETING.

FRIDAY, 12TH MAY, 1905.

E. R. SYKES, B.A., President, in the Chair.

H. O. Lange was elected a member of the Society.

The following communications were read:—

1. "Notes on Pleistocene and Recent Shells from Crete." By the Rev. R. Ashington Bullen, F.L.S., F.G.S.

2. "Notes on Land and Fresh-water Shells from the Alhambra Ditch, Granada, Andalucia, Spain; on Recent Land Shells from various localities near Carmona, Province of Sevilla; and on Land, Fresh-water, and Marine Shells from Holocene deposits, Carmona." By the Rev. R. Ashington Bullen, F.L.S., F.G.S.

3. "Description of a new species of *Vitrea* from Greece." By E. A. Smith, I.S.O.

4. "Descriptions of new forms of Marginellidæ and Pleurotomidæ." By E. R. Sykes, B.A.

The following specimens were exhibited:—

By E. R. Sykes: Specimens of *Neptunea despecta*, *Tritonofusus Islandicus*, and *Buccinofusus Berniciensis*, from off the west coast of Ireland. This apparently is the first record of the capture of living specimens of *Neptunea despecta* in the British seas.

By R. H. Burne: An example of *Ephippodonta Macdougalli*.

ORDINARY MEETING.

FRIDAY, 16TH JUNE, 1905.

E. A. SMITH, I.S.O., in the Chair.

C. Bülow was elected a member of the Society.

J. E. S. Moore, A.R.C.S., delivered a short lecture upon the Prosobranchiata, and gave reasons for the separation of the group into two main subdivisions—the hypoathroid and epiathroid—based, in the first instance, upon the arrangement of the ganglia in the central nervous system.

The following communications were read:—

1. "On the extension of the genus *Macrochlamys* to the Island of Mauritius." By Lieut.-Colonel H. H. Godwin-Austen, F.R.S.

2. "On the Mollusca procured during the 'Porcupine' Expeditions, 1869-1870. Supplemental Notes, Part II." By E. R. Sykes, B.A., F.L.S.

3. "On a small collection of Mollusca from Tierra del Fuego." By E. A. Smith, I.S.O.

4. "On two Miocene Gastropods from Roumania." By R. Bullen Newton, F.G.S.

5. "Revision of the New Zealand Patellidæ, with descriptions of a new species and subspecies." By Henry Suter.

6. "On the occurrence of *Planorbis vorticulus*, Troscchel, in the Pleistocene of England, with notes on some other Pleistocene Mollusca." By A. S. Kennard and B. B. Woodward, F.L.S., F.G.S.

7. "The Conehological Writings of Captain Thomas Brown." By C. Davies Sherborn, F.Z.S.

Exhibits:—

J. H. Ponsoyby exhibited living specimens of *Natalina Trimeni*, M. & P., from South Africa.

NOTES ON PLEISTOCENE AND RECENT SHELLS FROM CRETE.

By the Rev. R. ASHINGTON BULLEN, F.L.S., F.G.S.

Read 12th May, 1905.

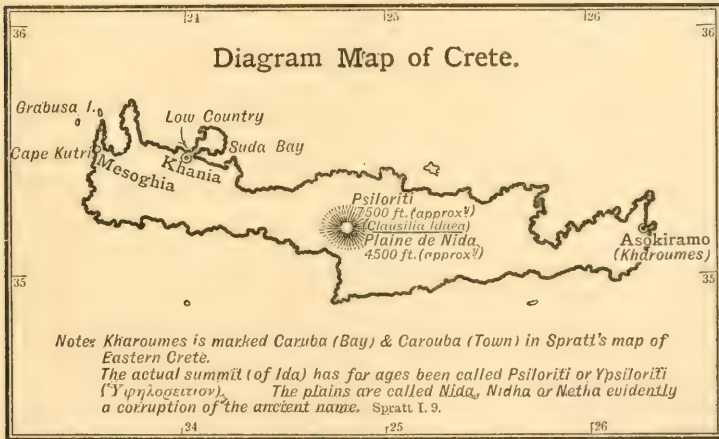
THE shells enumerated in the following notes were brought from Crete by Miss Dorothea M. A. Bate, and came into my possession last January.

A. PLEISTOCENE SHELLS.

These came from two cave-deposits, and were introduced into their position under different conditions.

(1) Two small red masses of cave-breccia contain land shells only. All the specimens seem to be identical, but of different stages of growth. They are referable to *Helix pellita*, Fér.

Pilsbry records *H. pellita* as a recent shell from Morca, Syra, and Rhodes. The present communication seems to be its first record in a fossil state.



Locality.—Pleistocene cave-deposit (upper layers) at Kharoumes, East Crete. (Asokiramo in the French military map, that of the Service géographique de l'Armée.)

(2) A small fragment of mammalian bone contains only marine shells and fragments. The largest is referable to *Calliostoma Laugierii* (Payraudeau), although its whorls are rather more tumid than those of recent specimens.

There is likewise a small fragment of a *Cardium*-like shell and of a Bryozoan colony (probably identifiable) adherent to the bone.

There are also a few nepionic shells, probably of the above-named species of *Calliostoma*. All are hardened by limestone infiltration and cemented to the bone fragment.

Locality.—Pleistocene cave-deposit at Kutri, West Crete.

Miss Bate gives evidence that the coast-level at Kutri has been lowered,¹ enabling the sea to break into the cave and wash away the greater part of the deposit. Later on, this coast had attained its present level, probably within historic times. In the same cave she discovered a quantity of sea-sand which had found its way into a crevice, and a number of other shells, which, recognizing as marine, she did not preserve.

B. RECENT SHELLS.

The following species were found in the low country between Khania and Suda Bay, North Crete:—*Helix aspersa*,² Müll.; *Pisana*,² Müll.; *vermiculata*,² Müll.; *aperta*,² Born; *Helicella Cretica*, Fér.; *Chondrula (Buliminus) pupa*, Fér.; *Clausilia candida*, Pfr.; *Stenogyra (Rumina) decollata*,² Linn., a very stunted form; *Vitrea* sp.; *Melanopsis laevigata*, Lam.; *Neritina fluviatilis*, Linn.

The following are from Mesoghia,³ an isolated homestead near and inland from Kutri, West Crete:—*Oleacina Algira*, Brug., young specimens; *Buliminus olivaceus*, Pfr.; *Clausilia Arthuriana*, Blanc.; *Grabusana*, Boettg.

The following comes from Psiloriti (anciently Mount Ida) at 4,500 feet O.D.⁴:—*Clausilia Idæa*, Pfr.

A solitary specimen in the British Museum is labelled as from 5,500 feet O.D.; the species occurs on limestone.⁵

Note.—The fossil shells have been given to the Geological Department, British Museum.

¹ "Search for Pleistocene Mammalia in Crete": Geol. Mag., May, 1905, p. 197.
See also Spratt: "Travels and Researches in Crete," vol. ii, ch. xix; London, 1865.

² Eaten in large quantities by the natives (Miss Bate in litt.).

³ Bate: op. cit., p. 197, et in litt.

⁴ O.D., see note, p. 313.

⁵ Bate: in litt.

NOTES ON LAND AND FRESH-WATER SHELLS FROM THE ALHAMBRA DITCH, GRANADA, ANDALUCIA, SPAIN; ON RECENT LAND SHELLS FROM VARIOUS LOCALITIES NEAR CARMONA, PROVINCE OF SEVILLA; AND ON LAND, FRESH-WATER, AND MARINE SHELLS FROM HOLOCENE DEPOSITS, CARMONA.

By the Rev. R. ASHINGTON BULLEN, F.L.S., F.G.S.

Read 12th May, 1905.

I. LAND AND FRESH-WATER SHELLS FROM THE DITCH OF THE ALHAMBRA (North of the Gate of Justice towards the Washington Irving Hotel).

The following shells were collected from an altitude of about 2,200 feet O.D.:—*Helicella maritima*, Drap.; (*Candidula*)*conspurcata*, Drap.; *Polita lucida*, Drap.; *Ena obscura*, Müll.; *Planorbis corneus*, juv., Linn.; *Pupa cylindracea*, Da Costa; *Limnæa* sp.; *Pisidium fontinale*, Drap.

The ditch was nearly dry at the time of exploring it, and the occurrence of *Planorbis*, *Limnæa*, and *Pisidia* at such a place is rather worthy of remark. The locality is shaded by the only elm-trees in Spain, planted by Arthur, Duke of Wellington, after the Peninsular War.

II. RECENT LAND SHELLS FROM THE NECROPOLIS ROMANA AT CARMONA.

Carmona is 27 miles E.N.E. from Seville, situated at about 600 feet O.D. The towns along the Alcores are built at the high levels where springs are found, partly for security and partly for reasons of health, there being always a plentiful supply of water at the higher level.

The Alcores are like an island surrounded by a 'sea' of land, the famous Vega, or barley-growing plain, cultivated from Neolithic times. Sickle-teeth, used by Neolithic men, and resembling those from Egypt (Kahun), are not uncommon at Acébuchal.

The following species were collected:—*Helix Pisana*, Müll.; *lactea*, Müll.; *Helicella caperata*, Mont.; *striata*, Müll.; *maritima*, Drap.; *conspurcata*, Drap.; *barbara*, Linn.; *Chondrula pupa*, Beck (? Fér.); *Caracolina lenticula*, Fér.; *Ferussaccia folliculus*, Gronov.; *Rumina decollata*, Linn.

[At Puerto de Brenes, about two miles south of Carmona, large specimens occurred of *Helix aspersa*, Müll.]

Many hundreds of small oblong Roman funeral urns of sandstone are arranged in the low walls in the Almond Orchard at the Necropolis Romana, and the smaller snails inhabit them in thousands (in conjunction with gecko lizards, scorpions, green frogs, etc.), probably using the burnt bone-lime which they contain.

Helix aspersa, *H. lactea*, *H. vermiculata*, *H. punctata*, and *H. barbara* live on the succulent blades of the aloe of which the hedges are made.

The four first-named are commonly hawked in Seville as food. Many leaves of the cactus or Barbary fig are completely perforated from side to side by these molluscs, which, commencing at one side, eat their way completely through the leaf.

On February 16th all the specimens of *Helix Pisana*, several hundreds, which I observed on the aloe, were making new 'shoots' to their shells.

III. HOLOCENE SHELLS FROM THE ROMAN TOMBS, NECROPOLIS ROMANA, CARMONA.

(1) *Tomb of Postumius.*

Helix lactea, Müll.; *Pisana*, Müll.; *Helicella barbara*, Linn.; *maritima*, Drap.; *variabilis*, Drap.; *Stenogyra (Rumina) decollata*, Linn.; *Caracolina lenticula*, Fér.

(2) *Tomb No. 198.*

Helix lactea, Müll.; *Pisana*, Müll.; *Helicella maritima*, Drap.; *Caracolina lenticula*, Fér.

(3) *Tumba del Elefante.*

Helix lactea, Müll.; *Helicella maritima*, Drap.

Since no remains later than the Roman occupation have been found in or near these and other Roman tombs, we conclude that the Roman Necropolis at Carmona was levelled by the Visigoths about the end of the fifth century A.D., the graves filled in, and the whole place turned into agricultural land. The few shells given above are only the gleanings from what remains of the earth once filling the tombs, the shells having been obtained *in situ* by Mr. G. Bonsor and myself in company. No doubt, had the earth thrown out from the tombs been searched at the time of their clearing, the list would have been much larger.

Mr. George Bonsor (who jointly with Senor Fernández López owns the estate), now that he knows the scientific value of such observations, is careful that all mollusca occurring in any of his excavations shall be preserved for examination and identification, and I trust that the result of his researches may be reserved for the Malacological Society.

(4) *From interments of various dates (Early Neolithic to Roman).*

The shells named in this section were collected by Mr. George Bonsor during excavations at various spots on the Alcores, all of which, but one, are in the neighbourhood of Carmona.

a. *From Silo burials, the earliest Neolithic burials on the Alcores.*

(The numbers are those marked on the shells by Mr. Bonsor for museum purposes.)

(i) At Campo Real.

Nos. 26 and 30, *Margaritana sinuata*, Lam.; No. 29, *Dentalium elephantinum*, Linn.; No. 27, *Unio pictorum*, Lam.; No. 28, *Unio littoralis*, Drap.

(ii) At El Carlero.

No. 11, *Glycimeris violascens*, Lam.

(iii) At Acébuchal.

Nos. 24 and 25, *Margaritana sinuata*, Lam.

Of the above shells, the occurrence of a Red Sea species, *Dentalium elephantinum*, at such an early period as that prehistoric era of Spain, which shows no traces of Greek, Phœnician, or Carthaginian influence, is decidedly interesting.

Margaritana sinuata probably occurs in the rivers, the Corbones, etc., not far distant, that flow into the Guadalquivir. Mr. Bonsor mentions¹ having found two carved specimens, but I have not seen these.

b. From Megalithic tombs (*Tombs à galerie*) at Bencarron: Middle Neolithic in date.

(i) Tombe à galerie No. 1.

Nos. 32, 35, 37, and 39, *Pecten maximus*, Linn.; No. 36, *Chlamys opercularis*, Linn.

The edges of *Patella Safiana*, Lam., Nos. 20 and 31, are ground to form scoops or spoons, and the whole outer surface of 31 has been ground down so smoothly as almost to obliterate the radial ribs.

c. From late Neolithic tombs (with characteristic pottery).

(i) At Castilleja de Guzman (near Seville).

Trivia Europæa, Mont.

About 200 of these occurred, bored for stringing as a necklace.

(ii) Copper Age or Transition Period. [Copper implements of small size occur with polished celts of diorite and other implements of the late Neolithic era in Bronze Age, prior to 1100 B.C., the generally received date of the arrival of the Phœnicians in Spain, at Acébuchal, etc.]

At Acébuchal.

Nos. 12, 13, 14, and 15, *Glycimeris violascens*, Lam.; No. 16, *Venus verrucosa*, Linn.

d. Iron Age (*Punic or Keltic*).

At Cruz del Negro, near Carmona.

Nos. 2, 3, 4, and 10, *Glycimeris violascens*, Lam.; No. 19, *Patella ferruginea*, Gmelin; No. 48, *Conus* sp.; Nos. 1 and 9, *Cardium rusticum*, Linn. (= *tuberculatum*, Linn.); Nos. 8, 17, 18, and 21, *Patella Safiana*, Lam.; Nos. 6 and 7, *Pecten maximus*, Linn.; Nos. 5 and 22, *Murex trunculus*, Linn.; No. 23, *Melanopsis* cf. *Dufouri*, Fér.

The *Conus*, No. 48, is about the size of *C. literatus*, and has been burnt with an incinerated burial. Messrs. E. A. Smith and R. Bullen Newton refer its provenance to the Indian Ocean in all probability.

No. 7, *Pecten maximus*, has been bored to make a box, with bronze or copper wire hinges. (See Fig., p. 312.)

¹ At Santa Lucia between Mairena and Viso: of Carthaginian date. Inside each was the figure of a lion, and outside a ram and a lotus bud. Bonsor, "Les Colonies Agricoles pré-Romaines": *Revue Archéologique*, tome xxxv (1899), p. 50; Paris (Leroux, éditeur).

Mr. Bonsor has made a sketch of a complete specimen now in the Louvre.¹ It may have been a lady's *mundus muliebris* or a box for ruddle (primitive 'rouge'). Nos. 17 and 21 have been carefully ground on the outside and round their edges to form 'spoons' or 'small scoops,' and they are both root-marked.

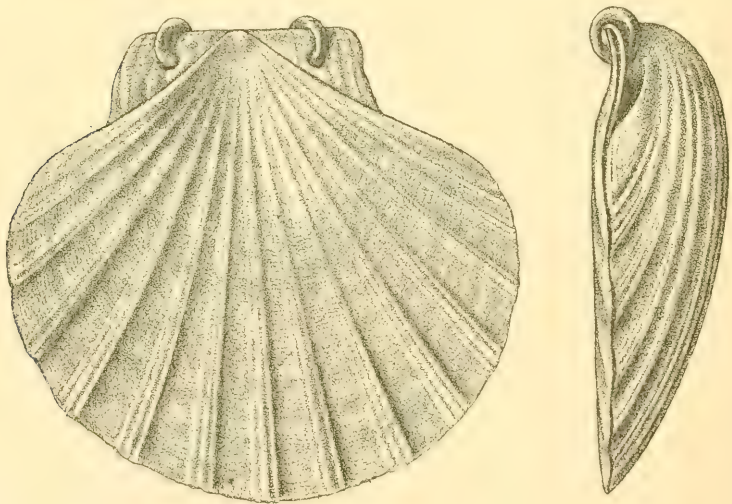
No. 23, *Melanopsis Dufouri*, occurs at Valencia. At this necropolis fibulæ, buckles, probably of Keltic manufacture, and engraved ivory combs of Punic workmanship have been obtained.

e. *Marine shells from Roman tombs at Carmona.*

No. 43, *Glycymeris violascens*, Lam.; No. 46, *Haliotis tuberculata*, Linn.; No. 42, *Cypræa pantherina*, Solander; No. 45, *Lampusia olearium*, Linn.; No. 47, *Cypræa spurca* (young), Linn.; No. 44, *Pecten maximus*, Linn.; No. 4, *Murex trunculus*, Linn.

Cypræa pantherina is a Red Sea species, but its occurrence in a Roman tomb is, of course, not so remarkable as that of *Dentalium elephantinum* in the early Neolithic silos at Campo Real.

Murex trunculus is still hawked in Seville.



The occurrence of fresh-water shells of the Unionidæ group is not remarkable perhaps, but that marine species from the Mediterranean or the Atlantic seaboard should be found in these tombs raises interesting questions. Carmona is, at the nearest, 87 miles from the mouth of the Guadalquivir. The question is, whether these marine mollusca had a food value, and if so, how were they kept alive and fresh and edible at such a distance from the sea?

¹ In Salle B, "Terres cuites de Myrina."

As a question in economic malacology the point is at all events worthy of notice, quite apart from the insertion of shell implements, or shells, as ornaments amid the funeral furniture at such widely separate epochs as these notes cover. As only single valves of bivalves have been observed, perhaps we have only dead shells to deal with, treasured as amulets or ornaments.

One noticeable point, though merely of negative value as the evidence is incomplete, is the non-occurrence of *Helix aspersa* in the Roman tombs.

My sincere thanks are due to Mr. George Bonsor for entrusting me with his shells to name; to Miss D. M. A. Bate for collecting the Cretan mollusca, at my request; to them both for notes of localities (many of the Spanish localities I have seen for myself under Mr. Bonsor's guidance); and also to Mr. E. A. Smith for access to the Cretan and Spanish collections in the British Museum, to him and Mr. R. Bullen Newton for help in identifying the critical specimens, and to Mrs. Bullen for help in boxing and labelling the specimens for the purposes of this paper.

Mr. Bonsor's specimens will be returned to the museum at Carmona.

Note.—O.D. signifies Ordnance Datum, i.e. the position of mean high-water mark.

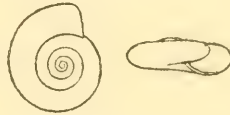
DESCRIPTION OF A NEW SPECIES OF *VITREA* FROM GREECE.

By EDGAR A. SMITH, I.S.O.

Read 12th May, 1905.

VITREA (*POLITA*) TOMLINI, n.sp.

Testa depressa, orbicularis, perspective umbilicata, supra fuscescenti-cornea, infra pallida, subpellucida, polita, lineis incrementi tenuissimis striata, striis permicroscopicis spiralibus confertis sculpta; spira depressa, ad apicem vix elata; anfractus 5-5½ leviter convexi, ad suturam linea angusta pallida marginati, ultimus ad peripheriam compresso rotundatus, antice haud descendens; apertura oblique lunata; peristoma tenue, ad insertionem prope umbilicum vix dilatatum vel reflexum. Diam. maj. 14, min. 12.5 mm.; alt. 5 mm.



Hab.—Pass of Thermopylæ, under stones in the bed of a dried-up torrent.

Six specimens of this species were collected by Mr. J. R. Le Brocton Tomlin at the above locality in April, 1903. Although very like some other forms in general appearance, still on close examination the present species appears to be separable. In comparison with the well-known *V. lucida* of Draparnaud it is seen to be a trifle flatter, the spire more depressed, the whorls more convex, and consequently the suture is deeper. The umbilicus is a little broader, and the microscopic spiral sculpture, although excessively minute and only visible under the microscope, is more apparent than in *lucida*. The last whorl in the latter is also a little broader than that of the present species, and consequently the form of the aperture is different. I have much pleasure in associating with this species the name of its discoverer. He submitted it to Dr. Boettger for determination, who kindly replied concerning it, "Ähnliche Arten sind weder aus Griechenland beschrieben, noch finden sich solche in meiner Sammlung."

DESCRIPTIONS OF NEW FORMS OF MARGINELLIDÆ AND
PLEUROTOMIDÆ.

By E. R. SYKES, B.A.

Read 12th May, 1905.

PLATE XVII.

THE forms now described have been received from various sources, the majority having been kindly placed at my disposal by Mr. Sowerby when he acquired Admiral Keppel's collection. I have taken the opportunity of characterizing a form of *Marginella* from the "Porcupine" Expedition, as it may be some little while ere I am able to deal with this group.

All the figured specimens are in my own collection.

MARGINELLA IMPERATRIX, n.sp. Pl. XVII, Figs. 1, 2.

Shell ovate-oblong, longitudinally costate, there being about 20 costæ on the last whorl, polished, shining, yellowish-white, with blackish-fuscous blotches and rows, both spiral and transverse, of black spots, these latter varying in shape from rounded or square to oblong; spire elevated, conoid; whorls $5\frac{1}{2}$, the protoconch being smooth and somewhat obtuse and of pale horn-colour, the later whorls moderately convex; aperture narrow, elongate, white within, columella almost straight at the base, with four folds, the lower pair ascending and the upper almost horizontal, these latter being (in the adult shell) provided with indications of smaller folds supporting them below; lip white, much thickened, and lightly crenulate within, the black spots being seen on and behind the outer margin.

Long. 38 mm.; diam. max. 18 mm.

Hab.—West Africa (Keppel).

A near ally of the well-known *M. pseudofaba*, Sby.; the present species is, however, a trifle larger, and narrower in proportion to the length, the spire being correspondingly a little more elongate; the columella is not so curved at the base, and the longitudinal costæ are more numerous, being on the last whorl in about the proportion of twenty as compared with twelve, while they are finer and extended over a larger portion of the shell. Young specimens of both species have been figured for comparison (Pl. XVII, Figs. 2, 4).

MARGINELLA KEPPEL, n.sp. Pl. XVII, Fig. 3.

Shell ovate-oblong, smooth except for obsolete longitudinal costæ which are inconspicuous and fairly numerous, polished, shining, greenish-white, with numerous black spiral lines (two of which appear on the upper whorls), and longitudinal black lines which are either straight, zigzag, or united into blotches; spire moderately elevated, conoid; protoconch blunt; whorls $4\frac{1}{2}$ to 5, plano-convex; suture inconspicuous; aperture rather narrow, white within; columella four-plaited, fairly straight at the base, the canal being tinged with black

inside; lip white, a trifle curved, thickened, slightly crenulate within, the black lines coming almost to the edge, but not appearing in front.

Long. 9.5 mm.; diam. max. 5 mm.

Hab.—West Africa (Keppel).

In colour pattern this very pretty shell recalls both *M. Bellii*, Sby., and *M. musica*, Hinds, since it has the longitudinal colour-marking of the former and spirals, though much narrower and more numerous, similarly placed to those of the latter. It is, however, a much smaller shell than either. In shape it reminds one of *M. Guillani*, Petit, but differs in colour pattern and in the more curved outer lip.

MARGINELLA REPENTINA, n.sp. Pl. XVII, Fig. 6.

Shell elongate-ovate, pellucid, thin, shining, the protoconch tinged with pink, the other early whorls whitish, the last whorl with a light red zone below the suture, but otherwise a darker red, the colour more intense at the periphery and behind the lip; spire but little raised; protoconch blunt; whorls 4, flattened, but with a well-marked suture; mouth gradually broadening towards the base, outer lip smooth inside; columella four-plaited; lip moderately thickened.

Long. 3 mm.; diam. max. 1.5 mm.

Hab.—Mayotte (Tripe Collection).

Apparently closely related to *M. Nevilli*, Jous. (*M. inconspicua*, Nevill, non Sby.), but differs in colour, being red in place of a uniform white; the present species is also a little smaller; the spire is not deformed to one side, and is slightly more pyramidal in shape.

MARGINELLA BINOTATA, n.sp. Pl. XVII, Fig. 5.

Shell ovate-oblong, polished, shining, transparent whitish, with on the last whorl two greyish-black bands encircling the shell, one of which is seen on the earlier whorls; protoconch white, tipped with brownish-grey; the above-mentioned colour-bands are produced on to and well marked on the lip, while there is a dark mark both at the junction of the upper canal with the shell and on the columella at the base; spire well elevated; protoconch blunt; whorls $4\frac{1}{2}$, flattened; aperture elongate, moderate in size, with the outer lip well incrassated, denticulate within, the upper denticle the largest; columella four-plaited.

Long. 3 mm.; diam. max. 1.3 mm.

Hab.—Indian Ocean (? Ceylon, Nevill Collection).

I would not have described this shell, from H. Nevill's collection, without being certain of the exact habitat, were it not for its rather striking colour-markings, which do not tally with those of any form known to me. I have seen several specimens, all in good condition, and they are in accord.

MARGINELLA HESPERIA, n.sp. Pl. XVII, Fig. 7.

Shell ovate-oblong, smooth, polished, shining, porcelain white; spire well elevated, protoconch blunt; whorls $4\frac{1}{2}$, plano-convex, with a well-marked suture; aperture fairly broad, elongate, outer lip thickened and smooth; columella almost vertical in the lower portion, with four plaits, the upper two nearly horizontal, the third a little ascending, and the lowest more noticeably so.

Long. 8 mm.; diam. max. 4 mm.

Hab.—“Porcupine” Expedition, 1870, Station 24, off Cape St. Vincent, in 292 fathoms.

A species with no very salient characters. As compared with the forms described and noticed by Locard,¹ it differs from *M. impudica*, Fischer, in its much smaller size, as also in shape; from *M. Marocana*, Loc., in its more pyramidal shape and in the relative length of the earlier whorls; from *M. crustata*, Loc., in its more slender form and more produced spire; from *M. parvula*, Loc., in the relative proportions of the spire and body-whorl, etc.

I have seen five adult shells and five young.

GENOTA VAFRA, n.sp. Pl. XVII, Fig. 9.

Shell elongate, mitriform, spire well produced; apex acute; pale yellow, with brown bands; sculpture, protoconch smooth, the next few whorls marked by spirals with a few oblique longitudinals, the whorls slightly angulated in the middle; gradually these longitudinals become stronger, until on the penultimate whorl there is a row of nodules just below the suture, followed by a few spirals and another row of larger nodules below; the last whorl has, in addition to this sculpture, a number of smaller nodules arranged in regular spiral, as also arcuate longitudinal, rows, these being continued to the base of the shell; whorls 10, plano-convex; aperture elongate, narrow, fairly straight, with a well-marked, wide notch below the suture.

Long. 31.5 mm.; diam. max. 10 mm.

Hab.—West Africa (Keppel).

Related both to *G. mitraformis*, Kien., and *G. papalis*, Rvc. As compared with these the present shell may be separated by its less produced spire, the conspicuous rows of granules or nodules on the last whorl, and the well-marked double row of nodules on the upper whorls.

PUSIONELLA REMORATA, n.sp. Pl. XVII, Fig. 11.

Shell elongate, turreted, fairly solid, shining, pale yellowish-white; protoconch acute, polished, whitish, smooth; sculpture, 3-4 spirals on the earlier whorls, mainly collected below the sutures; on the last whorl, in addition, about 6 spirals encircle the base, and indications of others are seen between the two series; the second, third, and fourth whorls also show traces of longitudinal sculpture, which appears on the later whorls only as lines of growth; whorls 11½, flat, the last measuring just over half the length of the shell; aperture ovate, with a short canal, lip thin.

Long. 38 mm.; diam. max. 13 mm.

Hab.—West Africa (Keppel).

The nearest ally appears to be the shell described by Petit² as *Fusus Molleti*, but the present species is a trifle more slender, the whorls are not so tabulate, and the longitudinal sculpture to which that author refers is almost entirely lacking.

¹ Expéd. Scient. Trav. Talisman, vol. i.

² Journ. Conchyl., 1851, p. 77, pl. i, fig. 6.

DRILLIA CONSOCIATA, Smith, var. RECORDATA, n.var. Pl. XVII, Fig. 10.

Shell differing from the type in its smaller size (an adult shell of the typical form, decollated, measuring 31 mm. long), by the slightly more swollen whorls, and the more numerous and more closely set longitudinal ribs, which latter are more produced over the whorls and do not leave so marked a smooth area below the suture.

Long. 23·4 mm.; diam. max. 9·5 mm.

Hab.—West Africa (Keppel).

The species was described from a young shell which is not in very good condition, and is now figured (Pl. XVII, Fig. 8), for purposes of comparison, from an adult shell which has been examined by Mr. Smith. The form now described as a variety may prove to be a distinct species. In fresh condition the shell is of an olive-green tint, with a brown area either covering the larger and lower portion of the last whorl or confined to a small region at the base. The protoconch, in the variety, is well elevated, acute, and, though a little worn, appears smooth.

EXPLANATION OF PLATE XVII.

| | | |
|--------|---|---|
| FIG. 1 | } | <i>Marginella imperatrix</i> , n.sp. |
| 2 | | |
| 3 | „ | <i>Keppeli</i> , n.sp. |
| 4 | „ | <i>pseudofaba</i> , Sby. |
| 5 | „ | <i>binotata</i> , n.sp. |
| 6 | „ | <i>repentina</i> , n.sp. |
| 7 | „ | <i>hesperia</i> , n.sp. |
| 8 | | <i>Drillia consociata</i> , Smith. |
| 9 | | <i>Genota vafra</i> , n.sp. |
| 10 | | <i>Drillia consociata</i> , Smith, n.var. |
| 11 | | <i>Pusionella remorata</i> , n.sp. |



1.



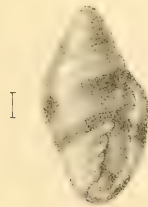
2.



3.



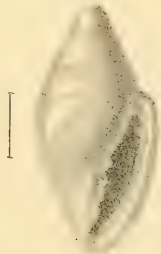
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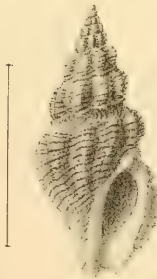
7.



8.



9.



10.



11.

A.H. Searle del. et lith.

A.S. Huth imp.

NEW SPECIES OF MARGINELLIDÆ AND PLEUROTOMIDÆ.

ON THE EXTENSION OF THE GENUS *MACROCHLAMYS* TO THE ISLAND OF MAURITIUS.

By Lieut.-Colonel H. H. GODWIN-AUSTEN, F.R.S.

Read 16th June, 1905.

PLATE XVIII.

I LAST month received from Monsieur E. Dupont, through Mr. John Ponsonby, three specimens, preserved in spirit, accompanied by the following short note by the donor:—" *Nanina* sp. from Mauritius, differing from *N. semifusca*, Desh. = *N. scalpta*, Mart., by its more shining appearance and more rounded periphery; resembles also *Nanina renitens*, Morel. of Mayotte. The animal has been drowned in fresh water before being put in spirits."

I have been trying for some years to obtain the animals of certain species of land mollusca from this part of the world, and lately, through the kind interest of the late Governor, Sir Charles Bruce, K.C.M.G., I got at last into communication with the Colonial Secretary and the Curator of the Muséum des jardins. My thanks are due to them and particularly to M. Dupont for the material which I now describe.

The bottle contained three specimens, two with their shells, one without. On looking them over, this last, I considered, was another species, quite distinct from the other. On a comparison of their respective external characters, I was still further agreeably surprised to find that these were typical of that very widely-spread Indian genus *Macrochlamys*. I at once proceeded to examine the animal of a specimen (having its shell) in detail, and as the several organs came to view, they each agreed in a most interesting degree of similarity with the respective organs of that genus. So similar were they, I felt at the time I was dealing with an importation into the Mauritius from some part of India. There was, however, less reason for this supposition when specific identification commenced.

I have refrained until now from cutting up the specimen sent without a shell in order to compare it better when further material may come to hand. That it belongs to the same genus I have not the slightest doubt, and the figures illustrating this paper sufficiently show this, the right and left shell-lobes being well developed (Figs. vi, vii). On writing to Mr. J. Ponsonby, after examination of the specimens, to tell him I had made out two species, he informed me he had identified three species among shells he had lately received from M. Dupont, as *scalpta*, v. Mts. The interest surrounding these land shells is thus still more increased. Mr. Ponsonby very kindly offered to send me examples to look at, and having done so I have no hesitation in confirming his opinion, and the late Dr. W. T. Blanford, to whom I showed them, coincided. What species they

really represent is a nice puzzle in identification and nomenclature, a subject for a future paper which I trust Mr. Ponsonby will eventually give us. I therefore restrict myself to a description of the animals, and shall say nothing of the shells.

MACROCHLAMYS, sp. A; Mauritius. Pl. XVIII, Figs. I-IV.

Animal with a long foot, pale grey in colour, right shell-lobe very short and blunt (Fig. I), recalling that of *M. pedina* of Bombay,¹ the left (Fig. II) feebly developed, triangular on a broad base; dorsal lobes as usual, the left in two parts, the posterior the smallest; peripodial grooves well marked, the fringed margin with its groovings numerous and set close together (Fig. IV); mucous gland at extremity of the foot large, and with an overhanging lobe; sole of foot with a central area.

The *genitalia* (Fig. III).—The amatorial organ is very large, long, and cylindrical, tapering gradually with the end, terminating rather squarely where the long retractor muscle is attached.

The penis has a large coiled cæcum, where it bends on itself. The retractor muscle is attached to it in the usual way. At the junction of the vas deferens with the penis a long flagellum is given off; the vas deferens itself is short, and thicker than usually seen, and it joins the prostate just above a swollen ochre-coloured portion of the vagina duct. Just below this is the spermatheca, very long, ample, and swelling slightly towards the free end. The jaw is dark-coloured, solid, strongly arched, with a projection on the cutting edge.

The radula has the formula 46 : 20 : 1 : 20 : 46, or 66 : 1 : 66, altogether 132 teeth in the row. The central tooth and admedians are rather narrow, sharply pointed teeth, with a cusp low down on the outer side; these at the twentieth tooth gradually merge into bicuspid laterals, the cusp well below the point, and as far as the outermost small teeth they never become evenly bicuspid.

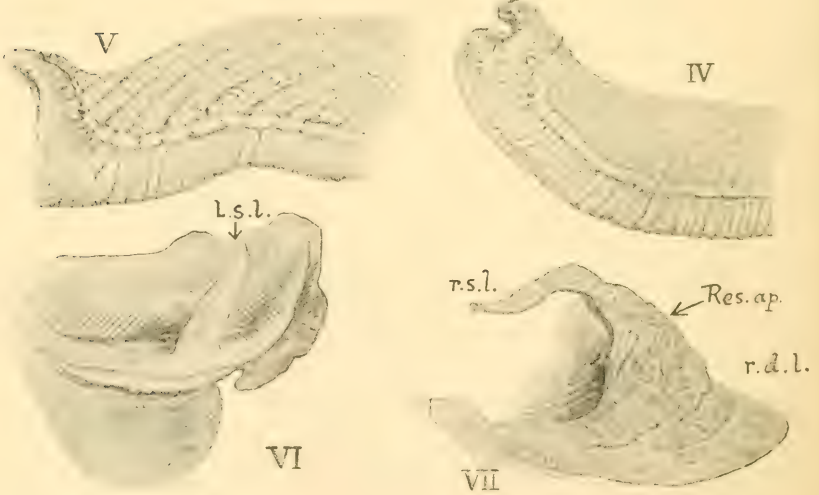
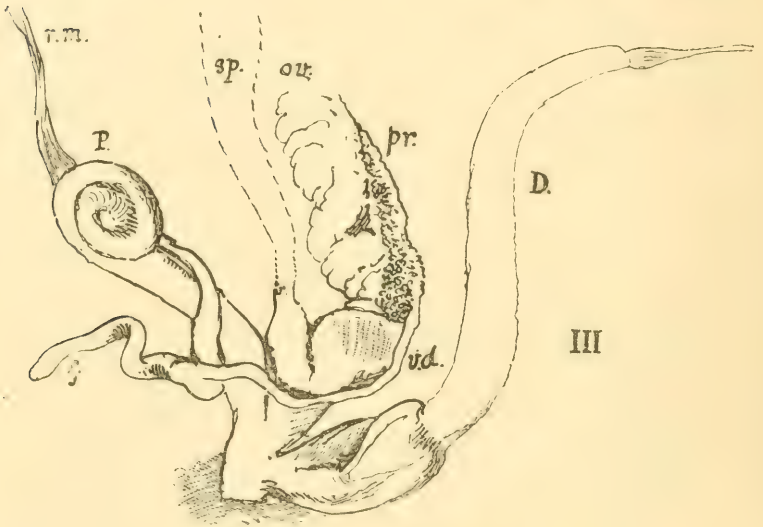
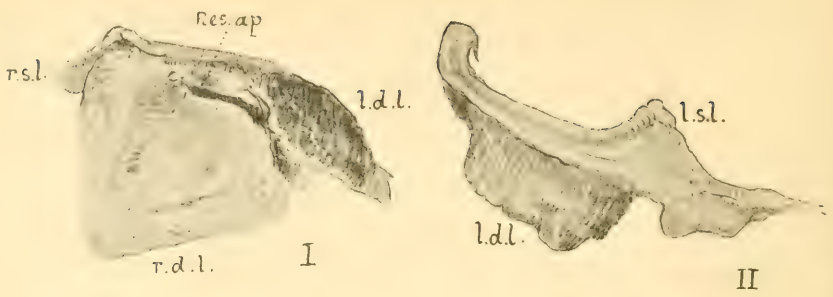
Of the rest of the anatomy there is nothing specially noticeable in the characters described. This species agrees in every way with an Indian *Macrochlamys* of typical species of Lower Bengal, such as *indica*, G.-A., from Calcutta, and in this connection even the type of shell-sculpture is the same, as well as the general form of the shell, so much so that I looked up the formula of the radula of *indica* to see what correspondence there might be; it differs very materially, being 34 : 2 : 9 : 1 : 9 : 2 : 34, or 45 : 1 : 45, or with only half the number of large admedian teeth.

MACROCHLAMYS, sp. B; Mauritius. Pl. XVIII, Figs. V-VII.

Animal not quite so grey as species A, but the membrane covering the branchial cavity is blacker, and freckled with the same colour, not seen in the other two specimens.

The fringe on the peripodial margin is in wider segments, and the longitudinal grooves leading upward from the peripodial grooves to the keel of the foot are very strongly marked. The mucous pore

¹ *Ide* L. and F.W. Moll. Ind., pl. xxxiii, fig. 1.



H. H. Godwin-Austen del.

has a well-developed overhanging lobe (Fig. v). The shell-lobes (Figs. vi, vii) are well developed, both long and tongue-like, the left dorsal in two parts, the posterior one being small. The form of the shell-lobes distinguishes this at once from sp. A.

The third species sent me by Mr. Ponsonby may possibly belong to the same genus, yet it might turn out to be some other; the interest will be increased if it should be a *Macrochlamys*, and leave less possibility of all three being imported species. It becomes now very important to know the exact localities in the island where these land shells were collected. If from the neighbourhood of town gardens, they may easily have been brought from abroad, particularly from botanical gardens in India, supplying plants to the Mauritius. If found in remnants of the old forests, far away from the coast, we should feel more confident they were indigenous forms. On this point I hope to hear more from Monsieur Dupont, and perhaps receive other material.

Geoffrey Nevill, in a paper ("Note sur deux coquilles terrestres, décrites par Deshayes comme recueillies à Pondichéry par M. Bélanger": Journ. Conchyl., xxvi, 1878, p. 59) which treats of two species, *semifusca*, Desh., and *Woodiana*, Pfr., says the former is excessively abundant in the vicinity of the town of Port Louis. He was evidently writing on one of the three species lately sent home. Further on he says: "D'après le souvenir que j'ai de l'animal, il se rapproche plutôt du type des *Macrochlamys* que de celui des *Rotula*, mais je puis, pourtant, me tromper, sous ce rapport." Semper has described two species from the adjacent island of Bourbon, viz. *celatura* and *rufa*, and places them in his genus *Rotula*. The anatomy of this genus differs in many important particulars from that of *Macrochlamys*, and shows it to be widely different. On the receipt of the Mauritian shells, I fully expected to find them species of *Rotula*.

The presence of true *Macrochlamys* in an island of the Indian Ocean, so far away to the south as the Mascarene Islands, is of extreme interest, provided we can feel clear it is an indigenous genus. Its presence would have a most important bearing on that very absorbing question, the ancient continuity of the Indian peninsula southward to Madagascar and Africa.

EXPLANATION OF PLATE XVIII.

FIGS. I-VII. *Macrochlamys* spp.; Mauritius.

| | | | |
|---------------|-------------------|-----------------|-----------------------|
| <i>D.</i> | amatorial organ. | <i>r.d.l.</i> | right dorsal lobe. |
| <i>f.</i> | flagellum. | <i>Res. ap.</i> | respiratory aperture. |
| <i>l.d.l.</i> | left dorsal lobe. | <i>r.m.</i> | retractor muscle. |
| <i>l.s.l.</i> | left shell-lobe. | <i>r.s.l.</i> | right shell-lobe. |
| <i>ov.</i> | ovary. | <i>sp.</i> | spermatheca. |
| <i>P.</i> | penis. | <i>v.d.</i> | vas deferens. |
| <i>pr.</i> | prostate. | | |

ON THE MOLLUSCA PROCURED DURING THE "PORCUPINE"
EXPEDITIONS, 1869-1870. SUPPLEMENTAL NOTES, PART II.¹

By E. R. SYKES, B.A., F.L.S.

Read 16th June, 1905.

IN the following pages I have dealt with the residue of the Tectibranchs, including the Pteropods, and also with the Heteropods. No new forms have been described, but some figures are given of little-known species. The next part will contain the Pleurotomidæ, of which there are a considerable number of deep-sea forms of interest.

The following addendum should be made to the list of stations of the 1869 cruise given *ante*, p. 25 :

23b. 56° 9' N. lat., 14° 10' W. long., 664 fath., 41° 7' Fahr. bottom temp.

There is also a slight confusion on p. 37; students are requested to transfer the entry of "Pl. III, Fig. 3" from the beginning of line 4 to the end of line 5.

RINGICULA, Deshayes.

Ringicula, Deshayes: Anim. sans Vert., 2nd ed., vol. viii (1838), p. 323.

The species of this group are exceedingly difficult to separate, and will, I think, prove to have a greater range of specific variation than is generally attributed to them.

The figures given by authors, including those of Morlet's monograph, are drawn on so small a scale that the characters are obscured, and, without a long series of specimens, it is impossible to be sure of the real status of many of the described forms.

In his manuscripts Jeffreys lists *R. Schlumbergeri*, Morlet,² but the specimens so labelled certainly do not belong to that species.

Only one specimen in the collection appears to be referable to *R. buccinea* (Br.); it is from "Cartagena," and is mentioned here owing to Jeffreys' identification. Personally, I attribute it to *R. auriculata*, and have doubts as to the specific distinction of the two forms. The following note relating to *R. buccinea*, from Jeffreys' MSS., seems of interest:—"Nothing is said in the short description about sculpture, but the figure evidently represents *R. ventricosa*, J. Sby., from the Crag. The latter is transversely striated, as in Seguenza's specimen from the Calabrian or Sicilian Pliocene, named *R. buccinea*. It appears to be distinct as a variety only from *R. auriculata* of Ménard, which is the common recent or living species. The shape, size, and sculpture are exceedingly variable. Examined a large series, recent and fossil, 11th Nov., 1872, J. G. J."

RINGICULA ADMIRABILIS, Morlet.

Ringicula admirabilis, Morlet: Journ. Conchyl., vol. xxx (1882), p. 203, pl. ix, fig. 3; Pilsbry, Man. Conch., vol. xv, p. 397.

"Porcupine" Expedition, 1870, "Atlantic" and "Mediterranean."

¹ For Part I, see *ante*, p. 23.

² Journ. Conchyl., 1882, p. 204 (not 1878, as given in Man. Conch.).

Distribution.—Mediterranean.

I have followed Jeffreys' identification, but the species is only known to me from the original figure and description. Unfortunately the boxes have upon them no exact localities.

RINGICULA AURICULATA, Ménéard.

Marginella auriculata, Ménéard: Ann. Mus., vol. xvii (1811), p. 331.

Ringicula auriculata, Ménéard: Pilsbry, Man. Conch., vol. xv, p. 395.

Ringicula auriculata, var. *conformis*, Monterosato: Nuova Revista, 1875, p. 45.

Ringicula conformis, Monterosato: Journ. Conchyl., vol. xxv (1877), p. 44, pl. ii, fig. 4; Pilsbry, Man. Conch., vol. xv, p. 396; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 90.

"Porcupine" Expedition, 1870, Stations 40, 50; Vigo Bay; Setubal Bay; off Cape Sagres; Tangier Bay; Gulf of Tunis; Adventure Bank.

Distribution.—Throughout the Mediterranean, to Atlantic coasts of Spain, Madeira, Canaries. A Tertiary fossil (cf. Locard, loc. cit.).

The *Ringicula conformis* of Monterosato appears to me to be, as originally surmised by him, a variety of this species.

RINGICULA NITIDA, Verrill.

Ringicula nitida, Verrill: Amer. Journ. Sci., ser. III, vol. v, p. 16; Pilsbry, Man. Conch., vol. xv, p. 399.

Ringicula leptochila, Brugnone.

"Porcupine" Expedition, 1870, Stations 3, 17, 56; Adventure Bank, 92 fathoms.

Distribution.—Coast of France, Spain, and Portugal; North America; Gulf of Mexico; Mediterranean.

I have followed the identification made by Dr. Dall and Mr. Pilsbry; see for a contrary opinion, Locard, Expéd. Scient. Trav. Talisman, vol. i.

RINGICULA PULCHELLA (Jeffreys), Morlet.

Ringicula pulchella, Jeffreys: Morlet, Journ. Conchyl., vol. xxviii, p. 158, pl. v, fig. 6; Pilsbry, Man. Conch., vol. xv, p. 398.

"Porcupine" Expedition, 1869, Station 28; 1870, Station 17, off Cape Espichel, 740 fathoms.

I believe nothing further is known as to the distribution of this species. According to Jeffreys, it was taken both by the "Talisman" and "Travailleur"; I do not, however, trace it in Locard's work, unless it be the shell he described as *R. minutula*, which appears to bear a close resemblance to the present form.

PHILINE, Ascanius.

PHILINE APERTA (L.).

Bulla aperta, L.: Syst. Nat., 12th ed., p. 1183.

Philine aperta, L.: Pilsbry, Man. Conch., vol. xvi, p. 10.

"Porcupine" Expedition, 1869, Donegal Bay, 25-40 fathoms (live); 1870, Tangier Bay, 35 fathoms; Gulf of Bona, 25 fathoms; Benzert Road, 40-65 fathoms; Adventure Bank, 92 fathoms.

Distribution.—From Norway to the Cape of Good Hope, also East Africa, and Mediterranean.

Mr. Pilsbry's note as to the difficulty of separating from this species the forms described from Eastern seas appears to be thoroughly justified. Jeffreys states that he has been unable to find conchological distinctions between the present species, that recorded from the "Challenger" as *P. orientalis*, Ad., the *P. Angasi* of Crosse, and the *P. Faillanti* of Issel. In specimens from the Baltic he also notes that the spire is visible.

Live specimens are in the museum from "Station 9," but without any indication as to which cruise they are from.

PHILINE CATENA (Mont.).

Bulla catena, Montagu: Test. Brit., p. 215.

Philine catena, Montagu: Pilsbry, Man. Conch., vol. xvi, p. 13.

"Porcupine" Expedition, 1869, Dingle Bay, 30–40 fathoms; 1870, Vigo Bay, 20 fathoms; Adventure Bank, 92 fathoms.

Distribution.—Norway to Canaries, and Mediterranean. Fossil in Coralline Crag.

PHILINE INTRICATA, Monterosato.

Philine intricata, Monterosato: Enum. e Sinon., p. 81; Nomencl. Gen. Spec. Medit., p. 147.

"Porcupine" Expedition, 1870, Adventure Bank, 92 fathoms.

Distribution.—Mediterranean.

My specimens, identified by the author, are not in sufficiently good condition to warrant an endeavour to describe and figure the form, which seems to rest only on the published name, and is not mentioned by Mr. Pilsbry in the "Manual."

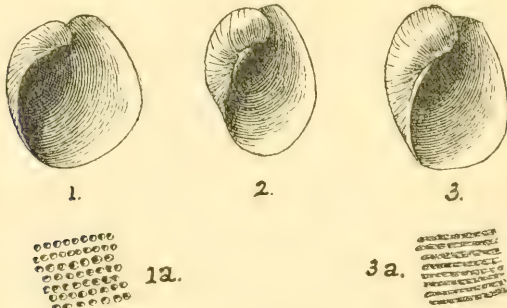


FIG. 1.—*Philine Monterosatoi* (Jeff.), Monts. $\times 4$.
 ,, 1a. ,, ,, sculpture. $\times 25$.
 ,, 2. ,, *membranacea*, Monts. $\times 6$.
 ,, 3. ,, *striatula* (Jeff.), Monts. $\times 8$.
 ,, 3a. ,, ,, sculpture. $\times 30$.

PHILINE MEMBRANACEA, Monterosato. Fig. 2.

Philine membranacea, Monterosato: Bull. Soc. Mal. Ital., vol. vi, p. 78 [nom. nud.]; Pilsbry, Man. Conch., vol. xvi, p. 22.

"Porcupine" Expedition, 1870, Station 45.

Distribution.—Mediterranean. Figured from the single specimen in the Museum.

PHILINE MONTEROSATOI (Jeffreys MS.), Monts. Fig. 1.

Philine Monterosati (Jeffreys MS.), Monterosato: Journ. Conchyl., vol. xxii, p. 281; Pilsbry, Man. Conch., vol. xvi, p. 20.

"Porcupine" Expedition, 1870, off Cape Espichel, 740 fathoms; off Cape Sagres, 45–58 fathoms; Adventure Bank, 92 fathoms.

Distribution.—Mediterranean and off the Portuguese coast.

In shape somewhat resembling *P. aperta*, but noteworthy for the fine, irregular, closely set spirals. Figured from one of the Museum specimens.

PHILINE NITIDA, Jeffreys.

Philine nitida, Jeffreys: Brit. Conch., vol. iv, p. 456; Pilsbry, Man. Conch., vol. xvi, p. 18.

"Porcupine" Expedition, 1869, Donegal Bay, 25–40 fathoms; 1870, Adventure Bank, 92 fathoms.

Distribution.—Norway to British seas, and Mediterranean.

PHILINE PRUINOSA (Clark).

Bullæa pruinosa, Clark: Zool. Journ., vol. iii, p. 339.

Philine pruinosa, Clark: Pilsbry, Man. Conch., vol. xvi, p. 26.

"Porcupine" Expedition, 1869, Dingle Bay, 30–40 fathoms (live); 1870, Adventure Bank, 92 fathoms.

Distribution.—From Norway, south to the Mediterranean.

PHILINE QUADRATA (Wood).

Bulla quadrata, S. Wood: Mag. Nat. Hist., n.s., vol. iii, p. 461.

Philine quadrata, Wood: Pilsbry, Man. Conch., vol. xvi, p. 19; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 39.

"Porcupine" Expedition, 1869, Station 28 (? live); 1870, Stations 3, 17.

Distribution.—Both sides of North Atlantic, and on eastern side south to St. Helena (for details see Pilsbry and Locard). A Tertiary fossil.

Jeffreys gives in his notes the following description of the animal taken from a specimen captured in "sandy mud in 43½ fathoms off Dogger Bank, Wednesday, 5th May, 1875":—

"Body whitish, with a greyish tint in front, microscopically of a parenchymatous appearance. Mantle large and covering the shell, resembling an open sack with two flaps behind, where it is deeply notched at each side. Tentacles broad, bilobed, and forming in front, with the edge of the foot, an elongated snout. Eyes none. Gizzard pink, observable through the tissues of the body, not calcareous. Liver yellow, occupying the shell. Foot very broad and flexible, occasionally folded at the sides on the back, wedge-shaped in front and truncated behind. Very sluggish, like other animals which inhabit mud."

PHILINE SCABRA (Müll.).

Bulla scabra, Müller: Zool. Danica, vol. ii, p. 41.

Philine scabra, Müller: Pilsbry, Man. Conch., vol. xvi, p. 12; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 37.

"Porcupine" Expedition, 1870, Stations 3, 17, 50; Vigo Bay, 20 fathoms; Adventure Bank, 92 fathoms.

Distribution.—Iceland to the coast of Spain, Mediterranean, and West Africa. A Tertiary fossil.

By a process of conjecture it might be possible to settle to which cruise and what stations the Museum specimens, some of which are 'live,' belong, but the result would probably be more injurious than helpful. Jeffreys suggests that *P. Loveni*, Malm., may be only a variety.

PHILINE STRIATULA (Jeffreys), Monterosato. Fig. 3 (p. 324).

Philine striatula, Jeffreys: Monterosato, Not. Conch. Med., 1872, p. 55 [nom. nud.]; Journ. Conchyl., vol. xxii (1874), p. 281; Jeffreys, Ann. Nat. Hist., ser. v, vol. vi, p. 318; Rep. Brit. Assoc., 1880, p. 387; Pilsbry, Man. Conch., vol. xvi, p. 22.

Utriculus striatulus, Jeffreys: Rep. Brit. Assoc., 1873, pp. 113, 114. Not *Philine striatula*, Jeffreys: Locard, Expéd. Talisman et Travailleur, vol. i, p. 41, pl. i.

"Porcupine" Expedition, 1869, Station 23a; 1870, Station 45; Adventure Bank, 92 fathoms.

Distribution.—Bay of Biscay (Jeffreys); Palermo and St. Vito, 90–200 metres (Monterosato).

Only two fragmentary specimens from Adventure Bank, named by the Marquis de Monterosato.

This species, like so many briefly diagnosed and unfigured forms, has an unfortunate history. Mons. Locard has identified, from two specimens which he states were named by Jeffreys, quite a different form to that preserved in the British Museum from the "Porcupine" collection. The latter is now figured from the small specimen from Station 45, referred to by Jeffreys. Under these circumstances the shell figured and described by Mons. Locard requires a new name, and I propose that of *P. Talismani* (nom. nov.).

Another box in the Museum is labelled "27, 28, 28a, Falm. to Gib."

AGLAJA, Renier.

Aglaja, Renier: Tavola Alphabetica, 1807, p. xvi. (For *A. depicta*, *tricarinata*, *granosa*, all of Renier.)

AGLAJA DEPICTA, Renier.

Aglaja depicta, Renier: Pilsbry, Man. Conch., vol. xvi, p. 46.

"Porcupine" Expedition, 1870, Adventure Bank, 92 fathoms.

Distribution.—Mediterranean Sea.

Two small shells, damaged. Better known as *Doridium membranaceum*, Meckel, with which the two specimens were identified by the Marquis de Monterosato.

TETHYS, L., 1758.

TETHYS PUNCTATA (Cuvier).

Laplysia punctata, Cuvier: Ann. Mus., ii, p. 295.

Tethys punctata, Cuvier: Pilsbry, Man. Conch., vol. xvi, p. 70.

"Porcupine" Expedition, 1870, Vigo Bay, 20 fathoms.

Distribution.—Norway to the Canaries, and Mediterranean.

A single immature shell, just over 2 mm. in length.

TYLODINA, Rafinesque.

TYLODINA DEUBENII, Lovén.

Tylodina Deubenii, Lovén: Ind. Moll. Scand., p. 19; Pilsbry, Man. Conch., vol. xvi, p. 187; Jeffreys, Proc. Zool. Soc., 1882, p. 673.

"Porcupine" Expedition, 1870, Stations 24, 27.

Distribution.—Norway, Bergen coast, 150–300 fathoms; near Elsinore, 12–14 fathoms (Jeffreys).

LIMACINA, Cuvier.

LIMACINA BULIMOIDES (D'Orbigny).

Atlanta bulimoides, D'Orbigny: Voy. Amér. Mérid., vol. v, p. 179.

Limacina bulimoides, D'Orbigny: Pelseneer, "Challenger" Report, Pteropoda, pt. ii, p. 30; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 26; Tesch, Thecosomata, etc., Siboga Exped., p. 13.

"Porcupine" Expedition, 1870, Stations 16, 17, 56.

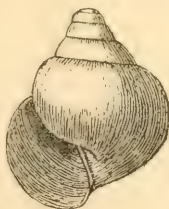
Distribution.—Widely scattered over the Atlantic and Pacific Oceans; dead shells in the Mediterranean.

Jeffreys notes, "Roundstone Bay, Connemara (Dr. Alcock)," but he does not mention whether live or dead shells.

LIMACINA CONTORTA (Monterosato).

Spirialis contorta, Monterosato: Nuova Rev. Conch. Medit., p. 50.

"Porcupine" Expedition, 1870, Station 56.



Distribution.—Mediterranean.

Though referred to on various occasions both by the author and others, this minute species seems never to have been described or figured. I now give a figure, taken from a specimen in my collection, so that those more competent than I may be able to judge of its validity. It seems nearly related to *L. trochiformis*.

LIMACINA HELICOIDES, Jeffreys.

Limacina helicoides, Jeffreys: Ann. Nat. Hist., ser. iv, vol. xix (1877), p. 338; Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 23, pl. i, fig. 5.

"Porcupine" Expedition, 1869, Station 28; 1870, Stations 16, 17.

Distribution.—Several stations in the Atlantic, from off the British Isles to the Azores, always dead and at considerable depths.

Locard¹ has, erroneously, placed this name in the synonymy of *L. Helicina*, Phipps; but he seems to have been unaware of Jeffreys' description and Pelseneer's figure.

LIMACINA INFLATA (D'Orbigny).

Atlanta inflata, D'Orbigny: Voy. Amér. Mérid., vol. v, p. 174.

Limacina inflata, D'Orbigny: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 17; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 22; Tesch, Thecosomata, etc., Siboga Exped., p. 11.

"Porcupine" Expedition, 1870, Stations 16, 17, 56.

Distribution.—Atlantic, Indian, and Pacific Oceans, etc. Fossil in South Europe.

LIMACINA RETROVERSA (Fleming).

Heterofusus retroversus, Fleming: Mem. Wernerian Soc., vol. iv, p. 498.

Limacina retroversa, Fleming: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 27; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 23.

"Porcupine" Expedition, 1869, Station 23b; 1870, Stations 3, 16, 17, 30, 56.

Distribution.—Both sides of North Atlantic.

At Stations 17 and 56 the series included the variety *Macandrea*. Despite the careful details given in the "Challenger" Report to show that this form is not found in the Mediterranean, but is there replaced by *L. trochiformis*, D'Orb., I have been unable to sever any of my specimens from *L. retroversus*. See, for an interesting note on the occurrence of the form in British seas, Proc. Soc. Glasgow, vol. iv, p. 230.

LIMACINA TRIACANTHA (Fischer).

Embolus triacantha, Fischer: Journ. Conchyl., vol. xxx (1882), p. 49.

Limacina triacantha, Fischer: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 20, pl. i, figs. 1, 2; Dall, Bull. U.S. Mus., vol. xxxvii, p. 80.

Protomedia triacantha, Fischer: Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 27.

Limacina carinata, Jeffreys: Ann. Nat. Hist., ser. v, vol. vi (1880), p. 375; Folin, Les Fonds de la Mer, vol. iv, p. 143.

"Porcupine" Expedition, 1870, Station 17.

Distribution.—Both sides of Atlantic (*vide* Locard, Dall, etc.).

If *Embolus elatus*, Seguenza, be identical, the species is also found in the Pliocene.

¹ Expéd. Scient. Trav. Talisman, vol. i, p. 21.

PERACLE, Forbes.

PERACLE RETICULATA, D'Orbigny.

Atlanta reticulata, D'Orbigny: Voy. Amér. Mérid., vol. v, p. 178.

Peraclis reticulata, D'Orbigny: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 34; Tesch, Thecosomata, etc., Siboga Exped., p. 15.

"Porcupine" Expedition, 1870, Station 56; off Jijeli, 40-80 fathoms.

Distribution.—Atlantic and Pacific Oceans.

PERACLE DIVERSA (Monterosato).

Spirialis diversa, Monterosato: Atti Acc. Palermo, vol. v (1875), p. 50.

Peracle diversa, Monterosato: Nomencl. Conch. Médit., 1884, p. 152; Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 29, pl. i, figs. 4-6.

Peraclis bispinosa, Pelseneer: "Challenger" Rep., Pteropoda, pt. ii, p. 36, pl. i, figs. 9, 10.

"Porcupine" Expedition, 1869, Station 23*b*; 1870, Stations 16, 17, 24.

Distribution.—Atlantic and Mediterranean.

I am unable to separate the form described by Mons. Pelseneer from specimens of *P. diversa*, identified by the author.

CLIO, L.

One or two single specimens have proved to be unidentifiable.

CLIO CONICA (Eschscholtz).

Creseis conica, Eschscholtz: Zool. Atlas, Heft iii, p. 17.

Clio conica, Eschscholtz: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 50.

"Porcupine" Expedition, 1870, Station 56.

Distribution.—Atlantic and Pacific Oceans, and Mediterranean Sea.

Five specimens, identified by Mr. Marshall.

CLIO CUSPIDATA (Bosc).

Hyalæa cuspidata, Bosc: Hist. Nat. Coquilles, vol. ii, p. 241.

Clio cuspidata, Bosc: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 66; Tesch, Thecosomata, etc., Siboga Exped., p. 30.

Cleodora cuspidata, Bosc: Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 16.

"Porcupine" Expedition, 1869, Stations 23*b*, 28; 1870, Station 15 (at surface, live).

Distribution.—Atlantic and Indian Oceans, and Mediterranean Sea. Tertiary of South Europe.

Jeffreys notes under Station 15: "Dredge came up quite empty; the scoop captured some live specimens of *Clio cuspidata*." He also gives the following notes on the animal, which seem of interest: "Body milk-white, except the mouth and viscera, which are of a purplish-brown colour. No eyes. Foot-lobes large, leaf-like, and palmated, of a parenchymous texture. The head is protected by

another lobe or flap, which resembles a hood; the foot-lobes being lateral, and apparently used for locomotion only. This third flap, however, forms part of the foot, and is merely a connecting membrane between the two side lobes. The foot-lobes are very flexible, curling inwards as well as flapping. Head triangular. The upper part (which represents the arc of a circle) is thickly studded with short tentacles. Heart bag-shaped, transparent, double, placed at the extremity of the body, and beating with a regular action like a pulse." Compare Souleyet, Voy. Bonite, Zool., vol. ii, p. 176.

CLIO PYRAMIDATA, L.

Clio pyramidata, L.: Syst. Nat., 12th ed., p. 1094; Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 63; Tesch, Thecosomata, etc., Siboga Exped., p. 29.

Cleodora pyramidata, L.: Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 14.

"Porcupine" Expedition, 1869, Stations 13 (live), 15, 16, 19, 20 (live), 28, 40; 1870, Stations 14, 16, 17, 30, 54; Vigo Bay, 20 fathoms; off Rinaldo's Chair, 60-160 fathoms; Rasel Amoush, 45 fathoms.

Distribution.—Almost worldwide. Tertiary of South Europe.

Several records on the boxes in the Museum have been omitted, as they appear either erroneous or not to refer to the "Porcupine."

CLIO STRIATA (Rang).

Creseis striata, Rang: Ann. Sci. Nat., ser. i, vol. xiii, p. 315.

Clio striata, Rang: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 54; Tesch, Thecosomata, etc., Siboga Exped., p. 27.

"Porcupine" Expedition, 1870, Station 56.

Distribution.—Atlantic, Indian, and Pacific Oceans. Tertiary of South Europe.

CLIO SUBULA (Quoy & Gaimard).

Cleodora subula, Quoy & Gaimard: Ann. Sci. Nat., ser. i, vol. x, p. 233.

Clio subula, Quoy & Gaimard: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 57; Tesch, Thecosomata, etc., Siboga Exped., p. 28.

Styliola subulata, Quoy & Gaimard: Locard, Expéd. Scient. Trav. Talisman, vol. i, p. 18.

"Porcupine" Expedition, 1870, Stations 16, 17, 56; Adventure Bank, 92 fathoms.

Distribution.—Atlantic, Indian, and Pacific Oceans. Tertiary of South Europe.

CUVIERINA, Boas, 1886.

CUVIERINA COLUMNELLA (Rang).

Cuvieria columnella, Rang: Ann. Sci. Nat., ser. i, vol. xiii, p. 323.

Cuvierina columnella, Rang: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 66; Tesch, Thecosomata, etc., Siboga Exped., p. 32.

"Porcupine" Expedition, 1870, Stations 16, 17, 22.

Distribution.—Atlantic, Pacific, and Indian Oceans.

CAVOLINIA, Abilgaard, emend.

CAVOLINIA GIBBOSA (Rang).

Hyalæa gibbosa (Rang), D'Orbigny: Voy. Amér. Mérid., vol. v, p. 495.

Cavolinia gibbosa, Rang: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 82; Tesch, Thecosomata, etc., Siboga Exped., p. 40.

"Porcupine" Expedition, 1870, Station 56.

Distribution.—Atlantic, Pacific, and Indian Oceans.

A fragment from Station 16 of the cruise of 1870 may belong here; several other station numbers also appear on a box in the Museum.

CAVOLINIA GLOBULOSA (Rang), Gray.

Cavolina globulosa, Rang: Gray, Cat. Brit. Mus., pt. ii, Pteropoda, p. 8.

Cavolinia globulosa, Rang: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 81; Tesch, Thecosomata, etc., Siboga Exped., p. 41.

Jeffreys notes in his manuscript that this form was taken in the cruise of 1870; the only box I can trace so named is labelled "No. 55, N.L. 37·30; W.L. 6·51, 1456 f." If we read W.L. as a slip for E.L. this agrees with Station 55, but probably the shells really come from Station 56 (see *ante*, vol. vi, p. 24).

CAVOLINIA INFLEXA (Lesueur).

Hyalæa inflexa, Lesueur: Bull. Soc. Philom., vol. iii, p. 285.

Cavolinia inflexa, Lesueur: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 85; Tesch, Thecosomata, etc., Siboga Exped., p. 43.

"Porcupine" Expedition, 1870, Stations 16, 17, 30, 56; Adventure Bank, 92 fathoms.

Distribution.—Atlantic, Indian, and Pacific Oceans. Italian and Sicilian Tertiaries.

Nineteen numbers appear on one box, but I have discarded them, as I expect they mostly or all refer to stations whence Jeffreys considered he had seen the species, and one cannot be sure to which cruise they refer.

CAVOLINIA TRISPINOSA (Lesueur), Blainville.

Hyalæa trispinosa, Lesueur: Blainville, Dict. Sci. Nat., vol. xxii, p. 82.

Cavolinia trispinosa, Lesueur: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 76; Tesch, Thecosomata, etc., Siboga Exped., p. 35.

"Porcupine" Expedition, 1869, Station 20; 1870, Stations 16, 17, 17a; Tangier Bay, 35 fathoms; Adventure Bank, 92 fathoms.

Distribution.—Atlantic, Indian, and Pacific Oceans. Fossil in European Tertiary.

CAVOLINIA TRIDENTATA (Forskål).

Anomia tridentata, Forskål: Descr. Anim. Orient., p. 124.

Cavolinia tridentata, Forskål: Pelseneer, "Challenger" Rep., Pteropoda, pt. ii, p. 83; Tesch, Thecosomata, etc., Siboga Exped., p. 37.

"Porcupine" Expedition, 1870, Station 17; Tangier Bay, 35 fathoms; Adventure Bank, 92 fathoms.

Distribution.—Atlantic, Indian, and Pacific Oceans. Fossil in European Tertiary.

CARINARIA, Lamarek, 1801.

CARINARIA LAMARCKII (Pér. & Les.), Blainville.

Carinaria Lamarekii (Péron & Lesueur), Blainville: Dict. Sci. Nat., vol. vii, p. 107; Smith, "Challenger" Rep., Heteropoda, p. 35.

Carinaria Mediterranea, Péron & Lesueur: Vayssière, Camp. Scient. Albert I^{er} Monaco, fasc. xxvi, p. 11.

"Porcupine" Expedition, 1870, Stations 17, 54, 56.

Distribution.—Mediterranean, and Atlantic coast of Portugal.

Considering the condition of the specimens, I have felt it best to refer them here rather than to endeavour to doubtfully identify them with other described forms; one specimen, from Station 54, recalls the little known *C. atlantica*, Ad. & Reeve. From Station 56 come a large number of specimens, consisting only of the embryonic whorls.

ATLANTA, Lesueur, 1817.

ATLANTA PERONII, Lesueur.

Atlanta Peronii, Lesueur: Journ. de Phys., vol. lxxv, p. 390; Smith, "Challenger" Rep., Heteropoda, p. 39; Vayssière, Camp. Scient. Albert I^{er} Monaco, fasc. xxvi, p. 49.

"Porcupine" Expedition, 1870, Stations 16, 17, 17a, 30, 51, 54, 56; Adventure Bank, 92 fathoms.

Distribution.—Atlantic, Pacific, and Indian Oceans (Smith).

Several other suggested station numbers on the Museum boxes are omitted.

ATLANTA FUSCA, Eydoux & Souleyet.

Atlanta fusca, Eydoux & Souleyet: Voy. Bonite, Zool., vol. ii, p. 39; Smith, "Challenger" Rep., Heteropoda, p. 42.

"Porcupine" Expedition, 1870, Station 56; Adventure Bank, 92 fathoms.

Distribution.—"All seas" (Eydoux & Souleyet).

ATLANTA SOULEYETI, Smith.

Atlanta Souleyeti, Smith: "Challenger" Rep., Heteropoda, p. 43.

Atlanta Lamanonii, Eydoux & Souleyet, *non* Eschscholtz.

"Porcupine" Expedition, 1870, Stations 17, 30.

Distribution.—Atlantic Ocean.

OXYGYRUS, Benson, 1835.

OXYGYRUS KERAUDRENI (Lesueur).

Atlanta Keraudrenii, Lesueur: Journ. de Phys., vol. lxxxv, p. 391.

Oxygyrus Keraudrenii, Lesueur: Smith, "Challenger" Rep., Heteropoda, p. 46; Vayssière, Camp. Scient. Albert I^{er} Monaco, fasc. xxvi, p. 56.

"Porcupine" Expedition, 1870, Stations 54, 56; Tangier Bay, 35 fathoms; Adventure Bank, 92 fathoms.

Distribution.—Atlantic Ocean and Mediterranean Sea.

ON A SMALL COLLECTION OF MOLLUSCA FROM
TIERRA DEL FUEGO.

By EDGAR A. SMITH, I.S.O.

Read 16th June, 1905.

THE specimens under consideration formed part of the zoological collections brought home by Captain Richard Crawshay from Tierra del Fuego a few months ago. Considering the smallness of the collection it is interesting to find so large a proportion of novelties. This is accounted for from the fact that the island has never been thoroughly investigated for mollusca. The Wilkes Exploring Expedition (1838-1842) discovered a number of new forms, and the French Mission Scientifique du Cap Horn (1882-1883) collected a few more. Dr. R. O. Cunningham, during the voyage of H.M.S. "Nassau" (1866-1869), and Dr. R. W. Coppinger, during the survey of H.M.S. "Alert" in 1879-1880, made considerable collections of mollusca in the Straits of Magellan and Southern Patagonia, although not actually on the shores of the island. No special list of the mollusca of Tierra del Fuego has hitherto been published,¹ so that the following may be regarded as the first instalment of such a catalogue. Captain Crawshay made no attempt at systematic shell-collecting, but merely picked up the few specimens that he came upon by chance. Consequently the small number of species obtained gives practically little idea of the probable richness or poverty of the fauna. The land shells at present known from the main and adjacent islands consist of about eight very small Helicoids and two or three species of *Succinea*. The only fresh-water forms are two species of *Limnæa*, two species of *Acyrogonia*, a group allied to *Limnæa*, and one or two species of *Chilina*, besides that now described. This genus has not previously been recorded from the main island.

Among the marine forms occurred a single worn shell (Fig. 1), of much interest, apparently belonging to a new genus. It has a subfossilized appearance, but my colleague, Mr. R. Bullen Newton, has failed to recognize it as a palæontological specimen. The rest of the collection consists of well-known Patagonian and Magellanic forms, such as *Trophon*, *Bullia*, *Photinula*, *Nacella*, *Modiolarca*, etc.

With reference to the localities quoted in the following pages, Captain Crawshay has supplied these notes:—

"'San Sebastian Beach' refers to the sea-shore of San Sebastian Bay. 'Rio McClelland' has a wider sense than merely the mouth of the river, and refers rather to the southern shore of Useless Bay, working from the Rio McClelland as a base.

¹ Most of the known species, however, are quoted by Mabile and Rochebrune in their account of the Mollusca of the Mission Scientifique du Cap Horn.

“The land shells from there were from the forested valley of the river, where they are usually found under decayed tree-trunks, but sometimes in the open.

“The Rio Marazzi flows into the head of Useless Bay. The fresh-water shells from this river were taken about two miles inland, where it is perfectly fresh.”

The following notes on the physical features of the island have also been furnished by Capt. Crawshay:—

“The shores of Tierra del Fuego afford a weird and fascinating study, for wind and wave have worked extraordinary results. Common objects are the bones of whales, carcasses of sea-lions and guanacos, ships' boats, spars, rudders, and other wreckage, tree-trunks, and endless odds and ends of timber in general.

“The line of the last high tide is marked by huge masses of seaweed, with quantities of mussel- and limpet-shells. The prevailing character of the beach in Admiralty Sound is grey shingle, with stretches of large, round, water-worn stones, similar to those of the British coast. In San Sebastian Bay, on the Atlantic side of the island, the sea recedes an immense distance at low tide, laying bare miles and miles of muddy sandflats. There I found several shells which do not seem to occur on the opposite side of the island. Shells are to be seen inland in Tierra del Fuego, on the surface and below it, on the downs some 200 feet above the sea, both on the east and west coasts of the island, thrown up by the burrowing *Ctenomys*, but whether these represent the work of Indians in bygone times or natural sea-deposits, I am not prepared to say. The shells thus thrown up are almost invariably limpets.”

I. Marine Species.

1. TROPHON GEVERSIANUS (Pallas).

Hab.—Rio McClelland, west coast of the island.

2. TROPHON MURICIFORMIS (King).

Hab.—Rio McClelland, Useless Bay, west coast of the island.

3. ACANTHINA CALCAR (Martyn).

Hab.—Rio McClelland and Admiralty Sound, west side of the island.

4. BULLIA SQUALIDA (King).

Bullia squalida, King: Reeve, Con. Icon., vol. iii, pl. iv, fig. 26.

Hab.—San Sebastian Bay, east coast of the island.

5. NATICA ATROCYANEA, Philippi.

Natica atrocyanea, Philippi: Conch. Cab., p. 53, pl. viii, fig. 7; Abbild., vol. ii, p. 41, pl. ii, fig. 1; Tryon, Man. Conch., vol. viii, p. 37, pl. xiv, fig. 21.

Hab.—San Sebastian Beach (Crawshay); Straits of Magellan (Philippi).

It is curious that the outer cretaceous coating of this shell is liable to be dissolved, leaving the deep purple under-layer exposed.

6. *PHOTINULA CRAWSHAYI*, n.sp. Fig. II.

Testa imperforata, turbinata, saturate lilacea; anfractus 6 (?), penult. et antepenult. sulcis spiralibus 3-4 sculpti, convexi, ultimus supra et infra obsolete sulcatus, infra suturam leviter impressus, ad peripheriam rotunde subangulatus, incrementi lineis tenuibus perobliquis striatus, infra medium lineis paucis concentricis saturatoribus pictus, circa regionem umbilici albus; apertura obliqua, intus obsolete sulcata; columella incrassata, reflexa, appressa, alba, callo tenui labro juncta.

Diam. maj. 21, min. 18 mm.; alt. 22 mm.

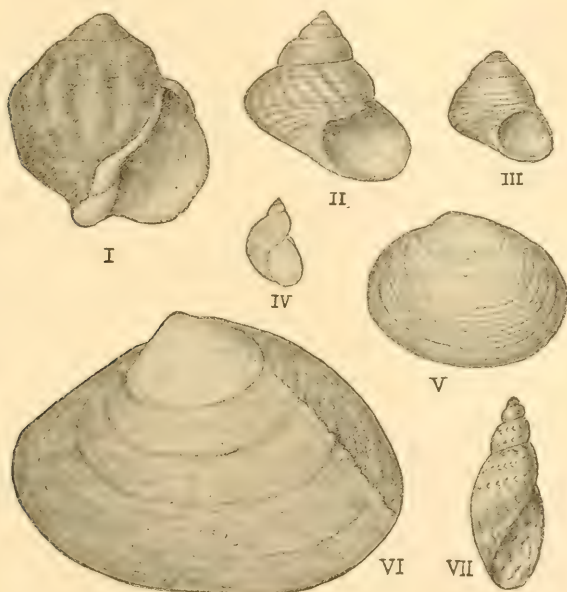


FIG. I. Gen. et sp. — ?
 ,, II. *Photinula Crawshayi*, n.sp.
 ,, III. ,, *roseolineata*, n.sp.
 ,, IV. *Succinea ordinaria*, n.sp.
 ,, V. *Chione Fuegiensis*, n.sp.
 ,, VI. *Mastra Fuegiensis*, n.sp.
 ,, VII. *Chilina Fuegiensis*, n.sp.

Hab.—Rio McClelland, Useless Bay.

In some respects this species approaches *P. Hyadesi* of Rochebrune and Mabile,¹ but the spire is more elevated, the penultimate whorl larger and more convex, and the colour different.

The single specimen has the apex broken away so that the number of whorls is given only approximately. The antepenultimate whorl

¹ Mission Scient. Cap Horn, vol. vi, Mollusques, pl. iv, fig. 8.

has around the lower part three distinct rounded spiral liræ which also extend on to the penultimate and gradually die out upon the last. The general tone of the shell is a deep lilac, but oblique streaks of a darker tint at irregular intervals are noticeable upon the body-whorl, the base of which exhibits some dark and light concentric zones, excepting around the umbilical region, which is white. The faint sulci within the aperture correspond with the almost obsolete external spiral liræ.

7. *PHOTINULA ROSEOLINEATA*, n.sp. Fig. iii.

Testa turbinata, imperforata, alba, lineis gracilibus spiralibus roseis picta, sub tegmine cretaceo lævi spiraliter tenuiter sulcata; spira convexe conica, ad apicem obtusa; anfractus 5 celeriter accrescentes, parum convexi, ultimus ad peripheriam rotunde obsolete angulatus, antice vix descendens, infra suturam versus aperturam leviter concave impressus, infra medium subplanatus; apertura obliqua, intus obsolete sulcata; columella oblique arcuata, incrassata, reflexa, appressa, alba.

Diam. maj. 15, min. 14·5 mm.; alt. 15 mm.

Hab.—San Sebastian Beach.

This species is well characterized by its peculiar form and colour. The outer calcareous coating of the shell, in which are the colour-lines, is almost smooth externally, but the pearly layer beneath is rather strongly sulcate. This is very evident where the outer layer has been chipped off. The penultimate whorl has four rose-coloured spiral lines and the last nine, four of which are upon the lower surface.

8. *PHOTINULA CÆRULESCENS* (King).

Trochus cærulescens, King: Philippi, *Conch. Cab.*, p. 250, pl. xxxvii, fig. 11.

Hab.—San Sebastian Beach.

One very large specimen is 29 mm. in diameter.

A second specimen is somewhat different, having the body-whorl more convex above and the base less impressed in the umbilical region.

I cannot agree with Pilsbry that this species is only a variety of the *P. tæniata* of Wood. In my opinion they are quite distinct.

9. *PHOTINULA VIOLACEA* (King).

Hab.—Rio McClelland.

10. *NACELLA MYTILINA* (Helbling).

Hab.—Rio McClelland.

11. *CHIONE FUEGIENSIS*, n.sp. Fig. v.

Testa parva, ovata, mediocriter compressa, inæquilateralis, dilute fuscescens; margo dorsi posticus declivis, rectiusculus, anticus brevior, æqualiter descendens, vix curvatus; latus anticus late rotundatum, posterius paulo angustius; valvæ crassæ, concentricè sulcatæ, sulcis hic illic cæteris profundioribus; pagina interna in medio albida, marginem minute crenulatum versus violacea; lunula angusta, elongata, linea incisa circumscripta; cicatrix antica elongata, irregulariter ovata, postica subpiriformis; sinus pallii brevis, subacutus.

Long. 25·5, alt. 19·5, diam. 11 mm.

Hab.—Rio McClelland.

This species is allied to *Chione crassa* of Quoy & Gaimard from New Zealand, but is more compressed, and ovate, the umbones being less prominent. The concentric sculpture also is hardly so strong as in that species. Only a single specimen was collected. The ligament, 6 mm. in length, is not prominent above the valves, being situated in a narrow but deep escutcheon. Besides the concentric sulci, the surface exhibits excessively minute radiating striæ, only visible under a strong lens. The hinge consists of three teeth in each valve, the central one in the left valve and the two posterior in the right being somewhat bifid.

12. *MACTRA FUEGIENSIS*, n.sp. Fig. vi.

Testa trigono-ovata, inaequalateralis, tenuis, alba, periostraco flavescente induta, concentrice tenuiter striata, carina ab umbone ad marginem posticum instructa; margo dorsi posticus arcuatim declivis, anticus æque descendens sed fere rectus; latus anticum acute rotundatum, posticum paulo latius; margo ventralis late curvatus vel in medio subrectus; umbones approximati, ad apicem leviter erosi; pagina interna alba, cretacea; cicatrices et linea pallii nitentes; cicatrix antica magna, piriformis, postica major, latior; sinus linguæformis, subprofundus.

Long. 51·5, alt. 37·5, diam. 21 mm.

Hab.—San Sebastian Beach.

This species of *Mactra* appears to be different from any of the known forms from South Patagonia, namely, *Mactra edulis*, King; *exalbida*, Gray; *Patagonica*, d'Orbigny; *marcida*, Gould; *levicardo*, Smith; and *Jousseaumi*, Mabilie & Rochebrune. It is rather like the last-named species as figured by Pilsbry (Amer. Journ. Sci., 1899, vol. vii, pl. i, figs. 1-3), but the umbones are less prominent, the anterior end is more pointed, and the size is smaller. The epidermal carina down the posterior side also tends to distinguish it. Mabilie & Rochebrune describe their shell as "solidula" and "intus roseo-alba," whereas the present species is light and thin, and dirty-whitish within.

The hinge is normal, but the lateral teeth are small and rather close up to the cardinals. The small external or marginal ligament is divided off from the resilium by the continuation of the single posterior lateral tooth of the left valve and the lower of the two of the right valve. The concentric sculpture upon the umbones, in fresh, unworn shells, is regular and thread-like, becoming finer as the shell increases. The epidermis is very finely lamellated, and somewhat wrinkled down the posterior side behind the radiating ridge. A second faint ridge is more or less evident down this part of the valves.

13. *DARINA SOLENOIDES* (King).

Hab.—San Sebastian Beach (Crawshay); Port Famine, Straits of Magellan (King).

The name *solenoides* was changed by Fischer¹ to *Kingi*, on the ground that Lamarek had already used it in the genus *Lutraria*, of

¹ Man. Conchyl., p. 1119.

which Fischer considered *Darina* merely a section. If, however, we consider it generically distinct, the alteration becomes unnecessary.

14. *MYTILUS FISCHERIANUS*, Canefri, var. (?).

Hab.—San Sebastian Beach.

A few small specimens which differ from the form figured by Canefri in having the ventral outline rather straighter, and the posterior adductor scar is somewhat smaller.

15. *MYTILUS (AULACOMYA) MAGELLANICUS*, Chemnitz.

Hab.—San Sebastian Beach.

16. *BRACHYDONTES* sp.

Hab.—San Sebastian Beach.

A single valve only, which I cannot identify at present. In shape and size very like *B. Darwinianus*, d'Orbigny, but more strongly radiately sculptured.

17. *MODIOLARCA TRAPEZINA* (Lamarck).

Hab.—Rio McClelland.

The specimens from this locality are of a deep purple-brown, which externally is somewhat obscured by a thin olivaceous periostracum. This species was figured by Küster in 1841 (Con. Cab., pl. vi, figs. 16, 17) as *Modiola trapezina*. The same figures have since been quoted by Clessin in the same work, Mytilidæ, p. 155, as representing *Dacrydium vitreum*, a minute northern mollusc, from which, of course, it is quite distinct.

Attention may also be directed to seven species (?), all from the same locality, Orange Bay, described and figured by Mabile & Rochebrune (Miss. Cap Horn, Moll., pp. 121–124, pl. vii, figs. 1a–7b). Personally I must confess to being unable to appreciate the specific value of these so-called species. Orange Bay is the same as Orange Harbour, where so many shells were collected by the United States Exploring Expedition under Commander C. Wilkes in 1838–1842. It is situated on the eastern side of Hoste Island, one of the smaller islands to the south of Tierra del Fuego.

II. Land and Fresh-water Species.

Only four land species and one from fresh water were obtained, namely, two forms of *Succinea*, two Helicoids, and a new species of *Chilina*.

18. *SUCCINEA PATAGONICA*, Smith, var.

Hab.—Rio McClelland.

A little smaller and narrower than the types collected by Dr. Copping. Perhaps the same as *S. Lebruni*, Mabile.

19. *SUCCINEA ORDINARIA*, n.sp. Fig. iv.

Testa imperforata, oblonga, tenuis, subpellucida, flavescens-cornea, versus apicem pallide rufescens; anfractus 3–3½ perconvexi, celeriter accrescentes, sutura obliqua profunda sejuncta, lineis incrementi subrugosa striati; apertura ovata; peristoma tenue, margine columellari callo tenui labro juncta.

Long. 10.25, diam. 6 mm.; apertura 6 mm. longa, 5 lata.

Hab.—Admiralty Sound.

Apparently very like *S. Lebruni*, Mabile,¹ but without the sanguineous apex, and rather more coarsely sculptured.

20. AMPHIDOXIA (STEPHANODA) LYRATA (Gould).

Hab.—Rio McClelland.

Two specimens apparently belonging to this species, which was collected originally by Couthony at Orange Harbour on the eastern side of Hoste Island, one of the detached islands south of the main island.

21. PAYENIA (?) sp.

A single immature shell from Rio McClelland may belong to this genus, created by Mabile & Rochebrune² for the *Helix saxatilis* of Gould from Orange Harbour.

22. CHILINA FUEGIENSIS, n.sp. Fig. VII.

Testa angusta, elongata, tenuis, sub tegmine terreno nigro olivacea, lineis rufis longitudinalibus undulatis picta, lineis incrementi tenuibus striata, striisque spiralibus minutis obscure sculpta; anfractus 5-6 valde convexi, ultimus elongatus, antice oblique descendens; apertura elongata, inverse auriformis, intus plus minus purpureo tincta et strigata; columella alba, plica tenui obliqua supra instructa, antice reflexa, superne callo tenui labro juncta.

Long. 24, diam. 10 mm.; apertura 13.5 mm. longa, 5.5 lata.

Hab.—Rio Marazzi, Useless Bay.

This species, the only one recorded from Tierra del Fuego, is remarkable on account of its slender form. All the specimens were coated with a black earthy deposit, which can easily be removed with a little diluted hydrochloric acid. Some examples are shorter than others, on account of the spire being less produced. In these specimens the mouth is consequently longer in proportion to the whole length of the shell. The following are the dimensions of such a specimen: length, 19 mm.; length of aperture, 12 mm.

¹ Mission Scient. Cap Horn, Moll., p. 14, pl. vi, fig. 4.

² *Ibid.*, p. 18.

ON TWO MIOCENE GASTROPODS FROM ROUMANIA.

By R. BULLEN NEWTON, F.G.S., etc.

Read 16th June, 1905.

THE Gastropod shells referred to in this paper were obtained by Lieut.-Colonel Thomas English, F.G.S., from the neighbourhood of Bustenari (Province of Prahova), a place twelve miles north of Ploesci in Roumania. Both specimens are of Miocene Tertiary age, but belong to different divisions of that period. The older represents a new species of the marine genus *Septa*, and may be referred to the Tortonian stage; the younger is an example of the peculiar shell *Valenciennesia*, which is characteristic of the fresh- and brackish-water deposits forming the uppermost part of the Miocene formation, and known as the Pontian Series, the fauna of which is analogous to that existing at the present day in the saline waters of Lake Aral and the Caspian Sea.

The geology of this part of Roumania has been mainly studied by Coquand,¹ Pilide,² Andrussow,³ and Sabba Stefanescu⁴; the most ancient fossiliferous rocks being apparently of Eocene age, are succeeded by Oligocene and the various members of the Miocene period, with the exception of the Burdigalian beds, which are not present in this immediate area of the country.

In tabular order, from the youngest group of beds downwards, the stratigraphical sequence is as follows:—

| | | | |
|------------|-----------------------------|------------------------|---|
| TERTIARY. | MIOCENE. | Pontian | Fluvio-lacustrine. |
| | | Sarmatian | Fluvio-lacustrine, with alter- nations of marine beds. |
| | | Tortonian (Leithakalk) | } Marine. |
| | | Helvetian | |
| | | Burdigalian (absent) | |
| OLIGOCENE. | Marine and Lacustrine beds. | | |
| Eocene. | Nummulitic ... | Marine. | |

It is satisfactory to note that Colonel English has presented these specimens to the Geological Department of the British Museum.

SEPTA ENGLISHI, n.sp.

Specimen massive, ventricose; whorls inflated, deep, irregular, descending obliquely from suture, subangulate posteriorly; ornamentation consisting of two distant rows of large, rounded, sometimes

¹ H. Coquand, "Sur les Gîtes de pétrole de la Valachie et de la Moldavie, et sur l'âge des terrains qui les contiennent": Bull. Soc. géol. France, sér. II, vol. xxiv (1867), pp. 505-569.

² C. D. Pilide, "Sur le Bassin Néogène de la région située au nord de Ploesci (Valachie)": Bull. Soc. géol. France, sér. III, vol. VI (1878), pp. 22-31.

³ N. Andrussow, "Kurze Bemerkungen über einige Neogenablagerungen Rumäniens": Verhandl. k.k. Geol. Reichs., 1895, pp. 189-197.

⁴ S. Stefanescu: "Études sur les Terrains tertiaires de Roumanie (Thèse)," Lille, 1897, pp. 178, with geological map.

triangular and V-shaped tubercles, which, on the body-whorl, form a kind of double angulation; aperture pyriform; inner lip with a thin, spreading callus; outer lip varixed. Height of specimen 120, of last whorl 97 mm.; greatest diameter of last whorl 87, smallest 75 mm.

Locality.—Near Bustenari, Roumania.

Formation.—Miocene (Tortonian).

This fragmentary specimen, showing the usual irregularities in the spire of this genus, consists mainly of a natural cast, very little of the original shell remaining. It shows the two last whorls and portion of a third, and, although so imperfect, the specimen represents one of the largest forms of this genus found in Tertiary rocks. The dorsal view (Fig. II) exhibits an expansive, swollen body-whorl, with a wide,



oblique surface extending from the suture to a sub-angulate margin formed by a series of large, rounded tubercles, beneath which, and parallel to them, is a similar row of tubercles; in the region of the outer lip these tubercles are much elevated, besides being triangular or V-shaped, with their apices directed towards the mouth.

The ventral aspect (Fig. I) shows the columella to be much excavated, whilst the inner lip is covered with the remnants of a thin callus; the labrum is distinctly varixed, but its internal characters are hidden with matrix; near the posterior corner of the aperture are two prominent triangular tubercles; the anterior canal is not present.

This fossil is most nearly related to *S. nodifera* (Lamarek), found in the Middle Miocene rocks of the Vienna Basin, Italy, etc., although much more massive in its proportions, whilst the whorls are deeper

and more swollen; the tubercles are, however, very similar in both forms, but smaller and rounder in *S. nodifera*. Stefanescu has recorded the occurrence of *Septa Apenninica* (Sassi) and *S. Grasi* (Bellardi) in the Tortonian beds of South-Western Roumania (Bahna, Vereiorova, etc.), but these species are in no way related to the present shell, being of much smaller size and bearing an entirely different ornamentation. There is no doubt that the horizon of this shell may be given as Tortonian, since a microscopical examination of the matrix discloses the presence of a nullipore structure of the genus *Lithothamnium*, a marine alga which largely constitutes the so-called 'Leithakalk' of the Vienna Basin, and which is characteristic of the Tortonian division of the Miocene system. Such Miocene rocks have already been recorded from near Slanic, in the neighbourhood of Bustenari, by Dr. Pilide,¹ who recognized the occurrence of similar nullipores in the limestone, accompanied by a number of marine shells, thus enabling him to correlate the deposits with the 'Leithakalk' of Austria. The specimen is of a brownish-black colour, having been found in association with petroleum.

The generic name of *Septa* here adopted for this shell was founded by Perry in 1811 ("Conchology, or the Natural History of Shells," pl. xiv, explanation) for a number of species belonging to *Cymatium* of Bolten and *Triton* of De Montfort. As De Montfort's *Triton* was previously occupied by Linnæus for another animal, Dr. W. H. Dall has selected *Septa* to take its place, recognizing *Septa rubicunda* of Perry as the type, which is said to be equivalent to *Triton nodiferum* of Lamarek. *Septa* will also include the second part of Schumacher's *Lampusia*, of which the type is *Murex tritonis*, Linnæus. For fuller information on this subject the student should consult Dr. Dall's pamphlet entitled "An Historical and Systematic Review of the Frog-Shells and Tritons," published August 6th, 1904, in the Smithsonian Miscellaneous Collections, vol. xlvii, Pub. No. 1467, p. 114.

VALENCIENNESIA ROUMANIENSIS, n.sp.

Shell orbicular, pileiform, fragile; apical region posterior, elevated, inflated; surface depressed beyond the apical area to anterior margin; sculpture entirely concentric, possessing numerous equidistant, deep sulcations margined by rounded or bluntly-edged, elevated, regular ridges (about 24), except towards anterior region, where the sulcations are shallower, and the ridges become merged together and less definite.

Height 58, width 46, convexity of apical region 12 mm.

Locality.—Near Bustenari, Roumania.

Formation.—Miocene (Pontian).

This species is intermediate between *T. Pauli* of Hoernes² and *T. annulata* of Reuss.³ From the former it differs in its much smaller

¹ C. D. Pilide, "Ueber das Neogen-Becken nördlich von Ploesci (Walachei):" Jahrb. k.k. Geol. Reichs., vol. xxvii (1877), pp. 134, 135.

² Rudolf Hoernes, "Ein Beitrag zur Kenntniss der Neogen-Fauna von Süd-Steiermark und Croatien-Congerien- (Valenciennesien-) Schichten von Knegec:" Jahrb. k.k. Geol. Reichs., vol. xxv (1875), p. 72, pl. iii, fig. 1.

³ A. E. Reuss, "Neue Fundorte von *Valenciennesia annulata*:" Sitz. k. Akad. Wiss. Wien, vol. lvii (1868), pp. 92-102, pl. iii, figs. 1-3.

size and the possession of closer concentric sculpture, from the latter in having a more rounded contour and in showing closer and more numerous concentric ridges and grooves.



The specimen described is much flattened, forming a kind of impression on the stiff greyish clay to which it is attached. It is, moreover, incomplete on the left side, the original margin having been worn away, but the concentric sculpture and definite border-line of the remaining part of the shell offer sufficient evidence for a complete restoration, if required, of its entire external contour. The condition of preservation is much the same as controls most examples of this genus, with the exception, perhaps, of Rousseau's¹ original type of *V. annulata*, which has a beautifully oval, arched, convex test, widely sculptured, sulcated surface, and non-spiral summit, displaying on the right side of the apex the characteristic swollen plication extending

¹ L. Rousseau, "Description des principaux Fossiles de la Crimée": A. de Demidoff's "Voyage dans la Russie Méridionale et la Crimée," 1842, vol. ii, p. 791, atlas, pl. iii, fig. 7.

from that point to the posterior margin. Such a plication exists in the specimen from Roumania, and, though somewhat obscure, it appears to have been a kind of narrow tube-like process leading from the apical region to the [absent] posterior border, and which internally would have corresponded with a longitudinal groove. The apex of this specimen is also wanting, its immediate area being obtuse or rounded.

The few species comprised in this genus certainly require some revision, if only suitable material were available for examination, from the fact that Reuss appears to have misinterpreted Rousseau's original type of *V. annulata*, which showed an external sculpturing of an Inoceramoid type, as well as a cancellated structure. The *V. annulata* of Reuss referred to a shell much more orbicular in contour, having a greater number of concentric ridges and grooves, and therefore closer together, and without evidence of surface cancellation. Judging from the figures, it would appear that Reuss' shell is not a great way removed from *V. Pauli* of Rudolf Hoernes, found in the Pontian beds of Croatia, and possibly the present form might be united to both, but, in the absence of better specimens for study, it is provisionally regarded as a new species under the name of *V. Roumaniensis*. Rousseau originally pointed out that this Pulmonate genus showed resemblances to *Ancylus* and *Siphonaria*, whilst Fischer in his "Manuel" (p. 502) has doubtfully placed it in the family Otinidæ and close to Benson's *Camptonyx*. In the case of *Camptonyx*, which is an Indian terrestrial shell, there are some features in common with *Valenciennesia*, viz., its pileiform shape, regular rugose surface, and the presence of an external swollen rib to the right of the summit; it differs, however, in possessing a sub-spiral instead of non-spiral apex, besides being of extremely small size, measuring only about 10 mm. in height. *Ancylus*, again, although of fresh-water habit, is of patelliform shape, with a spiral summit, and covered with fine and delicate radial markings; whilst *Siphonaria* is a marine genus, differing by being patelliform and showing sculpture with radiating costæ, but bearing a prominent external rib on the right margin.

In further comparison the following remarks by Benson, made at the conclusion of his paper on *Camptonyx*, are of interest:—

"The littoral genus *Siphonaria*, which Dr. Gray places between the Auriculidæ and Cyclostomidæ, is remarkable for the presence of a deep siphonal groove on the right side. Again, the large Tertiary fossil genus *Valenciennesia*, Rousseau, supposed to have been an inhabitant of brackish water, has a channel running from the under side of the beak of the shell to the right side of the aperture, much like the dorsal one of *Camptonyx*. It is supposed by M. Bourguignat to serve as a sheath to a siphonal tube. It probably communicates, as in *Camptonyx*, with the respiratory orifice, and does not necessarily contain a special organ. The strong concentric ribs of *Valenciennesia* present a curious analogy to the rugose surface of *Camptonyx*."

Valenciennesia is a characteristic genus of the fresh- and brackish-water Pontian deposits (= Congerien Schichten) which belong to the uppermost part of the Miocene system, and which extend from the

Vienna Basin through Hungary, Croatia, Dalmatia, Roumania to Southern Russia. Rousseau originally described it from the neighbourhood of Kertch in the Crimea, where it was found associated with *Limnæa velutina*, Deshayes, *Limnæa peregrina*, Deshayes, *Paludina casaretto*, Rousseau, and *Planorbis rotella*, Rousseau (see Bourguignat); *Congeria aperta*, Deshayes, *Cardium planum*,¹ Desh., *C. carinatum*, Desh., *C. crenulatum*, Rousseau, *C. acardo*, Desh., and *C. modiolare*, Rousseau (see Reuss).

Since then it has been recorded by Reuss from near Arcani in South-Western Roumania, and from near Gran in Hungary (Sitz. k. Akad. Wiss. Wien, 1868, vol. lvii, pl. iii, figs. 1-3, pp. 92-101). Oscar Lenz refers to its occurrence at Beocsin, Slavonia (Jahrb. k.k. Geol. Reichs., 1873, vol. xxiii, pp. 295-316); Brusina has obtained it from Agram in Croatia (Fossile Binnen-Mollusken, etc., 1874, pp. 102, 103); Dr. Sabba Stefanescu records it from the district of Gorjiu, South-Western Roumania, an area contiguous to that whence Reuss obtained his examples described in 1868 (Études sur les Terrains tertiaires de Roumanie: Mém. Soc. Géol. France, 1896, Mém. No. 15, pl. ix, figs. 34, 35, pp. 103-105); and Hoernes has also described it from Croatia (Jahrb. k.k. Geol. Reichs., 1875, vol. xxv, p. 72, pl. iii, fig. 1).

It may be mentioned that the generic name has undergone various orthographical changes. Rousseau dedicated the shell to Professor Valenciennes of Paris, but unfortunately adopted two renderings of it in his monograph, viz., in the text as *Valenciennius* and on the plate as *Valenciennensis*. To correct this want of uniformity Bourguignat² suggested *Valenciennia*, and lastly Paul Fischer³ more accurately defined the Latinized version of the name by introducing *Valenciennesia*, which is now generally accepted.

¹ As the different species of *Cardium* here enumerated are of brackish-water or lacustrine origin, and moreover differ internally (teeth, etc.) from the true marine forms of the genus, they are now recognized under other generic names, as follows: *Phyllocardium planum*, *P. depressum* (= *crenulatum*); *Pontalmyra carinata*, *P. modiolaris*; *Arcicardium acardo*.

² J. R. Bourguignat, "Aménités Malacologiques": Revue et Magasin Zoologie (Paris), ser. II, vol. vii (1855), p. 29, pls. i and ii.

³ P. Fischer, "Des genres *Camptomya* et *Valenciennesia*": Journ. Conchyl., vol. vii (1858), p. 318.

REVISION OF THE NEW ZEALAND PATELLIDÆ,
WITH DESCRIPTIONS OF A NEW SPECIES AND SUBSPECIES.

By HENRY SUTER.

Read 16th June, 1905.

Genus HELCIONISCUS, Dall, 1871.

Helcioniscus, Dall: Amer. Journ. Conch., vol. vi, p. 227 (type, *Patella variegata*, Reeve).

Helcioniscus, Pilsbry: Man. Conch. (1), vol. xiii, pp. 80, 123.

1. HELCIONISCUS DENTICULATUS (Martyn).

Patella denticulata, Martyn: Univ. Conch., vol. i, t. lxxv (1784).

„ *imbricata*, Reeve: Conch. Icon., vol. viii, fig. 93 (1855), not of Linné.

„ *Reevei*, Hutton: Man. N. Zeal. Moll., p. 108 (1880).

„ *margaritaria*, Martens: Crit. List. N. Zeal. Moll., p. 36 (1873), not of Chemnitz.

Helcioniscus denticulatus, Pilsbry: Man. Conch. (1), vol. xiii, p. 138, pl. lxxviii, figs. 23, 24; pl. xxi, figs. 49, 50 (1891).

The shell is mostly, but not always, elevated; one of my specimens has an altitude of 9 mm. only, with a length of 38 mm. The number of principal costæ varies from 22 to about 30, and they are imbricated or nodulous, but this character is very often lost in adult shells through the dissolving action of the water. The colour varies from light grey with brownish ribs to dark brown. Interior: The central area is always orange brown, the muscular scars in adult specimens bluish white and slightly raised. The yellowish spots on a chestnut-brown ground are marginal or extending up to the muscle-scar.

Dentition. The inner lateral tooth has a simple long cusp, and the outer lateral has one denticle on the outer edge. The dentition of *P. denticulata* published by Hutton (Trans. N. Zeal. Inst., vol. xv, p. 128, pl. xvi, fig. B) is that of *P. ornata*, Dillw.

Hab.—This species is very local in its distribution, but plentiful where it occurs. In Cook Strait it is common near Lyall Bay. Dunedin and Chatham Islands are mentioned by Capt. Hutton.

2. HELCIONISCUS TRAMOSERICUS (Martyn).

Patella tramoserica, Martyn: Univ. Conch., vol. i, pl. xvi (1784).

„ *Diemenensis*, Philippi: Zeitschr. f. Malak. (1848), p. 162.

„ *variegata*, Reeve: Conch. Icon., vol. viii, pl. xvi, figs. 36a-c.

„ *antipodum*, E. A. Smith: Voy. Erebus & Terror, Moll., p. 4, pl. i, fig. 25 (1874).

Helcioniscus melanoostomus, Pilsbry: Man. Conch. (1), vol. xiii, p. 151, pl. xxxii, figs. 67-69 (1891).

Helcioniscus tramosericus, Pilsbry: l.c., p. 142, pl. lxx, figs. 49-52.

Tate & May made *P. limbata*, Phil., a synonym, but I prefer to follow Pritchard & Gatliff, who consider it a distinct species, and I have never yet seen New Zealand specimens. Most of the synonyms here given are reproduced on the authority of the latter authors. Our specimens agree very well with those I have seen from Australia and Tasmania, and show also a great variability. The interior of the shell has narrow to broad dark rays, and the colour of the central area varies from greyish olive to chestnut brown. I have New Zealand specimens in my collection showing almost exactly the same dimensions as those quoted by Pilsbry.

The dentition is, as far as I am aware, unknown.

Hab.—Common in Australia and Tasmania. It is very local and rare in New Zealand. I have specimens from near Hokianga and the Hauraki Gulf, Wellington, and the Chatham Islands are mentioned by Hutton.

3. HELCIONISCUS RADIANUS (Gmelin).

Patella radians, Gmelin: Syst. Nat., vol. xiii, p. 3720 (1879).

„ *argyropsis*, Lesson: Voy. Coquille, p. 419 (1830).

„ *pholidota*, Lesson: l.c., p. 420.

„ *radiatilis*, Hombr. & Jacq.: Ann. Sci. Nat. (2), vol. xvi, p. 191 (1841).

„ *sturnus*, Hombr. & Jacq.: l.c., p. 191.

„ *fusca*, L.: Syst. Nat., vol. x, p. 784.

„ *sagittata*, Donovan: Rees' Encyclop., t. xvi (*vide* Pilsbry).

Helcioniscus radians, Pilsbry: Man. Conch. (1), vol. xiii, p. 139, pl. lxix, figs. 25–28.

This is a very variable shell, and with regard to synonyms there has been a great confusion. However, by collecting specimens from many localities and comparing them critically, I have been able to greatly reduce the number of synonyms, and to establish six distinct subspecies.

Pilsbry has given a capital diagnosis of the species. *P. pholidota*, distinguished only by the divaricating pattern extending over the posterior part of the shell down to the margin, cannot be separated for this reason alone from *P. radians*. As Hanley and Pilsbry pointed out, Linné's name *fusca* cannot be used, being “defined in an absurdly inadequate manner.”

The dentition was described and figured by Capt. Hutton in Trans. N. Zeal. Inst., vol. xv, p. 129, pl. xvi, fig. E (*argyropsis*). The anatomy was described by J. A. Newell in tom. cit., vol. xix, p. 157, pl. xi (1887).

Hab.—Throughout New Zealand, but more common on the east coast of the North Island. The Australian habitat, mentioned by Pilsbry, is no doubt a mistake.

Subsp. *argentea*, Quoy & Gaimard.

Patella argentea, Quoy & Gaimard: Voy. Astrolabe, Zool., vol. iii, p. 345, pl. lxx, figs. 16, 17 (1834).

The specimens obtained by the French naturalists were rather small, but much larger examples occur in many localities, especially in the

vicinity of Lyttelton, South Island. The shell has most of the characters of the species, but the interior has no radiate brownish bands. The surface is sculptured by about 20 more or less elevated ribs, and in each interval are several riblets. The main ribs are light brown, sometimes punctured with white. The ground colour is greenish or grey, often blotched with white. The naere is silvery white, often with a yellowish tint. Central area mostly greyish white, sometimes, in old shells, rusty. Adult shells are much higher than *radians*.

| | Length. | Breadth. | Height. |
|--------------------------|---------|----------|---------|
| Specimen from Sumner ... | 50 ... | 41 ... | 21 mm. |
| " " Napier ... | 42 ... | 34 ... | 15 " |
| " " Timaru ... | 53 ... | 44 ... | 17 " |
| Type-specimen of Q. & G. | 24 ... | 22·5 ... | 6·8 " |

I examined the dentition, and found it to be the same as in *H. radians*.

Hab.—Throughout New Zealand, most common on the east coast of the South Island.

Subsp. *decora*, Philippi.

Patella decora, Philippi: Zeitschr. f. Malak. (1848), p. 162; Abbild., pl. iii, fig. 3.

 " *decora*, Reeve: Conch. Icon., vol. viii, figs. 33a-c.

Helcioniscus decorus, Pilsbry: Man. Conch. (1), vol. xiii, p. 140, pl. lxix, figs. 29-31.

Shell mostly large, semiglobose, apex much inclined to the anterior, more rounded than in the typical species, with 20-24 distant reddish-brown ribs on a yellowish or greenish olive ground. Interior iridescent, with the brown radiating ribs shining through the pearly layer; central area milk white to greyish olive. My largest specimen, from Tauranga, has the following dimensions:—Length 60, breadth 50, height 18 mm.

The dentition is unknown.

Hab.—East coast of both islands, rare.

Subsp. *Earlii*, Reeve.

Patella Earlii, Reeve: Conch. Icon., vol. viii, fig. 71 (1855).

 " *flexuosa*, Hutton: Cat. Mar. Moll. N. Zeal., p. 45 (1873), not of Quoy & Gaimard.

Helcioniscus Earlii, Pilsbry: Man. Conch. (1), vol. xiii, p. 140, pl. xxi, figs. 51, 52.

Distinguished from the species by the rotundately ovate form, the convexly raised front, the broad blood-red blotches, and the milk-white central area. This is a very distinct and easily recognized subspecies. The altitude is generally not greater than in *radians*, but the breadth is much greater in proportion to the length.

I examined the dentition, and found it to be exactly the same as in the species.

Hab.—I have specimens from Tauranga, Te Onepoto and Sumner near Lyttelton, Akaroa, Timaru, and Preservation Inlet. In the first two localities perfectly typical specimens occur.

Subsp. *affinis*, Reeve.

Patella affinis, Reeve: Conch. Icon., vol. viii, fig. 108 (1855).

Nacella Earli, Hutton: Cat. Mar. Moll. N. Zeal., p. 45 (1873), not of Reeve.

Helcioniscus affinis, Pilsbry: Man. Conch. (1), vol. xiii, p. 140, pl. lxxix, figs. 32, 33.

Distinguished from the species by its smaller size, the elongated oval form, the numerous simple, smooth, slightly waved radiate ridges and striæ. The typical, close, divaricating colour-pattern is not always present, sometimes there are only brown radiate bands visible, which, especially in Chatham Island examples, coalesce, forming broad dark-brown or black patches. The concentric striation is mostly very distinct. A large specimen has the following dimensions:—Length 33, breadth 33, height 7 mm.

Hab.—I have specimens from Stonyhurst, Te Onepoto, Preservation Inlet, and from the Chatham Islands. It seems to be very local in its distribution.

Subsp. *flava*, Hutton.

Patella flava, Hutton: Cat. Mar. Moll. N. Zeal., p. 44 (1873).

Helcioniscus flavus, Pilsbry: Man. Conch. (1), vol. xiii, p. 142.

This subspecies is best described as a conical, pale yellow form of *decora*, Phil. The apex is subcentral, sometimes nearly reaching the anterior third of the length. Small shells are, as a rule, depressed, but adult individuals have mostly a high conical form. The distant broadly-rounded ribs number 20 to 22, and are almost always of the same colour as the shell; specimens from Stonyhurst have, now and again, one or several ribs dark brown. Interior light to orange yellow, iridescent, central area cream to light orange colour. To show the variability in form I give here the dimensions of specimens from three different localities:—

| | Length. | Breadth. | Height. |
|---------------------------------|---------|----------|---------|
| Kaikoura, South Island ... | 55 ... | 46 ... | 26 mm. |
| " " " ... | 46 ... | 39 ... | 14 " |
| Stonyhurst, " " ... | 50 ... | 42 ... | 22 " |
| " " " ... | 42 ... | 33 ... | 17 " |
| Napier, North Island ... | 50 ... | 43 ... | 25 " |
| " " " ... | 45 ... | 37 ... | 18 " |

I examined the radula of several specimens, and found the dentition the same as in the species. The gill cordon is interrupted in front.

Hab.—My collection contains specimens from Kaikoura, Stonyhurst, Motanau Island, South Island; Napier and Gisborne, North Island; Chatham Islands.

Subsp. *olivacea*, Hutton.

Patella olivacea, Hutton: New Zeal. Journ. Sci., vol. i (1882), p. 69.

Helcioniscus olivaceus, Pilsbry: Man. Conch. (1), vol. xiii, p. 141, pl. lxxx, figs. 46-48.

This subspecies is very much like the large conical form of *argentea*, Q. & G., but distinguished from it chiefly by the very numerous (about 70) fine and uniform radiate riblets, the olive colour of the shell, and the black margin on the inner edge, which, however, is not a constant character.

The dentition was described and figured by Hutton in Trans. New Zeal. Inst., vol. xv, pl. xvi, fig. D.

Hab.—From Sumner, near Lyttelton, along the east coast to Preservation Inlet, South Island. Rather rare, but always together with *argentea*, Q. & G.

4. *HELACIONISCUS STELLIFERUS* (Gmelin).

Patella stellifera, Gmelin : Syst. Nat., vol. xiii (1789), p. 3719.

„ *stellularia*, Quoy & Gaimard : Voy. Astrolabe, Zool., vol. iii (1834), p. 347, pl. lxx, figs. 18–20.

Helcioniscus stelliferus, Pilsbry : Man. Conch. (1), vol. xiii, p. 141, pl. lxx, figs. 43–45.

Usually the shell is reddish, but cream-white, cinereous, and purplish-black specimens occur occasionally. The white rays at the apex, forming the typical star, very often extend to the margin, and their number is very variable.

This species no doubt lives in deeper water, as only empty shells washed up on the beach are obtained. I know only of one specimen having been found alive at Island Bay, near Wellington. The animal and dentition are unknown.

Hab.—From Cape Maria van Diemen to Banks' Peninsula, but nowhere common.

N. subsp. *phymatia*.

Distinguished from the species by the high conical form and the strongly nodulous ribs. The shell is solid, oval or oblong, high conical, the height somewhat less than half the length of the shell;



apex at about the front third, more or less denuded. There are about 24 strongly nodulous radiate ribs, crossed by strong concentric lines of growth. As in the species, a white star or white bands extending to the margin are present, and the colour is yellowish red. The anterior slope is straight or slightly convex. Interior silvery white, central area white, sometimes tinged with light brown. Length 27, breadth 21, height 12 mm.

The animal and dentition are unknown.

Hab.—Together with the species.

Type in my collection.

5. HELCIONISCUS ORNATUS (Dillwyn).

- Patella ornata*, Dillwyn: Descript. Cat. Recent Shells, vol. ii, p. 1029 (1817).
 ,, *nodosa*, Hombr. & Jacq.: Ann. Sci. Nat. (2), vol. xvi, p. 191 (1841).
 ,, *denticulata*, E. A. Smith: Voy. Erebus & Terror, Zool., vol. ii, Moll., p. 4, pl. i, fig. 26, not of Martyn
 ,, *denticulata*, Hutton: Man. N. Zeal. Moll., p. 109 (1880), not of Martyn.
 ,, *margaritaria*, Reeve: Conch. Icon., fig. 74.
Helcioniscus ornatus, Pilsbry: Man. Conch. (1), vol. xiii, p. 137, pl. lxxviii, figs. 14-19; pl. xix, figs. 39, 40.

Specimens from Stonyhurst, South Island, have the apex quite anterior.

Dentition described and figured by Hutton in Trans. N. Zeal. Inst., vol. xv, p. 128, pl. xvi, fig. B (*P. denticulata*).

Hab.—Throughout New Zealand, but more common in the south.

Subsp. *inconspicua* (Gray), Hutton.

- Patella inconspicua*, Gray: in Dieffenbach's N. Zeal., vol. ii, p. 244 (1843).
 ,, *luctuosa*, Gould: Proc. Bost. Soc. Nat. Hist., vol. ii, p. 150 (1846), not of Hombr. & Jacq.
 ,, *inconspicua*, Hutton: Man. N. Zeal. Moll., p. 107; P.L.S. N.S. Wales, vol. ix, p. 375.
 ,, *inconspicua*, Hutton: Trans. N. Zeal. Inst., vol. xiii, p. 203 (1881); animal descr.
Helcioniscus ornatus, var. *inconspicua*, Pilsbry: Man. Conch. (1), vol. xiii, p. 138, pl. lxxviii, figs. 20-22.

Hab.—Throughout New Zealand, one of our most common limpets.

6. HELCIONISCUS STRIGILIS (Hombron & Jacquinot).

- Patella strigilis*, Hombr. & Jacq.: Ann. Sci. Nat. (2), vol. xvi, p. 190 (1841).
 ,, *Magellanica*, Hutton: Trans. N. Zeal. Inst., vol. xv, p. 128, pl. xvi, fig. A, dentition, not of Gmelin.
Helcioniscus strigilis, Pilsbry: Man. Conch. (1), vol. xiii, p. 137.

The situation of the apex is very variable. The type usually has the apex at about the anterior third of the length, but my collection contains specimens which have the apex at the anterior eighth of the length. This species attains sometimes a rather large size; a specimen from Campbell Island has the following dimensions: length 80, breadth 68, height 39 mm. The muscle-scar is occasionally much elevated, catenate.

Hab.—From Tauranga to the Bluff; Chatham, Auckland, Antipodes, and Campbell Islands. The type is from the Auckland Islands.

7. HELCIONISCUS REDIMICULUM (Reeve).

- Patella redimiculum*, Reeve: Conch. Icon., vol. viii, fig. 50 (1854).
 ,, *radians*, Reeve: l.c., fig. 25, not of Gmelin.

Patella Pottsii, Hutton: Cat. Mar. Moll. N. Zeal., p. 44 (1873).

Helcioniscus redimiculum, Pilsbry: Man. Conch. (1), vol. xiii, p. 136.

This species, nearly allied to *H. denticulatus* and *H. strigilis*, is very variable; the dentition is very much like that of the first species, but the shell characters are more in accordance with the latter. The form varies from round-oval to elongate-oval, depressed to conical, and the apex is to be found situated from the front fourth to quite close to the anterior margin. Sometimes the shells are beautifully coloured, the ribs brown and the intervals bluish white, whilst other specimens have the surface very much worn and eroded. Interior: The central area is normally cream white to light brown, but at the Chatham and Auckland Islands shells occur with the central area light blue to bluish grey and brown, like *H. limbatus*, Phil., from Tasmania.

Hab.—It is found on the eastern shores of the South Island from Stonyhurst to Preservation Inlet, and at the Chatham, Bounty, and Auckland Islands.

8. HELCIONISCUS CRATICULATUS, n.sp.

Shell small, thin, ovate, depressed conical, the apex at the anterior third of length, anterior slope straight, posterior very slightly convex. Surface black, brown, or yellowish grey; black shells sometimes



with concentric patches of grey; sculptured by 24 to 30 principal radiate ribs, the interstices having 1 to 3 smaller riblets, and they are crossed by very distinct, close-set concentric striæ, producing a finely granulated surface. The radiate ribs are alternately black and olive or black and reddish white, sometimes the black rays are quite absent, and the shell is uniformly flesh-coloured. Margin slightly crenulated. The interior is olive or white, tinged with orange outside the muscular scar, iridescent, and the black rays are distinctly visible through the pearly layer. The central area is chestnut brown.

The dimensions of a few specimens are:—

| | | | | | | |
|--------|-----|---------|-----|--------|---------|------------------|
| Length | 25, | breadth | 20, | height | 7 mm. | (Type-specimen.) |
| „ | 20, | „ | 17, | „ | 5 mm. | |
| „ | 19, | „ | 15, | „ | 4.5 mm. | |

The animal and dentition are unknown.

Hab.—Kermadec Islands. Specimens were collected by Captain Bollons, of the Government steamer “Hinemoa,” and kindly presented to me. Type in my collection.

This small limpet shows, like most of our species, a very great variability with regard to the colour pattern, and in this respect it stands nearest to *H. tramosericus*. The variety without black rays, of flesh colour, occurs on Raoul and Curtis Islands. The principal ribs are very often formed by two or three smaller riblets grouping together.

Genus *NACELLA*, Schumacher, 1817.

Nacella, Schumacher: Essai d'un nouv. Syst. (1817), p. 179 (type, *P. mytilina*, Helb.).

„ Pilsbry: Man. Conch. (1), vol. xiii, pp. 79, 114.

Sect. *Patinella*, Dall, 1871.

Patinella, Dall: Amer. Journ. Conch., vol. vi (1871), p. 272 (type, *P. Magellanica*, Gm.).

„ Pilsbry: Man. Conch. (1), vol. xiii, pp. 80, 116.

9. *NACELLA* (*PATINELLA*) *ILLUMINATA* (Gould).

Patella illuminata, Gould: Proc. Bost. Soc. Nat. Hist., vol. ii (1846), p. 149.

„ *Terroris*, Filhol: Compt. Rend., vol. xci (1880); Mission de l'île Campbell, p. 529 (1885).

Helcioniscus illuminatus, Pilsbry: Man. Conch. (1), vol. xiii, p. 142, pl. lxx, figs. 40-42.

The dentition was described and figured by Hutton in Trans. New Zeal. Inst., vol. xv, p. 128, pl. xvi, fig. C. I examined the radula of a specimen from Macquarie Island and found it exactly as figured by Captain Hutton. The foot of the animal has on its sides a scalloped frill, interrupted in front; the branchial cord is complete, not interrupted in front, and the branchial papillæ are elongated conical, transversely foliated; larger black lamellæ are placed at regular intervals, leaving two to three white papillæ between them, and have their base of insertion higher up on the inner side of the mantle.

Hab.—Auckland, Campbell, and Macquarie Islands.

10. *NACELLA* (*PATINELLA*) *FUEGIENSIS* (Reeve).

Patella Fuegiensis, Reeve: Conch. Icon., vol. viii (1855), fig. 73.

„ *Fuegiensis*, Filhol: Mission de l'île Campbell, p. 529.

„ *Fuegiensis*, Pilsbry: Man. Conch. (1), vol. xiii, p. , pl. , figs. .

Shell oval, rather thin, semitransparent, rather compressly raised, apex rounded, inclined anteriorly, radiately ridged, ridges thin, numerous, densely crossed with concentric striæ; greenish, more or less stained and blotched with chestnut brown, apex bronze, interior iridescent bronze, radiately grooved, grooves sometimes partially obsolete (Reeve).

Hab.—Campbell and Macquarie Islands; Tierra del Fuego, Falkland Is.; Kerguelen Island (Smith).

A delicate subpellucid species, elegantly many-ridged, of a pale greenish texture, partially, and sometimes almost entirely, stained and blotched with reddish chestnut (Reeve).

A specimen collected by Mr. A. Hamilton, now Director of the Colonial Museum, Wellington, and very kindly presented to me, perfectly agrees with Reeve's description and figure, with the exception of the situation of the apex, which is at the anterior fourth of the length, but this is subject to great variability with most of our limpets. My specimen is subpellucid, the radiate close ribs number about 40, and are crossed by close distinct concentric striae. It is a little smaller than the type; the dimensions are: length 33, breadth 24, height 9 mm.

It is quite distinct from *N. illuminata*, and forms a very interesting addition to the fauna of the Southern Islands of New Zealand.

Genus PATELLA, Linné, 1758 (s. str.).

Type: *Patella vulgata*, Linn.

Sect. *Ancistromesus*, Dall, 1871.

Ancistromesus, Dall: Amer. Journ. Conch., vol. vi (1871), p. 276
(type, *P. Mexicana*, B. & S.).

„ Pilsbry: Man. Conch. (1), vol. xiii, pp. 77, 79, 107.

11. PATELLA (ANCISTROMESUS) KERMADECENSIS, Pilsbry.

Patella (Scutellastra) Kermadecensis, Pilsbry: The Nautilus, vol. vii,
p. 106 (1894).

„ *Kermadecensis*, Taylor: tom. cit., p. 142.

„ *Kermadecensis*, Dall: MS., Jan., 1894.

„ *Pilsbryi*, Brazier: P.L.S. N.S. Wales, 1894 (1895).

„ *Kermadecensis*, Pilsbry: Proc. Acad. Nat. Sci. Philad. (1894),
p. 208, pls. vii, viii.

„ *Kermadecensis*, Suter: Journ. Malac., vol. ix (1902), p. 111,
pl. viii (animal and dentition).

Hab.—Kermadec Islands.

In Trans. N. Zeal. Inst., vol. xx (1888), p. 165, we find the following passage with regard to the mollusca of the Kermadecs:—
“A large limpet, more than 5 inch. in diam., is common on the rocks.”

Doubtful New Zealand Species.

PATELLA FLOCCATA, Reeve.

Conch. Icon., vol. viii, fig. 106 (1855). Collected in New Zealand by Mr. Earl.

We first find this species mentioned again by Hutton as *Nacella floccata*, Reeve, Hutton, Cat. Mar. Moll. N. Zeal., p. 45 (1873). Martens, in his Crit. List. Moll. N. Zeal., does not mention it at all. Hutton remarks: “This appears to me to be a variety of *N. argentea*.” Again, in his Révision des Coquilles de la Nouv. Zélande (1878), Capt. Hutton enumerates *Patella floccata* with the note: “Je n'ai vu aucun spécimen de cette espèce.” Further, in Hutton's Man. N. Zeal. Moll. (1880), we find this species as a synonym of *P. pholidota*, Lesson, and this is repeated in his revision of the Docoglossate Mollusca, P.L.S. N.S. Wales, 1884. Pilsbry accepts Hutton's synonymy in the Man. Conch. (1), vol. viii, p. 140, and reproduces Reeve's figures of *Patella floccata*, pl. lxix, figs. 38, 39.

I am confident that my collection now contains all the species of Patellidæ to be found in New Zealand waters, and I am unable to find anything amongst them corresponding with Reeve's species. Without seeing the type-specimen, it is not easy to locate this form, but I fully agree with Mr. E. A. Smith that it is an *Acmæa*, and there is no other New Zealand species attaining that size but *Acmæa pilcopsis*, Q. & G. This also is a very variable species, but I have examples which are decidedly convexly depressed, have the apex situated as the figure of *floccata* indicates, and several specimens are profusely and radiately dashed with white flakes.

PATELLA MAGELLANICA, Gmel.

Filhol records this species in the *Miss. de l'île Campbell*, p. 528. I have seen specimens from South America, but never anything like it from the Southern Islands of New Zealand. It seems that Filhol was partly misled by Hutton's enumeration of *P. Magellanica* in his *Man. N. Zeal. Moll.*, and it is most likely that he also took *H. strigilis* for *Magellanica*. Without having seen the specimens collected by the late Dr. Filhol, it is of course impossible to be quite positive on this point.

In Capt. Hutton's revision of 1884 the following species were omitted as not really inhabiting New Zealand:—*Patella granularis*, L., and *cochlear*, Born, from South Africa, and *stella*, Lesson. Habitat unknown.

The last mentioned is no doubt an *Acmæa*, and I have examples from New Zealand corresponding with Lesson's diagnosis; they are very near *A. corticata*, Hutt. I shall deal with this form in my revision of the Acmæidæ of New Zealand, which I hope to work out some day.

ON THE OCCURRENCE OF *PLANORBIS VORTICULUS*, TROSCHEL,
IN THE PLEISTOCENE OF ENGLAND, WITH NOTES ON SOME
OTHER PLEISTOCENE MOLLUSCA.

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

Read 16th June, 1905.

WHEN engaged in working out the very large series of molluscan remains obtained from the 100 feet terrace of the Thames at Swanscomb, several immature examples of *Planorbis* were noted, which we could not associate with any recent English species, and we are again indebted to Dr. A. C. Johansen for identifying the form as *Planorbis vorticulus*, Troschel, a species which had not hitherto been detected in these Islands, either fossil or recent. Since then we have recognized it as occurring in two other Pleistocene deposits, viz., the brickearths of Grays, Essex, which yielded a single example, and the well-known deposit at West Wittering, whence three or four specimens have been collected. We have so far failed to trace it from any other locality. On the Continent it has been recorded fossil from the Pleistocene of Weimar, Burg, and Gräfen in Thuringia by Dr. E. W. Wüst,¹ and from the Holocene (oak period Neolithic) of Refsnoes and Kareboek in Denmark by Dr. A. C. Johansen,² and we are informed by Dr. Johansen that it occurs in deposits of the same age in Scandinavia.

It is found living at Malmo according to Westerland, whilst Jordan³ records it as *P. acies*, Mühlf., from Holland, middle Germany, south-west Germany, Switzerland, and north Italy.

The species is an extremely interesting addition to what may well be termed the old Thames-Rhine fauna. In this country one first recognizes this group of mollusca in the Norwich Crag, where *Corbicula fluminalis* occurs. It is quite possible that *Vivipara media* and *Paludestrina Reevei* also are members, but of this fact no confirmatory evidence is yet forthcoming. In the newer Weybourn Crag we meet with *Lithoglyphus fuscus* and *Vivipara glacialis*, whilst in the Forest Bed there are five fresh forms which can be referred to it—*Nematurella Runtioniana*, *N. stenostoma*, *Valvata fluviatilis*, *Pisidium astartoides*, and *P. supinum*. In the Pleistocene of the 100 feet terrace of the Thames at Swanscomb we have the additional forms of *Vivipara diluviana*, *Neritina Grateloupiana*, *Planorbis vorticulus*, and *Valvata pisemalis*, var. *naticina*, whilst in the still newer Pleistocene of Grays one notes *Pisidium amnicum*, var. *Danubialis*.

¹ E. Wüst, 1901, "Untersuchungen über das Phozän und das älteste Pleistozän Thüringens": Abhandl. Gesell. Halle, xxiii, pp. 218-248.

² A. C. Johansen, "Om den Fossile Kvartære Molluskfauna i Danmark": Copenhagen, 1904, p. 66.

³ Nova Acta Acad. Cæs. Leop.-Carol. Nat. Cur., vol. xlv, No. 4, 1883.

Moreover, in the Holocene, *Planorbis Stroemii* is a noteworthy member of the same group. All these forms are only known fossil in these Islands from the Thames-Rhine system of deposits.

Umo littoralis, which first occurs fossil in the 100 feet terrace of the Thames at Swanscomb, and *Paludestrina marginata*, the first appearance of which in these Islands is in the Cromerian (Forest Bed of Norfolk and Suffolk), possibly reached England by two routes: one by means of the Rhine and Thames, whilst the other, since they occur in the Pleistocene of Cropthorne, in the Severn River system, was by way of the western rivers of France and the Severn, for the connection between the upper waters of the Severn and the Thames must have been severed for a long period when the Cropthorne Bed was deposited. The occurrence of *Corbicula fluminalis*, *Paludestrina confusa*, and *Planorbis vorticulus* at West Wittering furnishes additional proof that the rivers of Sussex were at one time connected with the Thames-Rhine system.

There is one living English species which is a well-marked member of this group, *Assemania Grayana*, known only from Denmark, Belgium, and the Thames Estuary, but as yet it is unknown in a fossil state, although the name has figured in some lists.

THE CONCHOLOGICAL WRITINGS OF CAPTAIN THOMAS BROWN.

By C. DAVIES SHERBORN, F.Z.S.

Read 16th June, 1905.

CAPTAIN THOMAS BROWN is credited with the following works on conchology :—

1. "The Elements of Conchology." London, 1816. 8vo; pp. viii, 168, 9 pls.
(Also advertised as "speedily will appear" in 1845, but unknown to me.)
2. "Illustrations of the Conchology of Great Britain and Ireland." Edinburgh, 1827. 4to; text of fly-leaves between the 52 plates.
In the British Museum (press-mark 443 i 16) are No. 1 (pls. xviii, xxiii, xxiv, xxxix), No. 2 (pls. iii, iv, vi, viii), No. 3 (pls. x, xiii, xxi, xxvii), each with accompanying fly-leaves. A note in the catalogue says "all published," but perfect copies are to be seen in the Bodleian, the British Museum (Nat. Hist.), and the Sykes Libraries. There has never been any question of the date of this book, so far as I am aware, and we can take it as it is dated, 1827.
- 2*a*. *Idem*, ed. 2. London, 1844. 4to; pp. xiii, 144, 59 pls. Printed in double columns. Many figures were added upon the old plates.
This book presents many difficulties; at pp. 14 and 21 the setting of the type alters. It was published in parts, of which nothing is known but the following information kindly supplied by Messrs. Smith, Elder, & Co., the publishers: "We find that 15 parts of 'Recent Conchology,' numbered 1 to 11 and 16 to 19, appear to have been issued, and that parts 1 to 4 were received by us for sale in 1837 and part 5 in 1839." In the "Elem. Foss. Conch." the advertisement says—"to be completed in 16 parts (62 pls.), of which 14 are out. 1843."
3. "The Conchologist's Text Book." Glasgow, 1833. 12mo; pp. x, 11-180, 19 pls.
- 3*a*. *Idem*, ed. 2.
- 3*b*. *Idem*, ed. 3.
- 3*c*. *Idem*, ed. 4 (called 5th on the boards). Glasgow, 1839. 12mo; pp. x, 11-180, 19 pls.
- 3*d*. *Idem*, ed. 5 (called 4th on title-page). Glasgow, 1839. 12mo; pp. x, 11-180, 19 pls.
- 3*e*. *Idem*, ed. 6. Edinburgh, 1845. 12mo; pp. 232, 21 pls. Edited by W. Macgillivray, and often called his 'Text Book.'
In eds. 1, 3, and 5 (4) the word 'striae' is misprinted 'stræ' on p. 167, line 8; the editions are identical with the exception of ed. 6.

4. "Illustrations of the Fossil Conchology of Great Britain and Ireland." London, 1849 (i.e. 1837-1849). 4to; pp. 273, 98 pls.
 4a. "Illustrations of the Fossil Conchology of Great Britain and Ireland." Edinburgh, 1834. 4to; parts 1-12. (Engelmann.)
 4b. "Fossil Conchology of Britain and Ireland." London, 1839. 4to. 25 numbers, of which 1-14 were issued by Messrs. Smith, Elder, and Co. in 1839. (Engelmann.)

We can take these three entries together : 4 is the correct one, 4a seems to be an error of Engelmann's, 4b seems to be a muddle. In Mr. Sykes' Library and also in the British Museum are preserved a series of numbers in the original wrappers. From them we learn the collation which follows :—

| No. | Pages. | Date. | No. | Pages. | Date. | |
|--------|--------|-------------------|------------|---------|-------|------|
| 1 | 1-4 | 1837 | 16 | 65-68 | 1843 | |
| 2 | 5-8 | | 17, 18 | 69-80 | | |
| 3 | 9-16 | | 19, 20 | 81-88 | | |
| 4 | 17-20 | | 21 | 89-108 | | |
| 5 | 21-24 | | 22, 23 | 109-116 | | 1844 |
| 6 | 25-28 | | 24, 25 | 117-124 | | 1845 |
| 7 | 29-32 | | 26, 27, 28 | 125-136 | | |
| 8 | 33-36 | | 29 | | | |
| 9 | 37-40 | | 30 | | | |
| 10 | 41-44 | 1838 | 31 | | | |
| 11 | 45-48 | | 32 | | | |
| 12 | 49-52 | | 33 | | | |
| 13, 14 | 53-60 | 1839 | 34 | | | |
| 15 | 61-64 | 1843 ¹ | 35 | | 1849 | |

The numbers in the British Museum were most of them dated in pencil as received, the year coming first, then the month, then the day, then the press-mark, but more exact information being forthcoming by the kindness of Messrs. Smith, Elder, & Co., I shall give that. Moreover, it appears that Nos. 1-12 were published in Edinburgh, and sent to Messrs. Smith, Elder, & Co. for sale, while the later numbers were published in London by Messrs. Smith, Elder, & Co. themselves. They write me under date May 30th, 1905 : " 'Fossil Conchology' extended to 35 parts, of which parts 1-8 were received in 1837, parts 9-12 in 1838, parts 13 and 14 in 1839, and parts 25 to 28 in 1845." To these I can add, No. 15 received by the British Museum March 6th, 1843, No. 21 on November 17th, 1843, Nos. 22 and 23 on July 9th, 1844, Nos. 24 and 25 on April 18th, 1845. The dates affixed to the parts given above are therefore approximately correct, and we must wait further evidence before being able to define them more exactly. At page 53 the setting of the type slightly alters. In the "Elem. Foss. Conch.," 1843, the advertisement says—"to be completed in 25 parts, of which 22 are out."

5. "The Elements of Fossil Conchology." Edinburgh, 1843. 12mo; pp. 1-138, 12 pls.

¹ Probably earlier ; on p. 64 the Trans. Manch. Geol. Soc., i, 1841, is quoted.

6. "Illustrations of the Land and Fresh-water Conchology of Great Britain and Ireland." London, 1845. 8vo; pp. xi, 142, 27 pls. In which book is advertised:—
 - 6a. "Illustrations of the Land and Fresh-water Conchology of the British Islands." 8vo; 27 pls. And:—
 - 6b. "Illustrations of the Land and Fresh-water Shells of Ireland." 8vo; 18 pls., both as "published."
- These three seem to be different advertisements of the same work, of which the first (6) appeared.
7. "A Catalogue of the Recent Conchology of Great Britain and Ireland." Price one shilling.
 8. "A Catalogue of the Land and Fresh-water Shells of Great Britain and Ireland." Price sixpence.

These two last are for the purposes of labelling collections.

It is curious how rarely any contemporary reference is found to these books. The same remark applies to their author. Captain Brown's history is so imperfectly known that it would be difficult to string together any running story. He is not referred to in the Dictionary of National Biography, and this not merely by oversight so far as the Supplement is concerned. The putting together of these notes must be regarded as a first attempt, and no one will welcome further information more gratefully than the writer.

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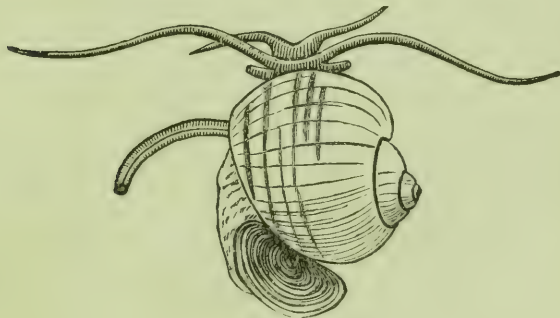
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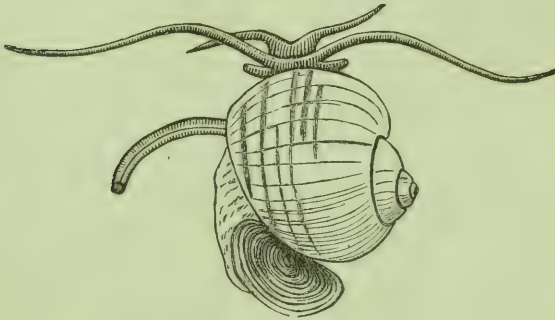
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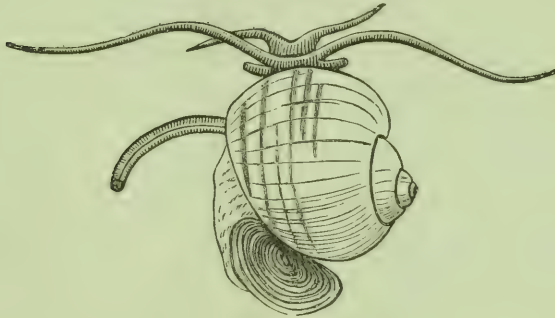
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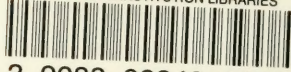
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