



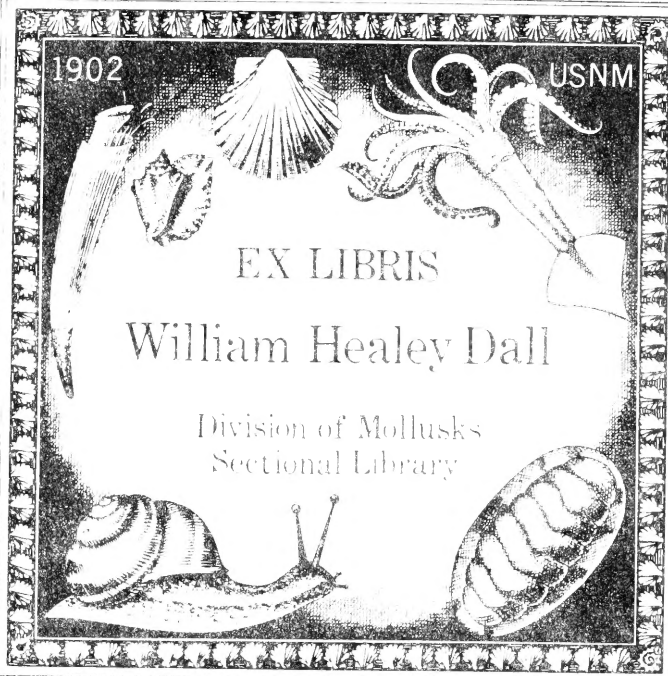
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MALACOLOGICAL SOCIETY OF LONDON.  
—  
VOL. XI.  
1914—1915.





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OF THE

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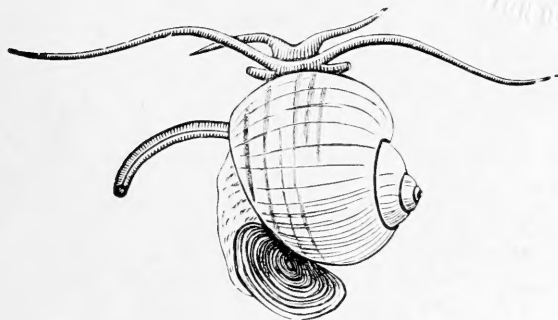
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E. A. SMITH, I.S.O., F.Z.S.

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VOLUME XI.

1914—1915.



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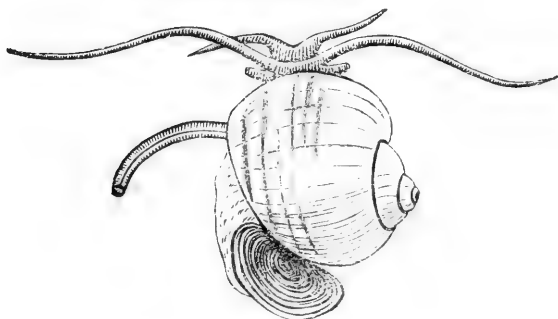
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# PROCEEDINGS

OF THE

# MALACOLOGICAL SOCIETY

## OF LONDON.



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# PROCEEDINGS

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### ORDINARY MEETING.

FRIDAY, 14TH NOVEMBER, 1913.

The Rev. A. H. COOKE, M.A., D.Sc., F.Z.S., President, in the Chair.

A. A. Hinckley was elected a member of the Society.

The following communications were read:—

1. "Note on *Halotis sieboldii*, Reeve." By E. A. Smith, I.S.O.
2. "Condensation of Moisture within and on glass specimen tubes." By B. B. Woodward, F.L.S.
3. "On *Testacella maugei* in Cornwall." By L. St. G. Byne, M.Sc.

Mr. A. S. Kennard, F.G.S., exhibited a specimen of *Helix pisana* which had been raised by him in his garden with others from immature specimens received from Staff-Surgeon K. H. Jones, who had collected them in Malta. Being originally of a pale yellowish colour, the additions made to the shell by the animal exhibited the normal blackish markings and banding of typical *H. pisana*, the contrast between the new and the old growth being very marked.

---

### ORDINARY MEETING.

FRIDAY, 12TH DECEMBER, 1913.

The Rev. A. H. COOKE, M.A., D.Sc., F.Z.S., President, in the Chair.

Junius Henderson and Major E. C. Freeman were elected members of the Society.

The following communications were read:—

1. "Descriptions of new species of Mollusca from New Caledonia, Japan, and other localities." By G. B. Sowerby, F.L.S.
2. "A Synopsis of the Family Veneridæ." Part I. By A. J. Jukes-Browne, F.R.S.
3. "Description of new species of land and marine shells from the Montebello Islands, Western Australia." By H. B. Preston, F.Z.S.
4. "The Chiton Fauna of the Kermadec Islands." By Tom Iredale.

Mr. C. Oldham exhibited specimens of *Vertigo alpestris* from Dolgelly, the first record for Wales; *Helicella heripensis*, from Tring; and a curious striated form of *Limnæa pereger* from Dolgelly.

Mr. F. H. Sikes, M.A., exhibited specimens of *Vertigo moulinsiana* from Berkshire, a new county record.

#### ORDINARY MEETING.

FRIDAY, 9TH JANUARY, 1914.

R. BULLEN NEWTON, F.G.S., Vice-President, in the Chair.

Major M. Connolly and Mr. A. S. Kennard, F.G.S., were appointed scrutineers.

The following communications were read:—

1. "On a new and remarkable sub-species of *Limnæa pereger* from Iceland" By H. B. Preston, F.Z.S.

2. "Characters of new Land Shells from the Naga Hills, Assam." By H. B. Preston, F.Z.S.

3. "Descriptions of new species of Helicoids from the Indian Region." By G. K. Gude, F.Z.S.

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## NOTES.

ON *TESTACELLA MAUGEI* IN CORNWALL. (*Read 14th November, 1913.*)

—I have pleasure in recording the occurrence of two rare varieties of this species. (a) Var. *viridans*, G. & F. Mr. Roebuck says it is the first example recorded since 1883, when he had it from county Waterford. (b) Var. *griseo-nigrescens*, G. & F. Only previously found in co. Tipperary and Pembrokeshire, twice, 1885 and 1904; up to the time of writing, 22nd February, 1913, these constitute two new records to the molluscan fauna of England. They were found under 12 in. chrysanthemum pots and old wooden planks in Mr. Howard Fox's beautiful garden at Rosehill, Falmouth; they are most abundant in the autumn. Two shells of this species in Penzance Museum are labelled Phillack near Hayle; the type has not occurred up to the time of writing this note.

L. ST. G. BYNE.

CONDENSATION OF MOISTURE WITHIN AND ON GLASS SPECIMEN TUBES.

(*Read 14th November, 1913.*)—In May last I exhibited a number of glass specimen tubes from my cabinets that were liable to become covered inside and out with condensed moisture, whilst other tubes placed under similar conditions remained dry. Investigation of these tubes was made in the Mineral Department of the British Museum (Natural History), where similar cases had been met with, and the question was referred by that department to the National Physical Laboratory. I am permitted to quote from the reply to Dr. Herbert Smith as follows: "The difference between the two tubes, so far as an examination of the glass can show, appears to be due to a difference in the composition of the glass of the two tubes, one of which is probably somewhat hygroscopic, while the other is free from that property. In order to arrive at a definite conclusion on this point, however, it would be necessary to undertake a fairly complete analysis of the glass . . . As a rule the more hygroscopic glasses contain too much alkali or too little lime, and the trouble can be avoided by the makers if sufficient care is taken."

B. B. WOODWARD.

NOTE ON *HALIOTIS SIEBOLDII*, REEVE.

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

*Read 14th November, 1913.*

THE unique specimen described by Reeve<sup>1</sup> as *Haliotis sieboldii* has been regarded by the monographers Sowerby,<sup>2</sup> Weinkauff,<sup>3</sup> and Pilsbry,<sup>4</sup> merely as a probable monstrosity of the *Haliotis gigantea* of Chemnitz as that species was defined by Deshayes<sup>5</sup> and is now understood.

A second, much larger specimen, has been presented to the British Museum by Mr. Henry Harvey, to whom the Museum has been indebted for many remarkable conchological abnormalities, and also for nearly all the types and figured specimens contained in the Sylvanus Hanley Collection.

The shell in question unfortunately has been denuded of its outer coating, so that only the pearly structure remains. The form, however, is practically identical with that of the type as depicted by Reeve, showing every appearance of regularity in its growth, and therefore I am inclined to regard these two specimens, not as abnormalities, but as representatives, either of a distinct species, or, at all events, of a local variation of the Chemnitzian shell.

A remarkable feature of *H. sieboldii*, besides its characteristic convex shape, is the almost marginal position of the spire. This, in the type, is rather eroded, but appears to have been almost on the margin, coiling away from it but very little. In Mr. Harvey's larger specimen it is more evident, the apex being at a distance of 13 mm. from the edge of the peristome.

Excepting towards the spire, the curve of the line of perforations is very slight as shown in Reeve's figures, whereas in typical examples of *H. gigantea* the curve is conspicuous, and the apex of the spire in a shell of the same size is from 25 to 30 mm. from the margin. Both examples of *H. sieboldii* are strongly radiately costate, so that the peristome is conspicuously frilled and the interior deeply sulcate.

The larger shell is 170 mm. in length, 125 in diameter, and 55 in depth.

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<sup>1</sup> Conch. Iconica, vol. iii, figs. 32a-b.

<sup>2</sup> Thesaurus Conch., vol. v, p. 18, pl. 437, fig. 72.

<sup>3</sup> Conchylien-Cab., p. 80, pl. xxx, fig. 1.

<sup>4</sup> Man. Conch., vol. xii, p. 85, pl. xv, figs. 78, 79.

<sup>5</sup> Lamarck's Anim. sans Vert., 2nd ed., vol. ix, p. 24.

DESCRIPTIONS OF NEW SPECIES OF MOLLUSCA FROM NEW  
CALEDONIA, JAPAN, AND OTHER LOCALITIES.

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

*Read 12th December, 1913.*

*NATICA PAUCIMACULATA*, n.sp.

Testa rotundata, crassa, polita, alba, rufo-fusco maculata; maculis medianis 4, grandiusculis, infernis minoribus, supernis minutis; spira brevissima, obtusa; anfractus 3, convexi, superne leviter oblique plicati; anfractus ultimus rotunde convexus, parum obliquus; umbilicus fere clausus; columella oblique rectiuscula, sinistrorsim calloso effusa; apertura semilunata, peristoma simplex. Alt. 15, maj. diam. 16 mm.



*Hab.*—New Caledonia.

A prettily marked shell, shining white, with a row of four bright reddish-brown blotches just above the middle of the body-whorl, a row of four smaller spots below, and a few minute dots above. The columella is almost entirely closed by the columella callus.

Although the operculum is wanting, there can hardly be a doubt that this is a true *Natica*, but it does not seem very closely allied to any known species.

*NATICA BALTEATA*, n.sp.

Testa ovata, solidiuscula, lævis, albo-straminea, balteo lato fusco-griseo colorata, apice fusco; spira elatiuscula, ad apicem obtuse



exserta; anfractus 5, convexe declives, læves, oblique obscurissime plicati; anfractus ultimus  $\frac{3}{4}$  longitudinis testæ æquans, ovatus; umbilicus clausus; apertura semilunata; peristoma acutum; columella

leviter obliqua, sinistrorsum callose effusa. Operculum testaceum, albo-nitidum, depressum. Alt. 12, maj. diam. 10 mm.

*Hab.*—New Caledonia.

Though of simple character this little shell does not seem to approach very closely to any hitherto known species. It is oval in form, rather solid, with a rather elevated spire; its surface is smooth, with the exception of a few inconspicuous oblique plicæ near the suture. The umbilicus is entirely covered by a thick white callus. The colouring of the shell consists chiefly of a broad brownish-grey belt, covering more than half of the body-whorl.

#### NATICA HILARIS, n.sp.

Testa globosa, tenuis, straminea, maculis fuscis numerosis plerumque subquadratis ubique ornata; spira brevis, obtusiuscula; anfractus 5, rotunde convexi, sutura angustissime canaliculata sejuncti; anfractus ultimus latiusculus, rotundatus, vix obliquus, juxta suturam leviter compressus; umbilicus latiusculus, callo albo semicirculari in medio instructus; columella tenuis, leviter obliqua; apertura latiuscula; labrum tenue. Alt. 20, diam. 20 mm.



*Hab.*—Kii, Japan (Hirase).

The colour spots adorning this shell resemble those of *N. pellistigra* (Chem.), but it differs considerably from that species in form and substance. It is quite thin and transparent, regularly globose in form, and has a thick rounded callus entering the umbilicus, while the columella is rather thin. The suture is very narrowly channelled.

#### NASSA EUGLYPTA, n.sp.

Testa fusiformi-ovata, crassiuscula, straminea, fusco tri-balteata; spira elata, acuta; anfractus 9, primi 2-3 læves, rotundati, deinde lævissime convexi, undique creberrime clathrati, ad suturam leviter angulati, costellis numerosis obliquiusculis, nodulosis, liris spiralibus parum elevatis sed conspicuis instructi; anfractus ultimus  $\frac{1}{2}$  longitudinis testæ æquans, leviter convexus, infra contractus, transversim oblique liratus; apertura ovalis, postice contracta, breviter sinuata, antice brevissime canaliculata, intus lirata; labrum acute serratum; columella arcuata, tenuiter callosa. Long. 29, maj. diam. 16 mm.

*Hab.*—Kii, Japan (Hirase).

Many years ago three specimens of this form were presented to our National Museum by Dr. J. Gwyn Jeffreys, and in 1879 described by Mr. E. A. Smith as a variety of *N. siquijorensis*, but without varietal name. I think it should have a name, and that the differences are sufficient to separate it specifically.



The chief differences are as follows:—

*N. siquijorensis*.—Suture distinctly channelled. Longitudinal riblets comparatively smooth. Spiral sculpture consisting of slightly depressed sulci.

*N. euglypta*.—Suture not channelled. Spiral sculpture, distinct liræ passing over the longitudinal riblets, and forming raised nodules at the points of intersection.

#### VERTAGUS COMPTUS, n.sp.

Testa elongata, pura alba, irregulariter parce varicosa; spira leviter convexa, acuminata, ad apicem acutissima; anfractus vix convexi, spiraliter leviter lirati, plicis longitudinalibus numerosis fere lævibus instructi; anfractus ultimus  $\frac{1}{3}$  longitudinis testæ vix æquans, subglabratus, plicis partim evanidis, infra conspicue uniliratus, ad basin concavus; rostrum breviculum, valde recurvum; apertura latiuscula, intus glabra; columella oblique rectiuscula, biplicata. Long. 29, maj. diam. 10 mm.



*Hab.*—Red Sea.

The nearest ally to this species is *V. lineatus*, from which it differs in being of a uniformly smaller size, in the comparative smoothness of its whorls, its much less prominent plicæ, and the absence of colour lines. Some specimens, however, of *V. lineatus* are destitute of lines.

I am indebted to Monsieur Vignal, who has made a special study of this family, for his opinion, in confirmation of my own, that this is a distinct species.

*ANABATHRON PAGODIFORMIS*, n.sp.

Testa parva, elongato-turrita, albida; spira elongata, ad apicem obtusiuscula; anfractus 6, primi 2 rotundati, leviter oblique declives, sequentes valde acute angulati, ad angulum acute squamosi, supra et infra concavi; anfractus ultimus spiram vix æquans, supra angulum leviter concavus, infra convexiusculus; apertura circularis; columella tenuis, rectiuscula; peristoma latiusculum, planum, extus triangulatum. Long.  $2\frac{1}{2}$ , maj. diam. 1 mm.



*Hab.*—New Caledonia.

A remarkable little shell, with a turreted spire and acutely angular whorls, the angle being sharply scaled, almost spinose. Of this very striking little species I have only seen four specimens, three perfect and well developed, the other not quite adult.

*DENTALIUM FESTIVUM*, n.sp.

Testa regulariter arcuata, crassa, latiuscula, albida, balteis interruptis rufo-carneis angulatis et undulatis pulcherrime ornata, longitudinaliter costata; costis numerosis et confertis, circiter 35, inæqualibus, leviter planulatis, et compresse rotundatis; apertura circularis. Long. 52, maj. diam. 9 mm.

*Hab.*—New Caledonia.



Of this beautiful gaily coloured shell I have only seen a single specimen. It is coloured with rose pink in broad interrupted bands, partly waved and partly angular; the ribs are very numerous and close-set, of unequal width, smooth, depressly rounded, the interstices being very narrow, without transverse sculpture.

I am not able fully to describe the apex of this species, as the specimen is rather incomplete, but it appears to have a rather broad notch on the convex side.



## BRACHYDONTES GRANOSISSIMA, n.sp.

Testa oblonga, sub-flabelliformis, tenuis, compressiuscula, nigro-fusca, radiatim densissime grano-lirata, antice acute acuminata, postice elliptica, latiuscula; margo dorsalis oblique rectiusculus, antice declivis, postice obtuse angulatus; margo ventralis arcuatim constrictus; latus posticum supra declivis, infra rotundatum; umbones haud elevati, subterminali; pagina interna margaritacea, hic illic cæruleo tincta, marginibus crenulatis; cardo lira elongata angusta instructus; ligamentum perelongatum, internum. Long. 80, maj. lat. 40 mm.

*Hab.*—Andaras, South America.



This shell in form closely resembles *B. demissa* (Dillwyn), but it is more sharply acuminated at the anterior end, and the more particular distinguishing character is found in the granular sculpture which adorns its surface. The radiating riblets of *B. demissa* are prominent and almost smooth, while in *B. granosissima* they are twice as numerous and composed of prominent close-set granules. As in other species of this group, there is a space towards the anterior end in which the radiating ridges become obsolete and are resumed at the extremity.

Small specimens of *granosissima*, generally of a more inflated form, have been received from Florida.

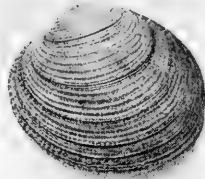
## CHIONE EUGLYPTA, n.sp.

Testa transverse ovalis, compressiuscula, sordide albida, costellis obliquis numerosis, liris concentricis crassiusculis squamoso-nodulosis elathrata; umbones ante medium locati, leviter incurvati; margo dorsalis anticus valde declivis, posticus arcuatus; margo ventralis rotunde arcuatus; ligamentum elongatum, immersum. Pagina interna alba, lævis, marginibus crenulatis. Dentes cardinales 3, crassiusculi, divergentes. Diam. antero-post. 26, umbono-marg. 22, crass. 15 mm.

*Hab.*—Japan.

Specimens of this species have been distributed as *V. adamsi* (Reeve), and the sculpture is similar, but the shell is very much smaller without

appearing to be young. I have seen a considerable number of specimens nearly equal in size, the largest not exceeding the dimensions



given above; whereas Reeve's species measures  $58 \times 49$  mm., and is of a lighter substance and a more elongated sub-quadrate form, so that its general aspect is very different from the shell now described.

TRIVIA EXIGUA, var. ALBA, n.var.

Among a lot of shells recently received from New Caledonia, I found several specimens of a pure-white variety of *Trivia exigua*, Gray (more generally known as *tremeza*, Duclos). The specimens differ from the type in being destitute of colour-markings, and those I have seen being of a somewhat larger size. The largest measures 7 and the smallest 5 mm. in length, while the typical ones before me from Mauritius and Lifu average something less than 5 mm.

ON A NEW AND REMARKABLE SUB-SPECIES OF *LIMNÆA*  
*PEREGER*, MÜLL., FROM ICELAND.

By H. B. PRESTON, F.Z.S.

Read 9th January, 1914.

THE series of specimens upon which the present sub-species is based were handed to me for examination by Mr. F. H. Sikes, in whose honour I have much pleasure in naming it, and who collected them in August, 1912, during his recent extensive travels in Iceland. As far as the collector is aware, they occur only in Rautharvatn or 'red lake', which, he informs me, is "little more than a tarn among a desert of red earth" situated between Reykjavik and Thingvellir.

Mr. Sikes paid three visits to this lake, and on each occasion took specimens on some submerged rocks which appear to be their only habitat. The only other species of mollusc represented in Rautharvatn is *Pisidium lilljeborgii*, Clessin,<sup>1</sup> which attains a large size, and the collector has pointed out to me at some length the almost exact similarity of the circumstances under which the present *Limnæa* was



collected to those in which he had previously taken the Irish *L. involuta*, Thomp.,<sup>2</sup> in Lough Crincaum, co. Kerry, which it would seem occurs also in that lake with but one molluscan co-inhabitant, but which in this latter instance proved to be *Pisidium* sp.

After careful examination of the very long series of *L. pereger* in Mr. Sikes' collection I have been unable to find any form to which the present sub-species may be profitably compared, its nearest ally being *ovata*, Draparnaud,<sup>3</sup> though from this it differs appreciably in many ways, among the more noteworthy being its more oblong shape, extremely thin texture, and much less exerted spire.

Mr. Sikes further informs me that the animals are of a very pale colour and the shell so fragile that he broke many specimens in attempting to extract them.

<sup>1</sup> Clessin in Esmark & Hoyer, Malak. Blätt., N.F., viii, p. 119.

<sup>2</sup> Ann. Mag. Nat. Hist., London, vol. v, p. 22, 1840.

<sup>3</sup> Hist. Nat. moll. terr. fluv. France, p. 52, pl. ii, figs. 30-1.

*LIMNÆA PEREGER SIKESI*, n.subsp.

Shell oblong-ovate, thin, yellowish-brown horn-colour; whorls 4, the first three small, not much exerted, regularly increasing, the last very large, smooth but for lines of growth; suture impressed; columella-margin very obliquely descending, a little bulging above, and diffused into a thin, ill-defined, parietal callus which reaches to the upper margin of the labrum; labrum acute above, a little dilated at the base; aperture oblong-ovate. Alt. 20 mm.; diam. maj. 13, min. 9.5 mm. Aperture: alt. 16, diam. 10 mm.

*Hab.*—Rautharvatn, S.W. Iceland.

Type in the British Museum, presented by Mr. Sikes. The Museum is also greatly indebted to him for his very fine and extensive collection of British land and freshwater shells, which he most liberally presented last year.

---

DESCRIPTION OF NEW SPECIES OF LAND AND MARINE SHELLS  
FROM THE MONTEBELLO ISLANDS, WESTERN AUSTRALIA.

By H. B. PRESTON, F.Z.S.

*Read 12th December, 1913.*

THROUGH the kindness of Mr. T. H. Haynes the author has been able to obtain a certain amount of material from the Montebello Islands, and though the greater part consists of well-known Indian Ocean forms, a few appear to have hitherto escaped description, and are in all probability peculiar to the West Australian region, if not actually to the Montebello Islands themselves. Of these species the author ventures to give the following diagnoses.

*RHAGADA MONTEBELLOENSIS*, n.sp.

Shell perforate, globose; whorls  $4\frac{1}{2}$ , marked with rather coarse growth-lines, the last whorl somewhat rapidly descending; suture almost incised; umbilicus narrow, deep, partly concealed by the reflexed columella-margin; columella-margin excavated above,



descending in an oblique curve; labrum slightly thickened, narrowly reflexed, the margins joined by a very thin callus; aperture broadly ovate. Alt. 13, diam. maj. 16, min. 13 mm. Aperture: alt. 9, diam. 8 mm.

*Hab.*—Montebello Islands, Western Australia.

*RHAGADA PLICATA*, n.sp.

Shell globular, scarcely perforate, solid, whitish; whorls  $4\frac{1}{2}$ , the earlier almost smooth, the later sculptured above with fine, closely



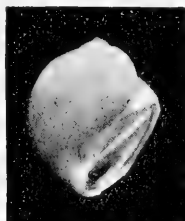
set, oblique and slightly arcuate, transverse costulae, painted with a light-brownish supersutural band, which appears as a peripheral

band on the last whorl; base of shell convex, sculptured with fine lines of growth only, and painted with several lightish-brown, very thin, revolving bands; suture impressed, somewhat crenulated; umbilicus reduced to a hardly perceptible chink; columella-margin excavated, much thickened in the umbilical region; labrum thickened, white, slightly expanded, the margins joined by a coarse callus; aperture obliquely, broadly lunate. Alt. 7·5, diam. maj. 10·25 mm. Aperture: alt. 4, diam. 4·5 mm.

*Hab.*—Montebello Islands, Western Australia.

NATICA REN, n.sp.

Shell ovate, imperforate, solid, whitish; whorls  $4\frac{1}{2}$ , the earlier whorls sculptured with fine, arcuate wrinkles, the last two whorls bearing this sculpture above only, being smooth below, a faint brownish band appearing on that portion of the shell where are situated the wrinkles; suture lightly impressed; columella-callus gibbous above, white, polished, very heavy, bulging outwards both above and below, and extending over the umbilical region; labrum

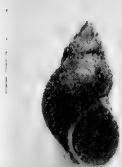


acute; aperture elongately ovate; interior of shell tinged with pale reddish-brown, especially above; operculum having 3 whorls, the inner side slightly convex, white, covered with a thin, pale-yellowish periostracum, the outer side, white polished, bearing posteriorly a reniform rich brown raised blotch. Alt. 22, diam. maj. 21, min. 13 mm. Aperture: alt. 14, diam. 7 mm.

*Hab.*—Montebello Islands, Western Australia.

PHASIANELLA MONTEBELLOENSIS, n.sp.

Shell turbinately fusiform, polished, flesh-coloured, painted with somewhat distant, narrow, interrupted, spiral bands of livid purple,



between which occur narrow, spiral bands of deep scarlet, regularly punctated with cream-coloured spots, and transversely painted with

broad, irregular, livid, purplish bands; whorls 7, convex, the last slightly descending in front, minutely sculptured with very fine, closely set spiral striæ, and marked with fine lines of growth; suture impressed, rather darkly tessellated and margined below; columella-margin white, arched; labrum simple, acute; aperture roundly ovate; interior of shell flesh-coloured. Alt. 20·5, diam. maj. 11·5, min. 9 mm. Aperture: alt. 8·5, diam. 5·5 mm.

*Hab.*—Montebello Islands, Western Australia.

*TURBO FOLIACEUS*, SCABROSUS, n.subsp.

Shell differing from typical *T. foliaceus*, Phil.,<sup>1</sup> in its much more coarsely scabrous sculpture, which gives to the spiral liræ the appearance of being ornamented with broad hollow spines.

*Hab.*—Montebello Islands, Western Australia.

*TURBO FOLIACEUS*, HAYNESI, n.subsp.

Shell imperforate, turbinate, moderately solid, tessellated with yellowish-pink, alternating with broad flame-markings of dark-green shading to olive; whorls  $5\frac{1}{2}$ , sculptured with two coarse tubercular carinæ, and several finer tubercular, spiral liræ, the interstices marked with fine spiral striæ, on the last whorl the tubercular carinæ increase to four, and the spiral liræ increase also in number; base of shell convex, sculptured with six revolving, tubercular riblets, and a number of fine striæ; suture narrowly and deeply channelled;



columella-margin descending in a curve, the inner margin iridescent, the outer margin covered with a thick white callus which is diffused above; labrum acute; aperture roundly ovate; operculum multispiral with sub-central nucleus, whorls  $4\frac{1}{2}$ , the inner side slightly convex, covered with a very thin, deciduous, light-brownish periostracum, marked with arcuate lines of growth, the outer margin of the earlier whorls flatly ridged, three such ridges appearing on the last whorl, the outer side white, much thickened, and almost smooth above,

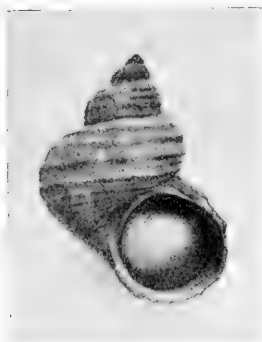
<sup>1</sup> Conch. Cab., 2nd ed., p. 41, pl. xi, figs. 2, 3.

granular below, and bearing a single, coarse, almost central, spiral rib on the last whorl. Alt. 35.75, diam. maj. 31 mm. Aperture: alt. 15, diam. 16 mm.

*Hab.*—Montebello Islands, Western Australia.

*TURBO FOLIACEUS, TURRIFORMIS, n. subsp.*

Shell perforate, turritiform, somewhat solid, whitish, painted with broad transverse, olive-green and black bands; whorls  $5\frac{1}{2}$ , very convex, sculptured with spiral liræ and riblets, between which occur very fine granular spiral striae crossed by fine, closely set, transverse lines, giving to the shell a finely scabrous appearance; suture impressed above, narrowly channelled below; umbilicus narrow, deep; columella-margin somewhat arched, white, extending into a narrow, heavy callus, which joins the upper margin of the labrum, and causes



the peristome to be nearly continuous; peristome acute; aperture sub-circular; interior of shell iridescent; operculum multispiral with nearly central nucleus; whorls 6, the inner side slightly concave, covered with a coarse, scaly, brown, horny periostracum, the outer side sparsely pustulate centrally, the pustules becoming much finer and more numerous towards the outer margin, centrally and posteriorly white, anteriorly dark-green except for a narrow, pale band round the outer margin. Alt. 33, diam. maj. 26 mm. Aperture: alt. 15, diam. 15 mm.

*Hab.*—Montebello Islands, Western Australia.

*TROCHUS MONTEBELLOENSIS, n. sp.*

Shell large, conic, ponderous, pale flesh-coloured, broadly, transversely streaked, blotched and banded with pink and purple; remaining whorls 6, the last slightly shouldered below, and bluntly angled at the periphery, sculptured with coarse, irregular, spiral, beaded liræ and very oblique, transverse striae, the upper whorls coarsely coronated immediately above the suture; suture weakly impressed; base of shell greyish brown, maculated with pale flesh-colour, sculptured with very fine radiate striae crossed by thirteen moderately coarse, revolving, finely beaded liræ which extend into



the interior of the shell, a narrow band of scarlet and chestnut running round the umbilical region; umbilical area pearly, sunk into a deep and narrow depression, a very thin polished callus extending from it to the upper margin of the labrum; columella-margin nacreous, twisted into a coarse fold above, descending in a very

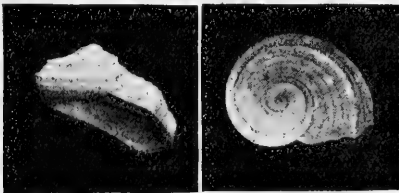


oblique curve and terminating below in a blunt, nodulous protuberance; labrum acute, receding posteriorly, obliquely extended anteriorly; aperture subrhomboidal; interior of shell nacreous, pale bluish white, slightly iridescent. Alt. 56.5, diam. maj. 49, min. 45 mm. Aperture: alt. 27, diam. 20 mm.

*Hab.*—Montebello Islands, Western Australia.

#### *STOMATIA SCULPTURATA*, n.sp.

Shell roundly auriform, narrowly perforate, rather thin, flesh-coloured, painted with pale cinereous brown, broad, transverse flame-markings, and tessellated below with the same colour; whorls  $3\frac{1}{4}$ ,



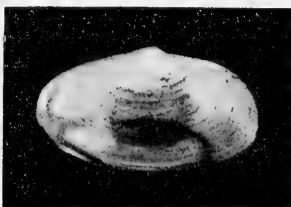
bearing a single tuberculous revolving carina and one coarse, peripheral, nearly smooth carina and a number of fine, almost smooth, spiral liræ, between all of which occur somewhat distant, spiral striæ and coarse, transverse lines of growth which develop into wrinkles

on the latter half of the last whorl; suture impressed; umbilicus reduced to a mere chink; columella-margin curved; labrum acute and coarsely serrated by the terminations of the revolving carinæ and liræ; aperture broadly ovate; interior of shell highly iridescent, showing the inverse sculpture. Alt. 14·5; diam. maj. 20 mm.

*Hab.*—Montebello Islands, Western Australia.

*PSAMMOBIA ECOLORATA*, n.sp.

Shell elongately ovate, thin, small, white, marked with concentric growth-lines and sculptured posteriorly with fine, scarcely noticeable, transverse, radiate striæ; umbones small; dorsal margin anteriorly sloping, posteriorly nearly straight; ventral margin scarcely rounded;

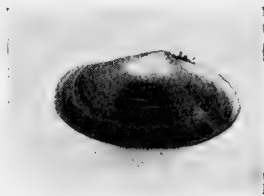


anterior side bluntly acuminate; posterior side angled above, obtusely rounded below; pallial impression broad, elongate, extending more than two-thirds of the total breadth of the shell; interior of shell white. Long. 10, lat. 17·5 mm.

*Hab.*—Montebello Islands, Western Australia.

*SOLENOTELLINA HAYNESI*, n.sp.

Shell elongately ovate, almost smooth, polished, livid purple, whitish in the sub-umbonal region, painted posteriorly with two pale, radiate bands, irregularly marked with lines of growth, and here and there showing closely set, transverse, wrinkled striæ; umbones small, not prominent, stained with dark purple, the stains spreading on either side; dorsal margin arched; ventral margin



scarcely rounded; anterior side somewhat acutely rounded; posterior side rounded above, then angled, and sloping below; pallial impression broadly elongate, marked with almost horizontal, scratch-like striæ; interior of shell minutely granulate, livid purple. Long. 14·25, lat. 26·5 mm.

*Hab.*—Montebello Islands, Western Australia.

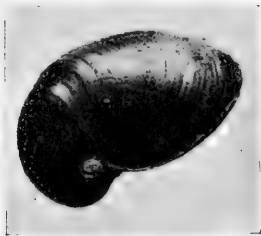
CHARACTERS OF NEW LAND AND FRESHWATER SHELLS  
FROM THE NAGA HILLS, ASSAM.

By H. B. PRESTON, F.Z.S.

*Read 9th January, 1914.*

AUSTENIA TIGRIS, n.sp.

Shell elongately ovate, rather flat, polished, shining, spirally rayed with bands of a darker colour, which are especially noticeable on the upper part of the last whorl and on the base of the shell; whorls 2, the first very small, pale yellowish-white, the last rapidly increasing in size, rather coarsely marked with radiate lines of growth, and

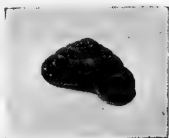


somewhat malleated; suture impressed; labrum thin, membranaceous; aperture auriform; interior of shell slightly nacreous in places. Alt. 11, diam. maj. 31, min. 19 mm. Aperture: alt. 19, diam. 24 mm.

*Hab.*—Naga Hills, Assam.

ÆGISTA COENI, n.sp.

Shell broadly turbate, dark reddish-brown; whorls 6, regularly increasing, not very convex, marked with closely set, oblique growth striæ; base of shell also marked with lines of growth, and very finely



spirally striate; suture well impressed; umbilicus wide, deep; columella whitish, diaphanous, rather broadly outwardly expanded above, obliquely descending; labrum not thickened, narrowly

reflexed; aperture obliquely sub-circular. Alt. 6, diam. maj. 9·5, min. 8·25 mm. Aperture: alt. 3, diam. 3 mm.

*Hab.*—Naga Hills.

*ÆGISTA* CONGENER, n.sp.

Shell differing from *Helix* (*Ægista*) *mitanensis*, Godwin-Austen,<sup>1</sup> in its broader and less elevated form, less angled periphery, and much wider umbilicus. Alt. (of type-specimen) 7, diam. maj. 12, min. 10 mm. Aperture: alt. 4·25, diam. 3·5 mm.



*Hab.*—Naga Hills.

The specimens of this shell which I have before me vary considerably in diameter.

*VIVIPARA* NAGAENSIS, n.sp.

Shell globosely turbinate, rimate, dark olive; whorls 5, regularly increasing, convex, painted with narrow, transverse stripes of reddish-brown, sculptured with fine, spiral and wavy, transverse striæ, suture well impressed; umbilicus reduced to a mere chink; labrum very



slightly reflexed, black, the margins joined by a light blackish callus; columella descending in a slight curve; interior of shell bluish; operculum thin, laminiferous, with excentric, depressed nucleus. Alt. 28, diam. maj. 22, min. 20 mm. Aperture: alt. 15·5, diam. 11 mm.

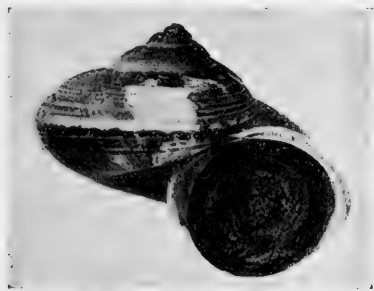
*Hab.*—Naga Hills.

*CYCLOPHORUS* AUSTENIANUS, n.sp.

Shell acutely turbinate, somewhat thin, strongly carinate at the periphery, pale reddish-brown, painted on the upper whorls with

<sup>1</sup> Ann. Mag. Nat. Hist., London (6), vol. iii, p. 108, 1889.

broad, zigzag flame-markings of dark chestnut, and with a broad, spiral band, or group of bands, on the base immediately below the peripheral keel; whorls 5, rapidly increasing, sculptured above with fine, closely set, spiral riblets, some of which coarsen into liræ below, crossed by very oblique, closely set, transverse striæ, which give the shell, especially on the upper half of the whorls, a finely granular appearance; base of shell sculptured with fine, wavy, revolving striæ and moderately fine liræ, which become obsolete in the umbilical



area; suture well impressed, incised, and slightly overhung below; umbilicus somewhat wide, deep; columella descending in a curve, a very thick, polished, transparent callus uniting it with the lip above, just behind its junction with the parietal wall; labrum white, thickened, laminiferous, rather narrowly expanded and reflexed; aperture sub-circular; interior of shell whitish, smooth, polished, showing the spiral liræ and dark, sub-peripheral bands through the test; operculum slightly concave, laminiferous, with central nucleus, having 7-8 whorls. Alt. 35.5, diam. maj. 42, min. 32.5 mm. Aperture: alt. 19.5, diam. 20 mm.

*Hab.*—Naga Hills.

*CYCLOPHORUS BEDDOMEANUS*, n.sp.

Shell large, turbanate, with rather acute apex, thin, yellowish, with one broad, super-peripheral, blackish-brown band and a broad sub-peripheral band, immediately below which are two narrow bands of the same colour on the last whorl, the earlier whorls being reddish-brown, mottled with yellowish-grey; whorls 5, the last two rapidly increasing, sculptured with irregular lines of growth, crossed by rather broad, but flat, spiral ridges, the last whorl carinate at the periphery; suture incised, narrowly margined above; umbilicus moderately broad, deep; labrum continuous, somewhat thickened, but not reflexed, crimson; aperture large, sub-circular; interior of shell glossy, smooth, polished, bluish, the colour-bands being visible through the test; operculum laminiferous, with central nucleus,

having about 8 convolutions. Alt. 44, diam. maj. 53·75, min. 40 mm. Aperture: alt. 24, diam. 25 mm.

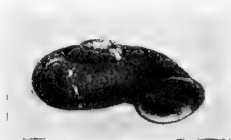


*Hab.*—Naga Hills.

A white-lipped variety also occurs which is otherwise indistinguishable from the type.

*PTEROCYCLUS MARIONÆ*, n.sp.

Shell somewhat orbicular, moderately depressed, covered with a thin, laminiferous, reddish-brown periostracum; whorls  $4\frac{1}{2}$ , regularly increasing, the last very obtusely angled at the periphery, and possessing a short, but rather broad, wing-like development just behind the labrum; suture very deeply impressed; umbilicus wide, deep; labrum reflexed, white, laminiferous, continuous but for a slight



break below the wing-like projection; aperture circular; operculum corneous, convex above, with central nucleus, bearing several raised, more or less foliaceous laminæ, which are especially strong towards the outer margin, below concave, polished, shining. Alt. 8, diam. maj. 20, min. 15 mm. Aperture: alt. 7, diam. 7 mm.

*Hab.*—Naga Hills.

*ALYCEUS (CHARAX) PELLEI*, n.sp.

Shell irregularly discoidal, moderately depressed, white; whorls 4, the last gibbous, thin, strongly strangulated, and again becoming gibbous just behind the labrum, sculptured with fine, somewhat

distant, transverse, arcuate striæ, which become closely crowded on the last whorl; suture rather deeply impressed; tube about 3 mm. in length; umbilicus rather widely ovate, deep; columella obliquely curved; labrum continuous, double above, treble below, erect, sinuous,



having two notches, one broad in front, the other narrower above; aperture irregularly sub-circular. Alt. 4, diam. maj. 6.5, min. 5.5 mm. Aperture: alt. 1.5, diam. 1.75 mm.

*Hab.*—Naga Hills.

*DIPLOMMATINA FRUMENTUM*, n.sp.

Shell fusiform with acute apex, pale-yellowish horn-colour, somewhat shining; whorls 8, the first six regularly increasing, the seventh broad and convex, the eighth swollen, but smaller, sculptured with fine transverse striæ; suture impressed; columella descending



vertically, bearing a rather fine, oblique plait situated well within the aperture, and diffused above into an arched, well-defined callus, which joins the upper margin of the labrum, and which is obliquely furrowed in the middle; labrum whitish, broad, somewhat thickened,

reflexed; aperture subquadrilateral. Alt. 6·5, diam. maj. 3, min. 2·75 mm. Aperture: alt. 1·5, diam. 1 mm.

*Hab.*—Naga Hills.

DIPLOMMATINA FALLAX, n.sp.

Shell a miniature of *D. frumentum*, Preston, but rather lighter in colour, and with much coarser sculpture, the parietal callus is broader and less arched, and is furrowed at its junction with the margin of



the labrum, the columella is more arched and has a rather coarser plait; the aperture also is rather sub-circular than quadrilateral, as in that species. Alt. 4·5, diam. maj. 2 mm. Aperture: alt. ·75, diam. ·75.

*Hab.*—Naga Hills.



## THE CHITON FAUNA OF THE KERMADEC ISLANDS.

By TOM IREDALE.

*Read 12th December, 1913.*

## PLATES I, II.

DURING 1908 I collected all the Chitons I could at Sunday Island in the Kermadec Group. Towards the end of 1907 my friend Mr. A. F. Basset Hull visited Lord Howe Island, one of his main objects being the collection of Chitons. Near the end of the succeeding year he made a trip to Norfolk Island, again one of his chief interests being this group of molluscs. Early in 1909 when passing through Sydney we examined each other's collections, since the zoology of these three localities has long been a theme for comparison. I proposed to withhold the results of my own studies until Mr. Hull's paper was published, since he had been first in the field. Having critically examined many Chitons at the British Museum, I included in some notes in this journal (vol. ix, pp. 160-2, 1910) a brief account of the habits and relationship of the forms I procured at the Kermadecs, making allusion to Mr. Hull's collection.

In the study of the Lord Howe and Norfolk Island Chitons Mr. Hull was assisted by Mr. Hedley, and their conclusions have recently been published (Proc. Linn. Soc. N.S.W., vol. xxxvii, pp. 271-81, 1912). As above noted, I profited by the interchange of specimens, but recently I have acquired very large collections of the Lord Howe and Norfolk Island species, made by my friend and companion collector at the Kermadecs, Mr. Roy Bell. These large collections enable me to deal very completely with the relationships of the species found at each group, and I therefore propose to divide this paper into two sections, the first being a systematic and descriptive account of the Kermadec Island Chitons, the second a comparative review of the Chitons of the three localities previously named.

## 1. SYSTEMATIC ACCOUNT.

The classification here utilized is based upon that proposed by Dr. J. Thiele in his "Revision des Systems der Chitonen", published in Chun's *Zoologica*, 1909-10. Hitherto most workers have made use of that introduced by Pilsbry in his memorable monograph of this group in the *Manual of Conchology*, vols. xiv and xv (part), 1892-4. Pilsbry's exposition was so brilliantly effected that it inaugurated a new era in the study of the group: based upon conchological characters easily grasped by any painstaking student, the work was so thoroughly done that improvement seemed impossible, more especially as the results of intricate investigations were so clearly expressed. As a matter of fact, for absolutely fifteen years it received no practical amendment; yet during the whole of that time work was being very assiduously carried on, the whole of this work being

entirely due to the impetus given to collectors by Pilsbry's masterly and most lucid treatment of the group. As stated above, Pilsbry's monograph was entirely a conchological one, and the few apparent discrepancies were not easily corrected by the study of the shells alone.

Dr. Thiele, in his Revision, through the co-ordinate study of the radular characters, has remedied some of these inconsistencies; the Revision is primarily constructed upon Pilsbry's monograph, and in the majority of cases full value has been given to conchological features. There can be no hesitation in accepting Thiele's Revision as a great advance upon the classification introduced by Pilsbry, and I hope, through the study of large quantities of Australasian material, to effect some improvements upon Thiele's Revision. My criticism of Thiele's Revision has been mainly conchological, so that it is most pleasing to find that we are so much in accord. In the succeeding pages I propose several amendments, and it is well to state that these proceed from the study of much Australasian material in conjunction with my Kermadec specimens. My earlier notes in these Proceedings concerning Australasian Chitons dealt mainly with the identification and nomination of species. In this paper I give more attention to the higher groupings, but also take the opportunity of correcting some errors occurring in those notes.

As Dr. Thiele's Revision may not be generally available to readers of these Proceedings, I would note here the groupings referring to the Kermadec Chitons thus:—

<i>Sub-order.</i>	<i>Family.</i>
Lepidopleurina.	Lepidopleuridæ.
	Callochitonidæ.
	Mopaliidæ.
Chitonina.	Cryptoplacidæ.
	Ischnochitonidæ.
	Chitonidæ.

I have not altered any of these family groupings, but give reasons for differing from both Thiele and Pilsbry as regards the genera utilized, and I am still continuing my researches in this direction. The notes given in quotation marks after the station of the species are extracts from my paper in this journal above noted, and are here introduced so that correlation with the previously unnamed species can be made.

## Order POLYPLACOPHORA.

### Sub-order LEPIDOPLEURINA.

#### Family LEPIDOPLEURIDÆ.

##### Genus PARACHITON.

*Parachiton*, Thiele: Chun's Zoologica, Heft lvi (Revision des Systems der Chitonen), pt. i, p. 14, 1909.

Type (by monotypy): *Lepidopleurus acuminatus*, Thiele.

At the place quoted Thiele described *Lepidopleurus acuminatus* from Duke of York Island. He introduced *Parachiton* as a sub-generic name to be used on account of certain peculiar features, one of which

was the extraordinary tail-valve. He referred the species to the genus *Lepidopleurus*, mainly on account of the lack of insertion-plates. I had already concluded that the genus *Lepidopleurus* was polyphyletic, and now anticipate its dismemberment as material becomes available. I had determined to remove the following species from *Lepidopleurus* before I recognized that it was certainly a second member of Thiele's sub-genus *Parachiton*. That fact at once compelled me to advocate the recognition of Thiele's sub-genus as worthy of full generic rank, and its inclusion in the family Lepidopleuridae is simply due to the fact that insertion-plates are absent. I believe that the division of the Polyplacophora into the sub-orders Lepidopleurina and Chitonina is artificial, and that further study will lead to the disintegration of the former and the transference of the present members of it to various families of the Chitonina.

PARACHITON MESTAYERÆ, n.sp. Pl. I, Fig. 1.

Shell elongate, faintly keeled, elevated, side-slopes slightly convex, *last valve disproportionately large*, girdle spiculose. General coloration pink, slashed with longitudinal white streaks. Anterior valve regularly quincuncially punctate. Median valves narrow, not beaked, first very slightly larger than the others; lateral areas little raised, the sculpture regular quincuncial punctation; the pleural areas are closely longitudinally striate, the striation becoming finer as it approaches the dorsal ridge, where, however, it still persists. Posterior valve much larger than the anterior valve; the mucro elevated at about the posterior fourth, the posterior area being concave. The anterior portion is triangular, its length twice as long as the preceding valve; it is similarly sculptured to the pleural areas of the median valves, whilst the posterior area is regularly quincuncially punctate, the punctation showing clearly on account of the protection afforded by the concavity of this area. Inside coloration pinkish-white. Insertion-plates absent. The sutural laminae small, irregularly quadrangular, and very far apart. The girdle, owing to the difficulty of preserving, appears somewhat imperfectly covered with very slender elongate needles, with a fringe of much longer silvery spicules.

A minute curled juvenile specimen shows the same sculpture as the adult; the quincuncial punctation appears more prominently, and the longitudinal striæ more pronounced. Length of type 11, breadth 6 mm. A much larger specimen curled up before it could be preserved.

*Hab.*—Sunday Island, Kermadec Group.

*Station.*—Dredged off the north coast on gravelly bottom in 15 fathoms; also in Denham Bay in 25 fathoms. "From 15 to 25 fathoms was dredged a fine *Lepidopleurus*, which has no near relation yet on record. It faintly resembles some Japanese species."

*Remarks.*—This is undoubtedly most nearly allied to *Lepidopleurus acuminatus*, Thiele, but otherwise no other shell is comparable. *L. acuminatus*, Thiele, has the apex of the posterior valve more posterior, and consequently the posterior area more diminished.

I have associated with this beautiful *Chiton* the name of my friend Miss M. K. Mestayer as a mark of her interest in this group.

### Genus LEPIDOPLEURUS.

*Lepidopleurus*, Risso: Hist. Nat. l'Eur. Mérid., vol. iv, p. 267, 1826.

Type (by subsequent selection by Pilsbry, 1892), *Chiton cajetanus*, Poli.

I am quite unable to accept the following species as a typical *Lepidopleurus*, and therefore designate it as the type of a new sub-genus.

LEPIDOPLEURUS (TERENOCHITON, n.subgen.) SUBTROPICALIS, n.sp.

Pl. II, Figs. 10, 17.

Shell small, elongate oval, highly keeled, side slopes straight and steep, girdle scaly. General coloration uniform, pale reddish-yellow to brick; two specimens blackish-brown. Anterior valve flattened, with the apex elevated and slightly recurved, the anterior slope being faintly concave; the sculpture consists of minute pustules, arranged in very close radial rows. Median valves have their lateral edges almost straight, but somewhat raised; the sculpture of the lateral areas, which are differentiated by a slight fold, is simply pustulose, with no defined arrangement; the pleural areas are sculptured with slanting longitudinal rows of separated tubercles; from the edge of the valve ten rows can be counted before they become ill-defined and merging on the dorsal area. Posterior valve small, with the mucro anterior and elevated, the lateral slope concave. Sculpture as in the median valves. Inside coloration white. Insertion-plates absent. Sutural laminae low and broad, higher towards the outer edges of the valves, sinus broad. Girdle densely covered with minute striated scales.

The preceding description is drawn up from a medium-sized specimen, selected as type. Minute juvenile specimens show the anterior valve, lateral areas of median valves, and posterior area of posterior valve to be simply pustulose, without any defined arrangement of the pustules, whilst the pleural areas of the median valves are sculptured with few well-defined longitudinal rows of tubercles, and the dorsal area is almost smooth. In an old crassate individual the pustules have developed into raised tubercles upon the anterior and posterior valves, and the dorsal area is strongly irregularly tuberculose, the longitudinal rows of the pleural areas showing indistinctly through the strong tubercles massing and somewhat merging. Length of type 6·5, breadth 4, size of largest specimen 8 by 4·5 mm.

*Hab.*—Sunday Island, Kermadec Group.

*Station.*—Living on the underside of embedded dirty stones below low-water mark. Only procured at Coral Bay on the east coast. "A small *Lepidopleurus* was living under dirty stones below low water. It was only on the underside of stones deeply embedded."

*Remarks.*—This little species recalls *Lorica* in miniature, and cannot well be confused with any other Australasian Chiton. Its nearest relations are *Lepidopleurus norfolcensis*, Hedley & Hull, from Norfolk Island, and *L. catenatus*, Hedley & Hull, from Lord Howe Island. The authors note the relationship of the latter, but do not compare the former, which they contrast with the New South Wales *L. badius*, Hedley & Hull. With the type of *Lepidopleurus* these small species have nothing in common save the absence of insertion-plates. I am therefore introducing the new sub-generic name *Terenochiton*, with *L. subtropicalis*, Iredale, as type, and would for the present include all the small Australasian '*Lepidopleurus*' under this heading, though I can see little direct affinity between the present species and the Neozelanian *L. inquinatus* (Reeve).

### Sub-order CHITONINA.

#### Family CALLOCHITONIDÆ.

##### Genus EUDOXOCHITON.

*Eudoxochiton*, Shuttleworth, Mittheil. naturf. Gesell. Berne, p. 191, 1853.

Type (by monotypy), *Acanthopleura nobilis*, Gray.

The genus *Eudoxochiton*, placed by Pilsbry in the family Chitonidæ, has been transferred by Thiele to his family Callochitonidæ, and in this latter disposition I have already expressed (Proc. Malac. Soc., vol. ix, p. 153, 1910) my concurrence.

#### EUDOXOCHITON PERPLEXUS, n.sp. Pl. I, Figs. 4, 6, 8.

Shell large, oval, *elevated*; valves arched, side slopes almost straight; girdle leathery, with short spinelets. Colour uniform reddish-brown, girdle greenish-brown. The only sculpture is minute punctulation, though indistinct radiation may sometimes be observed on the anterior valve, whilst growth-lines are commonly seen on the central areas. Anterior valve comparatively small. Median valves narrow, lateral areas well raised. Posterior valve with the mucro elevated at about the anterior third, the posterior slope slightly concave. Inside coloration pure white. Anterior valve has the insertion-plate very short, and cut into about twenty-three teeth, which are irregularly deeply pectinated. Median valves with sutural plates continuous, the sinus only indicated by a shallow depression. Insertion-plates short, with three or four teeth as in anterior valve. Posterior valve faintly emarginate on the posterior border, the insertion-plate very short and not projecting beyond the tegmentum. About twenty-three slits can be counted, the teeth as in anterior valve. Girdle leathery, covered with short brown spinelets. Length of type 59, breadth 40 mm.

*Hab.*—Sunday Island, Kermadec Group.

*Station.*—On rocks about low tide.

## EUDOXOCHITON IMITATOR, n.sp. Pl. I, Figs. 5, 7, 9.

Shell large, oval, *depressed*; valves slightly keeled, side slopes straight, girdle leathery with short spinelets. General coloration uniform dark-brown, girdle pale greenish-brown. Sculpture as in preceding species. Contrasted with the foregoing species the valves are more depressed, posterior valve with mucro planate, almost central. Inside coloration pure white. Sutural laminae longer than in the above species, and the sinus even less pronounced. Insertion-plates longer, and the anterior valve with more than twenty-five teeth, the posterior about twenty-two. Girdle leathery, with short brown spinelets. Length of type 59, breadth 40 mm.

*Hab.*—Sunday Island, Kermadec Group.

*Station.*—On rocks below low tide.

“*Eudoxochiton* is endemic in Neozelanic waters with two distinct species. *E. nobilis*, Gray, lives on the surf-swept boulders, and its form and internal characters are well suited to withstand the force of the waves. *E. huttoni*, Pilsbry, is easily separated by its much more depressed form and longer teeth, it is only found on the most exposed situations, and would appear to be much rarer. Which is the parent or to which would the parent form be more like would be difficult to suggest. The question is more complicated by the finding on Sunday Island of two forms of *Eudoxochiton*. . . . The *Eudoxochitons* of Sunday Island are very puzzling, as the existence of two forms on such a small island I could scarcely credit myself. Yet the shells seem easily separable into two lots, which might be classed as varieties of *nobilis*, Gray; they differ in general form as much from each other as from that species and are both less elevated. One form is even lower than *huttoni*, Pils., though in the characters and number of the teeth it absolutely agrees with the other. I have so far been unable to provide a satisfactory explanation for the differentiation of these from each other and from the *Eudoxochitons* of New Zealand.”

*Remarks.*—I have here admitted the two forms above indicated as distinct species, and would fully note the differences observed. *E. perplexus* was first collected, and it was noted as being less elevated than *E. nobilis* (Gray), though quite unlike *E. huttoni*, Pilsbry. Collectors of *Eudoxochiton* well know the rarity of the genus, and very few specimens were obtained. Valves were not uncommonly met with on the beach, and examination of these constantly gave the number of slits in the interior and posterior valves as about twenty-two or twenty-three. The notes I had with me (copied from Pilsbry) gave—

*E. nobilis*, Gray, anterior valve 30 slits; posterior 24–5 slits.

*E. huttoni*, Pilsbry „ „ 17 „ „ 19 „

This seemed to indicate that the Kermadec shell was not *nobilis* (I had not specimens with me for actual comparison), and it was certainly not *huttoni*.

In the winter the sand moved along the north coast and forced a large number of *Eudoxochiton* to come up to low-water mark. This unexpected opportunity was greedily seized to collect every specimen,

and it was then found that the majority of these differed in their depressed form and darker coloration, which was noticeable at sight. Moreover, they were beautifully clean specimens such as had never been collected before. In New Zealand even the smallest specimens of these Chitons are covered with ugly extraneous growths, and the earlier collected Kermadec specimens were dirty and worn. I have now concluded that this depressed form must be a deeper water dweller. It is easily separated from *E. perplexus* by its depressed form, different posterior valve, and longer teeth, whilst the coloration is also darker. It cannot be confused with either *E. nobilis* (Gray) or *E. huttoni*, Pilsbry, and, on account of its pseudo-resemblance to the latter, I have called it *E. imitator*.

There would seem to be grounds for supposing the depressed form to be the oldest, as juveniles of all four species are very flattened and scarcely determinable. The girdle is simply leathery with a crinkled appearance, with only signs of the short spinelets thereon. I have juveniles of the Kermadec species which I would not definitely distinguish, since I do not think they could be easily differentiated from juveniles of *E. nobilis* (Gray), which I collected in the South Island of New Zealand. It is certain that the Kermadec species are smaller than the New Zealand ones, the valves being comparatively broader and the girdle comparatively narrower. The largest Kermadec specimen is under 70 mm. long and 45 mm. broad, whilst an average-sized Neozelanic *E. nobilis*, Gray, measures 75 mm. long by 50 mm. broad, and specimens 110 mm. in length are known to exist. These measurements are taken from specimens with the girdle well preserved and flattened.

## Family MOPALIIDÆ.

### Genus PLAXIPHORA.

*Plaxiphora*, Gray, Proc. Zool. Soc. Lond., 1847, pp. 65, 68, 169.

Type (by monotypy), *Chiton carmichaelis*, Gray = *Ch. auratus*, Spalowsky.

In the *Manual of Conchology*, vol. xiv, p. 311, Pilsbry divided the genus *Plaxiphora* into two sub-genera, *Plaxiphora* and *Placophoropsis*. I would separate these generically. Pilsbry then indicated three sections of his sub-genus *Plaxiphora*, viz. *Plaxiphora* (s.str.), *Guildingia*, and *Frembleya*. Thiele (Revision, p. 116) admits two genera, *Plaxiphora* and *Frembleya*, noting no sections.

*Guildingia* I would generically differentiate, as the solitary species is well defined and cannot be confused with anything else; the valves are distinctive, whilst the radula seems to differ. The type of *Plaxiphora* is *Chiton auratus*, Spalowsky, and this species is well characterized by its large size, the lack of sculpture, the nature of the girdle, and the form of the posterior valve. The Neozelanic *Plaxiphora campbelli*, Filhol, with which *P. aucklandica*, Suter (Subant. Islands New Zeal., vol. i, Mollusca, p. 2, pl. i, fig. 1, 1909), based upon a juvenile, is synonymous, is typical.

*Plaxiphora biramosa* (Quoy & Gaimard) is quite unlike the preceding, though of large size. The exterior of the valves (which are very solid) is sculptured, whilst the sutural laminae are connected, a feature otherwise quite foreign to the genus, and the posterior valve is quite differently formed. I consider this species quite worthy of sub-generic distinction, and I propose for it the new sub-generic name *DIAPHOROPLEX*.

The group typified by *P. costata* (Blainville) is also easily diagnosed by the medium size of the members, the sculptured exterior of the valves, and the formation of the posterior valve. Study of Pilsbry's Manual (loc. cit.) suggested the use of *Euplaxiphora*, Shuttleworth, for this group, but reference to Shuttleworth's paper (Mittheil. naturf. Gesell. Berne, 1853) showed that this name was introduced (p. 193) in such a manner that it can only be treated as a substitute name for *Plaxiphora*, Gray, and is therefore unavailable. I propose to designate this sub-generic group *PONEROPLEX* and to name *Chiton costatus*, Blainville, as type.

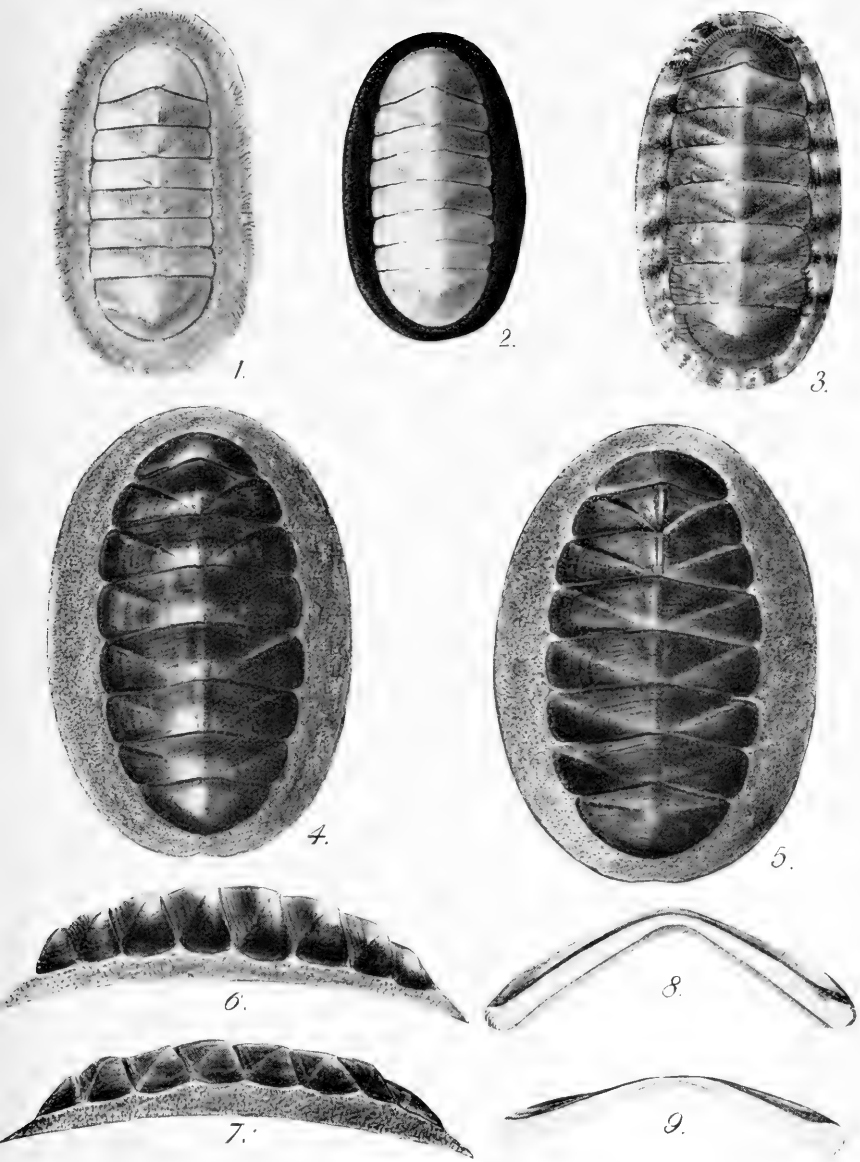
*Frembleya*, founded upon *P. egregia*, H. & A. Adams, has been admitted as a section by Pilsbry and as a distinct genus by Thiele. I would temporarily rank it as a sub-genus, the sculpture, small size, and peculiar posterior valve being diagnostic. The commonest *Plaxiphora* in New Zealand is *P. cælata* (Reeve), under which name more than one species appears to be confused. The small size, definite sculpture, and peculiar posterior valve determine this sub-genus; the tegmentum of the posterior valve ends in a pointed plane mucro forming a triangle. I propose for this sub-genus, naming *Chiton cælatus*, Reeve, as type, *MAORICHITON*.

My conclusions regarding the division of the Australasian *Plaxiphora* are as follows:—

Genus	<i>Guildingia</i> , Pilsbry.	Type	<i>G. obtecta</i> (Pilsbry).
„	<i>Plaxiphora</i> , Gray.	„	<i>P. aurata</i> (Spalowsky).
Sub-genus	<i>Plaxiphora</i> , Gray.		
„	<i>Diaphoroplax</i> (supra).	„	<i>P. biramosa</i> (Q. & G.).
„	<i>Poneroplax</i> (supra).	„	<i>P. costata</i> (Blainville).
„	<i>Frembleya</i> , H. & A. Adams.	„	<i>P. egregia</i> (H. & A. Ad.).
„	<i>Maorichiton</i> (supra).	„	<i>P. cælata</i> (Reeve).

The question may be raised whether this subdivision is necessary and will it be useful. To the first, I would point out that it tends to exactness and certainly makes work more facile and identifications more certain. To the second, I say emphatically that it will be most useful, especially to the zoogeographer, and I give the following notes. The genus *Plaxiphora* is admittedly Antarctic in its distribution. The typical sub-genus occurs in the Falkland Isles, Southern South America, the Sub-Antarctic Islands of New Zealand commonly, and the mainland more rarely. It does not occur in Australia. The sub-genus *Diaphoroplax* is, so far as I know, confined to New Zealand, as is the genus *Guildingia*. The sub-genus *Poneroplax* occurs throughout Australia, and possibly *P. frembleii*, Broderip, should be referred here. The species "*P. glauca*, Q. & G."





Roland Green del.

CHITONS FROM THE KERMADEC ISLANDS.



has been recorded from the Chatham Islands, but it is doubtful whether this identification be correct. Thiele has recently described *P. schauinslandi* from that locality, and this species does not belong to the sub-genus *Poneroplax*, but to the sub-genus *Maorichiton*. The sub-genus *Frembleya*, founded upon a New Zealand species, wrongly ascribed to Australia, appears to have a representative on that continent in my *P. matthewsi*. The sub-genus *Maorichiton* is typically Neozelanic, but it seems to include the small *Plaxiphora* recently described from South Africa and Ceylon.

Thiele has given excellent figures of the fifth and posterior valves of all these *Plaxiphora*, and I propose to give similar figures, elucidating the above classification, in a paper now in preparation. The species of *Plaxiphora* collected at the Kermadec Islands belongs to the sub-genus *Maorichiton*.

*PLAXIPHORA (MAORICHITON) MIXTA*, n.sp. Pl. II, Figs. 12, 15, 16, 18.

Shell small, elongate, somewhat elevated, valves keeled and beaked, girdle densely hairy. Coloration generally black, white, and green. Some specimens agree most accurately with E. A. Smith's description of his *C. terminalis* as regards coloration; sometimes dark blue with white markings; rarely rich brown with white markings; girdle always green. Anterior valve with eight radiating ribs not much elevated, and between each rib wrinkled V-sculpture. Median valves with the lateral area bounded on both sides by strong raised, somewhat nodulous ribs, between which appears a transversely wrinkled or V-sculpture; the pleural areas sculptured with irregular fine wavy longitudinal ridges, more pronounced at the edges, and becoming very fine on the dorsal area. Posterior valve triangular with the mucro terminal, and the posterior area reduced to raised ribs; the anterior portion sculptured like the pleural areas of the median valves. Inside coloration deep blue-green. Anterior valve with projecting insertion-plate, with grooved, widely spaced, somewhat irregular teeth; the slits eight in number. Median valves with projecting insertion-plate with one slit; sutural laminæ widely placed apart and whitish in colour, inside as well as out. Posterior valve with no insertion-plate, but a callused semicircular ridge, which is much exceeded by the pointed tegmentum. Girdle densely covered with long hairs, which are somewhat longer and bunched at the pores. Young specimens show the sculpture to be much stronger in the juvenile, the pleural areas of the median valves having well-marked and deep longitudinal ridges, and the lateral areas are bounded by heavy, somewhat nodulous ribs. The majority of adult specimens are covered with marine growths, and the tegmentum is much eroded. Length of type 32, breadth 15mm.

*Hab.*—Sunday Island, Kermadec Group (type); ? Macauley Island, Kermadec Group.

*Station.*—At Sunday Island it was rarely found in crevices of rocks between tide marks. I collected a few specimens at Macauley Island in deep rock pools between tides, but I am not satisfied that these are identical with the one here described.

*Remarks.*—In sculpture and form this shell is closely allied to *P. calata* (Reeve), differing at sight in the girdle characters.

Thiele (Revision, p. 23), meeting with Neozelanic *Plaxiphora*, has indicated the differences between *P. calata* (Reeve) and a young *Plaxiphora* from Lyttelton, New Zealand, and has also named the Chatham Island species *P. schauinslandi*. When I discussed Australasian *Plaxiphora* (Proc. Malac. Soc., vol. ix, pp. 92–100, 1910) I had no Lyttelton specimens before me. I had largely collected there, and receiving specimens I at once dissected some, and found them to agree with Thiele's description. When I collected them it was with much misgiving that I associated all my small *Plaxiphora* together as *P. calata* (Reeve). That species, determined by *P. terminalis* (Smith), was much larger, more elevated, differently coloured, with different shape and different girdle characters, whilst it lived lower down. Thiele's shell is the very common smaller shell living near high-water mark and always much eroded. A new name is not needed, as I would unhesitatingly identify the latter with *Tonicia zigzag*, Hutton (Trans. N.Z. Inst., vol. iv, p. 181, 1872), and it should be known as

#### PLAXIPHORA (MAORICHITON) ZIGZAG (Hutton).

The Kermadec species is allied to the true *P. calata* (Reeve) and not to *P. zigzag* (Hutton).

#### Family CRYPTOPLACIDÆ.

Thiele has amalgamated Pilsbry's two families Acanthochitidæ and Cryptoplacidæ under the latter name, admitting two sub-families of practically the same dimensions and names. He also admits as distinct genera *Cryptoconchus* and *Acanthochites*, a course I fully endorse. I note this here, as a valve which would seem referable to *Cryptoconchus* was found by Mr. Roy Bell in a rock pool on the east coast. Valves of two species of *Acanthochites* were met with in dredgings; both were minute, but no complete specimen was procured.

#### Family ISCHNOCHITONIDÆ.

##### Genus ISCHNOCHITON.

*Ischnochiton*, Gray, Proc. Zool. Soc., 1847, pp. 127, 168.

Type (by subsequent designation, Gray, 1847), *Chiton textilis*, Gray.

Thiele subdivides this genus in a somewhat conservative manner, recognizing three sub-genera, *Ischnochiton*, *Stenoplax*, and *Chondropleura*. Under the first he places with sectional rank only *Ischnoradsia*, *Stenochiton*, and *Heterozona*; the other divisions do not interest Australasian students. None of these, however, should admit *Stenochiton* as of sectional value only, whilst I should prefer *Ischnoradsia* given at least sub-generic rank. As, however, the Kermadec species is referable to *Ischnochiton*, s.str., I will defer discussion of the Thielean classification until I deal with species of *Ischnoradsia* at a later date.

## ISCHNOCHITON KERMADECENSIS, n.sp. Pl. I, Fig. 3.

Shell small, elongate, slightly elevated; valves faintly keeled; girdle scaly. Coloration varied: commonly olivaceous of various shades, sometimes splashed with lighter or darker; commonly brownish, with a brick wash fading to dirty yellow, sometimes splashed with lighter or darker markings, rarely with an uniform dorsal broad light stripe; frequently with lighter markings down the back extending on to some valves so as to recall the var. *picturatus* of *I. smaragdinus*; no specimens with the markings of the var. *decoratus* of *I. crispus*, Reeve, though similar markings occur in the Neozelanic *I. longicymba*, Quoy & Gaimard, not Blainville = *I. maorianus*, n.sp. Other colorations and variations occur more rarely. Anterior valve faintly but closely radiately ribbed. Median valves with the lateral areas small, but similarly sculptured; pleural areas finely quincuncially punctate. Posterior valve with the posterior area sculptured as the anterior valve, the anterior area as the pleural areas of the median valves. Internal coloration generally greenish-blue, but varying somewhat according to the external coloration. Anterior valve has the smooth insertion-plate variously slit, apparently the number of slits varying with age; at least, I am unable to separate the shells specifically, though dissections give the following results: anterior 13 slits, posterior 12 slits; ant. 9, post. 8; ant. 12, post. 12; ant. 11, post. 10; ant. 12, post. 9; ant. 12, post. 11 slits. The shells with the *largest* number of slits are the *smallest*, whilst the shells with the *fewest* slits are the *largest*. This is exactly the opposite to my anticipations regarding insertion-plate slitting. I am still engaged in the study of this variation in the slitting, and have made many dissections with no definite result as yet. Median valves have the sutural laminae short, broad, and placed far apart, the insertion-plate with one slit, the posterior tooth quite unlike either that of *I. crispus* (Reeve) or *I. maorianus* (= *I. longicymba*, auct.). In some cases it is longer than in others, but in all cases it is shorter than in the former, though longer than in the latter. Posterior valve with insertion-plate very short, and variously slit as above noted. Girdle covered with very minute regularly striated scales. Juvenile shells show a completely punctate surface, no radial ribbing being observed either on the anterior and posterior valves, or on the lateral areas of the median valves. As above noted, the slits in the anterior and posterior insertion-plates seem to be more numerous in this stage and decrease with age. Length of type 18, breadth 9 mm.

*Hab.*—Sunday Island, Kermadec Group.

*Station.*—On the underside of clean smooth stones below low tide marks. "On smooth stones just below low-water lived species . . . of *Ischnochiton*, of the *crispus*, Reeve, group."

*Remarks.*—When Hedley & Hull described their *Ischnochiton intermedius* from Norfolk Island they observed: "This shell is extremely common, and appears to occupy a position intermediate between *I. crispus*, Reeve, of Australia, and *I. longicymba*, Quoy, of New Zealand. Compared with *I. crispus*, the novelty is more elevated,

has more definitely sculptured lateral areas, and is especially distinguishable from both *I. crispus* and *I. longicymba* by the extremely minute girdle-scales. A similar, if not identical, species was found by Mr. T. Iredale on Raoul or Sunday Island, Kermadec Group." I regret that I cannot coincide with my friends' views in regarding the Kermadec shell as identical with the Norfolk Island species. The differences in this group are slight, but I fortunately have scores of each shell for comparison, and I find the Norfolk Island to be more strongly sculptured, to be a longer, narrower, and higher shell, with the back rounded and no keeling present. The girdle is also broader, whilst the scales on the girdle of the Kermadec shell are even smaller than those on the Norfolk Island one. The posterior valve in *I. intermedius* has the mucro more central and more elevated, the posterior slope being therefore shorter and steeper. Upon dissection I find the posterior tooth of the insertion-plate of the median valves to be very short, at once recalling that of *I. maorianus* (= *I. longicymba*, auct.), and shorter, noticeably, than that of *I. kermadecensis*. I purpose to have drawings of these valves made and published later.

A species, somewhat familiar to me, with which Hedley & Hull made no comparison, is *Ischnochiton gryei*, Filhol (= *fulvus*, Suter). This shell is less elevated, has a less prominent posterior valve, and larger girdle-scales.

When Pilsbry separated the New Zealand and Australian species of *Ischnochiton*, which had been previously confused under the name *I. longicymba*, he restricted that name to the New Zealand species, calling it *I. longicymba* (Quoy & Gaimard), and ignoring Blainville's prior *C. longicymba* as indeterminable. Under the present nomenclatural laws such action is inadmissible. Blainville's *C. longicymba* was described from King Island, Bass Strait, and is certainly not the New Zealand shell. Quoy & Gaimard simply used Blainville's name, and did not separate the New Zealand species. For this species, which is well described and figured in Pilsbry's monograph (Man. Conch., vol. xiv, p. 87, pl. xxii, figs. 58-66, 1892), I propose the name

#### ISCHNOCHITON MAORIANUS, n.sp.

This species differs from *I. crispus* (Reeve) in its larger size, more rounded back, less distinctly striated girdle-scales, and the short posterior tooth of the insertion-plates of the median valves.

*Hab.*—Throughout New Zealand.

Type from Otago Peninsula.

#### ISCHNOCHITON KERMADECENSIS, var. EXQUISITUS, var. nov. Pl. I, Fig. 2.

After much consideration I have concluded to introduce this shell with varietal rank only. I collected a number of these shells and found them to be fairly constant, but here accept their identity with the common Kermadec species. This variation seems unique in Australasian *Ischnochiton*, as it does not occur in any other species to my knowledge, and I have seen nothing like it from Norfolk Island.

The general coloration of the valves is cream, splashed longitudinally, but irregularly, with very pale orange, the girdle being uniformly black. The whole shell seems less elevated and less sculptured, and the girdle-scales are smaller, but I have decided to disregard these points in view of the known variation of the common darker shells. The internal coloration is whitish, the insertion-plates seem shorter and more delicate, whilst the slits are twelve in the anterior valve and twelve or more in the posterior. The continual recurrence of this peculiarly coloured shell suggests that in time this 'sport' might become fixed. The peculiar coloration met with in many species of *Ischnochiton* and *Chiton* seems to support this theory. Length of type 14, breadth 8 mm.

*Hab.*—Sunday Island, Kermadec Group.

*Station.*—With *I. kermadecensis*.

## Family CHITONIDÆ.

### Genus CHITON.

*Chiton*, Linné, Syst. Nat., 10th ed., p. 667, 1758.

Type (by monotypy!), *Chiton tuberculatus*, Linné.

Four species only were included by Linné in his genus *Chiton*, and as three are unrecognizable the genus must be considered to be based upon the second species only. Following Pilsbry, Australasian students have referred various distinct styles of shell to the genus *Chiton*. In the *Manual of Conchology*, vol. xiv, p. 149, he wrote: "The most natural primary division of *Chiton* is into two groups; one to include all American and some Old World species, in which the mucro is anterior and the scales smooth; the other to include Old World species having the mucro subcentral and the scales striated. As this division is based upon characters not always easy to see, the following divisions into sections is more convenient.

#### Section *Chiton* (restricted).

Median valves having a single slit in each insertion-plate; sinus generally denticulate; scales closely imbricating.

#### Section *Radsia*, Gray.

Median valves having two or more slits in each insertion-plate.

#### Section *Sclerochiton*, Cpr.

Median valves having a single slit in each insertion-plate; teeth of tail valve tending forward; sinus smooth, scales of girdle separated."

This arrangement appears to have been accepted without comment until Thiele (Revision, p. 117) stated his conclusions thus:—

"Genus *Chiton*, Linné.

Section *Radsia*, Gray.

Sub-gen. *Clathropleura*, Tiberi.

Genus *Sclerochiton*, Cpr."

When Pilsbry introduced *Sclerochiton* he wrote: "This section or sub-genus represents a further development of the Acanthopleuroid

characters which some Australasian species of the restricted genus *Chiton* assume. In *Ch. pellis-serpentis*, for example, the mucro is median, the posterior teeth tend forward somewhat, the sinus is smooth or only very obsoletely denticulate, and the girdle-scales are striated and rather separated. In *Sclerochiton* the mucro is slightly more posterior, the teeth slightly more tilted forward; the sinus is smooth, and the girdle-scales still more separated. *Ch. pellis-serpentis* could be placed almost as well in *Sclerochiton* as in *Chiton* s.s.; the necessity of reducing *Sclerochiton* to the rank of a section under *Chiton* will therefore be apparent." It must be remembered that Pilsbry was only conversant with *Sclerochiton* from a study of Carpenter's notes and figures. Since his time the genus has become fairly well known, and the species have never been confused with *Chiton*. *Sclerochiton* is nearly allied to *Acanthopleura* and *Liolophura*. In New Zealand the two commonest Chitons are *Ch. pellis-serpentis*, Quoy & Gaimard, and *Ch. quoyi*, Deshayes<sup>1</sup>; two more dissimilar species, as referable to the same genus, can scarcely be imagined. A third *Chiton* I not uncommonly obtained was *Ch. areus*, Reeve. Three distinct types of shell seemed confused under one generic name.

At the Kermadecs I found two species of 'Chiton' which greatly differed; one recalling *Ch. pellis-serpentis*, Quoy & Gaimard, the other vaguely resembling *Ch. areus*, Reeve. Critical examination proves their only resemblance to be the possession of a scaly girdle, and that the teeth of the insertion-plates are pectinated, but in this latter character they are very different. The dissection of many species of 'Chiton' provided much of interest with regard to many details of their structure, and one point worthy of consideration in the present place (I purpose to deal in much detail in this matter elsewhere) is the number of slits in the anterior insertion-plate. When Pilsbry was discussing *Plaxiphora* (Man. Conch., vol. xiv, p. 313, 1893) he wrote: "It must be understood that although in many groups of Chitons, such as all *Ischnochitoninae* and *Chitoninae*, the number of anterior slits is a character of merely specific importance, the case is far otherwise in those groups in which the slits correspond in number and position with external ribs such as *Nuttallina* and its allies, and the *Mopaliidae*, *Acanthochitidae*, etc. In these groups the number of slits in the anterior insertion-plate is a highly constant generic character, apparent exceptions being readily traceable to the splitting of one or more primary teeth."

I now suggest that when the genera '*Chiton*' and '*Ischnochiton*' are better known, the slitting of the anterior insertion-plate will be found of as much importance as in the genera Pilsbry named. The species similar to *Ch. areus*, Reeve, have been separated by Thiele as a sub-genus of *Chiton*, his conclusions being based on anatomical study.

<sup>1</sup> The correct name of this species is *Amaurochiton glaucus*, Gray (Spicilegia Zoologica, pt. i, p. 5, 1828): this name was rejected by Pilsbry as he concluded the description was inadequate and the type lost. I find the type is preserved in the British Museum, and, moreover, that it was recognized by Carpenter as well as other investigators, notes to this effect being inscribed upon the back of the type tablet.



The name chosen by Thiele was *Clathropleura*, Tiberi, the type of which is given as *Ch. siculus*, Gray. It might be noted that at one time *Ch. cereus*, Reeve, was considered synonymous with that species. The sub-genus '*Clathropleura*' is well represented in Australasian waters, and the dissection of many species shows that the anterior insertion-plate is normally eight-slit; this is very constant, any variation obviously being due to intersplitting. It is assuredly of no import that the external sculpture of the anterior valve is more or less than eight-ribbed. For these I propose (*infra*) to use *Rhyssoplax* generically, and would state that whether the species is heavily sculptured like *Ch. canaliculatus*, Quoy & Gaimard, and *Ch. vauchlusensis*, Hedley & Hull, or practically smooth, as *Ch. translucens*, Hedley & Hull, the internal structure is exactly comparable.

If *Ch. pellis-serpentis*, Quoy & Gaimard, be now examined, it will be found to differ in every detail. The shell is quite differently sculptured; the scales are more solid and of a different character and more loosely placed on the girdle; the insertion-plates are coarsely pectinate, of quite unlike appearance, the sinus scarcely appreciably denticulate, and *the anterior insertion-plate is never eight-slit*, twelve slits probably being the normal number.

The reference of *Ch. pellis-serpentis*, Quoy & Gaimard, to a distinct genus is the only course consistent with accuracy. It cannot be considered congeneric with the species of *Rhyssoplax*, and it cannot be ranked as a sub-genus of *Chiton*, as it is too different in every way. Pilsbry's comparison of this species with *Acanthopleura* is much nearer the truth, but the intervention of *Sclerochiton* disconnects it rather widely from that genus. For this species alone Thiele introduced *Sypharochiton*, and therefore in this place the generic names *Rhyssoplax* and *Sypharochiton* will displace the familiar '*Chiton*'.

#### Genus RHYSSOPLAX, Thiele.

*Rhyssoplax*, Thiele, *Das Gebiss der Schnecken*, vol. ii, p. 368, 1893.

Type (by monotypy), *Rhyssoplax janeirensis* = *Chiton affinis*, Issel.

In the Revision, Thiele admits the shells associated with, as regards shell characters, *Ch. olivaceus*, Spengler, as constituting a sub-generic group, and for these he uses *Clathropleura*. The group is well defined, and I would recognize it as a distinct genus, and would have used Thiele's name, but upon investigation this usage is found impossible. *Clathropleura* was introduced by Tiberi in the Bull. Soc. Malac. Ital., vol. iii, p. 136, 1877, as a sub-genus of *Chiton*. No diagnosis is given, but three species are cited, *Ch. levis*, *Ch. corallinus*, and *Ch. sulcatus*. No authorities are given for these specific names, and in *Das Gebiss der Schnecken*, vol. ii, p. 367, 1893, Thiele used this name and selected *Ch. siculus*, Gray, as type.

Upon reference to the British Museum (Nat. Hist.) copy of the Bull. Soc. Malac. Ital., 1877, a peculiar complication is seen to occur. Tiberi's sub-genus, as above noted, contained three species. On p. 143 *Ch. levis*, Pennant, is noted, and on the same page *Ch. corallinus* (*Lepidopleurus*), Risso, is discussed. Then, on p. 145, *Ch. sulcatus*

(*Lepidopleurus*), Risso, 1826, is recorded, and as a synonym *Ch. siculus*, Gray, 1831, is included. The wrappers of the parts of the Bull. Soc. Malac. Ital. are preserved and bound in, and it appears that p. 145 was the first page of a new part, which did not appear until 1878. That is, that the original introduction of *Clathropleura* did not include *Chiton siculus*, Gray, as a recognizable constituent. According to the International Rules of Nomenclature, this could not therefore be lawfully designated as type. I here designate *Ch. laevis* (Pennant) Tiberi, as type of *Clathropleura*, and that generic name must fall as a synonym of *Callochiton*, Gray.

There is almost as much difficulty in finding a substitute for *Clathropleura*, Thiele (not Tiberi), and I would use *Rhyssoplax*, Thiele. In *Das Gebiss der Schnecken*, vol. ii, 1893, Thiele carefully described the radulae of species of *Chiton*, and, magnifying the differences observed, introduced many new genera. Having accepted *Clathropleura* for *Ch. siculus*, Gray, and *Ch. affinis*, Issel, he proposed on the next page (p. 368) *Rhyssoplax* for two species identified as *Chiton janeirensis*, Gray, and *Ch. segmentata*, Reeve. On p. 377 he proposed *Anthochiton* for *Ch. tulipa*, Quoy & Gaimard. Sixteen years afterwards in the Revision Thiele explained that the species identifications were mostly wrong, having been made when the study of Chitons was in the dark ages before Pilsbry's monograph so clearly illuminated it. On pp. 2-4 he correlates the names used in 1893 with the correct name as determined by means of his own work based on Pilsbry's monograph. It is there stated that *Rhyssoplax janeirensis* (Gray), Thiele, 1893, and *Rh. segmentata* (Reeve), Thiele, 1893, both refer to the same species, which is none other than *Chiton affinis*, Issel. Further, it is noted that *Anthochiton tulipa* (Quoy and Gaimard), Thiele, 1893, is really *Chiton tulipa*, Quoy & Gaimard. Both these he would class under *Clathropleura* as synonyms, and as that name is untenable I conclude *Rhyssoplax* must be used. It may be argued that *Rhyssoplax*, 1893, is indeterminable, and should date from 1909. I quite agree with Thiele that *Rhyssoplax* cannot be used for *janeirensis*, Gray. If *Rhyssoplax* be postdated to 1909, the question of the usage of *Anthochiton* at once occurs. That name must be considered as dating from 1893, but since the radular characters given by Thiele for his genus *Rhyssoplax* are peculiar, I am regarding *Rhyssoplax* as dating from 1893, and having priority over *Anthochiton*. It is unfortunate that such a delightful and distinct genus should not be in possession of a name without so many complications. I have noted that *Chiton æreus*, Reeve, from New Zealand, was at one time synonymized with *Ch. siculus*, Gray, and as *Ch. affinis*, Issel, was also so considered, the close relationship of the Austro-Neozelanic species to the genotype is obvious. As noted previously, species referable to the genus *Rhyssoplax* vary from very heavily sculptured forms to absolutely smooth species. I examined a series of *Chiton æreus*, Reeve, and found that the most juvenile specimens were unsculptured, then the sulcations on the pleural areas appeared before the lateral radial ribbing was formed. The following species shows the same method

of growth. This implies that the primitive form was unsculptured, and the sculptured forms are more recent.

It is most interesting from this point of view to study the Australasian *Rhyssoplax* when we find this primitive form surviving unchanged in the species *Chiton translucens*, Hedley & Hull. The next stage is well known by means of *Ch. jugosus*, Gould, *Ch. coxi*, Pilsbry, etc., and the third stage by such species as the succeeding one and *Ch. æreus*, Reeve. A further development of stronger and more pronounced sculpture still is seen in *Ch. canaliculatus*, Quoy and Gaimard, and *C. vauchlensis*, Hedley & Hull. A still more complicated stage is exemplified by *Ch. limans*, Pilsbry, where, in addition to the production of strong sculpture, the girdle-scales develop, from ordinary convex scales, into abnormal mucronate ones. I have traced this species through the stages noted. An extraordinary and different mode of procedure is that adopted by *Ch. howensis*, Hedley & Hull. This species commences as a normal unsculptured shell, but no pleural sculpture is formed, and, instead of radial ribbing on the end valves and lateral areas of the median valves, concentric ridges are produced. The only other species yet known to be equally aberrant is *Ch. platei*, Thiele (Revision, p. 92, pl. ix, figs. 46-8, 1909), described from the Red Sea, whose radula Thiele has shown to be normal to this group.

*RHYSSOPLAX EXASPERATA*, n.sp. Pl. II, Fig. 13.

Shell of medium size, broadly elongate oval, elevated, not definitely keeled, side slopes nearly straight, girdle scaly. Colour variable, green splashed with lighter or darker being the predominant tints; the green may be very pale or dark; white prevails in a few specimens, but no absolutely uniformly coloured shell was obtained, though practically a white one and a black-brown one were noted. Anterior valve rayed with twenty raised ribs, slightly nodulous; at the outer edge intercalating riblets occur in adult specimens. Median valves have their lateral areas similarly four- or five-ribbed; the pleural areas are sculptured with slanting very closely packed sulci, twelve or more in number, none of which reach the anterior edge of the valve, and vanish before the dorsal area is reached, thus leaving the jugal tract smooth and polished. Posterior valve has the mucro elevated, before the centre, the anterior portion sculptured as the pleural areas of the median valves, the posterior portion as the anterior valve, the ribs being fifteen or sixteen and more nodulous in character. Inside coloration greenish, but varying a little, according to the external coloration. Anterior valve has a slightly projecting insertion-plate regularly cut by eight slits, the teeth beautifully pectinated. Median valves with the insertion-plate one-slit, the sutural laminæ low and broad, the sinus narrow and finely denticulate. Posterior plate less projecting than anterior, but more developed at sides than centre; the slits number eleven, but one is disproportionate, whilst the others are fairly equal, thereby suggesting twelve to be the normal number. Girdle covered with small oval scales, very closely imbricating, and regularly finely grooved.

The above description is drawn up from a normal specimen selected as type. Some specimens are almost keeled, with fewer sulci, less slanting, on the pleural areas, whilst sometimes the anterior valve-riding lacks nodulosity altogether, and in other cases it is well pronounced. A very juvenile specimen, 5 mm. long, is smooth throughout, the surface minutely quincuncially granulose. It recalls *Chiton translucens*, Hedley & Hull. Specimens, 6·5 to 7 mm. long, are still smooth, but there now appear five or six sulci on the pleural areas. In some concentric growth-lines can be observed. These suggest the *Ch. jugosus*, Gould, group, especially *Ch. torrianus*, Hedley & Hull. An older shell, though only 6 mm. long, shows the ribbing on the anterior valve to commence on the outside, fourteen being counted, which extend less than one-third the distance to the apex; the lateral areas are more strongly marked than in the preceding stage, a slight depression indicating the differentiation into ribbing; at the edge of the posterior valve nine nodules mark the beginning of the radial ribs; the pleural areas are sculptured with six clean-cut sulci, which extend across the valve. Specimens, 10 mm. long, in some cases show little advancement on the previous stage, whilst in others they show almost perfectly developed adult sculpture. Length of type 18, breadth 10·5 mm.

*Hab.*—Sunday Island, Kermadec Group.

*Station.*—On the underside of clean, smooth stones below low tides.

“On smooth stones just below low-water lived species of *Chiton*, of the *æreus*, Reeve, group. . . . I have written species as I have so far failed to realize how many or how few I have collected. The shells can be separated into three forms of *Chiton*. . . . If these forms could be classed as variations of one species, that would seem best, but then we are confronted with the fact that *C. æreus*, Reeve, and its relations are very constant. . . . Then how should a species of such group commence varying under such restricted conditions as is offered them on such a small area. These forms were all living under absolutely the same conditions, so that I have been forced to suggest that they present convergence of species through the action of identical external conditions.”

Somewhat against my will I here admit only one form, as though when collecting differences easily observable were noted, the dried shells show to me at present no constant characters whereby forms can be diagnosed. Under the heading *Ch. corypheus*, Hedley and Hull, from Norfolk Island, the authors write: “This shell appears to approach *C. discolor*, Souverbie, of New Caledonia, but differs from that species in the fewer radial ribs on the end valves, and the fewer and less anteriorly prolonged sulci in the central areas. *Chiton canaliculatus*, Quoy & Gaimard, from New Zealand, is also related, but is more elevated, and sharper keeled, and has a harsher sculpture. A similar, if not identical, species was found by Mr. T. Iredale on Raoul or Sunday Island, Kermadec Group.” I fully agree with the relationship of *Ch. corypheus*, Hedley & Hull, with *Ch. discolor*, Souverbie, but cannot see any close resemblance in that species to *Ch. canaliculatus*, Quoy & Gaimard, whereas it has a great likeness to

*Ch. æreus*, Reeve, from New Zealand. Hedley & Hull (Rec. Austr. Mus., vol. vii, p. 261, 1909) described *Ch. vauchusensis* from Port Jackson, which, though they did not note it, might have been compared with *Ch. canaliculatus*, Quoy & Gaimard, but neither much recall the present species or *Ch. corypheus*, Hedley & Hull.

The Kermadec species I have called *exasperata* on account of the variability of the shells, and my inability to account for it. It is very close indeed to *Ch. corypheus*, Hedley & Hull, but superficially the Kermadec shell has the ribbing on the anterior and posterior valves less nodulous, which is also the case with the lateral area sculpture of the median valves. Closer examination shows the scales on the girdle to be smaller in the Kermadec species, whilst the sulci on the pleural areas of the median valves are weaker. Internally, as was anticipated, little distinction can be seen, but the sinus in the Kermadec shells is noticeably narrower. I should consider that very probably these two are only subspecifically distinct, but, as I am continuing my investigations into this group, I am introducing my Kermadec shell as a species. From *Ch. æreus*, Reeve, my Kermadec species is easily separated by its much less size, much smaller girdle-scales, more closely spaced sulci on the pleural areas of the median valves, etc. *Ch. discolor*, Souverbie, is also a large species, whilst *Ch. suteri*, Iredale, from New Zealand, has widely spaced sulci and *glossy* girdle-scales.

#### Genus SYPHAROCHITON.

*Sypharochiton*, Thiele, Das Gebiss der Schnecken, vol. ii, p. 365, 1893.

Type (by monotypy), *Chiton pellis-serpentis*, Quoy & Gaimard.

#### SYPHAROCHITON THEMEROPIS, n.sp. Pl. II, Fig. 14.

Shell small, oval, elevated, keeled, side slopes almost straight, valves beaked, girdle scaly. Colour black; majority of specimens considerably eroded. Anterior valve with sixteen to twenty strictly radial rows of separated tubercles, the intervals minutely pustulose, the pustules being flat-topped and circular. Median valves with their lateral areas showing three or four separated tuberculose radial rows, the intervals pustulose; the pleural areas regularly pustulose, with no arrangement whatever into longitudinal rows. Posterior valve with the mucro elevate, sub-central, slightly anterior, the posterior slope faintly convex. The anterior portion is sculptured as the pleural areas of the median valves, the posterior as the anterior valve with few strictly radial rows of separated tubercles. Inside coloration dark blue-green. Insertion-plate of anterior valve with ten to twelve slits, the teeth coarsely pectinated and thick; the plate short, but somewhat projecting, and the slits irregular. Teeth pale green. Median valves have the insertion-plate one-slit, the posterior tooth short and stopping very abruptly before reaching the lateral edge of the valve. The sutural laminæ are pale green, rounded, low, and widely separated; the tegmentum generally approaches between, but, when the plate is recognizable, it is seen to be strongly denticulate.

Posterior valve with the plate very short and somewhat thrown backward; the slits, ten to twelve in number, are very irregular, while the teeth are thick and coarsely pectinate. The girdle is covered with medium size, rounded, a little separated, deeply grooved scales. The grooves number five to seven on a scale. This description is drawn up from a young shell, as old shells are too much eroded for any sculpture to be determined, save the ends of the radial rows of tubercles; such are more elevated than younger shells. Length of type 9, breadth 5 mm. Length of largest specimen 17.5, breadth 10.5 mm.

*Hab.*—Sunday Island, Kermadec Group.

*Station.*—In crevices of rocks between tides. “A *Chiton* was procured which had developed most peculiar habits; it lived in crevices of rock between tide-marks, huddling together, half a dozen being found one upon another, so that some did not touch the rock at all. This species was entirely black, and allied to *pellis-serpentis*, Q. & G.”

Hedley & Hull, having described *Chiton funereus* from Lord Howe Island and Norfolk Island, write: “A similar, if not identical, species was found by Mr. T. Iredale on Raoul or Sunday Island, Kermadec Group.” I think that in this case the words “if not identical” have slipped in by accident, as my friends had my shell for comparison, and there is only a slight superficial resemblance between the two.

*Sypharochiton themeropsis* differs from *Ch. funereus* in colour, shape, sculpture, girdle-scales, and internal structure. *S. themeropsis* is a heavy crass shell, whilst *Ch. funereus* is a delicately formed species; the former is always dead black, the latter varies from black to light brown, green, striped forms, etc.; the former is a somewhat elongate oval, the latter is a very broad oval; in the former the anterior valve is radially rowed with tubercles, the rows very distinct and widely separated; in the latter the tubercles are smaller, much more closely packed, and no distinct rows appear; in the former the pustules on the pleural areas of the median valves never show lineal arrangement; in the latter this is generally the case. The girdle-scales in *S. themeropsis* are deeply grooved with a few grooves; in *Ch. funereus* the girdle-scales are finely striate.

The dissected specimens compared show that in this state no confusion is possible; in the Kermadec shell the insertion-plates are comparatively long, with thick coarsely pectinated teeth, whilst in *Ch. funereus* the insertion-plates are very degraded, with the teeth very minute, and bearing very fine striæ. The differences are so pronounced as to suggest that *Ch. funereus* can scarcely rank in typical *Sypharochiton*, whilst *S. themeropsis* needs comparison with the type of that genus. *S. themeropsis* can be readily distinguished from *S. pellis-serpentis* (Quoy & Gaimard) by its smaller size, grooved girdle-scales, and lack of longitudinal sculpture on the pleural areas of the median valves. *S. sinclairi* (Gray) differs in its smooth pleural areas and *glossy* girdle-scales of larger size. I always found this diagnostic of this species when collecting, but have not seen it noted; even when the shell is eroded the *glossy* girdle-scales will distinguish it.

Genus LUCILINA.

*Lucilina*, Dall, Proc. U.S. Nat. Mus., 1881, p. 290.

Type (by monotypy), *Chiton confossus*, Gould.

Pilsbry for the Tonicoid Chitons accepted two genera *Tonicia* and *Onithochiton*, but separated these into two distinct sub-families, an altogether artificial and obviously imperfect classification. Thiele has so far amended the case that his conclusions read—

Genus *Tonicia*, Gray.

Sub-genus *Lucilina*, Dall.

Sub-genus *Onithochiton*, Gray.

Section *Onithoplax*, Thiele.

I have no hesitation in accepting the very close affinity of *Tonicia*, *Lucilina*, and *Onithochiton*, but I think that it is best expressed by accepting each as of generic rank. There can be no doubt that Thiele's action in associating these forms is an improvement on Pilsbry's, and it has the additional advantage of being based on examination of the radulæ of the Chitons. As, however, *Onithochiton* is well differentiated by means of its posterior valve lacking teeth, I consider the usage of this as generic should be maintained. I include the genus *Lucilina* to note that it lived at the Kermadecs, small valves being not uncommonly met with in shallow water dredgings. One specimen was obtained from a piece of coral pulled out of 6 feet of water at low tide, but I refrain from describing it; too many immature specimens have been lately described, and I do not think that many writers have studied the long series of juveniles that is necessary to understand the great changes that take place between the juvenile and adult in many species.

Genus ONITHOCHITON, Gray.

*Onithochiton*, Gray, Proc. Zool. Soc., 1847, p. 65.

Type (by subsequent designation, Gray, 1847), *Chiton undulatus* = *Onithochiton filholi*, Rochebrune.

It seems worthy of record that at the place cited, Gray introduced the genus *Onithochiton* with the diagnosis: "The hinder valve with a produced terminal apex; plate of insertion entire, rounded; valves thick; mantle covered with spines, bristles, or chaff-like scales." On p. 67 is noted: "This genus (*Acanthopleura*) gradually passes to *Onithochiton*," and on p. 68 we have given—

"ONITHOCHITON.

<i>O. gaimardi</i> . . .	<i>Chiton gaimardi</i> , Blainv., 546.
<i>O. hirtosus</i> . . .	<i>Chiton hirtosus</i> , Blainv., 546.
<i>O. undulatus</i> . . .	<i>Ch. undulatus</i> , Van Diemen's Land."

Later, typifying the genera of Mollusca, Gray (same Proceedings, p. 169) wrote:—

"*Onythochiton*, Gray, 1847 . . . *Ch. undulatus*."

Since that date it has been generally accepted that *Onithochiton* was introduced for *Ch. undulatus*, Quoy & Gaimard. Two points are noticeable; throughout the paper quoted Gray constantly referred to Quoy & Gaimard, and always noted them as authors save in this case; also Quoy & Gaimard described their shell from New Zealand, and it is not known from Tasmania, though Gray recorded it as collected there, and, at the time Gray wrote, four species had been proposed bearing the name *Ch. undulatus*, and it is impossible at this time to know which one Gray intended. To retain the generic *Onithochiton* in the sense now used, we must make use of the argument that *Ch. gaimardi* and *Ch. hirtosus*, Blainville, were species unknown to Gray, save from literature, whereas apparently he had a specimen of *Ch. undulatus* before him as he notes a locality, "Van Diemen's Land." When H. & A. Adams prepared the *Genera of Recent Mollusca* they restricted *Onithochiton* to the *Ch. undulatus*, Quoy and Gaimard, group, and rejected from it *Ch. gaimardi* and *Ch. hirtosus*, Blainville.

In the Proc. Malac. Soc., vol. ix, pp. 153-4, 1910, I made some comments on New Zealand *Onithochitons*, and, accepting Pilsbry's dictum regarding preoccupied names, which is now known to be incorrect, I admitted Quoy & Gaimard's specific name *undulatus* for the common species. As, however, that name is preoccupied, the common New Zealand *Onithochiton* must be now known as *Onithochiton filholi*, Rochebrune. The synonymy and species will remain as given in my paper quoted.

ONITHOCHITON OLIVERI, n.sp. Pl. II, Fig. 11.

Shell of medium size, rather broadly oval, slightly keeled, girdle densely spiculate. Coloration variable; dark green with lighter marblings being normal; one small shell is dark chocolate varied with cream and pink, whilst another is bright vermilion with cream markings. The whole shell is absolutely smooth and glossy, a few growth-lines only showing, the lateral areas of the median valves being indicated by a slight elevation. On the anterior valve twenty to twenty-five irregular radiating rows of eyes, about ten eyes to a row, can be counted. On the lateral areas one row, often doubled and trebled, can be noted. Inside coloration pinkish-white; the anterior valve with two reddish-brown marks on posterior edge; the first median valve with a large red-brown blotch similarly placed, which is more or less extensive on the succeeding valves, but absent from the posterior valve. Anterior valve with projecting plate regularly eight-slit, the teeth beautifully pectinate. Median valves with large sutural laminae, higher near the sinus, which is cleanly denticulate. Insertion-plate one-slit and pectinate. Posterior valve with the insertion-plate reduced to a callus, beyond which the tegmentum extends. Girdle covered with long sharp-pointed, glassy spikes. Length of type 24, breadth 15 mm.

*Hab.*—Sunday Island, Kermadec Group.

*Station.*—Living in crevices of rocks between tide-marks.



This species is named after Mr. W. R. B. Oliver, one of the members of the expedition, who collected most of the living specimens on Meyer Island.

*Remarks.*—This species is closely related to *Onithochiton filholi*, Rochebrune (= *undulatus*, auct.), from which it is at sight separable by the girdle characters. Every specimen found was *perfectly* smooth, and showed no approach to the ribbing which caused the 'semisculptus' confusion in the case of the Neozelanic species.

The types, which have been figured, are to be deposited in the Canterbury Museum, Christchurch. The figures here given show these shells which have not been dissected; I am having detail figures prepared which will be published later in conjunction with others covering the comparative questions raised.

## 2. COMPARATIVE REVIEW.

My remarks in the Proc. Malac. Soc., vol. ix, p. 160, 1910, read: "The noticeable features [of the Neozelanic Chiton fauna] are the poverty of species of *Ischnochiton*, the large size of the *Acanthochites*, the distinct nature of the *Plaxiphora* and *Onithochiton*, and the presence of the genus *Eudoxochiton*. The Chitons collected at Sunday Island agree in the majority of these items, yet possess so many peculiarities that they deserve some little notice." When making this statement I had been contrasting the Chiton faunas of the marine biological divisions of Australia, and I afterwards noted the nature of the Lord Howe and Norfolk Island Chitons from my examination of my friend Mr. Hull's collection. These have now been fully reported upon, and I propose to make comparisons with those, and show their essential distinction, though some apparent close relationship is at first noted. A tabulation of the species recorded from each group will aid in following my remarks.

KERMADECS.	LORD HOWE ISLAND.	NORFOLK ISLAND.
<i>Parachiton mestayeræ</i>	—	—
<i>Lepidopleurus subtropicalis</i>	<i>L. catenatus</i>	<i>L. norfolciensis</i>
<i>Eudoxochiton perplexus</i>	—	—
<i>Eudoxochiton imitator</i>	—	—
<i>Plaxiphora mixta</i>	—	—
( <i>Acanthochites</i> sp.)	<i>A. leuconotus</i>	—
( <i>Acanthochites</i> sp.)	<i>A. approximans</i>	<i>A. approximans</i>
( <i>Cryptoconchus</i> sp.)	—	—
<i>Ischnochiton kermadecensis</i> , var. <i>exquisitus</i>	—	<i>I. intermedius</i>
<i>Sypharochiton themeropis</i>	<i>Ch. (? S.) funereus</i>	<i>Ch. (? S.) funereus</i>
<i>Rhyssoplax exasperata</i>	<i>Ch. (R.) howensis</i>	<i>Ch. (R.) corrypheus</i>
( <i>Lucilina</i> sp.)	—	—
<i>Onithochiton oliveri</i>	<i>O. discrepans</i>	—

The merest glance will show that whereas from Lord Howe Island six species are recorded, from Norfolk Island there are only five. I make the Kermadec Chiton fauna to total nine species and one variety, with evidence of four others. Further study will show that in the nine species three additional genera are represented, whilst in

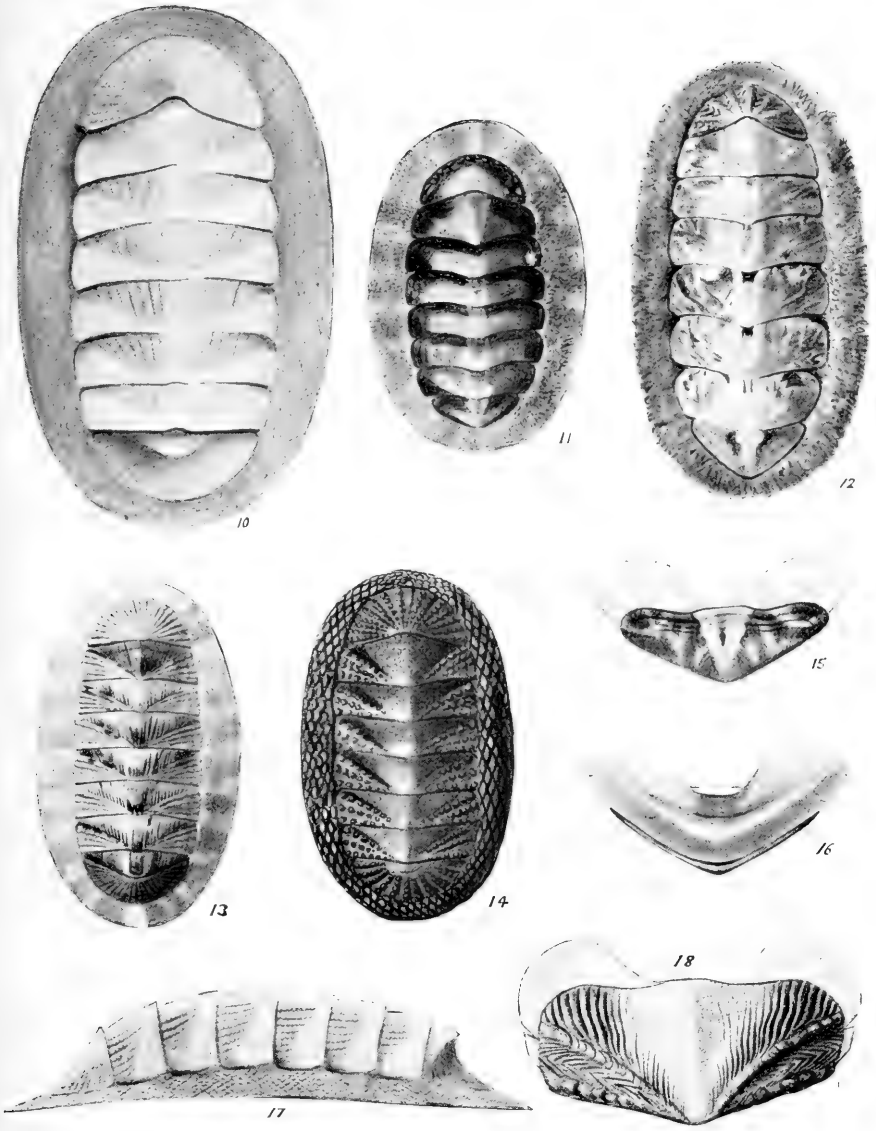
the four recognized, but unnamed, two further additional genera occur. When, however, the species are separately contrasted, the differences become more marked still. I will take them in the order of the tables above given, and this will conduce to facile reference.

*Parachiton mestayeræ*, Iredale, cannot be compared, as it is more than probable that this genus extends all over this part of the Pacific Ocean, the only other species of the genus, *P. acuminatus*, Thiele, having been described from Duke of York Island. There is a small species of *Lepidopleurus* found on each group, and, though they seem closely allied, very little stress can be laid upon this, as the small species of *Lepidopleurus* vary little over large areas. The Kermadec species is very distinct, as is that from Lord Howe Island. Hedley and Hull compare the Norfolk Island species with the New South Wales form, whilst it clearly recalls to me the Kermadec shell.

I have differentiated two forms of *Eudoxochiton* from the Kermadecs, and this genus is otherwise restricted to New Zealand with two species, and nothing nearly related occurs on Norfolk Island, Lord Howe Island, or the Australian continent. In consequence I lay great stress on this occurrence. A species of *Plaxiphora* was also found at the Kermadecs, whilst no form referable to the family was obtained at Lord Howe Island or Norfolk Island. The Kermadec species was, moreover, referable to the sub-genus *Maorichiton*, which is common throughout New Zealand, but which does not occur in Australia. This seems of great import to me.

From Norfolk Island a species of *Acanthochites* was recorded, which is considered by Hedley & Hull close to the Australian *A. granostriatus*, Pilsbry. The species also occurred on Lord Howe Island, where it was accompanied by another species which Hedley & Hull compare with the Australian *A. costatus*, Adams & Angas. It should be noted that we do not yet know the small species of *Acanthochites* from New Caledonia and Fiji, and the New Caledonian *A. tridacna*, Rochebrune, would seem to belong to the *A. costatus* group, whilst we know species not unlike *A. granostriatus*, Pilsbry, from North of Australia. Two small species of *Acanthochites* were noted as valves in dredgings at the Kermadecs, but no complete specimen was obtained. Of peculiar interest, however, was the collection of a valve which I refer to *Cryptoconchus*, a genus almost peculiar to New Zealand. The genus *Ischnochiton* was not represented at Lord Howe Island, though a species was found at Norfolk Island, and I have separated the Kermadec form, which looks so similar, that Hedley & Hull considered it identical. The characters in this group, however, are so slight, that I do not feel justified in advocating their identity. The absence of the genus *Ischnochiton* from Lord Howe Island cannot be explained at present, but it may be that this genus is also absent or ill-represented in New Caledonia.

The Neozelanic *Sypharochiton* is represented at the Kermadecs by the form I have called *S. themeropsis*. A species which recalls this occurs both at Lord Howe Island and Norfolk Island. Hedley and Hull remarked that the Kermadec species might be identical, but the internal features are very different, and I feel very doubtful whether



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CHITONS FROM THE KERMADEC ISLANDS.



the Lord Howe and Norfolk Island species is strictly referable to *Sypharochiton*. In any case it differs so much from the Kermadec species as to discount any value it might seem to have with regard to the zoological relations of the groups.

The genus *Rhyssoplax* is well developed in Australasia, but we do not know enough about it to gauge the value of the occurrence of a single species. Thus at the Kermadecs was found a variable species which is undoubtedly closely related to a species found at Norfolk Island, but which does not occur at Lord Howe Island. My species recalled to me *Ch. æreus*, Reeve, from New Zealand, whilst Hedley and Hull noted the relationship of theirs to the New Caledonian *Ch. discolor*, Souverbie. In each case the relationship is somewhat distant, and we cannot make any good comparison until the species of this genus are better known. Thus the genus is represented on Lord Howe Island by a species "not closely allied to any other Australasian Chiton", as Hedley & Hull remark.

A small species of *Lucilina* was observed at the Kermadecs, though not yet recorded from either of the other groups.

At the Kermadecs occurred a species of *Onithochiton* undoubtedly nearly related to the common Neozelanic species, whilst none was observed at Norfolk Island. Hedley & Hull contrast the species found at Lord Howe Island with the Australian species, but probably a nearer relative will be found in New Caledonia.

My own conclusions regarding these Chiton faunas is that they are each peculiarly distinct from each other, and, as I have advocated the extreme value of this group as a factor in solving zoogeographical problems, I would conclude as follows:—The Kermadec Chiton fauna leaves no doubt whatever that its source is Neozelanic, the Polynesian element being almost negligible. The genera *Eudoxochiton*, *Plaxiphora*, *Cryptoconchus*, mark the fauna in an unmistakable manner. The facts that the species of *Plaxiphora* must be classed in the Neozelanic sub-genus *Maurichiton*, that the species of *Onithochiton* is unquestionably only related to the Neozelanic species *O. filholi*, Rochebrune, whilst the species of *Sypharochiton* must also be considered of Neozelanic origin, confirm the preceding unequivocally.

The Norfolk Island Chiton fauna shows no characteristic forms, but a slight relationship with the Kermadec and with the Lord Howe species. Only five small species live there: the first, a *Lepidopleurus*, of no value in this discussion; the second, an *Acanthochites* which is considered identical with a Lord Howe species and its near affinity indeterminable; the third, an *Ischnochiton* very close to the Kermadec species, but on account of the great resemblance of the species in this group may prove less nearly related than is at present considered; the fourth, a *Chiton*, questionably a *Sypharochiton*, which is merged with the Lord Howe species. At present its nearest ally may be the Kermadec *Sypharochiton*, but it is very different from that; the fifth, a *Rhyssoplax*, is nearest to the Kermadec species, but the value of this affinity I cannot calculate with the available data. It is, however, remarkable that, omitting the *Lepidopleurus*, two Norfolk Island species are considered identical with two Lord Howe forms, the

remaining two with two Kermadec forms, and that the Lord Howe forms do not occur at the Kermadecs, nor the Kermadec species at Lord Howe. The result is that Norfolk Island has no peculiar or remarkable species, and that the species occurring there are in no way characteristic forms of the Neozelanic, Australian, or New Caledonian Chiton faunas, but merely referable to non-characteristic types. We have no knowledge of the Chiton fauna of the Fiji group, and little of the New Caledonian fauna, so that as regards Norfolk Island the Chiton fauna gives little clue to its zoogeographical position, *but strongly negatives its association with New Zealand*. The Lord Howe Chiton fauna, though only six species are as yet known, differs remarkably from the preceding two. *The Neozelanic element is completely absent*, whilst the peculiar species *Acanthochites leuconotus*, Hedley & Hull, *Ch. howensis*, Hedley & Hull, and *Onithochiton discrepans*, Hedley & Hull, again omitting the *Lepidopleurus*, which, however, is peculiar, completely differentiate this fauna from anything else. I have suggested that it is more nearly related to that of New Caledonia, and I still feel that in that fauna the nearest relations to the peculiar forms will be found. It is in no way related to the Chiton fauna of New Zealand.

Hedley & Hull, from their criticism of the Polyplacophora of Lord Howe and Norfolk Islands, conclude "The islands composing the Lord Howe, Norfolk, and Kermadec groups are small in size. Considering this, and the great distance of sea which intervenes between them, it is remarkable how much their fauna has in common. And here the Polyplacophora repeat conclusions drawn not only from the marine fauna in general, but also from the terrestrial fauna and flora. Beyond this interisland affinity the fauna and flora next express a kinship with those of New Zealand and New Caledonia. Lastly, the neighbourhood of the Australian continent has made an impression, especially on the nearer island". I deeply regret that I must disagree with some of my friends' conclusions, but having given prolonged study to this problem, and with more material than my friends, the results are different.

The Kermadec Islands as regards their fauna and flora must be relegated to the New Zealand Biological Region, but they claim full recognition as a separate province on account of the strong Polynesian element present in both the land and marine fauna and the flora. The relationship of the group to Norfolk Island is not marked as regards either the fauna or flora when full consideration is given to every detail. Thus, the marine faunas are very different in character, whilst I have in another place dilated upon the extraordinary dissimilarity of the terrestrial mollusca, which is borne out by the study of other groups.

Norfolk Island has little affinity with either Lord Howe or the Kermadecs, and the presence of the (extinct) avian genera *Nestor* and *Hemiphaga* is the most remarkable zoological item. The value of the existence of these two Neozelanic genera cannot be yet accurately determined, but a criticism of the land molluscs shows that the nearest land connexion of Norfolk Island seems to have been with

Fiji, and not with New Zealand. The Chiton fauna would confirm the non-existence of a Neozelanic land connexion, such as must have been between the Kermadecs and New Zealand.

Lord Howe Island again shows little direct kinship with either of the other two groups. The terrestrial fauna, the marine fauna, and the flora all agree in indicating this group as an outlier of New Caledonia. *The Neozelanic element is entirely missing in every branch*, but "the neighbourhood of the Australian continent has made an impression . . . on the . . . island". In making this statement the facts are in hand confirming such and will be fully given in a succeeding paper. New Caledonian Chitons are now being collected, and when these come to hand a comparison will be made with the Lord Howe forms.

Since the preceding was written Mr. Roy Bell has discovered the existence of a species of *Cryptoplax* at Lord Howe Island. This unexpected discovery remarkably confirms my conclusions regarding the relationships of this Chiton fauna, since with the scant material yet available I am unable to distinguish the Lord Howe shells from the New Caledonian *Cryptoplax huerteli*, Rochebrune.

# EXPLANATION OF PLATES I AND II.

## PLATE I.

- FIG.  
 1. *Parachiton mestayeræ*, n.sp.  
 2. *Ischnochiton kermadecensis*, var. *exquisitus*.  
 3.     "                 "                 n.sp.  
 4. *Eudoxochiton perplexus*, n.sp.  
 6.     "                 "                 side view.  
 8.     "                 "                 front view of median valve.  
 5.     "                 *imitator*, n.sp.  
 7.     "                 "                 side view.  
 9.     "                 "                 front view of median valve.

## PLATE II.

10. *Lepidopleurus subtropicalis*, n.sp.  
 17.     "                 "                 side view.  
 11. *Onithochiton oliveri*, n.sp.  
 12. *Plaxiphora mixta*, n.sp.  
 15.     "                 "                 exterior of posterior valve.  
 16.     "                 "                 interior of posterior valve.  
 18.     "                 "                 exterior of median valve of immature specimen  
   showing sculpture.  
 13. *Rhyssoplax exasperata*, n.sp.  
 14. *Sypharochiton themeropis*, n.sp.
-

DESCRIPTIONS OF NEW SPECIES OF HELICOIDS FROM THE  
INDIAN REGION.

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

Read 9th January, 1914.

HAVING been entrusted with the task of compiling the next volume of Land Mollusca for the *Fauna of British India*, I have had occasion to examine various public and private collections. In the course of this examination some shells proved to have been wrongly identified and to pertain to undescribed forms. A number of shells of *Plectopylis*, forming part of the Godwin-Austen Collection in the British Museum, and handed to me for identification, also comprised three specimens of an unknown species.

The object of the present paper is to publish the descriptions of these, which will ultimately be incorporated with the *Fauna of British India*.

*PHILALANKA QUINQUELIRATA*, n.sp.

Shell dextral, pyramidal, narrowly perforate, pale yellowish-corneous, semi-translucent, covered with a deciduous cuticle; finely and closely striated, the striæ being flexuous on the base, where there are also traces of excessively minute spirals. Spire convex, apex obtuse, suture deep. Whorls 6, tumid above, inflated below, increasing slowly and regularly, with five fine spiral liræ, one at the periphery, the other four between it and the suture; the last whorl not descending in front. Aperture nearly vertical, semi-lunate; peristome thin, the lower margin slightly, the columellar margin strongly reflected, and partly overhanging the narrow perforation. Diam. 5·25, alt. 4·25 mm.

*Hab.*—India: Anamullay Hills (Beddome).

Type in the British Museum, presented by Mr. J. H. Ponsonby.



Five specimens, labelled *tricarinata*, Blanford, received by Mr. Ponsonby from the late Colonel Beddome, proved upon examination to be quite distinct, and as they also differ from all other known forms I venture to base a new species upon them. My own collection contains two specimens from the same source.

*Philalanka quinquelirata* is much larger than *P. tricarinata*, which measures less than 2 mm., and possesses, moreover, only three revolving liræ, the lowest of which is below the periphery, whereas in the new species it is peripheral. The perforation of *P. tricarinata* is proportionately wider, and the columellar margin is not reflected, whilst the aperture is higher in proportion to its width than is the case in *P. quinquelirata*.



*THYSANOTA FLAVIDA*, n.sp.

Shell narrowly umbilicate, depressed trochiform, finely plicate-striate, pale yellowish-corneous; spire sub-convex, suture impressed, apex obtuse. Whorls  $6\frac{1}{2}$ , increasing slowly and regularly, convex above and below, carinated, the carina exserted, except in the protoconch, with a raised spiral thread a short distance above the carina, and densely crowded with impressed spiral lines, more distinct on the under than on the upper side; the carina and spiral thread fringed with deciduous coarse cuticular processes, resembling flattened hairs. Aperture oblique, securiform; peristome acute, the outer margin sub-convex, basal arcuate, columellar almost vertical, slightly dilated. Diam. maj. 12, min. 11.5 mm.; alt. 7 mm.



*Hab.*—India: Nilguries (Beddome).

Type in my collection.

A specimen received from the late Colonel Beddome as *T. crinigera* proved upon examination to differ from that species in being more convex, and more elevated in the spire, in the whorls being more convex and in the narrow umbilicus; the keel is also more exserted, while the plicate transverse striae are much less pronounced, those in *crinigera* being almost lamellate. Mr. Ponsonby possesses two immature specimens, which I refer to the new species. They were likewise received from Colonel Beddome as *crinigera*, and, although labelled only South India, are probably from the same locality.

*PLECTOPYLIS (CHERSÆCIA) KENG TUNGENSIS*, n.sp.

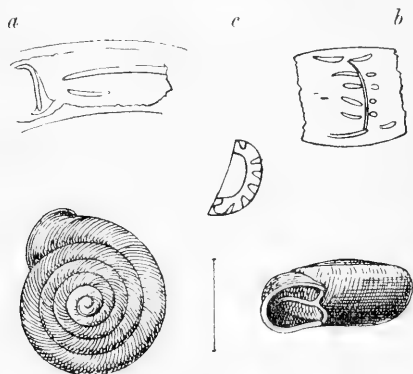
Shell sinistral, widely umbilicated, discoid, corneous. Whorls  $6\frac{1}{4}$ , narrow, increasing slowly and regularly, somewhat flattened above, rounded below, the last abruptly and shortly descending in front, and slightly dilated at the mouth. Spire a little raised, suture impressed. Aperture obovate, peristome slightly thickened and reflected; upper margin nearly straight, outer rounded, columellar ascending; parietal callus with a raised flexuous ridge slightly notched at the junctions above and below.

Parietal armature (Fig. *b*) composed of a vertical plate, deflected posteriorly above, with a short obliquely ascending ridge below, projecting on both sides; a long horizontal fold rises a short distance from the vertical plate, running parallel with the whorl and joining the raised ridge at the aperture; below this occurs a second, but very short fold, 2 mm. long, also rising close to the vertical plate, and in a line with its lower extremity; below the vertical plate runs a third, but very thin and slight horizontal fold close to the lower suture, and joining the ridge at the aperture. The palatal armature

(Fig. *a*) consists of: first a thin bilobed horizontal fold near the upper suture; next, two horizontal rather thin elevated folds, followed by two stouter and rather less elevated folds, obliquely ascending towards the mouth; and lastly, a thin horizontal fold near the lower suture, longer than the others and gradually attenuated anteriorly; all, except the first fold, are provided posteriorly with a slight denticle, while a low transverse ridge unites their posterior terminations. Fig. *c* gives the posterior view of the parietal and palatal barriers. Diam. maj. 12, min. 10 mm.; alt. 4.75 mm.

*Hab.*—E. Burma: Kengtung (Woodthorpe).

Type in the British Museum, presented by Lieut.-Col. H. H. Godwin-Austen.



Three specimens in the Godwin-Austen Collection, British Museum, were found upon examination to be closely allied to *P. nagaensis*, G.-A. The new species, however, is more depressed, and lacks the spiral sculpture of its ally, which also has the barriers placed nearer the aperture, and the third, fourth, and fifth palatal folds more oblique, while *kengtungensis* possesses a short horizontal median fold which is absent in *nagaensis*. It also resembles *P. muspratti*, Gude, in having the palatal folds united posteriorly by a low ridge and in having the barriers at the same distance from the aperture, but in the latter species the palatal folds are much shorter and stouter, and it lacks the long horizontal parietal fold as well as the short median fold, being only provided with a short fold at the aperture.

#### CHLORITIS (TRICHOCHLORITIS) LEITHI, n.sp.

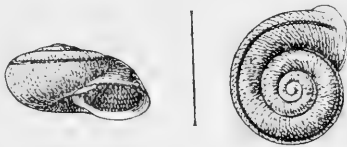
Shell rather widely umbilicated, depressed-conoid, thin, transparent, corneous, with a narrow chestnut supra-peripheral band, finely plicate-striate, somewhat sparsely covered with soft hairs placed in pits and arranged in quincunx. Spire low, apex sunken, suture deep. Whorls 4, convex above, tumid below, increasing rapidly, the last exceeding in width the total of the other three, dilated at the mouth, not constricted behind the peristome, shortly but deeply descending in front, sub-angulated around the umbilicus, which is rather wide

at first, showing the greater part of the penultimate whorl, when it suddenly contracts, leaving only a very narrow perforation. Aperture sub-circular, margins approaching; peristome scarcely thickened, expanded, but not reflexed; the columellar margin triangularly dilated and slightly overhanging the umbilicus. Diam. maj. 14·5, min. 11·5 mm.; alt. 7 mm.

*Hab.*—India: Bombay (Dr. Leith).

Type in the British Museum. The type was labelled '*H. helferi*', but upon comparison with Benson's type, kindly lent to me for the purpose by Dr. L. Doncaster, of the University Museum of Zoology, Cambridge, I was able to satisfy myself that it was quite distinct.

From that Andaman species, it differs in being much thinner in texture, in having the hairs, which are larger and softer, much



more crowded, and in being coiled differently, as it has the last whorl proportionately wider. It also bears some superficial resemblance to *Chloritis propinqua*, but that species is a much stouter shell, with a more elevated spire, while in *C. leithi* the umbilicus, although wider at first, becomes more contracted. Two other specimens in the Museum, also from Bombay and received from Dr. Leith, are like the type, but they are slightly damaged. Mr. Ponsonby possesses a specimen which, like the Museum shells, was labelled *H. helferi*. It is a trifle smaller than the type, measuring 14 : 10·75 : 6·75 mm., and is labelled *Unjunera*. I have been unable to trace any such locality, the nearest approach to it being Anjar, a district of Cutch, likewise, therefore, in the Bombay Presidency.

*CHLORITIS (TRICHOCHLORITIS) THEOBALDI*, n.sp.

Shell moderately umbilicated, depressed-conoid, pale corneous, with a very faint supra-peripheral band, finely striated transversely, and densely covered with hair-scars arranged in quincunx. Spire conoid, apex prominent, suture rather deep. Whorls  $5\frac{1}{2}$ , convex, increasing slowly and regularly, the last widening towards the mouth, not constricted behind the peristome, slightly angulated at the periphery at first, the angulation disappearing near the mouth; angulated around the deep umbilicus, which shows nearly the whole of the penultimate whorl. Aperture sub-circular, margins distant, united by a thin sinuous callus on the parietal whorl; peristome white, thickened and shortly reflexed; margins regularly curved, columellar ascending, triangularly dilated, and slightly overhanging the umbilicus. Diam. maj. 24·5, min. 21 mm.; alt. 16 mm. Aperture: width 10, height 9·5 mm.

*Hab.*—Shan States.

Type in the British Museum.

This new species is based on a specimen found with *C. anserina* in the Theobald Collection of the British Museum. It differs from that species in having a more conical spire and a wider umbilicus, the base is less inflated, and consequently the aperture is more dilated laterally. It is also differently coiled, for, while measuring one-fifth less in diameter, it possesses half a whorl more, and the hair-sears, moreover, are much finer and more crowded, while the presence of a supra-peripheral band unfortunately omitted in the above figure still further differentiates it from *C. anserina*.

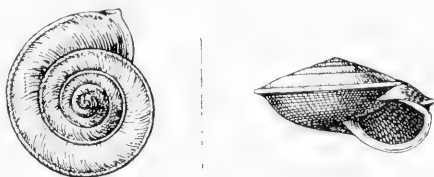


*C. theobaldi* bears a striking resemblance to *C. franciscanorum*, Gredler, a Chinese shell, but it has the umbilicus a little more contracted, the spire is relatively higher, and the aperture is less dilated laterally, while the columellar margin ascends less obliquely; the hair-sears are also finer.

I have much pleasure in associating the late Mr. W. Theobald's name with this new species.

#### PLECTOTROPIS NUTANS, n.sp.

Shell depressed-conoid, rather widely and perspectively umbilicated, thin, light corneous under a pale-yellowish corneous deciduous cuticle, finely and somewhat irregularly striated, very minutely spirally striated above, the base covered with much coarser incised, slightly wavy spirals. Spire low, suture linear, apex acute. Whorls  $5\frac{1}{4}$ – $5\frac{1}{2}$ , increasing slowly and regularly at first, the last rather suddenly; flattened above, the last convex below, keeled at the periphery, the



keel being rather pinched above and below, angulated around the umbilicus, not dilated at the mouth, very shortly and slightly descending in front. Aperture oblique, sub-hastate, margins approaching, united by a very thin callus on the parietal wall; peristome rather thin, scarcely thickened, but distinctly expanded, slightly reflexed; upper margin slightly curved, forming an obtuse angle with the outer margin, which is also slightly curved, the basal margin strongly

curved, slightly angulated at the junction with the columellar margin, which is almost straight, ascending obliquely, triangularly dilated, but not overhanging the umbilicus. Diam. maj. 16·5–17, min. 14–14·5 mm.; alt. 8 mm.

*Hab.*—India: Habiang, Garo Hills, Assam (Blanford); also West Khasia, Assam.

Type in the British Museum, presented by the late Dr. W. T. Blanford.

In shape the new species somewhat resembles the var. *theobaldi* of *P. tapeina*, but the shell is much thinner, the whorls are more flattened above and less tumid below, the keel is more pronounced and pinched, and the aperture quite different. The principal character, however, separating it from *P. tapeina* and its varieties lies in the absence of cuticular granules or squamæ and in the deciduous cuticle. I found specimens in Mr. Leman's collection and in the British Museum—both the Blanford and the general collection—with the MS. name *Trachia nutans*, Blf. The specimen in the general collection of the British Museum is a trifle larger, measuring 18 mm. in diameter, and more solid, while the last whorl descends for a considerable distance. Mr. Ponsonby possesses two specimens, received from Lieut.-Colonel Godwin-Austen, labelled "Habiang, Garo". One of these measures 18 mm. in diameter and has the aperture more dilated and the basal and columellar margin more curved than the other specimens I have seen.

## A SYNOPSIS OF THE FAMILY VENERIDÆ. PART I.

By A. J. JUKES-BROWNE, F.R.S., F.G.S.

Read 12th December, 1913.

DURING the course of the past eight years I have collected and studied the members of this family, both recent and fossil, and the results of my studies of some of the generic groups have been communicated to this Society from time to time. I have now prepared a general synopsis of the whole family in order to record my final views on the affinities and taxonomic values of the numerous groups, generic and sub-generic, which have been recognized by different writers at various times.

The family is a large one, and has generally been divided into three or four tribes or sub-families. Thus Deshayes, in 1853, made four such divisions which he called *Dosiniana*, *Meretriciana*, *Venusina*, and *Tapesina*.<sup>1</sup> Fischer, in 1887,<sup>2</sup> only recognized three such tribes, viz. *Meretricinæ*, *Venerinæ*, and *Tapetinæ*; but Dr. Dall, in 1902, again proposed to make four sub-families, viz. *Dosininæ*, *Meretricinæ*, *Venerinæ*, and *Gemminæ*. He rightly considered that the distinction between *Venerinæ* and *Tapetinæ* could not be maintained; but in my opinion the same must be said of the supposed distinction between *Dosininæ* and *Meretricinæ*, for the difference between the shells of *Dosinia* and *Pitaria* is very small, and there is probably quite as little difference between the animals. The two genera are linked together by the sub-genera which have been described by M. Cossmann and myself under the names of *Sinodia* and *Cordiopsis*.

With respect to the *Gemminæ*, they are separated by Dr. Dall because their embryos are incubated by retention within the mantle-cavity, as in the case of *Sphærium* and *Pisidium*. He calls this viviparous reproduction, but the term is hardly correct, for, as Professor Pelseneer has remarked, "there are no viviparous Lamelli-branches, though a certain number of them appear to be so because they are incubators." The fact that *Gemma*, *Parastarte*, and *Psephidia* protect their young in this way is interesting, but it does not follow that they are closely related in other respects, and we know so little about the developmental arrangements of other genera that it seems unnecessary at present to separate these groups from those which seem to be their nearest allies. For instance, the shell of *Psephidia* closely resembles that of *Gomphina*, and it is quite possible that *Gomphina* incubates its embryos: we simply do not know. Consequently I do not propose to recognize the *Gemminæ* as a distinct sub-family, believing that it is at present not convenient to make more than two such divisions, viz. the *Meretricinæ* and the *Venerinæ*.

I had hoped that the nomenclature of the various genera and sub-genera would have been settled before I set myself to draw up this

<sup>1</sup> Catalogue of the Conchifera in the British Museum, London, 1853.

<sup>2</sup> P. Fischer, *Man. de Conch.*, Paris, 1887.

synopsis, but unfortunately this is not the case. The strict application of the rule of priority has created many difficulties and absurdities which were not foreseen by those who drew up the International Code of Rules. A notable instance of such an irrational consequence of the existing rule is that of *Callista*, for if this name is abandoned the well-known group of shells which it connotes will have to take a subordinate place, the name *Macrocallista*, which was proposed for a small section of the genus, becoming the generic name, while the really typical group would receive the name of *Chionella*, with an Eocene fossil for its type instead of the well-known recent *Venus chione*, which has always been regarded as its typical example.

Again, if Bolten's Museum Catalogue is recognized as a scientific publication, and is not excluded from the law of priority, his names would supplant those of Lamarck, which have been in general use for a century or more. Moreover, Bolten's Catalogue gives no definitions of genera or sub-genera, and is absolutely devoid of any scientific value; while Lamarck's genera were properly discriminated and defined. I hold, therefore, that such a displacement of names is unjust, unnecessary, and inconvenient, and as the Zoological Congress has now resolved that exceptions may be made to the rule of priority I hope that Bolten's Catalogue may soon be declared an exception.

Meantime I refuse to be bound by the trammels of this rule in the strict fashion which some still advocate. I shall therefore retain the name *Callista* as used by Mörch in 1853 and by the Adams in 1857, ignoring its use by Leach in 1852 with a different signification which can never become operative. Similarly, I shall not accept the revived use of the names *Cytherea* and *Paphia*, as proposed by Dr. Dall, who adopts and adapts them from Bolten.

As I have described most of the fossil groups in previous papers it will suffice for my present purpose if I mention them in their proper places, with only brief notices of their chief characteristics. The most ancient genera appear to be *Callista*, *Dosiniopsis*, *Cyprimeria*, *Flaventia*, and *Baroda*, all of which are found in the Cretaceous deposits of Europe and India. *Pitaria* appears in the Eocene, and is probably the ancestor of *Dosinia*, which does not make its appearance till the Oligocene, and then only in America, the earliest European *Dosinia* being of Miocene date, though the sub-genus *Cordiopsis* occurs in the Oligocene.

*Dosiniopsis* does not seem to me to have any closer affinity to *Dosinia* than to *Callista*, but it is certainly related to *Sunetta* through the Eocene *Meroëna*; the latter, indeed, might be regarded as a *Dosiniopsis* in which the posterior lateral teeth have been obliterated by the extreme depression of the posterior border.

With regard to the shells to which I gave the name of *Flaventia* in 1908, I am still of opinion that *Clementia* is their nearest living representative, but the group is really a comprehensive or less differentiated type, combining characters now found in *Clementia* and *Samarangia*. It may also have been the ancestor of *Venus* and *Chione*, but if so the links have not yet been discovered.

## Sub-family MERETRICINÆ.

## Genus CALLISTA, Mörch (after Poli).

The shells of this genus were included under *Meretrix* (= *Cytherea*) by Lamarek, but were recognized as a sub-genus by Mörch in 1853, and as a genus by the Adams in 1857. Having fully described this group of shells in a recent paper,<sup>1</sup> and having therein given my reasons for attaching to it as sub-genera the recent and fossil groups known as *Aphrodina*, *Tivelina*, *Transenella*, and *Lepidocardia*, I need hardly reprint all the descriptions there set forth, but shall merely give a generic description and enumerate the subordinate groups.

Type, *Venus chione*, Linn. (fixed by Meek in 1876).

Synonyms: *Chione*, Gray, 1838 (not Megerle); *Dione*, Gray, 1847 (not Hubner); *Chionella*, Cossmann, 1886.

Shell oval or elongate, smooth, striate or concentrically ridged. Lunule circumscribed, but escutcheon not defined. Hinge of left valve with a strong anterior lateral and three cardinals, of which the two anterior are united at the top, and the posterior is confluent with the nymph; in the right valve are two anterior laterals and three cardinals, of which the two anterior are near together. Right posterior margin always, and left anterior margin generally, grooved, the opposite margins being bevelled to fit into these grooves. Ventral margins smooth (except in *Transenella*). Pedal scar connected with that of adductor by a long narrow canal.

Section *Callista*, s.s. Type, *Venus chione*, Linn.

Surface glossy and vernicose, with minute discontinuous ingrained radial striæ. Pallial sinus wide, horizontal, and pointed in front. Right posterior cardinal narrow and superficially grooved.

Section *Macrocallista*, Meek (1876). Type, *V. nimbosa*, Sol.

Section *Callistina*, J.-Br. (1908). Type, *Cytherea plana*, Sow. (Cret.).

## Sub-genera.

**Lepidocardia**, Dall, 1902. Type, *Venus africana*, Phil.

Shell small, compressed, and posteriorly attenuated. Hinge short and teeth crowded.

**Transenella**, Dall, 1883. Type, *Cytherea conradiana*, Dall.

Pallial sinus rounded. Valve-margins tangentially grooved.

**Tivelina**, Cossmann, 1887. Type, *Cytherea tellinaria*, Lam.

Small and compressed. Cardinal teeth all short. Pallial sinus small, rounded, and ascending (Eocene).

**Aphrodina**, Conrad, 1868. Type, *Meretrix tippana*, Conr.

Cardinal teeth widely divergent. Pallial sinus deep, ascending.

Cretaceous and Eocene fossils.

## Genus AMIANTIS, Carpenter, 1865.

Synonyms: *Dione*, Gray, 1847 (not 1851); *Dione*, Römer, 1862; *Dione*, Fischer, 1887; *Hysteroconcha* is pre-Linnæan.

<sup>1</sup> Proc. Malac. Soc., vol. x, p. 335, 1913.



Shell oval, concentrically ridged. Lunule impressed and circumscribed. Escutcheon generally defined, but narrow. Hinge like that of *Callista*, but the pit between the laterals of the right valve is continued into a channel which passes under the anterior cardinal. Pallial sinus deep and horizontal. Right posterior margin grooved, but not the left anterior. Pedal scar opening freely or by a short channel into that of the adductor.

Section *Amiantis*, s.s. Type, *Cytherea callosa*, Conrad.

Shell thick, glossy, and broadly ribbed over whole or part of surface. Hinge strong, with rugose nymphs. Pallial sinus generally pointed. This includes only three species, *A. callosa*, *A. umbonella*, Lam., and *A. purpurata*, Lam.

Section *Lamelliconcha*, Dall. Type, *Cytherea concinna*, Sow.

Shell concentrically ridged. Hinge-plate excavated and attenuated behind. Nymphs longitudinally striated. Pallial sinus obtuse or regularly rounded. The shells known as *Dione dione*, *D. lupanaria*, *D. rosea*, *D. circinata*, *D. unicolor*, and *D. cor* (Hanley) belong to this section.

*Venus dione*, Linn., ought to have been taken as the type of the *Lamelliconcha* section, but Dr. Dall was under the erroneous impression that Fischer had proposed the name *Hysteroconcha* with *V. dione* as its type, whereas he merely mentioned it as a synonym of Gray's *Dione*. Dall's *Lamelliconcha* only differs in the absence of spines, which I regard as a specific and not a sectional character.

#### GENUS PITARIA, Römer, 1857, em.

This genus was also fully discussed in the article above-mentioned, and reasons were given for establishing the two sub-genera to which I gave the names of *Callizona* and *Leucothea*, but it has been pointed out to me that both these names are preoccupied and I am consequently obliged to propose substitutes. For the former I propose *Tinctora* (from *tincta* and *ora*, a border), and for the latter *Aphrodora* (from *αφρος*, foam, and *δωρα*, a gift). I also separated a section under the name of *Pitarina*. By an oversight, however, the section *Agriopoma* was placed under *Amiantis*, instead of under *Pitaria*, where it properly belongs. The following is an amended synopsis of the genus:—

Synonym: *Caryatis*, Römer, 1862.

Shell oval or sub-trigonal, smooth or finely striate; lunule superficial; escutcheon not defined. Teeth of the left valve like those of *Amiantis*, but the posterior cardinal generally more or less separate from the nymph; in the right valve the two outer cardinals often united to form an arch over the median. Pallial sinus short and rounded. Right posterior and left anterior dorsal margins grooved as in *Callista*. Pedal scar confluent with that of adductor.

Section *Pitaria*, s.s. Type, *Venus tumens*, Gmel.

Nymphs longitudinally striated. Left posterior cardinal confluent with the nymph, median triangular; right cardinals separate. Pallial sinus deep and pointed.

Section *Calpitaria*, J.-Br., 1908. Type, *Cytherea sulcataria*, Lam.

Nymphs striated. Left posterior cardinal partly free and extending across the hinge-plate; left median triangular. Right cardinals separate. Pallial sinus short and rounded (Eocene to Recent).

Section *Pitarina*, J.-Br., 1913. Type, *Cytherea citrina*, Lam.

Nymphs smooth; left posterior cardinal wholly free and oblique; outer cardinals of right valve united at top to form an arch; pallial sinus short, rounded, and ascending.

Section *Agriopoma*, Dall, 1902. Type, *Cytherea texasiana*, Dall.

Shell dull white; nymphs smooth; left posterior cardinal long and partly free; outer cardinals of right valve forming a complete arch; pallial sinus sharply angular.

#### Sub-genera.

**Tinctora**, n.n., J.-Br., 1914. Type, *Cytherea vulnerata*, Brod.

Synonym: *Callizona*, J.-Br., 1913.

Shell thick, sub-orbicular, glossy; valve-margins crenulated; left posterior cardinal long and partly free from nymph; median very thick; pallial sinus short and rounded. Pedal scar as in *Callista*.

**Callocardia**, A. Adams, 1864. Type, *C. guttata*, A. Adams.

Shell very thin. Hinge-plate narrow and excavated between the teeth. Two cardinals in each valve, united to form complete curved arches. Left posterior cardinal long and free. Right posterior formed of two narrow plates. Pallial line believed to be entire.

**Aphrodora**, n.n., J.-Br., 1914. Type, *Callocardia birtsi*, Preston.

Synonym: *Leucothea*, J.-Br., 1913.

Shell thin, white. Hinge-plate short, curved, and narrowed posteriorly. Teeth thin and weak; left posterior short and confluent with the nymph, right outer cardinals forming a complete arch. Pallial sinus short and rounded.

**Atopodonta**, Cossm., 1886. Type, *Venus conformis*, Desh.

Shell small, but not thin. In the right valve the posterior cardinal consists of two separate plates, one of which is united to the anterior tooth, forming an arch over the median, which is bifid and  $\Lambda$ -shaped. Pallial line entire.

#### Genus LIOCONCHA, Mörch.

This genus was separated from *Circe* by Mörch in 1853 and was placed as a sub-genus of *Meretrix* by Fischer in 1887, but was adopted as a genus by Dr. Dall (1902). I agree with Dr. Dall's view of its taxonomic importance, for it is undoubtedly more nearly related to *Callista* than to *Circe*, and yet it differs from the former in several important particulars, as will be seen from the following definition.

Type, *Venus castrensis*, Linn.

Shell oval or sub-trigonal; smooth or concentrically ridged. Lunule superficial. Escutcheon not defined. Hinge-plate thick; teeth like those of *Callista*, but left posterior long and partly free from the nymph. Right posterior entire or feebly grooved. Dorsal margins grooved as in *Callista*. Pallial line entire. Pedal scar confluent with that of the adductor.

The genus includes two slightly different groups of shells; the one typified by *castrensis* is nearly smooth, the other typified by

*trimaculata* is finely striated or grooved, and more oblique in form, the posterior end being somewhat produced; the latter group includes *L. sulcatina*, Lam., and *Dione philippiana*, Hanley.

#### Genus *SAXIDOMUS*, Conrad, 1857.

The true position of this genus as a member of the Meretricinæ was established by Dr. Dall in 1902.<sup>1</sup> The anterior laterals are placed so near the anterior cardinals that they have been mistaken for supernumerary cardinals, and the shell has consequently been located near *Tapes* and *Venerupis*. It is, however, more nearly related to *Callista* than to any other genus, and is to some extent linked with *Callista* by the Japanese species *C. chishumana*, which has a corrugated shell and oblique anterior lateral teeth. The dentition of *Saxidomus* differs from that of *Callista* much in the same way as the hinge of *Dosinia* differs from that of *Pitaria*. The animal is said to have long and closely united siphons.

Only three living species of *Saxidomus* are known, namely, *S. nuttalli*, Conrad (= *aratus*, Gould, and *maximus*, Anton), *S. giganteus*, Desh., and *S. purpuratus*, Sow. They all come from the North Pacific, ranging from California northwards to Alaska and Japan. In time they go back to the Eocene of California.

Type, *S. nuttalli*, Conrad.

Shell oval, concentrically corrugated; without defined lunule or escutcheon; slightly gaping posteriorly. Ligament large and conspicuous. Hinge-plate curved and narrow, with irregular teeth; left valve with an oblique anterior lateral and three cardinals, which are narrow and near together, the posterior being separate from the nymph; right valve with two small anterior laterals and three cardinals, of which only the posterior is grooved. Valve-margins smooth and without any groove in either valve. Pallial sinus deep and horizontal. Muscular impressions large; pedal scar opening irregularly into that of the adductor.

#### Genus *DOSINIA*, Scopoli, 1777.

This genus and its subdivisions have also been fully discussed in a previous paper, to which the reader is referred.<sup>2</sup> Here, therefore, I need only give a generic definition and an abbreviated synopsis of the sections and sub-genera which I think worth recognition. The *Dosinorbis* of Dall was based on *D. bilunulata*, which has a defined area outside the true lunule; similar areas exist in *Chione roborata* and *Ch. calophylla*, and are only of specific importance. The sub-genera *Sinodia* and *Cordiopsis* may be regarded as links between the genera *Dosinia* and *Pitaria*.

Synonyms: *Orbiculus*, Megerle (1811); *Artemis*, Poli in Oken (1815); *Asa*, Leach in Basterot (1825); *Arctoe*, Risso (1826); *Exoleta*, Brown, 1827. Not *Dosina*, Gray (1838).

Shell sub-orbicular, more or less compressed, concentrically striated

<sup>1</sup> Proc. U.S. Nat. Museum, vol. xxvi, p. 356.

<sup>2</sup> Proc. Malac. Soc., vol. x, p. 95, 1912.

or corrugated. Lunule generally small and impressed. Escutcheon seldom well defined; ligament generally deeply sunk. Hinge-plate deep and strong; cardinal teeth 3-3, with one anterior lateral in the left and two small ones in the right valve; right posterior cardinal bifid, and often a supplementary tooth-like ridge at the base of the right nymph. Left posterior cardinal long and extending obliquely across the hinge-plate. Right posterior margin generally grooved for a short distance, but the left anterior only in *Sinodia* and *Cordiopsis*. Pedal scar confluent with that of the adductor.

*Dosinia*, s.s. Type, *D. africana*, Gray.

Escutcheon depressed. Anterior lateral large and strong. Left middle cardinal broadly bifid. Pallial sinus long, narrow, ascending.

Section *Dosinella*, Dall, 1902. Type, *D. angulosa*, Phil.

Lunule shallow. Escutcheon ill-defined. Anterior lateral small or obsolete; left middle cardinal broad and bifid. Pallial sinus very deep, ascending and rounded at the end.

Section *Austrodosinia*, Dall. Type, *D. anus*, Phil.

Escutcheon ill-defined. Anterior lateral strong and rugose. Left middle cardinal entire and solid. Pallial sinus short, horizontal.

Section *Phacosoma*, J.-Br., 1912. Type, *D. japonica*, Reeve.

Escutcheon well-defined by lamellose ridges, and the inner edges turned up on each side of the ligament. Anterior lateral strong and left median cardinal oblique, rugosely striated, but not bifid. Pallial sinus deep and angular.

Section *Pectunculus*, Da Costa (= *Orbiculus*, Megerle). Type, *D. exoleta*, Linn.

Escutcheon not defined. Anterior lateral small, and left middle cardinal obscurely and unequally bifid. Pallial sinus deep, ascending, rounded or obtusely angular.

Section *Dosinidia*, Dall, 1902. Type, *D. concentrica*, Born.

Escutcheon not defined and lunule very little impressed. Anterior lateral small and pustular. Left middle cardinal broad and obscurely bifid. Pallial sinus deep, angular, and ascending. Dorsal margins not grooved.

#### *Sub-genera.*

**Sinodia**, J.-Br. Type, *Dosinia trigona*, Reeve.

Shell convex. Lunule superficial, not impressed. Escutcheon not defined. Anterior lateral strong and distant. Middle left cardinal solid and central. Both left anterior and right posterior margins grooved for some distance. Pallial sinus rather short and rounded.

Since the publication of my paper on *Dosinia* I have discovered that *Cytherea gouldi*, Reeve, belongs to this sub-genus. The type is in the British Museum, and Mr. E. A. Smith writes that "it is certainly a *Sinodia*, the hinge being exactly the same as in *trigona*".

**Cordiopsis**, Cossmann. Type, *Cytherea incrassata*, Sow.

Shell thick, sub-orbicular, convex and cordiform, with prominent incurved umbones. No lunule or escutcheon. Left anterior lateral small and becoming obsolete with age; middle cardinal thick, rugose, and central. Left anterior and right posterior dorsal margins grooved. Pallial sinus short, sub-angular, ascending.

**Pelecypora**, Dall, 1902. Type, *Cytherea hatchetigbeensis*, Aldrich.

This shell seems to be distinguished by its rugose nymphs and narrow angular pallial sinus. It is a fossil from the Eocene of the United States.

Genus **DOSINIOPSIS**, Conrad, 1864.

Synonym, *Æora*, Conrad, 1870.

Type, *Cytherea lenticularis*, Rogers.

Shell sub-orbicular or rounded oval. Lunule indistinct. Escutcheon often defined and depressed. Cardinal teeth three in each valve, separate, divergent, and entire, except the right posterior, which is bifid. Left median strong, central, and triangular. Anterior lateral elongate, rugose, and a simple pit for its reception in the right valve; a single posterior lateral in each valve. Nymphs finely granulated. Dorsal margins not grooved. Pallial sinus rather short, ascending, rounded or sub-angular.

This genus is extinct, and is only known from fossil representatives in the Cretaceous and Eocene deposits. The Cretaceous species *D. subrotunda* and the Eocene *D. orbicularis* have sharply depressed escutcheons, and it is from them that *Meroena* and *Sunetta* have been derived.

Genus **SUNETTA**, Link, 1807.

At the present day this genus is specially characteristic of the Indo-Pacific region, but it extends round the Cape to the west coast of Africa, as far north as Senegal. In Eocene and Miocene times it lived in European seas, but no species has survived in the Mediterranean area. In eastern seas it ranges from Japan on the north to the coast of South Australia. The animal is unknown.

Synonyms: *Cuneus*, Megerle, 1811 (not Da Costa); *Meroe*, Schumacher, 1817.

Shell oval or sub-orbicular, sub-equilateral, rather thick, smooth or concentrically grooved, with obscure radial riblets. Lunule impressed and circumscribed; escutcheon narrow and deeply depressed. Cardinal teeth 3-3, straight, separate, and touching dorsal border; the medians fairly stout, the others narrow, and all generally entire; the left posterior confluent with the nymph. Anterior laterals strong, one in left and two in right valve. Right posterior and left anterior marginal grooves short or obsolete. Nymphs finely denticulate. Pallial sinus short, sub-angular, and horizontal. Ventral and lateral margins crenulated (except in *Meroina*). Pedal scar under hinge-plate and confluent with that of the adductor.

*Sunetta*, s.s. Type, *Donax scripta*, Linn.

Shell elongate-oval, compressed or inflated, either equilateral or posterior side the shorter. Left posterior cardinal short, right one smooth and entire.

*Sunettina*, Jousseaume, 1901. Type, *S. sunettina*, Jous.

Shell sub-orbicular, compressed; posterior side expanded and rather longer than the anterior. Left posterior cardinal long and thin, the right one grooved at the top.

I have not recognized the section *Solanderina*, created by Dr. Dall in 1902 for *S. solandri* (Gray) with the brief definition that it is "inflated, smooth, and sub-equilateral", because the convexity of the valves is really the only point of difference. *S. scripta* is just as smooth, *S. truncata* and *S. karachiensis* just as equilateral, and yet both are compressed. The internal characters of *solandri* are the same as those of the type: the only other species which could be classed with it is *S. neglecta*, Smith, but that is less inflated and is more nearly allied to *S. vaginalis*, which I should refer to the section *Sunettina*.

*Sub-genus.*

**Meroina**, J.-Br., 1908. Type, *Cytherea trigonula*, Desh.

Shell oval or sub-trigonal, but posterior side the longer. Escutcheon less deeply sunk, and borders less acute than in recent forms. Right posterior cardinal grooved. Anterior laterals short and distant from cardinals. Ventral and lateral margins smooth.

Genus *CIRCE*, Schumacher, 1817.

This genus dates from Eocene times through the sub-genera *Gouldia* and *Circenita*, but no representative of the typical section has yet been found earlier than the Oligocene. At the present day this group of shells is widely distributed over the whole world, but the typical section of *Circe* (s.s.) and the sub-genus *Crista* are only found in the tropical parts of the Indo-Pacific region.

Synonyms: *Paphia*, Oken, 1815 (not Lamarck); *Gafrarium*, Dall after Bolten, 1902.

Shell oval or sub-orbicular, with concentric or radiate sculpture or a combination of both. Lunule flat, long, and narrow; the escutcheon when defined is very narrow. Hinge-plate deep and triangular, with three straight, separate, and slightly divergent cardinal teeth in each valve. Right posterior dorsal margin always grooved, but on the left anterior side only the lunular margin is narrowly grooved. Lower margins smooth or crenulated. Pallial line entire or slightly sinuated. Pedal scar small, round, and separate from the adductor (except in *Gouldia*).

*Circe*, s.s. Type, *Venus scripta*, Linn.

Shell compressed and flattened at the umbones, with dominant concentric sculpture, but often divaricately ribbed on the dorsal margins or umbonal disk. Escutcheon very narrow, and ligament deeply sunk. Valve-margins smooth. Left posterior tooth long, the median bifid and rugose, the others entire. Pallial line entire. This typical section includes *plicatina*, *rivularis*, *undatina*, and var., *orbica*, *tumefacta*, *nummulina*, and *lirata*, Röm., but not *sulcata*, which belongs to *Gouldia*.

*Farmulina*, Dall, 1902. Type, *Circe corrugata*, Chem.

Shell thick, sub-orbicular, much flattened on the umbonal area, which is rugosely ribbed, the rest of the surface being concentrically sulcated or striated. Teeth generally more divergent. Ventral margins crenulated. Pallial line entire. So far as I can ascertain

only three species belong to this section, viz. *C. corrugata*, Chem., *C. crocea*, Gray, and *C. intermedia*, Rve. All of these live on the Arabian coasts from the Red Sea to the Gulf of Oman, and *crocea* ranges down the African coasts as far as Zanzibar, but I cannot learn that any of them have been recorded from India.

*Sub-genera.*

**Crista**, Römer, 1847. Type, *Venus pectinata*, Linnæus.

Synonyms: *Paphia*, Oken, 1815 (not Lam.); *Gafrarium*, Dall after Bolten.

Shell not flattened at the umbones, convex or compressed, with radial and concentric sculpture, the radials divaricate. Escutcheon narrow and impressed, and the ligament sunken. Hinge-plate short and triangular. In the left valve the median cardinal is grooved, and the posterior is short. The margins of the valves are generally but not always crenulated. This group includes *C. gibbia*, Lam., *C. divaricata*, Chem., *C. æquivoca*, Chem., *C. dispar*, Chem., *C. cuneata*, Lam., *C. australis*, Sow., and *C. transversaria*, Desh. Typical *dispar* has smooth margins, while those of *cuneata* are crenulate; similarly, those of *transversaria* are smooth and of *æquivoca*, which it much resembles, are crenulate.

**Circenita**, Jousseume, 1888. Type, *Circe arabica*, Chem.

Shell oval, convex, concentrically ribbed or striated, and without radial sculpture. Escutcheon not defined, and ligament exposed. Cardinal teeth small, near together, and entire; the anterior laterals comparatively large. Ventral margins always smooth. Pallial line slightly sinuated. This is a very small group, including only three well-marked species, viz. *arabica*, Chem., *lentiginosa*, Chem., and *callipyga*, Born, but several varieties have been given names, such as *adenensis*, Phil., *pulchra*, Desh., *splendens*, Sow., *semiarata*, Dkr., and *funiculata*, Römer.

**Gouldia**, C. B. Adams, 1847. Type, *Circe cerina*, Adams.

Shell rather small, oval, convex, with dominant concentric sculpture, but sometimes having fine radial striation at the sides. Escutcheon not defined. Teeth more widely divergent; right posterior cardinal grooved, but the rest entire. Posterior dorsal margins of both valves strongly grooved, each generally having a ridge and a groove. Ventral margins smooth or irregularly rugose (not crenulate). Pallial line slightly inflected. Pedal scar confluent with that of the adductor. This group includes *C. minima*, Mont. (Atlantic and Mediterranean), *C. bermudensis*, Smith (Bermuda and West Indies), *C. sulcata*, Gray (Red Sea to Philippines and Fiji), *C. nana*, Melv. (Persian Gulf to Siam), *C. melvilli*, Lynge (Siam), and *C. amica*, Smith (Pacific Islands).

**Meretrissa**, Jukes-Browne, 1908. Type, *Tivelina depressa*, Desh. (fossil).

In 1908 I separated two species of small shells occurring in the Oligocene of the Paris Basin under the name of *Meretrissa*, and regarded them as a link between *Tivelina* and *Meretrix*. More recent scrutiny of the specimens then sent me by M. Cossmann, and the

removal of some adherent sand in order to expose their pedal scars, has induced me to change my opinion so far as the relationship to *Meretrix* is concerned.

I find that in both species the pedal scar is small and separate from that of the adductor, a feature which is not found in any Meretricine genus except *Circe*. The cardinal teeth, being straight, separate, and nearly equally divergent, also resemble those of *Circe* (especially of *Gouldia*) quite as much as they do those of *Meretrix*; but *Meretrissa* differs from both in exhibiting a small pallial sinus which is more than a mere inflection of the pallial line, though it is not deep.

Further, since *Circe*, in the forms of *Circenita* and *Gouldia*, co-existed with *Tivolina*, while *Meretrix* has not been found in any of the European Tertiaries, I now consider *Meretrissa* to be more closely allied to *Circe* than to *Meretrix*. It may be regarded as a link between *Tivolina* and *Circenita*, but, as the internal features resemble the latter more than the former, I group it here as a sub-genus of *Circe*.

Shell small, sub-trigonal, nearly smooth, compressed. Hinge weak with three divergent cardinals, the anterior of the right valve pointing to the anterior lateral pit, the median grooved, and the posterior entire. Pallial line with a short rounded sinus. Pedal scar separate from adductor.

#### Genus MERETRIX, Lamarck, 1799.

This genus is very distinct both in general form and in dentition from all the preceding genera, and it is, therefore, far from being a good type of the sub-family to which it gives its name. The species of which it consists are few, and they are restricted to the Indian and Chinese seas, extending from Aden and the Gulf of Oman to Timor and the Philippines, and as far north as Japan; but I have not been able to find any record of its occurrence in Australian waters, nor in the Pacific Ocean, nor have I been able to ascertain how far it reaches southward along the east coast of Africa, but it does not exist in Natal or Cape Colony.<sup>1</sup>

Moreover, it appears to be of comparatively recent origin, for it does not occur in any of the Tertiary faunas of Europe, neither can I find that any ancestral form has been described from those of India or Burmah. At present, therefore, it seems impossible to say when or where it originated, but its distribution suggests that its centre of dispersal was either from Siam or the Malay Archipelago, for most of the species are found in that region.

<sup>1</sup> *Meretrix lusoria* has been recorded from Natal by Mr. G. B. Sowerby (Journ. Conch., 1894, p. 377), but he subsequently found that it was really a species of *Tivela*, and in his Appendix to *Marine Shells of South Africa*, published in 1897, he described the species under the name of *Tivela alucinans*. In 1903 (Proc. Malac. Soc., vol. v) Mr. E. A. Smith identified it with *Tivela natalensis* of Dunker, and he informs me that it was by mistake that the name of *Meretrix zonaria* was included in the same list, the shell being really *T. natalensis*.



I hope that palæontologists will give heed to the facts above mentioned, and will not continue to record *Meretrix* from Cretaceous or Tertiary deposits when they only mean some species of '*Cytherea*' in its widest sense, which they cannot determine more precisely from the external characters. In most cases it would be better to record it as *Callista* (?), or else to continue the use of the name *Cytherea* for indeterminate fossil forms.

Synonyms: *Cytherea*, Lam., 1805; *Nympha*, Mörch, 1853.

Type, *Venus meretrix*, Linn.

Shell oval or trigonal, sub-equilateral, thick, generally smooth, but sometimes concentrically lirated, with a vernicose periostracum and a minute oblique striation on the posterior slope. Neither lunule nor escutcheon is clearly defined. Ligament rather short and very prominent on strong elevated nymphs. Hinge-plate thick, with three separate cardinals in each valve diverging from a point beneath the umbo; left posterior confluent with the nymph, right posterior narrow and superficially grooved, others entire. Lateral teeth strong. Both nymphs are corrugated. Ventral margins smooth. Pallial line with a small and shallow sinus. Pedal scar confluent with that of adductor.

The species are not very numerous, as most of those which have received distinctive names are only colour varieties of *M. meretrix*, but I should recognize the following as distinct species—*petechialis*, Lam., *lusoria*, Chem. (= *formosa*, Sow.), *lamarecki*, Hanley, *lyrata*, Sow., and *exilis*, Desh.

#### Genus TIVELA, Link, 1807.

Synonyms: *Trigona*, Megerle, 1811; *Trigonella*, Conrad, 1837.

Shell trigonal, sub-equilateral, solid, smooth, with a more or less deciduous periostracum. Lunule long, but faintly circumscribed. Escutcheon not defined. Ligament very short, prominent, based on thick nymphal plates. Cardinal part of the hinge short and triangular, anterior part elongated. Cardinal teeth 3-3, all narrow and entire, except the left median, which is sometimes grooved; the left anterior points to the elongate anterior lateral, and the right anterior is close to the lunular margin. Nymphs strongly corrugated, and sometimes divided into a series of ridges which occupy part of the hinge-plate, and simulate supplementary teeth. Dorsal margins grooved as in *Callista*, etc. Ventral margins smooth. Pedal scar very long and confluent with that of the adductor.

*Tivela*, s.s. Type, *Venus corbicula*, Gmel. (= *V. mactroides*, Born).

Ventral margins smooth.

*Eutivela*, Dall, 1891. Type, *T. perplexa*, Stearns.

Ventral margins crenulated. Only known from Brazil.

#### Sub-genus.

**Grateloupia**, Desmoulins, 1828. Type, *Donax irregularis*, Bast.

Synonym: *Cytheriopsis*, Conrad, 1833.

Shell like *Tivela*, but with a number of oblique parallel ridges on the nymphs, and sometimes a thickening on the posterior dorsal

margin which simulates a posterior lateral tooth. Species occur in the Eocene of America and the Miocene of Europe, and in the latter they are associated with a true *Tivela*.

The hinge of *Tivela* has been fully described by me in a previous communication,<sup>1</sup> in which I showed that the normal teeth are always present, though they are often crowded into the anterior half of the hinge-plate by the great development of the nymphal plates. The relationship of *Grateloupia* was discussed in the same paper.

#### Genus ANTIGONA, Schumacher, 1817.

This genus comprises the shells which Gray regarded as the typical group of the *Venus* of Lamarck, taking the type to be *Venus verrucosa*, but not himself designating it as such.<sup>2</sup> In this view he was followed by Deshayes (1853) and the Adams (1857), and they all included the genus in the sub-family which possesses an anterior lateral tooth. Römer, however, in 1867 introduced confusion by regarding the group as part of the genus *Chione*, not even distinguishing it as a separate section, but grouping the species in the same section as the typical *Chione* under the name of *Omphalocladrum*. Paul Fischer (in 1887) adopted Römer's method of classification, and most French geologists have followed in his footsteps, so that even such conchologists as Cossmann and Peyrot include the *Antigona* group under a comprehensive *Chione* genus, though they do separate it as a section under Möhrh's name.

In America Dr. Dall has followed the English view of complete generic distinction, and has placed the two genera in separate sub-families. Unfortunately, however, he has revived the abandoned name of *Cytherea* from Bolten's catalogue, and has applied it to this genus with *V. puerpera* as a type. Hence, though agreeing with his recognition of the genus, I cannot accept his nomenclature.

Of course, the whole question of generic difference depends upon the structural importance of the small tooth on the front part of the hinge-plate. Römer must have regarded it as a mere excrecence, and not as a definite anterior lateral, though how he could possibly hold such a view with regard to *Ant. lamellaris* (= *A. lamarcki*, Gray) is really incomprehensible. The fact is that different species of *Antigona* show every gradation between the well-developed laterals of *A. lamellaris* (in both valves) and the little pustular tooth in the left valve of *A. reticulata*, which looks like an outgrowth from the anterior cardinal and has no corresponding pit in the right valve. Yet comparison with other species shows that the pustule is undoubtedly an atrophied anterior lateral, apparently in process of being crowded out by a shortening of the hinge-plate and the greater development of the anterior cardinal.

It may, of course, be argued that the *Chione* group has been evolved

<sup>1</sup> Proc. Malac. Soc., vol. x, p. 266, 1913.

<sup>2</sup> See my discussion of the name *Venus* in Proc. Malac. Soc., vol. ix, p. 242, 1911.

from *Antigona* by the gradual elimination of the anterior laterals, and I am quite disposed to think that such has been its origin; but our genera are established for the sake of convenience in classification, and not for the purpose of expressing a theory. There is no difficulty in distinguishing the two groups and in recognizing them as genera, and they have certainly had a separate existence ever since the Miocene period. In the recent forms the anterior lateral is persistent from youth to full age, and if there are fossil forms in which it disappears with growth, they must be allocated on the sum of their other characters, but I do not know of any.

Here I must correct an error into which I fell in 1908 when describing the Veneridæ of the Eocene and Oligocene deposits. An Oligocene shell described by M. St. Meunier under the name of *Venus loewyi*<sup>1</sup> was then ascribed to the genus *Chione*, because M. Cossmann had referred it to that genus, and because reference to the published figures seemed to show that such reference was correct. Recently, however, by the publication of MM. Cossmann & Peyrot's *Conchyliologie Néogénique de l'Aquitaine*, I became aware that their genus *Chione* was the antiquated conception of Römer, and that it included the groups of *Clausina*, *Omphaloclathrum*, etc. In reply to inquiry M. Cossmann informs me that his valves of *Venus loewyi* show a distinct anterior lateral tooth in the left valve and a pit for its reception in the right. It is clear, therefore, that the shell is a species of *Antigona*, and does not belong to *Chione*; it follows, moreover, that *Antigona* dates from the Oligocene period, and that *Chione* does not, so far as we yet know.

It may also be stated that the *Ventricoloidea* of Sacco (1900)<sup>2</sup> appears to be a synonym of *Artena*, Conrad (1870).<sup>3</sup> The type of the former is *Cytherea multilamella*, Lam., and having compared specimens of this shell, which I owe to the kindness of Professor Peyrot, with the descriptions and figures of *Artena* given by Dr. Dall, I have no hesitation in saying that it accords with *Artena* in all essential particulars. As Dr. Dall remarks, *Artena* bears the same relation to the typical *Antigona* (*A. lamellaris*) as *Ventricola* does to the group which he calls *Cytherea* (i.e. *A. puerpera*), and this I understand to be exactly the idea which Professor Sacco wished to express.

It is unfortunate that the genotype of *Antigona* (*V. lamellaris*, Schum.) is so different from all the other recent members of the genus that it stands by itself. It is one of the absurd results created by the plan of fixing genera by 'types', and by the rigid rule of priority that the so-called typical section of a large genus may include only one species! This, however, makes no difference to the definition of the genus as a whole, and I therefore give such a description before indicating the various divisions of it.

<sup>1</sup> Nouv. Arch. Mus. d'Hist. Nat. Paris, sér. II, tom. iii, p. 235, pl. xiii, figs. 11, 12.

<sup>2</sup> I Moll. Terz. Piem., pt. xxviii, p. 30, 1900.

<sup>3</sup> Amer. Journ. Conch., vol. vi, p. 76.

## ANTIGONA, Schum., 1817.

Synonyms: *Dosina*, Gray, 1838; *Venus*, s.s., Gray, 1847, and Deshayes, 1853; *Omphaloclathrum*, Mörch, 1853; *Venus* (*Antigona*), E. A. Smith, 1885 (Challenger Report); *Cytherea*, Dall (after Bolten), 1902.

Shell convex and generally globose, with prominent concentric lamellæ and sometimes with radial sculpture. Lunule and escutcheon both clearly defined. Umbones prominent and incurved. Inner margins crenate. Hinge thick and teeth strong; each valve with three divergent cardinals, of which three are grooved, and the posterior of the left valve is confluent in the nymph. The anterior lateral of the left valve is often small and papillose, and those of the right are obsolete. Pallial sinus short, either angular or rounded. Pedal scar generally separate from that of the adductor.

*Antigona*, s.s. Type, *Cytherea lamellaris*, Schum.

Shell oval, with strong concentric lamellæ, crossed by radial riblets. Lunule impressed, and escutcheon defined in both valves. Ligament exposed. Teeth widely divergent, and both anterior cardinals directed forward; a strong anterior lateral in the left, and two small ones in the right valve. Nymphs long and striated. Pallial sinus small and acutely angular.

*Artena*, Conrad, 1870 (= *Ventricoloidea*, Sacco, 1900). Type, *Venus straminea*, Conrad, 1842 (not of Conrad, 1837).

Shell oval, globose, with sharp concentric lamellæ, and striated interspaces, but no radial ribs. Left anterior lateral well developed, and two strong laterals in the right valve with a long, deep pit between them. Other teeth normal. Pallial sinus small and angular.

The type is an American Miocene fossil. European species are *Venus loewyi*, Meun. (Oligocene), *Cytherea multilamella*, Lam. (Miocene and Pliocene), *Venus burdigalensis*, Mayer (Miocene).

## Sub genera.

**Periglypta**.<sup>1</sup> J.-Br., 1914 (= *Cytherea*, s.s., Bolten in Dall). Type, *Venus puerpera*, Linn.

Shell cancellated by strong concentric ridges crossed by radial riblets which crenulate the ridges. Escutcheon narrow, and the right half overlapping the left. Ligament deeply sunk. Nymphs usually having a finely rugose area. Anterior lateral very small and close to the anterior cardinal. Pallial sinus usually wide and rounded.

This group includes the following species which are currently known as '*Venus*': *V. reticulata*, Linn., *V. crispata*, Desh., *V. listeri*, Gray (W. Indies), *V. clathrata*, Desh., *V. sowerbyi*, Desh. (E. Indies), *V. multicostata*, Sow., and *V. monilifera*, Sow. The forms known as *lacerata*, Hanley, *magnifica*, Hanley, and *reticulata*, Sow., are probably only varieties of *puerpera*. Two other species, *V. laqueata*, Sow., and *V. chemnitzii*, Hanley, differ from all the rest in the following

<sup>1</sup> From *περι*, very much; *γλυπτος*, carved.

particulars: they have smooth nymphs, a small angular sinus, and the pedal scar is confluent with that of the adductor.

*Clausina*, Brown, 1827. Type, *Venus verrucosa*, Linn.

Shell oval or rotund, globose or compressed, with dominant concentric structure. Lunule and escutcheon well defined, the latter being unequally divided between the valves. Teeth less widely divergent than in *Periglypta*, but normal, except that the anterior lateral is small. Nymphs smooth. Pallial sinus always small and angular.

*Clausina*, s.s. Inflated and often globose, concentric ridges crossed by irregular radial riblets which sometimes become nodular prominences. Left anterior lateral very small and pustular; right laterals and pit often becoming obsolete. Pedal scar large, oval and separate from adductor scar.

Only a few species can be included in this group, viz., *V. verrucosa*, Linn. (with the vars. *canariensis* and *rosalina*), *V. nodulosa*, Sow., *V. toreuma*, Gould, *V. jukesi*, Desh., and *V. fordii*, Dall.

*Ventricola*, Römer, 1857. Type, *Venus rigida*, Dillw. (= *rugosa*, Chem.).

Shell globose or merely convex, ornamented with numerous regular concentric lamellæ with striated interspaces and sometimes weak radial striæ on the posterior slope. Anterior denticle and its corresponding pit both persistent. Pedal scar confluent or opening by a channel into the adductor scar.

This group includes *V. casina*, Linn., *V. foveolata*, Sow., *V. oblonga*, Hanley, *V. declivis*, Sow., *V. lyra*, Sow., *V. effossa*, Phil., *V. strigillina*, Dall, *V. magdalena*, Dall, *V. rugatina*, Heilprin (if not vars. of *rigida*).

*Circomphalus*, Mörch, 1853. Type, *V. plicata*, Gmel. (fixed by Sacco, 1900).

Shell compressed with flattened umbones, encircled by distinct concentric lamellæ which pass posteriorly into expanded elevations. Hinge-plate much curved and attenuated posteriorly. Anterior lateral very small and often impersistent; pit in the right valve obsolete. Pedal scar rather small, nearly separate, but connected with the adductor scar by a narrow channel. Valve-margins very finely crenate.

The name *Circomphalus* was adopted by Mörch from Klein, and applied to the following small group of shells: *V. peruviana*, Sow., *V. dysera*, Linn. (= *plicata*, Gmel.), *V. calophylla*, Phil., *V. tiara*, Dillw., and *V. berryi*, Gray. In 1857 the Messrs. Adams also adopted it for the same group, and included many other species allied to *V. tiara*, but without indicating any one as a type. In the same year Römer proposed the name *Anaitis* for what was practically the same group, but this name was preoccupied by Duponchel in 1829, and cannot therefore be used.

No one seems to have selected a type for *Circomphalus* until 1900, when Professor Sacco definitely indicated *V. plicata*, Gmelin, as the type of a small group including *V. lamellata* and *V. calophylla*, but without giving any diagnosis, merely remarking that its members were species which could not be referred to other sub-genera such as

*Chione*, *Clausinella*, and *Anaitis*.<sup>1</sup> In 1902 Dr. Dall gave *V. plicata* as the type of *Circomphalus*, but without reference to Sacco or to anyone else in explanation of such a selection.<sup>2</sup>

It is much to be regretted that the name should thus come to be attached to *V. plicata* instead of to some member of the *tiara* group, for which it was evidently intended both by Mörch and by H. & A. Adams. They only included *V. plicata* in that group because they supposed it to resemble the rest in having no lateral teeth, or because they did not regard the small anterior tubercle as a normal tooth.

Neither *V. lamellata* nor *V. calophylla* can be grouped with *V. plicata*, for neither of them shows any trace of an anterior lateral even in very young shells, and through the kindness of Dr. J. C. Verco, of Adelaide (S.A.), I have been able to examine young shells of both these species. Another shell which much resembles *V. plicata* in external characters is *V. yatesi*, but the specimens which I have seen show no trace of an anterior denticle. Indeed, so far as I can ascertain there is no other recent species which can be associated with the type of *Circomphalus*. There are, however, several species in the Miocene and Pliocene deposits of France, Italy, and Austria which certainly belong to it; these are *V. subplicata*, d'Orb., *V. basteroti*, Desh., *V. dertoparva*, Sacco, and *V. scalaris*, Bronn. By Messrs. Cossmann and Peyrot these species have been referred to the *Clausinella* section of *Chione*, but that must be reserved for the shells which have no rudiment of a lateral tooth, as there is none in *C. fasciata* which is the type. The other species which they associate with *V. plicata* I should refer to *Ventricola*; these are *V. casinoides*, *V. fasciculata*, and *V. haidingeri*. Professor Sacco has figured many varieties of the above-mentioned species, but I do not think he has correctly referred all his specimens to their proper species, for he evidently regards the anterior denticle as of no importance even in the distinction of species.

I am quite prepared to admit that the *fasciata* and *tiara* group has probably been derived from the *plicata* group by the elimination of this anterior lateral, but I regard the retention of the lateral tooth as a feature of generic importance. This question will be further discussed in the sequel.

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<sup>1</sup> I Moll. Terz. Piem., pt. xxviii, 1900.

<sup>2</sup> Proc. U.S. Nat. Mus., vol. xxvi, p. 356, 1902.

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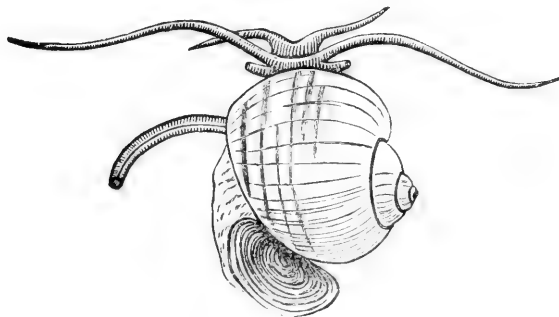
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## A SYNOPSIS OF THE FAMILY VENERIDÆ. PART II.

By A. J. JUKES-BROWNE, F.R.S., F.G.S.

*Read 13th March, 1914.*

I HAVE followed Gray and Deshayes in dividing the Veneridæ into sub-families, but into two only, the Meretricinæ and the Venerinæ, according to the presence or absence of an anterior lateral tooth. By this criterion the genus *Antigona* is separated from the genera *Venus* and *Chione*, but I do not wish it to be supposed that I regard these two sub-families as two distinct lines of evolution. On the contrary, I think each series includes several stirpes or branches of development, and I think that the *Chione* group has been developed directly from the *Antigona* stock by suppression and elimination of the anterior lateral tooth.

On this point I again find myself in disagreement with Dr. Dall, who imagines that there are important anatomical differences between the animals of *Chione* and *Antigona*, and thinks that the possession of an anterior lateral is correlated with such differences. In his own words, "there is not *a priori* any very good reason why the presence or absence of a minute pustule of shelly matter in front of the cardinal teeth should count for much in the classification of species (or) genera, or still less be the criterion for determination of the sub-family to which a species belongs. Yet in making comparisons of the anatomical features of these animals this little tooth or pustule is found an excellent index to important anatomical differences. So, whether it has any intrinsic value or not its correlation with important characters must be admitted."<sup>1</sup>

Dr. Dall, however, does not state what these characters are or how the animal of *Antigona*, which he calls *Cytherea*, differs from that of *Venus* and *Chione*. He only states under the head of Meretricinæ that they have "siphons of moderate length with papillose orifices, the tubes united for a great part of their length, the margin of the mantle largely free, more or less papillose, the foot large, hatchet-shaped, not byssiferous"; and that in the Venerinæ "the siphons are usually comparatively short and more or less separate from one another. The foot is hatchet-shaped, and in the adult not byssiferous except among the nestlers". He might also have added that the mantle-margins are free and generally fringed, and that the orifices of the siphons are often cirrhose; and he should have said that the length of the siphons varies much in different genera.

It will be seen, therefore, that in the characters which are generally considered to be of importance for the purposes of comparison there is no essential difference between the animals of the Meretricinæ and Venerinæ, unless he intended to signify that the siphons of the latter are always more separate than those of the former. On this point

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<sup>1</sup> Trans. Wagner Free Inst. Science, vol. iii, pt. vi, p. 1281, 1903.

I have made inquiries, more particularly in regard to the *Antigona* and *Ventricola* group, with the following results: in *Clausina verrucosa* the siphons are said to be completely separate, but there is no record about those of *Ventricola casina*; I therefore applied to Professor Herdman, who kindly informs me that in this species the siphons are united for a great portion of their length, i.e. for about half their extension outside the shell. Again, to Mr. H. Suter, of New Zealand, I owe the information that *Ventricola oblonga* has "short and rather small siphons which are united to their tips". There is, therefore, great variation with regard to the union of the siphons in this genus.

There seems to be an equal lack of uniformity in the *Venus* and *Chione* group, though they are usually united for about half their external length. This is the case in *Venus mercenaria* as figured by Dr. Dall himself;<sup>1</sup> also in *Chione gallina* and *Ch. fasciata*, but in *Timoclea ovata* they are united for three parts of their length, and it is stated that the same is the case with some varieties of *Ch. gallina*. In the case of *Ch. grus*, moreover, a West Indian species, Dr. Dall himself states that "the animal has two subequal closely united fringed siphons", so that his own statements are inconsistent with one another.

The facts above are sufficient to dispose of the theory, stated by Dr. Dall as if it were a proved fact, that there is any correlation between the anatomical characters of the animals and the presence or absence of an anterior lateral tooth on the shell. On the other hand I am decidedly of opinion that this anterior pustule or 'dentelon' has an intrinsic value of its own, for if it is the vestigial relic of an anterior lateral tooth, then it represents an important structural element in the dental armature of the hinge-plate.

It may of course be argued that if *Venus* and *Chione* may be descended from species of *Antigona* they should not be placed in different sub-families, and to this there is no answer except that no sub-families could then be recognized, and that it does seem useful to emphasize the importance of looking for this little tooth, and of using it as a basis of classification.

Among the *Venerinæ* the groups which I recognize as having the rank of genera are—*Venus*, *Protothaca*, *Samarangia*, *Gomphina*, *Gemma*, *Clementia*, *Cyclina*, *Cyprimeria*, *Marcia*, *Tapes*, *Paratapes*, *Baroda*, and *Venerupis*. A few remarks on the taxonomic values of certain groups may be useful to explain the connotation of these genera and some of their divisions.

In the first place I do not find any differences of real generic importance between *Venus* (= *Mercenaria*) and *Chione*, so that I rank the latter as a sub-genus of the former; nor is there any good reason for the generic separation of *Anomalocardia*, which combines some characters of *Mercenaria* with some of *Chione*. As a matter of fact it would be more reasonable to separate those *Chione* which are destitute of radial sculpture, such as *roborata* and *tiara*. It seems more natural and convenient, however, to regard all these three

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<sup>1</sup> Bull. U.S. Nat. Mus., No. 37, pl. lv, 1889.

groups *Chione*, *Anomalocardia*, and *Clausinella* as sub-genera of a comprehensive genus *Venus*.

With regard to *Timoclea*, of which the type is *Venus ovata*, Pennant, I am convinced that it cannot be separated from the typical section of *Chione* either solely or principally on the ground of its external sculpture. There is every gradation between the cancellated forms of *Chione* and the *Timoclea* type, in which the concentric ridges are reduced to scales or nodes on the radial ribs. The distinction must be found in other points of difference, and *Venus ovata* can be grouped with other species which have a similar ovate sub-equilateral shape, the same widely divergent teeth, with an obtuse or rounded pallial sinus; I also find that in all these species the pedal scars are separate from those of the adductors, while in the typical section of *Chione* there is almost always an open connexion between the two scars, which means of course a more or less complete union of the pedal and adductor muscles.

In this connexion it is curious to find that M. Cossmann has proposed to make *Timoclea* a separate genus, but this estimate of its importance is partly due to his confusion of *Chione* with *Antigona*. Moreover, he relies entirely on the characters of *T. ovata*, and consequently he does not give such a comprehensive definition of *Timoclea* as would make it comprise such species as *V. marica*, *V. striatissima*, *V. subnodulosa*, and *V. arakanensis*. It may be noted also that the straight inner border of the hinge-plate, which he mentions as distinctive, is largely a function of the sub-equilateral shape of the shell, for an oblique curvature of the shell naturally produces a curvature of the hinge-line.

Again, the differences between the *Clausinella* of Gray and the *Lirophora* of Conrad (which should have been written *Lirifera*) seem to me so small and unimportant that no good purpose can be served by laying much stress on them. The real fact is that these names, through the types attached to them, belong to exceptional forms of a large natural group. Thus *Venus fasciata* is a European form, which, in its compressed shape and its sculpture of broad flattened ridges, stands quite by itself, while Conrad's type was a fossil nearly allied to the West Indian *Venus paphia*, Linn., a species in which the ridges pass into erect posterior expansions, and also exhibit an obscure radial striation.

Now the natural group to which these species belong is that typified by *Venus tiara*, Dillwyn, *V. berryi*, Gray, and *V. roborata*, Hanley. It was this group for which Mörch, in 1853, used Klein's name of *Circomphalus*, and if subsequent writers had only taken note of this (Tryon, Sacco, and Dall) they would not have chosen *V. plicata* as the type (see *ante*, p. 73). The name *Clausinella*, however, was published in 1851, and has priority, so that obviously the best course to pursue is to adopt it for the whole natural group, though *Lirophora* may be used for the few recent American shells which conform to Dr. Dall's definition, and for their fossil representatives.

*Venus gallina*, the type of Mörch's *Chamelea*, is another exceptional form which is allied to the *V. tiara* group, and seems to be connected

with it by some fossil species, both in Europe and America. It may therefore be regarded as a section of *Clausinella*, which will thus become a sub-genus of as much importance as *Chione*. In this appreciation of *Clausinella* I find myself in accord with Messrs. Cossmann and Peyrot, but they have made the mistake of including *V. plicata* in the group and several fossil species which do not belong to it.

My reasons for the elevation of the group named *Protothaca* by Dr. Dall to the rank of a genus will be given in the sequel, but, briefly stated, they are that when one species included in the group by that author has been restored to *Chione*, and another one to *Tapes*, the remainder form a small genus which can be satisfactorily defined, and which seems to be intermediate between *Chione* and *Tapes*.

Under the head of *Clementia* it will be found that I have separated certain recent species as a new section with the name of *Terentia*, and I desire to thank Mr. MacAndrew for giving me the opportunity of examining his specimens of these rare species. The Cretaceous fossils, for which I created the sub-genus *Flaventia* in 1908, have again occupied my attention, and the examination of the interior of a left valve of *Fl. ovalis*, preserved in the Royal Albert Museum at Exeter, has confirmed my opinion of the relationship between *Flaventia* and *Clementia*.

I have included *Clementia* and *Cyclina* in this sub-family because of their conchological characters, which, in the Lamellibranchs and for the purposes of classification, I consider to be of more importance than the small differences which are observable in the animals within the limits of a family. I am aware that Deshayes described the animal of *Clementia papyracea* as resembling that of *Dosinia*, and as having completely united siphons and a compressed hatchet-shaped foot; so that if we trusted to the characters presented by the animal of this species we might place *Clementia* in the Meretricinæ near *Dosinia* or *Pitaria*, which latter, according to Adanson, has an animal of similar structure.

But we have no detailed information about other species of *Clementia*, except that Dr. Dall has recently stated<sup>1</sup> that the animal of *Cl. subdiaphana* (an American species) is 'veneroid'. He does not explain what he means by this term, but it can only mean that the siphons are wholly or partially free and that its foot is tongue-shaped, and he has consequently referred this species to his genus *Marcia* (i.e. *Samarangia*). There can be no doubt, however, that the shell and dentition of *C. subdiaphana* is more like that of *Clementia* than that of *Samarangia*, and that it is still more different from the fossils called *Venerella* by Cossmann. Hence I agree with Carpenter in regarding *subdiaphana* as a species of *Clementia*, akin to *C. ratheleti* and *C. cumingi*, and, if their animals differ from that of *C. papyracea*, it may be convenient to establish them as a section or sub-genus. Probably, however, the differences are no greater than those which exist between different species of *Tapes*, as will be made manifest in the sequel.

<sup>1</sup> *Nautilus* for January, 1914, p. 103.

I have made a careful investigation of the shells which have hitherto been included in the genus *Tapes*, with the result that I propose its division into two genera and the transference of the *T. pullastra* group to the genus *Venerupis*. The reasons for this are discussed under the head of *Tapes*.

### Genus VENUS, Linnæus.

Animal with frilled or fringed mantle-margins. Siphons rather short and united for half their external length or more. Foot linguiform, thick or compressed, often extensile.

Shell oval or sub-trigonal, more or less inequivalve. Lunule and escutcheon generally well defined. Sculpture concentric or cancellate. Hinge-plate thick, with three divergent teeth in each valve, the left posterior being long, narrow, and adherent, or adjacent to the nymph. Pallial sinus small. In the right valve the posterior dorsal margin is always grooved, but in the left there is seldom any groove. Ventral margins crenulated.

#### *Sub-genera.*

**Venus** (s.s.), Lamarek, 1799. Type, *V. mercenaria*, Linn. Synonym: *Mercenaria*, Schumacher, 1817.

Shell ovate, convex, solid. Sometimes nearly smooth, sometimes ornamented with thin, concentric lamellæ and by faint radial striation on the posterior side. Teeth not widely divergent, not occupying more than a right angle; left anterior straight, right posterior and both medians generally grooved. Pedal scar separate from the adductor, with a thread-like channel between them. Pallial sinus triangular.

This group is restricted to the coasts of North America and Japan; it includes *V. campechiensis*, Gmelin (= *mortoni*, Conrad, and *fulgurans*, Tryon), *V. kennicotti*, Dall, *V. apodema*, Dall, and *V. stimpsoni*, Gould. Geologically it dates from the Oligocene, and several species have been described by Conrad and Dall from the Miocene and Pliocene of the United States.

**Chione**, Megerle, 1811. Type, *Venus cancellata*, Lam.

Shell oval or sub-trigonal, oblique or sub-equilateral. Sculpture always comprising concentric and radial elements. Hinge-plate short, teeth becoming solid and entire with growth, but both medians grooved when young, each set generally widely divergent.

Section *Chione* (s.s.). Shell oblong or obliquely trigonal, inequilateral, umbones prominent. Sculpture cancellate. Lunule and escutcheon always well defined. Pallial sinus small and angular. Pedal scar confluent with that of adductor. Marginal crenulation sometimes obsolete posteriorly.

This section includes *granulata*, Gmelin, *pectorina*, Lam., *subrostrata*, Lam., *crenulata*, Sow. (= *pubera*, Val.), *grata*, Say (= *histrionica*, Sow.), *undatella*, Sow., *succincta*, Val., *pulicaria*, Brod., *amathusia*, Phil., *gnidia*, Brod. & Sow., *asperrima*, Sow., *columbiensis*, Sow., *subrostrata*, Lam., *compta*, Sow., and *stutchburyi*,

Gray. These are all American species except the last, which is a New Zealand shell.

Section *Timoclea*, Brown. Type, *Venus ovata*, Pennant.

Shell oval and nearly equilateral, the umbones being generally sub-central and not prominent. Sculpture cancellate, and the radials sometimes stronger than the concentric ribs. Hinge-plate straight, and the anterior teeth directed forward so that there is a wide divergence. Nymphs high and rather short. Pallial sinus obtuse or rounded. Pedal scar separate from the adductor. Valve-margins strongly crenulated all round.

This section includes the following species—*lagopus*, Lam., *gallinula*, Lam., *australis*, Sow., *costellifera*, Ad. & Rve., *scabra*, Wood, *striatissima*, Sow., *marica*, Linn., *recognita*, Smith, *arakanensis*, Sow., *subnodulosa*, Sow., *siamensis*, Lyngé, *micra*, Pilsbry, *imbricata*, Sow., *lionata*, Smith, *pygmæa*, Lam. The only American species known to me which can be referred to *Timoclea* (as above defined) is *pygmæa*, which has an obtuse sinus and a separate pedal scar, though it is far from being equilateral.

*Anomalocardia*, Schum., 1817. Type, *Venus flexuosa*, Linn.

Synonyms: *Triquetra*, Anton after Blainville, 1818; *Cryptogramma*, Mörch, 1853.

Shell trigonal, convex, posteriorly attenuated and angulated. Sculpture mainly concentric, in broad rounded ribs crossed by finer radial riblets. Teeth solid and widely divergent. Nymphs rugose. Pallial sinus very small and sometimes obsolete. Pedal scar opening narrowly into that of adductor.

This is a small section only, including the species *flexuosa* (Linn.), *brasiliانا*, Gmelin (= *macrodon*, Hanley), *cuneimeris*, Conrad (= *rostrata*, Sow.), *subimbricata* (Sow.), *subrugosa* (Sow.), *puella* (Pfeiffer), and *leptalea* (Dall). All these, except the type, are American species. Dr. Dall regards *Venus squamosa*, Linn., as an *Anomalocardia*, and separates it as a section under the name of *Anomalodiscus*, but in my opinion both it and *subrostrata*, Lam., belong to the typical section of *Chione*, for I see no difference except in shape. On the other hand, *Venus impressa*, Hanley, has smooth ventral margins as well as smooth nymphs, and is consequently a remarkable exception to the crenulated margins of the genus. It might be regarded as a section with the name of *Cryptonema*, in allusion to the concealment of the radial striation along the margins.

*Clausinella*, Gray, 1851.

Synonyms: *Circumphalus*, Mörch, 1853 (no type specified); *Anaitis*, Römer, 1857 (in part), not of Duponchel, 1829.

Shell with dominant concentric sculpture of strong ribs or ridges, radial striation being absent or obscure. Teeth widely divergent and solid in the adult, though the medians are often feebly grooved in young shells. Lunule and escutcheon well defined, but the latter more marked in the left valve. Nymphs striated and sometimes rugose. Pallial sinus very small, angular or rounded. Pedal scar very narrowly connected with that of adductor.

*Clausinella*, s.s. Type, *Venus fasciata*, Da Costa.



Shell sculptured in regular concentric ridges, which do not rise into erect lamellæ, and seldom show any radial striation. Interspaces finely concentrically striated. Nymphs with one or two longitudinal striæ.

The majority of the species belonging to this section occur in the Indian, Australian, and Pacific regions. They include *tiara*, Dillw., *foliacea*, Phil., *roborata*, Hanley, *isabellina*, Phil., *berryi*, Gray, and *roseotincta*, Sow. In Europe it dates back to the *Helvetian* stage of the Miocene (*V. dertoparva*).<sup>1</sup>

*Lirophora*, Conrad, 1864. Type, *Venus athleta*, Conrad.

Shell sculptured in thick concentric ridges, which are rounded in the centre, but pass into erect lamellæ posteriorly, and often show radial striæ on their ventral sides. The interspaces are concentrically striated. Nymphs more or less rugose.

This group is chiefly American, and includes *V. paphia*, Linn., *V. mariæ*, d'Orb., *V. peruviana*, Sow., and *V. kellestii*, Hinds. In Florida it appears to date back to the Oligocene, and there are many Miocene species.

*Chamelea*, Mörch, 1853. Type, *Venus gallina*, Linn.

Synonyms: *Ortygia*, Brown, 1827 (not of Boie, 1826); *Hermione*, Leach, 1852 (not of Blainville, 1828); *Chamelea*, Adams, 1857.

Shell sculptured in narrow close-set concentric rounded riblets, which are often oblique and irregular; the radial striæ are sometimes faintly visible. Nymphs nearly smooth. Pallial sinus angular.

*V. interpurpurea*, Conrad, of the Caribbean Sea, and *V. crassa*, Q. & G., of New Zealand, may be referred to *Chamelea*, and the group dates back to the Miocene epoch in Europe (*V. cothurniæ*, Dujardin), and to the Oligocene in the United States.

**Salacia**, Jukes-Browne, 1914. Type, *Venus lamellata*, Lam. Etym.: *Salacia*, the wife of Neptune.

Shell oblong or oval, flattened at the umbones, with distant, thin, erect, or recurved concentric lamellæ. Lunule small and lanceolate. Escutcheon only defined in left valve. Median teeth always bifid. Nymphs smooth. Margins feebly crenulate. Pallial sinus moderately deep. Pedal scar long, narrowly confluent with adductor.

This group seems to be restricted to Australia and New Zealand. It comprises *Chione yatesi*, Gray, and *Ch. jacksoni*, Smith, and perhaps *C. calophylla*, which links it with *Clausinella*.

*Bassina*, J.-Br., 1914. Type, *Venus paucilamellata*, Sow. (= *V. alata*, Reeve). Dedicated to Lieut. Bass, after whom Bass' Straits were named.

Shell sub-trigonal, thick, convex, brownish, concentrically striated with only a few erect scales on the anterior slope. Escutcheon not defined. Both dorsal margins of the right valve grooved, and those of the left bevelled to fit.

The only species known occurs along the south coast of Australia and round Tasmania.

<sup>1</sup> It was by mistake that this species was referred to *Circomphalus* on p. 74.

Genus *PROTOTHACA*, Dall, 1902.

Type, *Chama thaca*, Molina (= *Venus dombeyi*, d'Orb.).

This group of shells was separated by Dr. Dall in his "Synopsis of the Veneridæ",<sup>1</sup> and placed as a sub-genus of *Tapes*. I have protested against this allocation on two previous occasions, holding that the species which he took as his type, i.e. that usually known as *Venus dombeyi*, is much more closely allied to *Venus* and *Chione* than to *Tapes*. A careful examination of all the species which Dr. Dall then included under the name *Protothaca* has convinced me that they do not form a homogeneous natural group, but a heterogeneous assemblage. One of the species belongs to the typical section of *Chione*, another is an abnormal form of *Tapes*; but the rest (including the type) do present peculiarities which distinguish them both from *Chione* and *Tapes*, and possess characters which make it inconvenient to class them as a sub-genus of either.

The fact is that Dr. Dall's diagnosis only records some of the differences between *Protothaca* and *Chione*, and those are chiefly superficial differences. He dwells chiefly on the external sculpture, and does not say a word about the disposition of the teeth, nor does he sufficiently distinguish the group from *Tapes*. The sculpture, being partly concentric and partly radial, differs little from that possessed by the typical section of *Chione*, and would not entitle the shells to more than sectional value, but there are points of much more importance, and one of these is the closer approximation of the teeth. No doubt this was perceived by Dr. Dall, and was the chief reason for his placing the shells under *Tapes*, although he does not say so, nor does he distinguish *Tapes* from *Chione* by the divergence of the teeth.

It is a fact, however, that in *Protothaca* both the posterior cardinals are shorter than in *Chione*, the left posterior being a short oblique tooth crossing the hinge-plate on a line nearly parallel to the hinder side of the median, while in *Chione* it is a long tooth, parallel to the base of the ligament. *Protothaca* resembles *Chione* in having a strong hinge-plate, and consequently there is a space between the left posterior cardinal and the base of the ligament. The ligament itself is very long, extending nearly to the end of the posterior dorsal slope, the consequence being that the groove, which is usually found on this margin of the right valve, is in *Protothaca* merely a short indentation for the reception of an equally short projection on the left valve. In this respect it differs from *Chione*, and resembles some forms of *Tapes*, such as *T. decussatus* and *T. pullastra*.

The following is a list of the recent species which are referred to *Protothaca* and its section *Callithaca* by Dr. Dall:—

*Chione grata*, Say (= *Venus discors*, Sow., and *V. histrionica*, Sow.).

*Chama thaca*, Molina (= *Venus dombeyi*, d'Orb.).

*Chione rudrata*, Desh.

<sup>1</sup> Proc. U.S. Nat. Mus., vol. xxvi, p. 364, 1902.

- Ch. petiti*, Desh. (as *Saxidomus*; = *Venus rigida*, Gould, and *Tapes diversa*, Sow.).  
*Ch. staminea*, Conrad (= *Venus mundulus*, Reeve).  
*Tapes orbella*, Carpenter.  
*T. laciniata*, Carp.  
*T. tenerrima*, Carp. (the type of *Callithaca*, Dall).

Of these eight species I consider the first to be a typical *Chione*, for it has the teeth of *Chione* with the left posterior parallel to the nymph, and it may be regarded as the Pacific analogue of the Caribbean *Ch. granulata*, which Dr. Dall himself classes as a *Chione*. The last species on the list is very different from all the others, and I regard it as a form of *Tapes*. The remaining six species do form a special group with characters of their own; they differ from *Chione* in the features already mentioned, as well as in the greater depth of the pallial sinus. The sub-genus of *Tapes* which they most nearly resemble is *Ruditapes* (*T. decussata*), but from this they differ in the following particulars, i.e. in having—

1. A stronger hinge-plate with a broader anterior expansion.
2. Longer and stronger teeth.
3. Smooth nymphs, never corrugated.
4. Left anterior tooth entire, not grooved.
5. Crenulated valve-margins.
6. Pedal scar confluent with adductor.

The fact is that the *Protothaca* group has characters which make it inconvenient to include it either under *Venus* or under *Tapes*, and I therefore propose to consider it a genus, especially as I believe the following species may also be referred to it, *Chione jedoensis*, Lischke, *Ch. hirasei*, Pilsbry, *Ch. costata*, Q. & G., and possibly the shell known as *Petricola elliptica*, Sow. (from Peru). The group is essentially a Pacific one, and may be defined as follows:—

Shell oblong, of dull white, yellow, or brownish colouring, sculpture more or less cancellate, but the radial ribs often becoming dominant. Lunule defined, but escutcheon absent, or only defined in the left valve. Ligament very long and prominent. Hinge-plate strong and deep; teeth separate and rather near together, both medians bifid, and both posteriors more oblique than in *Chione*. Nymphs smooth. Pallial sinus fairly deep and rounded in Californian species, short and subangular in others. Pedal scar confluent at top with that of the adductor. Ventral margin crenulated, but often becoming smooth posteriorly. Ridge and groove on dorsal margins very short.

Dr. Dall describes the animal of the type as having short siphons which are united to their tips, the foot hatchet-shaped (? linguiform), and not byssiferous nor exhibiting even a byssal groove.

There is another shell which I am inclined to place under *Protothaca* in spite of the fact that its margins are entirely smooth, and that it was placed under '*Marcia*' by Dr. Dall. This is the *Venus rufa*, Lam., a large, thick, oval shell which has a curiously curved hinge-plate and teeth, which are quite different from those of *Samarangia*.

I propose to make it a sub-genus of *Protothaca* with the name of *Rhomalea*, from *ῥομαλεός*, strong. It can be defined thus:—

*Sub-genus.*

**Rhomalea**, J.-Br., 1914. Type, *Venus rufa*, Lamarek. Habitat, Peru.

Shell similar to *Protothaca*, but nearly smooth; showing faint radial striae all over the surface, obscured on the anterior side by stronger concentric striae. Ligament very large and prominent. Hinge-plate curved and both posterior teeth very short. Interior margins smooth, pallial sinus sharply pointed. Pedal scar small and separate from that of adductor. *Venus kenneerlyi* may perhaps be associated with *rufa*, as its dentition and sinus are similar.

Genus **SAMARANGIA**, Dall, 1902.

Shell oval or sub-quadrate, concentrically striated or minutely reticulated. Inner margins of valves smooth. Lunule flat, circumscribed. Escutcheon not defined. Hinge-plate short, with a flat or concave anterior expansion. Teeth divergent, three in each valve, the left anterior and median united at top, and fitting over the right anterior; left posterior generally long and partly confluent with the nymph. Pallial sinus fairly deep. Pedal scar more or less confluent with that of the adductor.

*Samarangia*, s.s. Type, *Venus quadrangularis*, Ad. & Rve.

Shell solid, sub-quadrate, dull white. Ligament long. Valve-margins smooth. Pallial sinus horizontal, linguiform, and pointed. Pedal scar oval, very narrowly confluent with that of adductor. So far as my own knowledge goes, this section only includes *quadrangularis*, *lenticularis*, Sow., and *exalbida*, Chem.

*Sub-genera.*

**Mercimonia**, Dall, 1902. Type, *Venus bernayi*, Cossmann (Eocene fossil).

Shell sub-orbicular, substantial, convex, concentrically striated. Lunule feebly defined, ligament sunk. Hinge-plate deep, and anterior concavity well developed. Right posterior tooth widely bifid, and both posteriors curved. Left median and anterior united at top and both entire. Posterior marginal groove long. Pedal scar confluent with that of adductor. Pallial sinus variable in depth and shape.

A perusal of the description given by Messrs. Cossmann and Peyrot of *V. dujardini* of the Bordeaux Miocene, and the examination of a left valve, for which I am indebted to Professor Peyrot, have convinced me that it belongs to the same group as the Eocene shells described by M. Cossmann and mentioned by me in a previous volume of these Proceedings (vol. viii, p. 169).

**Textivenus**, Cossmann, 1886. Type, *Venus texta*, Lam. (Eocene).

Shell small, oval, ornamented with raised obliquely reticulate striae. Valve-margins smooth. Only right posterior margin grooved. Pallial sinus ascending. Pedal scar narrow, and confluent with that of adductor.

## Genus GOMPHINA, Mörch, 1853.

The isolation of *Gomphina* as a genus was discussed and maintained by me in 1909,<sup>1</sup> and at the same time it was pointed out that the small group of shells now known as *Liocyma* seemed to stand in the relation of a sub-genus. Since then I have ventured to affiliate the small American shells called *Psephis* by Carpenter in 1864, but renamed *Psephidia* by Dr. Dall in 1902, and I have also described a new sub-genus under the name of *Acolus*, based on a species from the Falkland Islands which was referred to *Psephis* by Messrs. Preston and Cooper in 1910.<sup>2</sup> The species of *Gomphina* proper are only found on the western side of the Pacific Ocean from Australia northward to Japan, and the other groups are entirely American.

Generic characters: Shell trigonal or oval, solid, smooth or concentrically striated. Lunule flat, circumscribed. Escutcheon not defined. Valve-margins smooth or tangentially grooved. Right posterior and left anterior dorsal margins grooved to receive the opposite bevelled margins. Hinge-plate short and triangular; teeth equally divergent, and both medians generally grooved. Pallial sinus small. Pedal scar separate from that of the adductor.

*Gomphina*, s.s. Type, *Venus donacina*, Chem.

Shell trigonal, smooth, and near equilateral. Three teeth in each valve, the left posterior confluent with the nymph, and sometimes rugose, as also the right nymph. Pallial sinus short and rounded.

*Sub-genera.*

**Psephidia**, Dall. Type, *Psephis lordi*, Baird.

Shell small, smooth, sub-equilateral. Left posterior tooth free. Inner margins tangentially grooved and microscopically crenulated. Pallial sinus short, triangular.

**Acolus**, Jukes-Browne. Type, *Psephis foreolata*, Preston & Cooper.

Shell small, trigonal, equilateral. Teeth 3 in the left valve, 2 in the right. Ventral margins smooth, but dorsal margins striated. Pallial line very slightly inflected.

**Liocyma**, Dall. Type, *Venus fluctuosa*, Gould.

Shell oval, inequilateral, oblique, concentrically striated. Three teeth in each valve. Pallial sinus short and rounded. Valve-margins smooth.

## Genus CLEMENTIA, Gray, 1842.

Animal having long siphons, united for their whole length, with plain orifices. Foot compressed and sub-quadrate (or hatchet-shaped) like that of *Dosinia*. Mantle-margins plain.

Shell oval or oblong, convex, thin or substantial, sculpture generally concentric and feeble, but sometimes reticulate. Lunule indefinite or feebly defined. Escutcheon generally depressed, but not defined. Valve-margins smooth, and right posterior dorsal margin grooved. Hinge-plate weak or strong in relation to the thickness of the shell, with a concave expansion in front of the teeth;

<sup>1</sup> See Proc. Malac. Soc., vol. viii, p. 233.

<sup>2</sup> See Ann. Mag. Nat. Hist., vol. xii, p. 479, 1913.

three divergent teeth in each valve, the right posterior being generally bifid or composed of two laminae; the left posterior is a short tooth crossing the hinge-plate. Pallial sinus variable.

*Clementia*, s.s. Type, *Venus papyracea*, Gray.

Shell thin, oval, concentrically undulated and striated. Hinge weak, teeth separate, right posterior bifid or composed of two compressed plates, median and anterior near together, left median sometimes bifid. Pallial sinus generally subangular and ascending. Pedal scar large, oval, and opening narrowly into that of the adductor.

*Terentia*, Jukes-Browne, 1914. Type, *Clementia granifera*, Sow.

Shell thin, oblong, very inequilateral, ornamented with irregular divaricate or reticulate striae. No escutcheon. Hinge narrow, teeth short, and anterior concavity small; all the teeth entire, the right posterior being tall and narrow, the left very slight and feeble. Pallial sinus very large and deep, and partly confluent with the pallial line. Pedal scar large and confluent with that of adductor.

#### *Sub-genera.*

**Flaventia**, Jukes-Browne, 1908. Type, *Venus ovalis*, Sow. (a Cretaceous fossil).

Shell elongate-oval, fairly strong, with a defined lunule. Teeth all entire, except the right posterior, which is widely bifid, the hinder lamina being much longer than the other; left median narrow and oblique, anterior triangular. Pallial sinus deep, ascending and rounded.

**Psathura**, Deshayes. Type, *Venus fragilis*, Lam. (an Eocene fossil).

Shell thin. Teeth small; right posterior bifid, median grooved; all in left valve entire. Pallial line without inflection.

#### Genus *CYCLINA*, Deshayes, 1849.

Type, *Venus sinensis*, Gmelin.

Shell orbicular, convex, concentrically striated with subordinate radial striae in the typical section. No defined lunule or escutcheon. Hinge-plate well developed, with a short anterior and long posterior extension, so that the teeth only occupy a small space. Both posterior teeth are short, and traverse the plate obliquely. Right posterior and sometimes left median bifid. Pallial sinus deep and ascending. Pedal scar small and confluent with that of adductor.

*Cyclina*, s.s. Valve-margins crenulated. Pallial sinus angular in *sinensis*, but rounded in *flavida*, and subangular in *orientalis*.

#### *Sub-genus.*

**Cyclinella**, Dall, 1902. Type, *Dosinia tenuis*, Récluz.

Hinge-plate and teeth like that of *Cyclina*, but valve-margins smooth. Pallial sinus sharply angular, ascending.

#### Genus *GEMMA*, Deshayes, 1853.

As I have recently described this genus in the *Annals and Magazine of Natural History*<sup>1</sup> and have given a corrected description of it with

<sup>1</sup> Ser. VIII, vol. xii, p. 473, 1913.

reasons for regarding *Parastarte* as a sub-genus, I need only here quote the definitions there printed. It is a small group of small American shells which seems to stand by itself, though, by the characters of the hinge and the crenulation of the margins, it resembles *Chione* more than any other.

Shell small, oval or sub-trigonal, smooth or concentrically striated. Lunule large, superficially defined. No escutcheon. Hinge-plate short. Teeth widely divergent, the left posterior inconspicuous or obsolete, but, when present, parallel to the nymph; left median and right posterior bifid, all the rest entire. Right postero-dorsal and left antero-dorsal margins grooved to receive ridges on the opposite margins. Ventral margins finely crenulated.

*Gemma*, s.s. Type, *Venus gemma*, Totten.

Shell oval, striate. Three teeth in each valve. Marginal grooves long and deep. Pallial sinus generally rounded, ascending.

#### *Sub-genus.*

**Parastarte**, Dall. Shell thick, smooth, equilateral, and sub-trigonal. Three teeth in the right valve and only two in the left. Marginal grooves narrow. Pallial line only slightly inflected.

#### Genus CYPRIMERIA, Conrad, 1864.

Fossil shells of Cretaceous age, and represented by one small species in the Eocene of the Paris Basin.

Shell more or less orbicular, smooth or concentrically striated. Umbones small. Lunule superficial and feebly defined. No escutcheon. Hinge-plate prolonged anteriorly to form a concave space. Teeth widely divergent, the right posterior being so broadly bifid that its components form two separate teeth, while the median and anterior are directed forward. Left median thick and sometimes bifid.

*Cyprimeria*, s.s. Type, *Cytherea excavata*, Morton.

Shell sub-orbicular, compressed. Left median tooth thick, triangular and bifid; left posterior long and nearly parallel to the nymph. Pallial line with a very slight inflection.

*Cyclorisma*, Dall, 1902. Type, *C. carolinensis*, Conrad.

Shell oval or sub-orbicular, convex. Left median tooth entire, left posterior short and crossing the plate obliquely. Pallial sinus fairly deep, ascending and subangular.

#### Genus MARCIA, H. & A. Adams, 1857.

This genus and its separation from *Tapes* have been fully discussed in a previous paper.<sup>1</sup> The name was proposed by the Messrs. Adams in their *Genera of Recent Mollusca* in 1857 for a group of shells which they regarded as a sub-genus of *Chione*. By Römer, however, these species were included in his *Hemitapes* and *Katelsysia* groups, the former being regarded as a section of *Tapes*; and in 1887 Fischer recognized *Marcia*, as well as *Hemitapes* and *Katelsysia*, placing them

<sup>1</sup> Proc. Malac. Soc., vol. viii, p. 233, 1909.

all under *Tapes*. It was Dr. Dall in 1902 who first proposed to separate this assemblage as a genus under the name of *Marcia*, but he was mistaken in supposing that a type had been properly indicated, so that it was not until 1909 that *Venus pinguis* was definitely selected as its typical species, and that *Samarangia* was excluded from the genus. The following is an abstract of the generic definition then given by me:—

Shell oval or oblong, inequilateral and oblique, smooth or concentrically striated. Lunule well defined, but escutcheon only defined by absence of sculpture. Valve-margins smooth. Hinge-plate short, with three fairly strong, divergent, and nearly equidistant teeth; the right posterior and median, as well as the left median, are bifid or grooved, and frequently all the teeth are rugose. The right nymph and the left posterior tooth are striated with linear riblets; the posterior right and anterior left dorsal margins are grooved. Pallial sinus of moderate depth and rounded. Pedal scar separate from that of the adductor.

*Marcia*, s.s. Type, *Venus pinguis*, Chem.

Shell oval or oblong, convex, smooth or obscurely waved, often attenuated posteriorly. Lunule distinct and impressed. Teeth rather small and widely divergent, the left posterior rugose and confluent with the nymph, left anterior and median both grooved.

This group includes *V. nebulosa*, Chem., *paupercula*, Chem. (with the varieties *kochi*, Phil., *ambigua*, Desh., and *kraussi*, Desh.), ? *interrupta*, Koch., and *fumigata*, Sow. (= *laevigata*, Sow.). It inhabits the Indian Ocean from the east coast of Africa to Australia and the Philippine Islands.

#### Sub-genera.

**Hemitapes**, Römer, 1864. Type, *Venus rimularis*, Lam.

Shell oval or sub-trigonal, convex, and generally tumid. Sculpture of narrow irregular concentric ribs. Teeth short, the left posterior oblique and only in part adherent to the nymph; both the anterior teeth are tall and entire. Pallial sinus fairly deep.

This group is also East Indian and Australian, including *flammiculata*, Lam., *striata*, Chem., *cor*, Sow. (non Hanley), *philippii*, Desh., *marmorata*, Lam., *variabilis*, Phil. (with its varieties *laterisulca*, Sow., *orientalis*, Desh., *ustulata*, Desh., and *recens*, Sow.), *flammea*, Gmelin (= *radiata*, Chem.), and *recens*, Chem. (not Sow.).

**Katelysia**, Römer, 1857. Type, *Venus scalarina*, Lamarek.

Shell obliquely oval, compressed or convex, anterior side very short; sculpture of strong concentric ridges which are sometimes corrugated by radial ribs. Teeth nearly straight, but divergent, and all more or less rugose. Pallial sinus small, obtuse, or rounded.

This is a small group of Australian shells comprising *Venus strigosa*, Lam., *V. corrugata*, Lam., *V. peronii*, Lam., *V. aphrodina*, Lam., and *V. regularis*, Desh. To these may, I think, be added the shell described by Deshayes as *Saxidomus decussatus* and said to come from South America, but of which I have specimens from Japan.



The genus *TAPES*.

Even after the separation of *Marcia* and its allies, the shells which have been grouped under the head of *Tapes* form a heterogenous assemblage which is difficult to define in terms that would be applicable to all of them. If we neglect the variations in shape and external sculpture, and confine our attention to the internal characters, we find that the group typified by *Tapes litteratus* differs considerably from that which was called *Textrix* by Römer, and still more from the shell which is commonly known as *Tapes pullastra*, which last is in many respects more closely allied to *Venerupis* than to *Tapes* proper. So great is this resemblance that the cavicular variety of *T. pullastra* was supposed to be a distinct species by Lamarck, and was by him classed as a *Venerupis* under the name of *V. perforans*.

After a careful examination of the two assemblages which have gone under the names of *Tapes* and *Venerupis* I have come to the conclusion that they really form a connected series with *Tapes litteratus* at one end and *Venerupis irus* at the other; and further that it is almost impossible to frame a definition of the one that would exclude the other. Consequently I would either make one genus of them under the name of *Tapes* with *Venerupis* as a sub-genus, or divide the series into three genera which could then be more easily defined and distinguished. On the whole, and having special regard to the characters of the hinge, I prefer the latter arrangement, and find it more convenient to create a new genus for the shells which occupy an intermediate position between the two extremes.

Here, however, we are brought up against the thorny fence of priority in the selection of a name and type for this intermediate genus. The groups of which it can be formed are those for which the following names have been proposed: *Textrix*, *Paratapes*, *Pullastra*, *Politiitapes*, *Callistotapes*, and *Protapes*. Of these, *Pullastra* is the oldest, having been proposed by Sowerby in 1826, while the *Textrix* of Römer only dates from 1857, and was, moreover, preoccupied by Sundeval in 1833, so that the next name was *Paratapes* (Stoliczka, 1871). *Pullastra*, however, can only be recognized as a subsidiary group, whereas the type of *Paratapes* is the first species on Römer's list of *Textrix*, so that the one name could stand for the other, and could be defined so as to include the same species.

Under the International Rules, however, the oldest name in any assemblage of groups must be taken as the generic name, and, if we submit to this ruling, *Pullastra* would be the name of the genus, and *Paratapes* would have to rank as a sub-genus. The only other way out of the difficulty is to detach *Pullastra* from the intermediate genus, and to consider it as a sub-genus of *Venerupis*. This indeed I regard as the most convenient and most natural arrangement of the several groups, for *Pullastra* is intimately connected with *Venerupis* through the species which were separated by the Messrs. Adams under the name of *Myrsus*. Some of these species have since been referred to *Tapes* and some to *Venerupis* by different authors, but they are best united under the head of *Pullastra*.

It must here be remarked that a genus *Pullastra* was first proposed by Sowerby in 1826,<sup>1</sup> and it included most of the species which Megerle and Lamarck had respectively allotted to their genera *Tapes* and *Venerupis*. One can only suppose that Sowerby was ignorant of Megerle's name, and did not agree with Lamarck's separation of *Venerupis*. Anyway, the name might have been dropped as a synonym of *Tapes* if it had not been revived by subsequent authors for a section of that genus. The Messrs. Adams used it in 1857 for a group of species which did not include *V. pullastra*, a group which was in the same year called *Paratapes* by Römer. Under the International Rules a genus which contains a species bearing the same name must take that species as a type; consequently Fischer was right in giving *Tapes pullastra* as the typical example of his section *Pullastra*, and Dr. Dall was right in definitely indicating that species as the type of a sub-genus *Pullastra*.

Lastly, with regard to the animals of the different forms of *Tapes*, the differences which exist between them are not in very close correlation with the differences of the shells, and would not lead us to the same generic grouping. If, for instance, we were to group them in genera according to the partial union or the total separation of the siphons, we should get a different classification from that based on the characters of the shells.

Thus *Tapes litteratus* has long and nearly equal siphons which are entirely separate from one another. In *Paratapes euglyptus*, for a specimen of which I am indebted to Mr. Hirase of Kyoto, the siphons are also quite free and separate from one another, but in *Polittapes* (both *rhomboides* and *latus*) the siphons are united for about half their length. Again, in *Tapes decussatus*, the type of *Amygdala*, the siphons are free and separate, but in *Tapes philippinarum* (sent me by Mr. Hirase) they are united for three-quarters of their length.

The differences in the foot also show the same want of correlation. In *T. litteratus* the foot is long and tongue-shaped, but does not possess a byssus, nor even a byssal groove, so far as I could see in the spirit-preserved specimens sent me by Mr. J. Banfield of Dunk Island, Queensland. In *Paratapes* the foot is very large, thick, and elongated, and there is no trace of a groove at its base, while in *P. rhomboides*, and in the *aureus* group, the foot is rather small, with a byssal groove, and *castrensis* is said to have a small byssus. *Tapes decussatus* has a small byssus, while *T. philippinarum*, or, at any rate, the specimen examined by me, has only a groove; both have a broad lanceolate foot, not thick, but rather compressed.

The distribution of these Tapesine genera at the present day is interesting, for the restricted section of *Tapes* is essentially tropical, being only found in the Indian Ocean and in the western Pacific from Japan to the northern parts of Australia.

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<sup>1</sup> Genera of Shells, Zool. Journ., vol. iii, p. 134.

*Amygdala* has a wider range, extending from the west coast of Europe through the Mediterranean and the Indian Ocean to the Philippines, Australia, and New Zealand. *Callithaca* is the only American representative.

The typical section of *Paratapes*, again, is Indo-Pacific, the type being quoted from Natal, India, Tasmania, but *Polinitapes* is restricted to the Mediterranean and the western coasts of the Old World.

It has been supposed that the name *Amygdala* could not be used for a mollusc because it was preoccupied for an Echinoderm. This idea was based on a statement of Agassiz, who referred to "*Amygdala*, Van Phelsum, 1774", but Mr. Sherborn found that this was a mistake, and that the name did not occur in Van Phelsum's work on Echinoderms (see Index Animalium, p. 46). Neither can the name be rejected on account of the *Amygdalum* of Megerle (1811); consequently it can be accepted from Römer (1857), and since his first species was *Tapes decussatus*, and this has been given in textbooks as the typical example of *Amygdala*, that species should be regarded as the type.

The several groups above-mentioned are distributed in the three genera *Tapes*, *Paratapes*, and *Venerupis* as follows.

#### Genus *TAPES*, Megerle, 1811.

Shell oblong, inequilateral, and generally expanded posteriorly; concentrically striated or radiately ribbed. Lunule defined, but escutcheon often obscure. Ligament long and prominent. Hinge with three divergent teeth in each valve, only three of the six being bifid; the left posterior directed backward so as to be nearly parallel to the nymph. Valve-margins smooth. Pallial sinus fairly deep, horizontal, and rounded.

*Tapes*, s.s. Type, *Venus litterata*, Linn.

Shell rather compressed, with small flattish umbones, concentrically striated or grooved. Escutcheon defined, but narrow. Left median tooth broad, triangular, and deeply bifid. Pedal scar separate from adductor.

Besides the varieties of *T. litteratus* this group includes *T. turgida*, Lam., *T. sulcaria*, Lam., *T. deshayesi*, Hanley, *T. similis*, Desh., and *T. phenax*, Pilsbry.

#### Sub-genera.

***Amygdala***, Römer, 1857. Synonym: *Ruditapes*, Chiamenti, 1900.

Shell convex, bearing radiate ribs which are more or less decussated by concentric ridges. Escutcheon not defined. Hinge-plate narrow and curtailed behind, so that the posterior teeth are both very short. Pallial sinus deep. Pedal scar small and narrowly confluent with that of the adductor.

This group includes *Tapes indicus*, Sow., *T. variegatus*, Sow., *T. philippinarum*, Ad. & Rve., *T. bruguieri*, Hanley, and *T. intermedia*, Q. & G.

**Callithaca**, Dall, 1900. Type, *Tapes tenerrima*, Carpenter.

Shell broadly oblong, sculptured, with fine radial riblets, crossed by distant concentric ridges. Hinge-plate long with a space in front of the teeth. Dorsal margins not grooved; ventral margin feebly crenulated when young, but smooth in adult. Pallial sinus very long and turned up at the end. Pedal scar elongate, separate, with a connecting canal.

This species appears to stand by itself, and its dentition is very different from that of *Protothaca*, with which Dr. Dall placed it.

#### Genus PARATAPES, Stoliczka, 1871.

Synonyms: *Pullastra*, Adams; *Textrix*, Römer, 1857 (not of Sundeval); *Eutapes*, Chiamenti, 1900; *Paphia*, Dall after Bolten, 1902; *Protapes*, Dall, 1902.

Shell smooth or concentrically ribbed; generally coloured with a glistening brownish periostracum. Lunule defined, but not the escutcheon. Hinge-plate narrow, teeth short, near together, slightly divergent, and of nearly equal length. Right dorsal margin grooved. Pallial sinus moderate and rounded. Pedal scar always separate from that of adductor.

*Paratapes*, s.s. Type, *Venus textilis*, Linn. (= *textus*, Chem.).

Shell oblong-elongate. Two of the teeth in each valve bifid or grooved, and the posteriors curved. Pallial sinus obtuse and ascending.

This section includes *undulatus*, Born, *rotundatus*, Linn., *sulcosus*, Sow., *amabilis*, Phil., *semirugatus*, Phil., *politus*, Sow., *graffei*, Dunker, *schnellianus*, Dunker, *inflatus*, Desh., *meroeformis*, Sow., *liratus*, Phil., *euglyptus*, Phil., *malabaricus*, Chem., and *declivis*, Sow.

*Polititapes*, Chiamenti, February, 1900. Type, *Venus aurea*, Gmelin.

Synonym: *Callistotapes*, Sacco, April, 1900 (type, *Tapes vetulus*).

Shell oval or oblong, concentrically grooved, with sometimes obscure radial striation. Pallial sinus nearly horizontal.

This is a small group of European and West African shells which seems to take the place of *Paratapes* in those regions. There are a number of Mediterranean forms which some regard as varieties of *aureus*, but *latus*, Poli, *texturatus*, Lam. (= *petalina*), and *castrensis*, Desh., seem good species. Other species are *rhomboides*, Penn. (= *virgineus*, auctorum), British, and *durus*, Sow., from West Africa. It has fossil representatives in the Miocene and Pliocene deposits.

#### Genus VENERUPIS, Lamarek, 1818.

Type, *Venus irus*, Linnæus.

Shell oblong, often irregular from its nesting habit. Sculpture of radial lines or riblets, crossed by concentric ridges or striæ. Lunule indefinite. Escutcheon not defined, or only on left valve. Hinge-plate very short and narrow, excavated and curtailed posteriorly, so that all the teeth are very short, near together, and nearly parallel to one another. Two of them in each valve are bifid or grooved, but the teeth are often irregular and malformed. Groove on the posterior dorsal margin obsolete. Ventral margin smooth. Pedal scar separate from adductor.

*Venerupis*, s.s. Type as above. Shell with radial riblets crossed by distant concentric ridges. Escutcheon defined by a ridge in the left valve. Pallial sinus generally short, subangular, and ascending.

*Claudiconcha*, Fischer, 1887. Type, *V. monstrosa*, Chem.

Shell very irregular and inequivalve, the posterior margin of the right valve so expanded as to overlap that of the left. Escutcheon not defined. Pallial sinus variable.

The typical section of *Venerupis* includes *V. elegans*, Desh., *V. exotica*, Lam., *V. lamellifera*, Conrad, *V. crenata*, Lam., *V. carditoides*, Lam., *V. planicosta*, Desh., *V. mitis*, Desh., *V. pulcherrima*, Desh., and possibly *V. diemenensis*, Q. & G.

*Claudiconcha* includes *V. cumingi*, Desh., and *V. madreporica*, Jonas.

#### Sub-genus.

**Pullastra**, Sowerby, 1826. Type, *Venus pullastra*, Mont.

Shell with shallow radial or corrugated concentric sculpture. Escutcheon not defined. Pallial sinus large and deep, sometimes touching the pallial line below. Pedal scar separate.

The other species are *P. geographica*, Lam., *P. fabagella*, Desh., *P. galactites*, Lam., *P. corrugata*, Chem., *P. cumingi*, Sow., *P. disrupta*, Sow., and ? *P. dactyloides*. I see no reason for separating the four last as a distinct section under the name of *Myrsus* (Adams); some specimens of *P. pullastra* are nearly as rough as *corrugata*, and the pallial sinus varies both in depth and width. Moreover, two species generally assigned to *Venerupis*, viz. *V. rugosa* and *V. siliqua*, have a deep rounded pallial sinus, and are better placed under *Pullastra* than under *Venerupis*.

#### Genus BARODA, Stoliczka, 1871.

The separation of this genus from *Tapes* was advocated by me in 1908,<sup>1</sup> and at the same time I pointed out the close resemblance between the hinges of *Baroda* and *Venerella*, the former being a Cretaceous fossil and the latter being small oval shells found in the Eocene of the Paris Basin. I see no reason to alter the opinion then formed, because the similarity of the dentition is to my mind of more importance than the dissimilarity of shape; but those who think otherwise will doubtless agree with M. Cossmann in placing *Venerella* near *Mercimonia*. On my view the following is a comprehensive generic description.

Shell oblong or oval, concentrically striated, and sometimes also radiately ribbed. Lunule superficial. Escutcheon not defined. Hinge with three entire teeth in each valve, even the right posterior being entire and very narrow. In the right valve the anterior and median are placed under the umbo and directed forward, while the posterior is directed backward, so that there is a wide space between it and the median with an excavated border. In the left valve the teeth are more equally divergent, and the plate is excavated between each of them. Valve-margins smooth.

<sup>1</sup> Proc. Malac. Soc., vol. viii, p. 171.

*Baroda*, s.s. Type, *Venus fragilis*, d'Orbigny.

Shell oblong and much elongated posteriorly. Sculpture concentric only. Pallial sinus ample, horizontal, and rounded. Posterior teeth very long and parallel to the nymphs.

*Icanotia*, Stoliczka, 1871. Type, *Psammobia impar*, Zittel.

Shell similar to *Baroda*, but having well-marked radial sculpture.

*Sub-genus.*

**Venerella**, Cossmann, 1886. Type, *Venus hermonvillensis*, Desh.

Shell small, oval, short, concentrically striated. Hinge as above. Pallial sinus fairly deep, ascending, rounded. Pedal scar small, but apparently confluent with that of the adductor.

In the preparation of this account of the Veneridæ I have received much valuable assistance from Mr. J. C. Melvill and Mr. J. J. MacAndrew, who have most kindly lent me specimens in their collections for examination, and also from Mr. E. A. Smith, to whom I am indebted for much information, not only about shells in the British Museum but about matters which required reference to various publications. I have also to thank Mons. M. Cossmann, of Paris, and Professor Peyrot, of Bordeaux, for specimens of Eocene and Miocene species, and for information respecting other species from those formations.

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# MALACOLOGICAL SOCIETY OF LONDON.

## INCOME AND EXPENDITURE FOR THE YEAR ENDED DECEMBER 31, 1913.

Dr.	£ s. d.	Cr.	£ s. d.
To Balance from last year . . . . .	4 10 11	By Cost of "Proceedings"—	
Annual Subscriptions—		Printing and Postage . . . . .	£79 19 1
Ordinary Members . . . . .	£33 1 6	Illustrations . . . . .	11 16 10
Corresponding Members . . . . .	24 7 5		91 15 11
Annual Subscriptions in arrear—	57 8 11	Printing Circulars . . . . .	2 9 0
Ordinary Members . . . . .	£1 1 0	Cheque-book . . . . .	0 2 6
Corresponding Members . . . . .	1 17 6	Linnæan Society—	
Annual Subscriptions in advance—	2 18 6	Expenses incurred by use	
Ordinary Members . . . . .	£3 13 6	of Rooms . . . . .	£3 3 0
Corresponding Members . . . . .	1 3 0	Gratuities to Attendants . . . . .	2 10 0
Entrance Fees . . . . .	4 16 6	Secretary's Expenses . . . . .	5 13 0
Composition Fee . . . . .	5 15 6	Transfer to Special Fund . . . . .	3 8 3
Sale of "Proceedings" . . . . .	5 5 0	Balance . . . . .	7 13 0
Donations for Illustrations, etc. . . . .	44 9 8		22 0 9
Dividend on £50 Metropolitan 2½% Stock . . . . .	6 12 5		
	1 5 0		
	£133 2 5		£133 2 5
		<i>SPECIAL FUND.</i>	
To Balance from last year . . . . .	12 7 0	To Balance in hand January, 1913 . . . . .	£20 0 0
Transfer from General Account . . . . .	7 13 0		
	£20 0 0		

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. PONSOMBY, Hon. Treasurer.  
January 31, 1914.

M. CONNOLLY } Auditors.  
A. S. KENNARD }

## ANNUAL GENERAL MEETING.

FRIDAY, 13TH FEBRUARY, 1914.

The Rev. A. H. COOKE, M.A., D.Sc., F.Z.S., President, in the Chair.

Mr. F. W. Reader and Mr. F. H. Sikes were appointed scrutineers.  
The following report was read:—

“Your Council, in presenting their twenty-first Annual Report, refer with pleasure to the fact that the Society has now attained its majority, and may look back with extreme satisfaction on the amount of useful work accomplished during the period of its existence and published in the ‘Proceedings’ of the Society.

“The papers printed during the preceding year, details of which are given below, have maintained their usual standard of excellence.

“It is with great regret your Council have to record the loss by death of two members, Mr. R. Bruce Foote, F.G.S., and Mr. W. Moss, while, owing to resignation and other causes, four more names have been removed from the Society’s roll.

“During the year nine new members have been elected, so that the membership of the Society on December 31st, 1913, stood as follows:—

Ordinary members . . . . .	71
Corresponding members . . . . .	94
	<hr/>
Total . . . . .	165

“As regards finance, the position of the Society shows an improvement on last year’s figures. The current account shows a balance of £22 0s. 9d., while the special fund has £20 standing to its credit, one composition fee of £5 5s. having been added and £2 8s. transferred from current account. The Society, moreover, still holds the sum of £50 invested in Metropolitan 2½ per cent stock.

“Three parts of the ‘Proceedings’, forming the last half of Vol. X, have been issued during the year 1913. They consist of 134 pages of text, illustrated with 5 plates and 30 text-figures. A portrait of Lieut.-Col. H. H. Godwin-Austen, President of the Society 1898-9, was issued with Part V as a frontispiece to the volume.

“The following authors have very kindly contributed towards the cost of illustrations, or have furnished drawings or photographs for the plates or text-figures: C. R. Boettger, Rev. A. H. Cooke, T. Iredale, A. J. Jukes-Browne, Marquis de Monterosato, H. B. Preston, G. C. Robson, and H. Suter.

“The thanks of the Society are again especially due to the Council of the Linnean Society for permitting the meetings to be held in Burlington House as in previous years.”

On the motion of Mr. F. W. Reader, seconded by Mr. E. A. Smith, the above was adopted as the Annual Report of the Society.

The following were elected Officers and Council for the year 1914:—  
*President.*—Rev. A. H. Cooke, M.A., D.Sc., F.Z.S.



*Vice-Presidents.*—A. S. Kennard, F.G.S., R. Bullen Newton, F.G.S., H. B. Preston, F.Z.S., E. R. Sykes, B.A., F.L.S., F.Z.S.

*Treasurer.*—J. H. Ponsonby, F.Z.S.

*Secretary.*—G. K. Gude, F.Z.S.

*Editor.*—E. A. Smith, I.S.O.

*Other Members of Council.*—G. C. Crick, F.G.S., T. Iredale, C. Oldham, G. C. Robson, B.A., J. R. Le B. Tomlin, M.A., B. B. Woodward, F.L.S.

On the motion of Mr. H. Fulton, seconded by Mr. C. Oldham, a vote of thanks was passed to the Retiring Officers and Members of the Council and to the Auditors and Scrutineers.

#### ORDINARY MEETING.

FRIDAY, 13TH FEBRUARY, 1914.

The Rev. A. H. COOKE, M.A., D.Sc., F.Z.S., President, in the Chair.

The President delivered his Annual Address, entitled "Some Points and Problems in Geographical Distribution".

On the motion of Mr. B. B. Woodward, seconded by Mr. R. H. Burne, a vote of thanks was passed to Mr. Cooke for his interesting address, which it was resolved should be printed *in extenso*.

#### ORDINARY MEETING.

FRIDAY, 13TH MARCH, 1914.

The Rev. A. H. COOKE, M.A., D.Sc., F.Z.S., President, in the Chair.

The following communications were read:—

1. "Diagnoses of four new species of Land Shells from German New Guinea." By Cæsar R. Boettger.
2. "Characters of three new species of *Ennea* from Southern Nigeria." By H. B. Preston, F.Z.S.
3. "A Synopsis of the Veneridæ." Part II. By A. J. Jukes-Browne, F.R.S.

#### ORDINARY MEETING.

FRIDAY, 17TH APRIL, 1914.

R. BULLEN NEWTON, F.G.S., Vice-President, in the Chair.

The following communications were read:—

1. "A list of Australian Mactridæ, with a description of a new species." By E. A. Smith, I.S.O.
2. "On the generic name *Martensia*, Semper." By Tom Iredale.
3. "Some more notes on Polyplacophora." Part I. By Tom Iredale.
4. "Description of a new recent *Pholadomya* (*P. tasmanica*)." By C. Hedley and W. L. May.

Mr. B. B. Woodward exhibited a large specimen of *Helix desertorum*, with an abnormally high spire, and specimens of *Pisidium vincentianum* from Turkestan.

## OBITUARY NOTICES.

It is with much regret that we have to record the death on the 17th June last of William Moss in his 70th year.

He was one of the original members of the Society, but being a resident in the North of England he was scarcely ever able to be present at the meetings. He, however, contributed, in conjunction with Mr. W. M. Webb, one paper to the "Proceedings". Altogether he was responsible between the years 1892 and 1912 for nine different papers, issued in various journals, either entirely his own writing or in collaboration with W. M. Webb, F. Paulden, and A. E. Boycott.

His work in connexion with the Mollusca chiefly treated upon some points in the anatomy of certain Helicoid forms, and with special reference to the radulæ and genitalia. It is curious that the last paper from his pen was an obituary notice of his old friend Robert Cairns, published in 1912 in the *Journal of Conchology*, and in part vi of that publication issued in April this year some further information respecting himself is given by Mr. R. Standen.

For twenty-three years he was a member of the Conchological Society, where, as a regular attendant, his genial presence was greatly appreciated.

E. A. SMITH.

ROBERT BRUCE FOOTE, F.G.S., a member of the Society since 1894, died in India on the 29th December, 1912, aged 78 years. He was formerly senior Superintendent of the Geological Survey of India, having joined the staff of that institution in 1858, retiring in 1891 after a service of thirty-three years.

On leaving the Survey he became Geologist to the State of Baroda, issuing a valuable report on that area of India in 1898, which was published in Madras under the auspices of His Highness the Gaekwar of Baroda. His geological researches were mainly restricted to the Madras and Bombay Presidencies, most of his results appearing in the 'Records' and 'Memoirs' of the Geological Survey of India. He was also a great authority on the Palæolithic period of India, being specially interested in the history of flint implements.

His malacological work was chiefly in connexion with the fossils he collected during the various surveys in which he was engaged, consisting of lists of genera characterizing the various formations. One of the lists thus issued dealt with the Cretaceous fossils of Trichinopoli in Southern India, which contained references to some Cephalopod remains under the genera *Rhyncholites*, *Belemnites*, *Ammonites*, and *Baculites*, mention being also made of the Gastropoda and Pelecypoda met with in the same series of deposits (Records Geol. Survey India, vol. xii, pp. 159-61, 1879). Although a member of the Society for eighteen years, he never contributed a paper to its "Proceedings".

R. B. NEWTON.

NOTE.

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*PISIDIUM VINCENTIANUM* LIVING IN TURKESTAN. (*Read 17th April, 1914.*)—Amongst a number of *Pisidia* from Russian localities forwarded for determination by Herr W. A. Lindholm was one gathering from Tschatyr-Kul on the Thian-schan range, Turkestan, obtained in 1906 by D. D. Pedaschekon, that proved to be the first living examples of *Pisidium vincentianum*, B. B. Woodw. The species was originally described from specimens coming from the Pleistocene (Campinien) at Soignies, Belgium (Cat. Brit. *Pisidium*, Brit. Mus., p. 127), and it was noted at the time that the only species at all resembling it was the living *P. stewarti*, Preston, from Tibet. Its discovery, therefore, in Turkestan is both of interest and significance.

B. B. WOODWARD.

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## PRESIDENTIAL ADDRESS.

*(Delivered 13th February, 1914.)*

## SOME POINTS AND PROBLEMS OF GEOGRAPHICAL DISTRIBUTION.

By the Rev. A. H. COOKE, M.A., D.Sc., F.Z.S.

I RISE to address you to-night, in accordance with the custom—desirable perhaps from your point of view, quite the reverse from mine—which imposes upon your President for the time being the task of delivering an annual disquisition on some branch of malacological science. You will not expect from me, and you will certainly not receive, an address that will bear any comparison with those of my predecessors, in respect either of encyclopædic knowledge or powers of exposition. You must have been well aware, when you placed me in the position which I have the honour to occupy, that my hours of scientific leisure were but few, and that I was of necessity, though not of choice, in respect of the objects of our common worship, “*parcus deorum cultor et infrequens*.”

I propose for your consideration a few points and problems of Geographical Distribution, relating wholly to the Marine Mollusca. My endeavour will be, not so much to solve these problems as to raise them, perhaps to propose difficulties rather than to suggest explanations. One of the soundest ways of learning is, and has been from the time of Socrates till now, by grasping the fact of our own ignorance. And one has little fear that nature will have, even for our children’s children, no secrets still to be revealed.

Geographical distribution, if one may so put it, forms a kind of background or setting to the whole study of zoology. The subject of our investigation, whatever it may be, lives its life within a certain definite area or areas of the earth’s surface, to the exclusion of the rest—it is ‘here’ and not ‘there’. To state the fact is to invite the demand: Why are certain forms of life found in some localities and other forms in other localities? Modern science answers the question by pointing out a certain correspondence between the organism and its environment, between the circumstances of life and the power to live. When we find an organism living under surroundings, whether of food, light, temperature, soil, etc., which enable it to attain, so far as we can judge, the maximum of its efficiency, and produce descendants equally efficient, we speak of it as enjoying the optimum of environment, and, so long as this optimum of environment is maintained, so long, other things being equal, will the organism continue to live and flourish. On the other hand, if certain of its surroundings become continuously and considerably modified, if, in other words, the environment begins to decline from the optimum, the organism may and probably will be modified also in a manner adverse to its perfect development. And if this process of change in the environment becomes emphasized and prolonged, it may

be that surroundings are produced which are wholly unfavourable to the organism under consideration—in other words, it may be unable to sustain existence any longer.

So far as our present knowledge extends, we are unable to determine, with any approach to demonstration, what amount of modification in surroundings becomes unfavourable to the life of a particular species. Changes apparently insignificant on the one side produce, at times, profound modifications on the other, and it is seldom an easy matter to refer with certainty the production of a definite change in form to its *causa causans*, or, conversely, to predict with accuracy what particular modification of form will result from a known environmental change. For instance, specimens of *Littorina rudis*, Mat., from the coast of Labrador, are habitually much eroded,<sup>1</sup> and our common *L. obtusata*, L., as we follow it northwards in Norway tends more and more to assume the form known as *palliata*, Say; but no precise explanation of these modifications is forthcoming. Conversely, we cannot predict what particular change of form will occur when *Limnæa pereger* is found living in hot water, nor would it be reasonable to assume that all *Limnæa* living in hot springs were similarly modified. One thing is plain, that violent and rapid changes of condition destroy life, while gradual changes are readily tolerated. Even this rule would seem to have its apparent exceptions, for nothing is more striking than to note how certain common littoral marine species begin to die out or become rare on the coasts of South-West Sweden and East Denmark, where the water is not yet brackish. The water of the Kattegat can be but slightly affected by the diminished salinity of the Baltic, and yet we find that such species as *Purpura lapillus*, *Patella vulgata*, *Ostrea edulis*, and all the littoral Trochidæ, which are entirely wanting in the Baltic, are but feebly represented in that broad strait.

Science has long been accustomed to distinguish various areas or zones of distribution, the littoral, the laminarian, the nullipore, or coralline, and the benthal, abyssal, or deep-sea zone, each characterized by its own peculiar groups of Mollusca. Scientific expeditions, from those of the *Lightning* and *Porcupine* in 1868–70, and of the *Challenger* in 1873–6, down to the most recent dredgings of the Prince of Monaco in the *Hirondelle* and *Princesse Alice* in 1912, have established the fact that an increasing number of species are found to live at very distant points on the ocean floor, the uniformity of environment, the absence of sharp breaks in the conditions of life in the great depths, offering only slight barriers to dispersal, and admitting of the widely extended range both of genera and species. Thus *Scaphander punctostriatus* has been found off Spitzbergen, in the West of Ireland, the Azores, and off Culebra Island, West Indies; *Philine aperta* not only in the seas of Norway, the whole of Western Europe, and the Mediterranean, but also off the Canaries, the Cape Verde, the Cape of Good Hope, East Africa, and the Philippines.<sup>2</sup>

<sup>1</sup> K. J. Bush, Proc. U.S. Nat. Mus., vol. vi, pp. 236–47, 1883.

<sup>2</sup> N. Odhner, Kungl. Svensk. Vetensk. Handl., vol. xli (4), pp. 46, 55, 1907.

The *Challenger* dredged *Arca corpulenta* off North-East Australia in 1,400 fathoms, in mid-Pacific in 2,425 fathoms, and near Juan Fernandez in 1,375 fathoms; *Lima goliath* off South Japan in 775 fathoms, and off South Patagonia in 245 fathoms.

It is obvious, however, that our ability to study the vital conditions which govern the existence of the Mollusca, not only in these great depths, but even in comparatively shallow water, is infinitesimal as compared with our opportunities of studying the life conditions of Mollusca which live habitually between or not far below tide-marks. In the one case we can only do a little scraping of the bottom here and there, in the other we have the coastline of all the seas in the world to work upon. It seems possible that in the zeal for deep-sea exploration, which has been prosecuted with such signal success in every branch of marine zoology for more than forty years, we may have lost sight of the rich harvest of knowledge which must assuredly be reaped by a further study of the habits, mode of life, and distribution of the shore fauna, using the term to include the shallow-water fauna as well.

Let me indicate a few problems of distribution which may be said to be waiting for solution.

How does it come about that *Siphonaria*, a littoral genus which occurs in a profusion of individuals wherever it is found, is common throughout the Tropics, and ranges as far south as Cape Horn, the Falklands, St. Paul's Island, and Kerguelen Island, in an area of cold water, whose surface temperature in winter barely exceeds 40° F., and even in summer does not exceed 50° F., while at the same time, in European seas, it only reaches a point on the Spanish coast, somewhere north of Cadiz, where the summer surface temperature is 68° F. and the winter temperature is scarcely less than 60° F.? The same phenomenon is repeated on the south-east coast of North America, where *Siphonaria lineolata*, Orb., reaches its extreme northern range in Georgia, and *S. alternata*, Say, in East Florida and in Bermuda. On the other hand, on the west coast of North America, a species (*S. thersites*, Carp.) is reported from Vancouver and up to 57° N. lat.<sup>1</sup> Is it possible that at the present moment *Siphonaria* is spreading northward along the western shores of Europe and the eastern shores of America? If not, special investigation might throw light on the anomalies of its distribution.

The geographical range of *Patella* forms another subject of interest. It is a remarkable fact that, although many of our own littoral mollusca occur on the eastern and some also on the western coasts of North America, both East and West America, north of the Tropics, are destitute of *Patella* proper altogether. If we may assume that the focus of distribution of a genus is the area, be it great or small, within which the genus attains its largest number of species and its general maximum of development, the foci of the distribution of *Patella* are South Africa, and to a much less considerable extent Southern

<sup>1</sup> P. P. Carpenter, Report, 1863, p. 133 (647); G. W. Taylor, Trans. Roy. Soc. Canada, ser. II, vol. i (4), pp. 17-100, 1895.

Australia and New Zealand. Krauss<sup>1</sup> enumerates no less than twenty-one species of Cape *Patella*, which more modern investigation only reduces to seventeen. *Patella* proper occurs almost all over the world, but is not characteristic of the cold boreal or Antarctic waters. In the latter, as well as in the Californian region, it is largely replaced by the *Nacella* group, while in North Europe and the north-east coast of Asia it becomes rare in species. Our own *Patella vulgata*, L., finds its northern limit in the Faroe and Lofoden Islands; it does not occur in Iceland or in Greenland, and thus took no part in the spread of those littoral Mollusca which are conveniently described as 'circumpolar'. The *Helcioniscus* group of *Patella* spreads all over the Eastern Hemisphere and touches the Western at Chili, Juan Fernandez, and the Sandwich Islands, but is absent from West Africa, where *Patella* proper is strongly represented. On the western shores of North and South America *Patella* is replaced by *Acmæa*, except within the Tropics, where a few species of true *Patella* occur, amongst them the giant *P. mexicana*, Brod., ranging from Mazatlan and Acapulco to Paita, and occasionally measuring 14 inches in length. The fact is significant that *Acmæa* is entirely absent from all African waters, where *Patella* is so abundant, while it occurs liberally in certain districts, i.e. Western North America, from which *Patella* proper is absent. Yet it would not be safe to assume that the genera are mutually exclusive, or that shores not occupied by the one genus have been appropriated by the other. Further study of their distribution would probably throw light on these points. The scarcity of Patellidæ on the coast of East America may perhaps be due to the want of rocky surface to which they could attach themselves, the coast being, in the main, low-lying and sandy.

*Haliotis* is another genus, belonging in the main to shallow water, whose distribution would repay further investigation. Certain facts are plain: that Australia and the adjoining seas are the focus of its distribution, and that there are two well-marked sub-foci in Japan and North-West America. "Not one species<sup>2</sup> is found on the eastern coast of North or South America, and only one (*H. pourtalesii*<sup>3</sup>) on the west coast of America south of Lower California." The northern range of our own *H. tuberculata* is, as is well known, the Channel Islands, 49° N. lat. It would be interesting to know exactly how far north *H. kamschatkana*, Jonas, extends on the coasts of British Columbia and Kamschatka. Nothing definite seems to be known of the range of the South African species on the east and west coasts of that continent.

The distribution of *Purpura*, a very marked littoral genus, would amply repay careful study. Especially one would like to know the

<sup>1</sup> *Südafrikanischen Mollusken*, pp. 43-57.

<sup>2</sup> H. A. Pilsbry, *Manual of Conchology*, vol. xii, p. 73.

<sup>3</sup> Dredged in 33 f. sand, at Charles I., Galapagos. Pourtales dredged one living *Haliotis* (the specimen has since been lost) from the bed of the Gulf Stream, in 200 f., near Florida reefs. No specimens of *Haliotis* have since been found in the West Atlantic or Gulf of Mexico.

extreme north and south limits of our own *P. lapillus*, L., no less in Europe and Africa than on both sides of North America and in Japan, and whether Adanson was right or wrong when he enumerated it among the Mollusca of Senegal.<sup>1</sup>

*Purpura hæmastoma*, L., has long been known to inhabit both sides of the tropical Atlantic, from West Africa, the Mediterranean, and the coasts of Portugal and France on the one hand, to Brazil, the West Indies, and the southern states of Eastern North America on the other. But it is only of recent years that we have learned that *P. coronata*, Lam., has crossed the Atlantic too, and has appeared in Demerara<sup>2</sup> and Trinidad and in East Guatemala.<sup>3</sup> The West Indies have retaliated by sending to West Africa a form (*P. eudeli*, Sow.) whose relationship to *P. patula*, L., is so close as to leave no doubt of its origin, and scarcely any that it should be counted as a mere variety.<sup>4</sup> Has this process of exchange between the shores of the Atlantic at its narrowest part, over 1,600 miles, gone any further, e.g. in any form of *Littorina* possessing a free-swimming larva? The transit of the larval form from one coast to another would be facilitated by the remarkably equable temperature of the intervening water (a steady 77°–80° F. all the year round), by the absence of any strong north or south current, and by the more or less circulatory drift of water between the two continents.

If larval forms of *Purpura* can pass from West Africa to South America, and vice versa, it is easy to understand how *P. columellaris*, Lam., an obvious derivative of *P. patula*, L., became established at the Galapagos, only 600 miles from the nearest mainland. The heated water of the Bay of Panama follows the coast southward until it reaches Cape San Lorenzo, in lat. 1° S., where it is deflected westward, straight for the islands. Trees from the mainland, with the leaves still upon them, have been found cast up on the island shores. The molluscan fauna of the Galapagos thus exhibits large contributions from the Panamic and Peruvian regions, with a very slight admixture of the Indo-Pacific element.<sup>5</sup>

Again, *P. neritoidea*, L., is a common West African littoral shell. It is also found in the Cape Verde, 300 miles from the coast, and, as a variety scarcely distinguishable from the type, on Ascension Island, nearly 900 miles from the nearest African land.

Further research on the relationships of adjacent groups of *Purpura* would probably bring out valuable results, for the genus is almost worldwide and abundant in species and in individuals. Some light might be thrown on the remarkable way in which it is replaced, on the coasts of Chili and of the Magellanic and part of the Patagonian

<sup>1</sup> M. Adanson, Hist. nat. Sénégal: Coquillages; Paris, 1757, pp. 106–7, pl. vii, fig. 4.

<sup>2</sup> A. H. Cooke, Journ. Malac., vol. iv, p. 69, 1895.

<sup>3</sup> H. A. Pilsbry, Nautilus, vol. xiii, p. 130, 1900.

<sup>4</sup> The species was described by Sowerby in Journ. Conch., vol. x, p. 74, 1903.

<sup>5</sup> These facts are due to W. H. Dall, Report on a Collection of Shells from Peru, etc.: Smiths. Inst. Proc. U.S. Nat. Mus., vol. xxxvii, pp. 147–294, 1909.



province, by the singular toothed *Acanthina* (*Calcar*) and by *Concholepas*, both of which genera appear to have a wide but as yet undetermined range on the coasts of West America.

Similar attention might be paid to *Nerita* and also to *Littorina*, due regard being had to the fact<sup>1</sup> that, in the latter case, some species which live in the neighbourhood of high-water mark are viviparous, while others, which live at a lower tide-level, produce a trochosphere or veliger embryo. The exact distribution and economic habits of such widely spread species as *mauritiana*, Lam., *aspera*, Phil., the group which centres round *scabra*, L., *miliaris*, Quoy, and *malaccana*, Phil., would repay investigation and might bring out some interesting facts.

We still continue to speak of the distribution of marine Mollusca under the headings of 'districts' or 'provinces' or 'regions', or whatever name we choose to employ, and indicate the fact that certain wide areas or stretches of adjacent coast-land are characterized by the occurrence of certain genera and species, as contrasted with the phenomena observed in the case of other geographical areas. This method of subdivision is convenient, but it needs careful handling. The results of deep-sea dredging during the past few decades have accentuated the fact that these subdivisions apply solely to the Mollusca of the shore or of shallow water. And we must be careful to recollect that in scarcely any instance is it possible to draw a hard and fast line between one 'region' and another. On the contrary, adjacent regions seldom fail to overlap. On the west coast of America, for instance, the Magellanic region overlaps the Peruvian, and the Peruvian the Panamic, and the same is the case with the regions further north, the Californian and the Aleutian, while the Aleutian in its turn graduates into the north circumpolar region. All that we can allow ourselves to mean, when speaking of the limits of a region, is that at a certain point on the map we are able to say that the characteristic fauna of that region occurs infrequently, or is beginning to be sensibly replaced by a fauna characteristic of another region.

Some regions, owing to special geographical facts, may be more sharply defined than others, at one or at both extremes. If we were asked to cite the sharpest break in existence between one marine fauna and another we should lay our finger on Cape Hatteras, at which point a vast number of prominent tropical species find their northern limit. But how can we name a point of separation between, say, the Californian and Panamic, or between the Panamic and Peruvian regions? The main but not the only factor in determining the limits of a region is the surface temperature of the sea-water, as distributed by ocean currents.

The truth is that the present state of our knowledge, as regards the geographical limits of this or that fauna, is singularly defective. Large portions of coastline remain at present unexplored, and it is

<sup>1</sup> W. M. Tattersall, quoted by B. B. Woodward in Proc. Malac. Soc., vol. viii, p. 282, 1909.

only necessary to point to the map of Africa, from Morocco and the mouth of the Orange River, and from Lorenzo Marques to Cape Guardafui, or to the coast of China from the mouth of the Mekong to Korea, to show that at present our knowledge is limited to the species which have been collected at a few isolated spots, while no systematic exploration worth the name has as yet taken place. One is not without the hope that before long expeditions will be equipped with the sole object of exploring the fauna of *certain definite pieces of coastline*, more particularly those where geographical and faunistic regions, as at present understood, tend to merge into one another—the marchlands of adjacent kingdoms.

P. Fischer defines<sup>1</sup> the Lusitanian region as comprising the Atlantic coasts of France, Spain, and Portugal, the Mediterranean, the North-West African coast from Tangier to Cape Juby, and the Azores, Madeira, and Canary groups. Paul Pallary, after remarking<sup>2</sup> that recent researches tend to show that even the Mediterranean fauna is not yet completely known, continues as follows: “Si donc la faune d’une mer entourée de pays civilisés et d’une étendue relativement restreinte est encore incomplètement étudiée, quoi de surprenant que nous ne sachions que bien peu de chose sur celle des côtes occidentales de l’Afrique?” And he goes on to say that he found, between Cape Spartel and Mogador, *Patella compressa*, three species of *Yetus*, four of *Marginella*, including *glabella*, *monilis*, and *cornea*, and a *Pusionella*, all species characteristic of the Senegalian fauna, and never before recorded from so high a latitude. Already in the Canaries a considerable proportion of equatorial species occur, and he thinks that the tropical fauna comes up very high on the west coast of Africa, even reaching the Algerian coast, so that the limits of the old Lusitanian province or region must be modified and made to lie much further north, at least as far as the Straits of Gibraltar. And when one adds that the proposal implies the addition of at least 800 miles of coastline to the Senegalian region, it is quite clear that further exploration of obscure and remote coast-lands promises to provide us with plenty of material for discussion.

Conversely, M. Ph. Dautzenberg, remarking<sup>3</sup> on the molluscan fauna of the inhospitable coast between the bay of Lévrier and Sénégal (N. lat. 21°–16°), says that the proportion of ‘Mediterranean’ species which spread along the western coast of Africa is greater than has been supposed. Thus, in the collection under review, of ninety-eight Mediterranean species which occur, fifty-eight live in the Cape Blanco seas and thirty-four on the coasts of Mauretania and Senegal.

The problems involved are not of a simple nature, and may be complicated by all manner of interferences on Nature’s side. As an

<sup>1</sup> Man. de Conch., p. 143.

<sup>2</sup> Bull. Sci. France Belgique, vol. xli, pp. 421–5, 1907.

<sup>3</sup> “Sur les Mollusques marins provenant des campagnes scientifiques de M. A. Gruvel en Afrique occidentale, 1906–9”: Comp. Rend. Acad. Sci., vol. cxlix, pp. 745–6, 1909.

example of a district on which we are remarkably destitute of information we may take the whole South American coastline from Venezuela to Buenos Aires, and even further south. What little we know inclines us to believe that the Mollusca of these thousands of miles of coast is typically Antillean in character; at any rate *Purpura hæmastoma*, L., both typical and in varieties, is found as far south as Rio Grande do Sul (32° S.) and the mouth of the Rio de la Plata. That many thoroughly littoral species should be able to cross the present volume of the discharge of Amazonian fresh-water, covering some hundreds of square miles, seems so incredible that it may be held that the existing coast fauna antedates the existence of that and other streams, at least in their present immensity.<sup>1</sup>

Verrill has pointed out<sup>2</sup> that the entrance of Long Sound and the bays and sounds lying south of South Massachusetts are inhabited by two separate molluscan faunas, the shallower waters of the bays being occupied chiefly by southern forms belonging to what he then calls the Virginian fauna, while the deeper channels of the central parts of the sound are inhabited exclusively by a northern fauna. The cause of this apparently anomalous state of things is that an offshoot of the cold Arctic current which sweeps round Nova Scotia sets into the middle of the sound and produces, both at the surface and at the bottom, a change of temperature, which, within a space of only 2 miles, amounts to as much as 5° F. Thus the littoral fauna is of a comparatively southern type, while even the shallow-water fauna, at depths of no more than 18 to 39 fathoms, is strictly northern, consisting of the following amongst other species: *Molgula pilularis*, *Glandula mollis*, *Cardita borealis*, *C. novangliæ*, *Yoldia sapotilla*, *Y. limatula*, *Nucula proxima*, *Astarte quadrans*, *A. castanea*, *Modiolaria nigra*, *M. corrugata*, *Chrysodomus pygmæa*, *Margarita obscura*, *Cylichna alba*, and many others.

Much useful aid in exploration may be gained from geology in showing that certain modifications of climate and of elevation, otherwise unsuspected, must have taken place. Thus, to take one instance out of many, G. Bardason has shown,<sup>3</sup> from the evidence of Pleistocene marine beds in North Iceland, that within comparatively recent times the sea was at least 4 metres above its present level, with the effect that the temperature of that particular region must have been higher than it is at the present epoch, or much as it is now in South-West Iceland. This is shown by the presence in the deposits of *Purpura lapillus* and *Zirphæa crispata*, and by the absence of *Pecten islandicus*. As the sea retreats the temperature, in northern regions, becomes lower, and the conditions assume a more Arctic character.

<sup>1</sup> W. H. Dall, "Additional Notes from the Coast of Southern Brazil": *Nautilus*, vol. vi, pp. 109-12, 1893. "List of Shells collected at Bahia, Brazil, by Dr. H. von Ihering": *ibid.*, vol. x, pp. 121-3, 1897.

<sup>2</sup> *Ann. Mag. Nat. Hist.*, ser. IV, vol. ix, pp. 92-7, 1872.

<sup>3</sup> "Maerker efter Klima- og Niveauforandringer ved Húnaflói i Nord-Island": *Vid. Medd. Copenhagen*, 1910 (ii), pp. 35-79.

Again, certain northern species which are littoral under normal conditions of life tend to seek deeper water as they move southward, while exactly the reverse is the case with certain southern species, which are found in shallower water in northern than in southern latitudes.<sup>1</sup> This seems to emphasize the point that temperature is of prime importance in determining habitat, northern species finding the cold they are accustomed to by migrating to somewhat deeper water in the south, and southern deepish water species finding the low temperature they need in shallower water as they move north. Mediterranean species of the coralline and abyssal fauna are found to live, as a rule, in depths less profound than they do in the Atlantic. *Buccinum undatum*, L., which is common at low-water mark at certain places in Northern and Eastern England, is never found between tide-marks at Scilly. *Neptunea antiqua*, L., may be found alive on the shores of Shetland, but in Southern and Western England it retires into deeper water. *Emarginula crassa*, J. Sow., is not rare on the shore at Oban; in the Gulf of Gascony it has only been dredged at 400-500 metres.

It must not be forgotten that conditions of life in every quarter of the globe can never be regarded as absolutely permanent. Changes of environment, some vast and sweeping, others apparently trivial and scarcely detected, are in operation and must affect, to a greater or less degree, the life of the organisms which inhabit the different areas. Collectors who work a particular ground are familiar with the fact that certain species may be found by the score or by the hundred in a given locality, and then for years they will be extremely scarce, and then will reappear again, as numerous as before. Of *Aplysia depilans*, L., "a small fleet arrived in Torbay in 1875 and lingered for a couple of years . . . previous to that only one specimen had been found there." Of *Oscanus membranaceus*, Mont., "in 1874 a large fleet appeared simultaneously at Weymouth and at Torbay, and again in the latter district in 1877 and 1887."<sup>2</sup> "At one time *Nassa fossata*, Gld., at another *Periploma discus*, Stearns, at another *Lima orientalis*, Cpr., or *Scalatella striata*, Cpr., are found by the dozen in San Pedro Bay [Cal.], and then for years after only a few are found at a time."<sup>3</sup> It must be remembered too that certain Mollusca, notably the Opisthobranchia and Nudibranchia, come ashore in the breeding season to deposit their eggs and then retire to deep water.

Occasionally we are able to observe a definite extension of area on the part of a species, without being able to assign any definite cause. When Jeffreys wrote his *British Conchology* (1865 is the date of vol. iii) *Acmæa testudinalis*, Müll., had not been observed on our eastern coast south of Hartlepool; in 1890 it had reached Scarborough, in 1910 it was south of Bridlington, and is said to be extending its range rapidly

<sup>1</sup> See W. H. Dall, Bull. U.S. Nat. Mus., vol. xxxvii, pp. 1-221, 1889.

<sup>2</sup> J. T. Marshall, Journ. Conch., vol. xiv, pp. 65, 66, 1913.

<sup>3</sup> S. P. Monks, Nautilus, vol. vii, p. 75, 1893.

still further south.<sup>1</sup> Has anyone observed that the surface temperature of the water on our north-eastern coast has fallen, during the last fifty years? *Cassidaria tyrrhena*, L., which was first added to the British fauna in 1870, and subsequently dredged off the Kerry coast and off the Scillies, has of late been trawled in considerable numbers in the deep trough between Milford Haven and the Irish coast, off the Saltees lightship, and appears to be moving northward.

In the list of the Mollusca of Long Island<sup>2</sup> published by Sanderson Smith and Temple Prime in 1870, a list which embodied the results of eleven years' collecting, *Littorina littorea*, L., did not occur. F. N. Balch, publishing<sup>3</sup> in 1899 a list of the marine Mollusca of Coldspring Harbour, Long Island, remarks: "Ten years ago it might have been possible to define a spot within 60 miles by saying it was a place where *Purpura lapillus* was not, and *Litt. littorea* was, found, but now the wave of the conquering European species has spread far down toward Virginia, and at Coldspring the native competitor (*Nassa obsoleta*) begins to yield room."

When the agency of man gives them a chance of extending their area the Mollusca are as quick to take advantage of their opportunity as the rabbit was in Australia. The spread of Mediterranean and Red Sea species into the waters of the Suez Canal has been commented upon by Tillier and Bavay, by Faurot and others. No doubt our American friends will be equally ready to note the results of the opening of the Panama Canal, and to observe whether the 'homologous species' which, in some numbers, inhabit the two sides of Central America, show any signs of approximation, as a result of the mingling of waters which have been separated since the Miocene epoch.

We have watched the almost meteoric swiftness with which *Petricola pholadiformis*, Lam., and *Crepidula fornicata*, Lam., have established themselves in European waters. The former, after having first been noticed in the River Crouch, Essex, in 1890, was at Shellness and Herne Bay in 1896, in 1901 it had reached Belgium, and was notified from Ostend in 1903 and Dunkirk in 1906, in 1907 it had spread all over the Suffolk coast, Denmark notified it in 1906-7, in 1908 it was at Noordwijk, Holland, in 1910 at the mouth of the Medway, and the same year at Shallinger, Denmark. It will be interesting to see at what point short of the Baltic it stops. Of *C. fornicata*, dead shells of which were first notified at Cleethorpes in 1887, 10 tons of live specimens were dredged<sup>4</sup> in four weeks in the Blackwater River twenty years later.

*Urosalpinx cinerea*, Say, has been transplanted with East American oysters to the Pacific coast. A quart of specimens of this oyster scourge has been collected in less than ten minutes at Belmont, near San Francisco.<sup>5</sup>

<sup>1</sup> J. A. Hargreaves, Journ. Conch., vol. xiii, p. 89, 1910.

<sup>2</sup> Ann. Lyc. Nat. Hist. N. York, vol. x, pp. 377-407, 1870.

<sup>3</sup> Proc. Boston Soc. Nat. Hist. (7), vol. xxix, pp. 133-62, 1899.

<sup>4</sup> J. Murie, Zoologist, ser. IV, vol. xv, pp. 401-15, 1911.

<sup>5</sup> R. E. C. Stearns, Nautilus, vol. viii, p. 13, 1894.

The best-studied coastline in the world is, beyond a doubt, that of Eastern North America, from Texas and Florida to Labrador, thanks to the work of Dall, of Verrill, Bush, and many others. Let us for a moment employ some of the material gathered by them,<sup>1</sup> and fix our attention on the tropical fauna of the extreme south-east States, a fauna which is in close alliance with the West Indian. What is the extreme northern range along that coast of such thoroughly tropical genera as *Conus*, *Cypræa*, *Trivia*, *Strombus*, *Oliva*, *Olivella*, *Fasciolaria*, and the *Phyllonotus* group of *Murex*?

Of *Conus* ten species occur, nine of them on Florida Keys; four reach Cape Hatteras, none further north.

Of *Cypræa* there are three species, all West Indian; one only (*C. exanthema*, L.) reaches Cape Hatteras, and no further.

Of *Trivia* there are seven species, all found on Florida Keys, but only one reaches Cape Hatteras, and no further.

*Strombus* is represented by five species (four of them West Indian); all five occur on Florida Keys; three only reach East Florida, one reaches Georgia, one (*pugilis*, L.) Cape Hatteras, and no further north.

*Oliva* has two species; one of these reaches Cape Hatteras, and no further.

*Olivella* has six species, all West Indian; three reach Cape Hatteras, but no further north.

Of *Fasciolaria* there are three species, all represented on Florida Keys; all reach Cape Hatteras, but no further.

Finally, of *Phyllonotus* there are four species; two of these reach Cape Hatteras, but no further.

This list might be considerably extended, and it would not be easy to find a more striking instance of the power of a current of warm surface-water to carry a tropical fauna northward. Cape Hatteras, be it remembered, is in about the latitude of the Straits of Gibraltar. The Gulf Stream, issuing from the Gulf of Mexico, makes a right-angled turn at Cape Sable, the extreme southern point of Florida, and hugs the East American coast more or less closely until it reaches Cape Hatteras, when it parts company with the land and moves north-east and east across mid-Atlantic. A further factor which accentuates the sudden break in the range of the tropical fauna, and makes the northward barrier more effective, is the fact that a cold current, the remains of the Polar and Labrador drift, running a westerly and southerly course from the outer banks of Newfoundland<sup>2</sup> and the south coast of Nova Scotia, parallel to, but in the reverse direction to, the Gulf Stream, impinges on the North American coast

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<sup>1</sup> See particularly W. H. Dall, "A preliminary Catalogue of the Shell-bearing Marine Mollusca . . . of the south-east coast of the United States": Bull. U.S. Nat. Mus., vol. xxxvii, pp. 1-221, 1889.

<sup>2</sup> "The Grand Banks of Newfoundland . . . are inhabited by an extremely Arctic fauna, including many species of Mollusca which have not yet been found further south" (A. E. Verrill, Trans. Connect. Acad., vol. v, pp. 447-587, 1878-82).

somewhere just north of where the Gulf Stream leaves it, and thus brings a cold-water fauna down to a point in the latitude of Lisbon, and effectually prevents the tropical fauna from creeping any further north. Thus *Acmæa testudinalis*, Müll. (a cold-water species), ranges as far south as New Jersey, in N. lat.  $40^{\circ}$ , while on the European side it has not been found south of about  $54^{\circ}$  on the east coast of England, and about  $53^{\circ}$  on the Irish coast, while hardy circumpolar species like *Macoma balthica*, L., *Mya arenaria*, L., and *Mytilus edulis*, L., creep as far south as Hatteras and even Georgia.

It is interesting to observe that besides the migrants from the sub-Arctic fauna southward, and from the tropical fauna northward, the eastern shores of North America have a temperate fauna of their own, which appears to be comparatively unaffected by the great change of temperature which occurs at Cape Hatteras. For we find a large number of species, corresponding to the temperate element in our own seas, which occur commonly between Cape Cod and Georgia or even Florida. Possibly this fauna may be considered to have taken up its abode on these coasts before the present conditions of current became fixed. Thus there are five species of *Fulgur*, all of which occur in Georgia, which may be regarded as their metropolis; three of these reach the West Indies and three Cape Hatteras, but two range northward as far as Cape Cod. *Nassa trivittata*, Say, extends from St. Augustine in North Florida to Nova Scotia, *N. vibex*, Say, from Aspinwall to Cape Cod, *N. obsoleta*, Say, from Tampa to Nova Scotia. Two muricidan species, both strongly characteristic of East American temperate shores, are *Urosalpinx cinerea*, Say, and *Eupleura caudata*, Say. The former ranges from Florida to Nova Scotia, the latter from Florida to Cape Cod. Similarly, *Astyris lunata*, Say, ranges from Turtle Harbour in West Florida to Cape Ann, and *Anachis avara*, Say, from Florida Keys to Massachusetts Bay. In all these cases what may be called the indigenous fauna pass with ease a barrier which proves so formidable to the northern and southern migrants.

Now let us compare the position on the western side of North America. Our information may not be quite so full, but the general trend of distribution is plain. Here the tropical fauna of the Panamic region, instead of being carried far northward along the coast by a warm-water current, is checked by the far-reaching effect of a stream of cold water. The Kuro Shio current, issuing from the warm seas to the south of Japan, and crossing the North Pacific, loses much of its warmth in the passage, and is very possibly reinforced by cold water from the north. It impinges on the West American coast about the latitude of Queen Charlotte Island (N. lat.  $52^{\circ}$ ), and breaks into two branches, the northern of which washes the coasts of North Canada and Alaska, while the southern moves southward along the coasts of Oregon and California. The effect of this cool current sweeping southward must obviously be to keep back the northward spread of the tropical species. The result is that the same genera, *Strombus*, *Oliva*, *Cassis*, *Conus*, etc., which were well represented up

to lat.  $36^{\circ}$  N. on the eastern side, are far less numerous at the same latitude on the western. Santa Barbara, in  $35.5^{\circ}$  N. lat., shows few traces of a tropical fauna. The surface temperature of the sea-water at Cape Hatteras in August is  $77^{\circ}$  F., in February  $68^{\circ}$  F. (mean  $72\frac{1}{2}^{\circ}$  F.); the corresponding temperatures at Sta. Barbara are  $66^{\circ}$  F. and  $59^{\circ}$  F. (mean  $62\frac{1}{2}^{\circ}$  F.); in other words, the February temperature on the east coast exceeds the August temperature on the west on the same parallel.

These special conditions enable the temperate fauna of Upper California to penetrate far southward; *Priene oregonensis*, Redf., e.g., has been found at Monterey, several of the *Chlorostoma* group at Margarita Bay, in lat.  $24^{\circ}$  N., *Purpura ostrina*, Gld., at the same place. Closer investigation of the fauna of Lower California is much to be desired, but one interesting fact is plain, that the great Gulf of California, nearly 900 miles in length, forms a great hot-water basin and is quite unaffected by the ocean currents. The result is that it bears a tropical fauna up to its extreme northern point, so that the Californian peninsula, more particularly in its northern portion, has a tropical fauna on its eastern side, and a mixed tropical and sub-tropical fauna on its western, and at certain points these two fauna are within 50 to 60 miles of one another across the isthmus. The mean annual surface temperature of the water inside the gulf is somewhere near  $80^{\circ}$  F., on the outside it is about  $72^{\circ}$  F.

It may be remarked parenthetically that the Red Sea and the Persian Gulf offer similar examples of enclosed seas whose surface temperature is very high. That of the lower portion of the Red Sea rises to  $90^{\circ}$  F. in the summer, and that of the Persian Gulf to the astonishing figure of  $95^{\circ}$  F. The heat of the Red Sea explains why at Suez we have tropical forms such as *Pyrula*, *Strombus*, *Murex* (typical), and *Nerita* living on the shore, in a latitude well to the north of the Canaries. The head of the Persian Gulf is in exactly the same latitude as Suez.

Now to come a little nearer home. On the eastern shores of the Atlantic many southern species enjoy a wide range northward, and many northern species an equally wide range southward. This is due to the extremely equable temperature of the surface-water of the sea from Norway to Morocco. Along this vast stretch of coast there is no pronounced equatorial current moving northwards to bar back the northern species, still less is there any polar current sweeping southward along the coast to check the spread of the southern species. It is quite true that the Gulf Stream and Antillean Current exercise a powerful influence upon the temperature of our northern waters, but that influence is so widely diffused, and the changes it induces are so gradual, that at no point is there any sudden variation in temperature, such as is found on the western side of the Atlantic. Even the south-western shores of Nova Zembla (N. lat.  $72^{\circ}$ ) are washed in August by water no colder than  $40^{\circ}$  F.

The isothermal line of  $50^{\circ}$  in August all but touches the North Cape; the isotherm of  $60^{\circ}$  in the same month is not reached till south of the Wash, on the east of England, and Lough Swilly, to



the west. Southward of these points the temperature of the surface-water continues singularly equable, for the August isotherm of  $70^{\circ}$  F. is not reached till Cadiz, and that of  $77^{\circ}$  F. not till N. lat.  $20^{\circ}$ , far to the south of the Tropic. And the February surface temperatures are equally striking. Water from  $40^{\circ}$ – $49^{\circ}$  F. tempers the Norwegian coasts as far north as the Arctic Circle, and encloses the whole of the British Isles and the French coast as far south as La Rochelle. Here begins the isotherm of  $50^{\circ}$  F., coming down from a point off North-West Ireland; water at  $60^{\circ}$  F. is not reached on the Portuguese coast till Lisbon, and the isotherm of  $68^{\circ}$  F. is attained near the latitude of the Cape Verde, well to the south of lat.  $20^{\circ}$  N.

These singularly equable conditions of surface temperature seem to explain many of the prominent features of the distribution of the shallow-water and shore Mollusca of Western Europe. We can understand, on the one hand, how it is that Finmark and the Mourmane coast have a rich littoral fauna,<sup>1</sup> that warm-water genera such as *Pinna* and *Meretrix*, *Ovula* and *Truncatella*, *Phasianella*, *Triforis*, *Ocenebra*, *Haliotis*, and *Litorium* reach our own coasts. And we can also understand how northern species have penetrated southward; how, for instance, *Buccinum undatum*, L., and *Neptunea antiqua*, L., reach South-Western France, how *Littorina littorea*, L., reaches the Straits of Gibraltar, *L. obtusata*, L., the Western Mediterranean, and *Purpura lapillus*, L., Algarve and even Mogador. R. T. Lowe remarks<sup>2</sup> that of a collection of marine Mollusca picked up on the shore at Mogador, close upon three-fifths are found commonly in Britain. R. McAndrew, dredging in 35–40 fathoms off Mogador, obtained 22 species of shells, 16 of which were British; and of 125 species obtained by him at Madeira, 58 are common to our own shores.<sup>3</sup>

I should like to see the distribution of the marine Mollusca of Western Europe, both in its northern and southern extension, and in range of depth, worked out with the same precision and accuracy as has been done in the case of the Mollusca of the eastern coast of North America. At present there is plenty of enthusiasm, but little organization, plenty of statistics, but no centralized store-room for their preservation. Britain, in virtue of its central position, looking as it does both north and south, and possessing an enormous stretch of coast-land, should take the lead, and I can think of no body better fitted to undertake the task of collecting material, sifting evidence, formulating tables of statistics, and keeping them up to date, and generally of acting as a depository of facts and an authoritative court of reference, before which all questions bearing on the subject ought to be brought, than the Society which I am now addressing. The task would be serious; it ought not to be beyond our powers.

The British marine molluscan fauna—leaving out of consideration such abyssal species as may be reckoned in the list—is clearly made

<sup>1</sup> S. Herzenstein, Congrès intern. Zool., vol. ii, pt. ii, pp. 127–47.

<sup>2</sup> Journ. Linn. Soc., Zool., vol. v, pp. 169–204, 1861.

<sup>3</sup> Ann. Mag. Nat. Hist., ser. II, vol. x, pp. 100–8, 1852.

up of three elements: (1) a northern element, consisting of species which may be supposed to have spread southwards from Arctic or sub-Arctic latitudes; (2) a southern element, consisting of species which have spread in the reverse direction from more southern latitudes; (3) an element which is probably indigenous in our own and neighbouring temperate seas.

Perhaps the most striking way of bringing out this point is to instance particular genera which happen to include species of both northern and southern origin. Of *Littorina*, for instance, we have four species on our shores, three of which are northern and one southern in origin: *littorea*, L., a northern form, ranges from the White Sea and Mourmane coast to Lisbon and the Straits of Gibraltar; *rudis*, Mat., from the Glacial Ocean to Southern Spain<sup>1</sup>; *obtusata*, L., extends from the White Sea, Finmark, and Iceland to South Spain and South France, but not further east in the Mediterranean. All these three species are found on the east coast of North America. *L. neritoides*, L., on the other hand, is a markedly southern species, ranging from the Canaries and Madeira to North Britain. Of *Acmæa* we have two species, one of markedly southern, the other of equally clear northern origin; *A. virginea*, Müll., ranges from St. Helena, the Azores, and Madeira to North Norway; *A. testudinalis*, Müll. (a thoroughly Arctic form), occurs from Nova Zembla, North Labrador, Greenland, and all Arctic seas to the Yorkshire coast on this side of the Atlantic, and to New Jersey on the other. *Emarginula* is represented by three species, each of which appears to belong to a different fauna; *E. crassa*, J. Sow., is a northern form, curiously, as it seems, absent from the eastern coasts of Britain, and found in littoral and shallow waters no further south than Dublin Bay; *E. fissura* (L.), with a range from Finmark to the Canaries, seems characteristic of the temperate fauna, while *E. conica*, Schum., is a strictly southern form, ranging from the Mediterranean and South Spain to the Dorset coast, but no further north. The same point may be illustrated in other of the genera occurring on our shores, e.g. *Modiolaria*, *Crenella*, *Rissoa*, *Scala*, *Calliostoma*, and *Lunatia*, of which latter genus *pallida*, Brod., *montagui*, Forbes, and *affinis*, Gmel., are northern forms, *alderi*, Forbes, belongs to the temperate fauna, while *catena* (da Costa) and *sordida*, Phil., are of southern origin.

The following members of the British marine fauna rank as 'northern' species (the list has no pretensions to completeness, and Nudibranchia and Cephalopoda are not included):—

\*†‡*Tonicella marmorea* (Fabr.).<sup>2</sup>

†*T. rubra* (Lowe).

\*†*Craspedochilus albus* (L.).

\*†‡*Nuculana tenuis* (Phil.).

\**Limopsis aurita* (Broc.).

†‡§*Modiolus modiolus* (L.).

<sup>1</sup> Unless we unite *rudis*, Mat., and *saxatilis*, Oliv., in which case the range extends all over the Mediterranean, Adriatic, and Black Seas.

<sup>2</sup> R. McAndrew is said to have dredged this species at Carthage in 5–10 f., which seems improbable.

- \*†† *Modiolaria discrepans* (Leach).  
 \*†† *Crenella decussata* (Mont.).  
   \* *Lima elliptica*, Jeff.  
 †† *L. subauriculata* (Mont.).  
   \* *Linea sarsii* (Lov.).  
 \*† *Astarte compressa* (Mont.).  
   † *Arctica islandica* (L.).  
   \* *Cryptodon croulinensis* (Jeff.).  
   \* *Cuspidaria abbreviata* (Forb.).  
   \* *Dentalium striolatum*, Stimps.  
   \* *D. agile*, M. Sars.  
 \*† *Acmæa testudininalis* (Müll.).  
 \*†† *Lepeta cæca* (Müll.).  
   *L. fulva* (Müll.).  
 \*† *Puncturella noachina* (L.).  
   † *Emarginula crassa*, J. Sow.  
   \* *Propilidium ancyloide*, Forb.  
   *Rissoa albella*, Lov.  
   † *Onoba striata* (J. Ad.).  
   † *Skenea planorbis* (Fabr.).  
 \*†† *Lunatia pallida* (Brod. & Sow.).  
   *L. montagui* (Forb.).  
 \*† *Amauropsis islandica* (Gmel.).  
 †† *Velutina lævigata* (Penn.).  
 \*†§ *V. flexilis* (Mont.).  
   \* *Scala grænlandica* (Chem.).  
   *Cæcum imperforatum* (G. Ad.).
- \* These species have seldom, if ever, been found south of the Wash.  
 † Also occurs in East North America.  
 ‡ Also occurs in West North America.  
 § Also occurs in Japan and Kamschatka.
- \* *Trichotropis borealis*, Brod. & Sow.  
 † *Buccinum undatum*, L.  
   *B. humphreysianum*, Benn.  
   *Liomesus dalei* (J. Sow.).  
 \*†§ *Volutopsis norvegica* (Chem.).  
   \* *Beringius turtoni* (Bean).  
   † *Tritonofusus islandicus* (Chem.).  
     *T. gracilis* (da Costa).  
   \* *T. propinquus* (Ald.).  
   *T. fusiformis* (Brod.).  
   *Buccinofusus berniciensis* (King).  
 ††§ *Purpura lapillus* (L.).  
   \*† *Admete couthouyi*, Jay.  
 \*††§ *Eumargarita helicina* (Fabr.).  
   \*† *E. grænlandica* (Chem.).  
     *Solariella cineta* (Phil.).  
   \*† *Calliostoma occidentale* (Migh.).  
 ††§ *Lacuna crassior* (Mont.).  
   † *Littorina obtusata* (L.).<sup>1</sup>  
   †† *L. rudis* (Mat.).  
   † *L. littorea* (L.).  
   † *Bela turricula* (Mont.).  
   †† *B. trevelyana* (Turt.).  
   *Typhlomangilia nivalis* (Lov.).  
   *Tornatina nitidula* (Lov.).  
 †† *Bullinella alba* (Brown).  
   † *Philine quadrata* (S. V. Wood).

The following members of the British molluscan fauna rank as 'southern species' (the list is not meant to be complete):—

- Lepidopleurus scabridus* (Jeff.).  
*Acanthochites discrepans* (Brown).  
*Barbatia lactea* (L.).  
*Modiolus barbatus* (L.).  
*Modiolaria costulata* (Risso).  
*Crenella rhombea* (Berk.).  
*Pteria hirundo* (L.).  
*Pinna fragilis*, Penn.  
*Loripes lacteus* (L.).  
*Divaricella commutata* (Phil.).  
*Diplodonta rotundata* (Mont.).  
*Lepton squamosum* (Mont.).  
*L. sulcatulum*, Jeff.  
*Galeomma turtoni*, Brod. & Sow.  
*Ervilia castanea* (Mont.).  
*Tellina squalida*, Pult.  
*T. donacina*, L.  
*Donax variegatus* (Gmel.).  
*Mactra glauca*, Born.  
*Lutraria oblonga* (Chem.).
- Meretrix chione* (L.).  
*Venus verrucosa*, L.  
*Tapes decussatus* (L.).  
*Cardium aculeatum*, L.  
*C. tuberculatum*, L.  
*Phasianella pullus* (L.).  
*Littorina neritoides* (L.).  
*Rissoa guerini*, Récl., var. *costulata*, Ald.  
*Alvania cancellata* (da Costa).  
*A. lactea* (Mich.).  
*Ceratia proxima* (Ald.).  
*Setia pulcherrima* (Jeff.).  
*S. fulgida* (J. Ad.).  
*Gallodina carinata* (da Costa).  
*Adeorbis subcarinatus* (Mont.).  
*Truncatella truncata* (Mont.).  
*Calyptrea chinensis* (L.).  
*Simnia patula* (Penn.).  
*Erato lævis* (Don.).

<sup>1</sup> North American, if *palliatæ*, Say, is to be regarded as a variety of *obtusata*, L.

*Lunatia catena* (da Costa).  
*L. sordida* (Phil.).  
*Triforis perversa* (L.).  
*Cerithiopsis tubercularis* (Mont.).  
*Scala clathratula* (Ad.).  
*Lotorium nodiferum* (Lam.).  
*L. cutaceum* (L.).  
*Cassidaria rugosa* (L.).  
*C. echinophora* (L.).  
*Cardium papillosum*, Poli.  
*Solec curtus scopula* (Turt.).  
*S. antiquatus* (Pult.).  
*Barnea parva* (Penn.).  
*Thracia pubescens* (Pult.).  
*Dentalium vulgare*, da Costa.  
*Emarginula conica*, Schum.  
*Fissurella græca* (L.).  
*Haliotis tuberculata*, L.  
*Gibbula magus* (L.).  
*G. umbilicata* (Mont.).

*Monodonta crassa* (Montf.).  
*Calliostoma montagui* (W. Wood).  
*C. exasperatum* (Penn.).  
*C. striatum* (L.).  
*C. granulatum* (Born).  
*Donovania minima* (Mont.).  
*Ocenebra erinaceus* (L.).  
*O. corallina* (Scac.).  
*Hædropleura ecostata* (da Costa).  
*Mangilia attenuata* (Mont.).  
*M. rugulosa* (Phil.).  
*M. brachystoma* (Phil.).  
*Bellardiella gracilis* (Mont.).  
*Clathurella reticulata* (Ren.).  
*C. purpurea* (Mont.).  
*Haminæa hydatidis* (L.).  
*Philine catena* (Mont.).  
*Aplysia depilans*, L.  
*Pleurobranchius plumula* (Mont.).  
*Oscanius membranaceus* (Mont.).

The following species occur in the Channel Islands, but have not yet been met with in waters on the north side of the English Channel:—

? *Teredo pedicellata*, Quat.  
*Setia pulcherrima* (Jeff.).  
*Haliotis tuberculata*, L.

*Lotorium nodiferum* (L.).  
*L. cutaceum* (L.).  
*Ocenebra corallina* (Scac.).

Of the above, *L. nodiferum* has not again been found in British waters since three living specimens were trawled off Guernsey between 1825 and 1832. *L. cutaceus* is probably still an inhabitant, though rarely, of this station. I have myself picked up two worn shells at Herm, and Mr. Marshall dredged a living specimen off Guernsey, in 22 fathoms, in 1885.<sup>1</sup> *Purpura hæmastoma*, L., has probably not lived on these shores in recent years. There is a record<sup>2</sup> of the discovery of three specimens at Guernsey, but they were probably due to the refuse of French trawlers. Brest is the most northern authentic recorded habitat of the species.

P. Fischer remarks<sup>3</sup> that the English Channel “est une véritable barrière qui limite l’expansion vers le nord de 81 espèces de la côte française et de la Méditerranée”. I do not feel quite clear whether Fischer meant that all the eighty-one species inhabit the southern coast of the English Channel. If they do not—and a consideration of the list makes it seem very unlikely that they do—the effectiveness of the ‘véritable barrière’ tends to disappear. Certainly, of forty-nine species which he cites specifically, six at least have been found on the northern side of the Channel since he wrote. A juster view of the case would appear to be, that not more of the Lusitanian fauna ‘drop off’ on the northern, as compared with the southern, side of the English Channel than one would naturally expect.

<sup>1</sup> Journ. Conch., vol. xiii, p. 202, 1911.

<sup>2</sup> J. T. Marshall, *ibid.*, p. 197.

<sup>3</sup> Man. de Conch., 1887, p. 145.

The following species just reach the western coasts of the Channel and South and West Ireland:—

*Lepidopleurus scabridus* (Jeff.).  
*Acanthochites discrepans* (Bronn).  
*Pterid hirundo* (L.).  
*Crenella rhombea* (Berk.).  
*Divaricella commutata* (Phil.).  
*Lepton squamosum* (Mont.).  
*L. sulcatulum*, Jeff.  
*Galeomma turtoni*, Brod. & Sow.  
*Cardium tuberculatum*, L.  
*C. papillosum*, Poli.  
*Thracia pubescens* (Pult.).  
*Macra glauca*, Born.

*Donax variegatus* (Gmel.).  
*Emarginula conica*, Schum.  
*Calliostoma exasperatum* (Penn.).  
*C. striatum* (L.).  
*Truncatella truncata* (Mont.).  
*Calyptrea chinensis* (L.).  
*Cassidaria tyrrhena* (L.).  
*C. echinophora* (L.).  
*Donovania minima* (Mont.).  
*Mangilia rugulosa* (Phil.).  
*Aplysia depilans*, L.

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DIAGNOSES OF FOUR NEW SPECIES OF LAND SHELLS FROM  
GERMAN NEW GUINEA.

By CÆSAR R. BOETTGER.

*Read 13th March, 1914.*

PLATE III.

THE following four new species of pulmonate land shells were collected, together with other well-known species, at Sattelberg, near Finschhafen, German New Guinea, and presented to me by the late U. Stahlberg of Schwerin, Mecklenburg. The types are preserved in my private collection.

1. *HELICARION NOVÆGUINÆ*, n.sp. Pl. III, Figs. 1-2.

Testa imperforata, tenuis, cornea, nitens, lineis accrescentibus indistinctis anguste striata. Anfractus 5, convexiusculi, celeriter accrescentes, sutura subplana, linea impressa comittata separati; ultimus non descendens. Apertura ovata, obliqua; peristoma simplex, acutum. Alt. 9, diam. maj. 15, min. 12 mm.; apertura, alt. 8, lat. 9 mm.

*Hab.*—Sattelberg, near Finschhafen, German New Guinea.

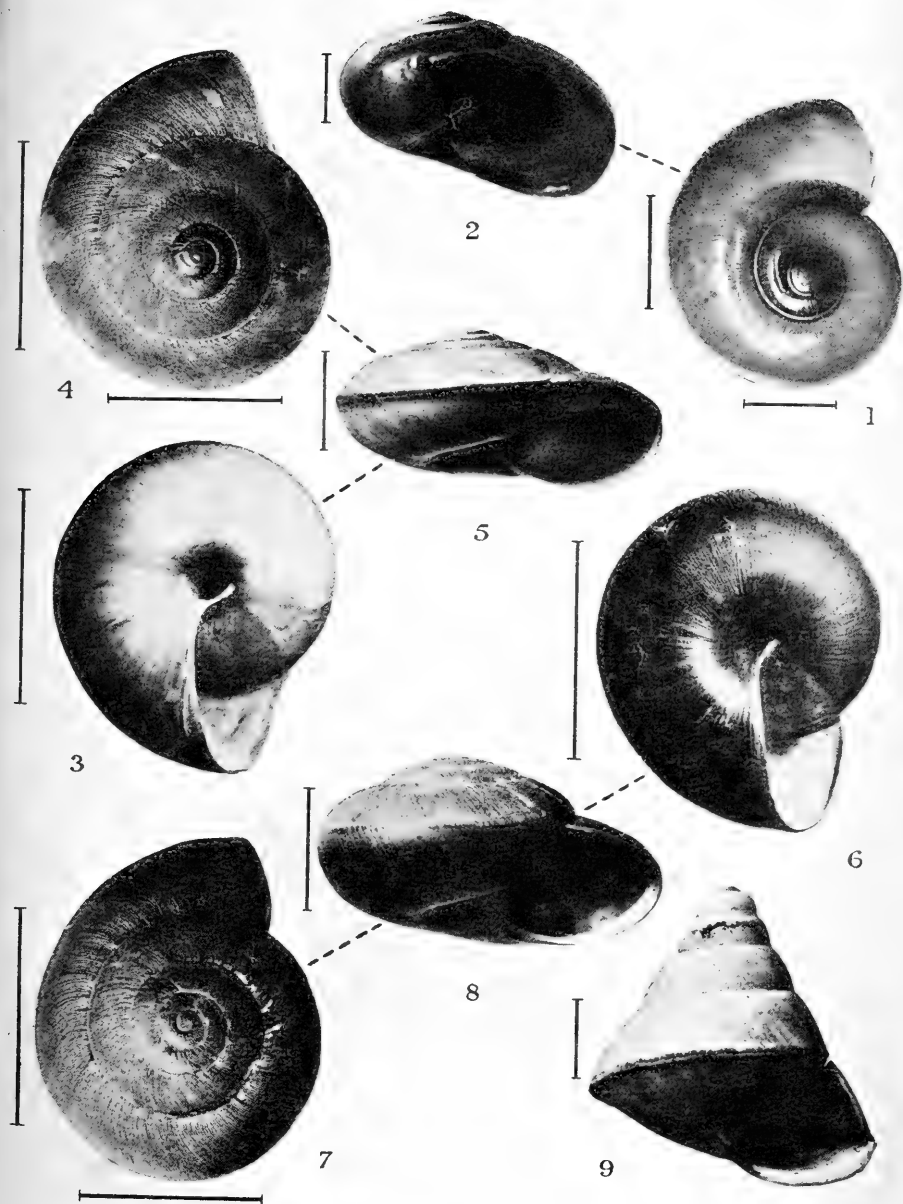
Shell imperforate, thin, corneous, shining, striated by indistinct lines of increment. Whorls 5, moderately convex, quickly increasing in size, separated by an almost flat suture, which is provided with an impressed line; the last whorl not descending in front. Aperture ovate, oblique; peristome simple, acute.

2. *HEMIPLECTA PAPUANA*, n.sp. Pl. III, Figs. 3-5.

Testa umbilicata, applanata, carinata, supra corneo-fusca, infra pallidior, sericea, striis spiralibus minutissimis et costulis transversis angustis minutissime cancellata, sub carina linea castanea basim versus evanescente ornata. Anfractus 6, subplani, regulariter accrescentes, sutura plana separati; ultimus non descendens. Apertura angulato-ovata, obliqua, intus colore et pictura externa translucetibus; peristoma simplex, acutum. Alt. 14, diam. maj. 29, min. 24 mm.; apertura, alt. 11½, lat. 15 mm.

*Hab.*—Sattelberg, near Finschhafen, German New Guinea.

Shell umbilicate, flattened, keeled, corneous brown above and lighter below, with a silky lustre, surface finely cancellated by very minute spiral lines and narrow transverse riblets, under the keel ornamented with a chestnut band, which becomes indistinct on the underside. Whorls 6, almost flat, regularly increasing in size, separated by a flat suture; the last whorl not descending in front. Aperture angulate-ovate, oblique, displaying the external colour and painting; peristome simple, acute.



NEW SPECIES OF LAND SHELLS FROM NEW GUINEA.





3. *HEMIPLECTA SERICEA*, n.sp. Pl. III, Figs. 6-8.

Testa anguste umbilicata, solida, carinata, sericea, costulis angustis et striis spiralibus angustissimis minutissime cancellata, supra brunnea, ad carinam linea flavesciente supra non definita, infra sub carina nigrescente brunnea, basim versus in colorem olivaceo-brunneum clarescente. Anfractus  $5\frac{1}{2}$ , convexiusculi, regulariter accrescentes, sutura subplana, antice profundiore, separati; ultimus non descendens. Apertura ovata, obtusissime angulata, obliqua, intus albida, colore et pictura externa translucentibus; peristoma simplex, subacutum, basi incrassatum, marginibus callo tenuissimo junctis. Alt.  $16\frac{1}{2}$ , diam. maj.  $29\frac{1}{2}$ , min.  $24\frac{1}{2}$  mm.; apertura, alt. 12, lat. 15 mm.

*Hab.*—Sattelberg, near Finschhafen, German New Guinea.

Shell narrowly umbilicate, solid, very faintly keeled, with a silky lustre, cancellated by fine riblets and very fine spiral lines, brown above, with a yellowish band on the keel, which is not well defined above, blackish-brown under the keel, becoming by and by olive-brown towards the base. Whorls  $5\frac{1}{2}$ , moderately convex, regularly increasing in size, separated by an almost flat suture, becoming deeper towards the aperture; the last whorl not descending in front. Aperture ovate, obtusely angulated, oblique, whitish within, displaying the external colour and painting; peristome simple, almost acute, incrassated at the base, the margins united by a very thin callus.

4. *COLIOLUS STAHLBERGI*, n.sp. Pl. III, Fig. 9.

Testa rimata, turrita, distinctissime carinata, luride albida, ad carinam linea fusco-purpurascente ornata; apex albidus, nitens. Anfractus 6, superiores inflati, sequentes plani, regulariter accrescentes, sutura plana separati; ultimus non descendens. Apertura angulato-ovata, subobliqua, intus colore et pictura externa translucentibus; peristoma reflexum. Alt.  $15\frac{1}{2}$ , diam. maj. 15, min. 13 mm.; apertura, alt. 7, lat. 8 mm.

*Hab.*—Sattelberg, near Finschhafen, German New Guinea.

Shell rimate, turreted, very sharply keeled, dirty whitish, at the keel ornamented with a purplish-brown band; apex whitish, shining. Whorls 6, upper whorls inflated, the others flat, regularly increasing in size, separated by a flat suture; the last whorl not descending in front. Aperture angulate-ovate, little oblique, displaying the external colour and painting; peristome reflexed.

## EXPLANATION OF PLATE III.

- FIGS. 1-2. *Helicarion novæguineæ*, n.sp.  
 „ 3-5. *Hemiplecta papuana*, n.sp.  
 „ 6-8. *H. sericea*, n.sp.  
 „ 9. *Coliolus stahlbergi*, n.sp.

THE GENUS-NAME *MARTENSIA*, SEMPER.

By TOM IREDALE.

*Read 17th April, 1914.*

AT my suggestion Mr. Robin Kemp made the magnificent collections of East African Land Molluscs which have been studied by Mr. H. B. Preston. Most of this material was casually examined by myself as it passed through my hands, and thus a slight acquaintance was made with this prolific land molluscan fauna. This apology seems necessary to account for my present incursion into a field quite foreign to my labours.

An outstanding Zonitoid genus of which a number of species was collected by Mr. Kemp was that known as *Martensia*, Semper. This name was proposed in the *Reisen im Archipel der Philippinen*, vol. iii, p. 42, 1870, for the species *Helix mozambicensis*, Pfeiffer (*Proc. Zool. Soc.*, 1855, p. 91) alone. It has been continually used, and I have noted no fewer than ten workers on African molluscs accepting it without question. Yet upon reference to Seudder's *Nomenclator Zoologicus* a prior *Martensia* is indicated, and this is proven upon confirming that work, as Agassiz in the *Contr. Nat. Hist. United States*, vol. iii, p. 195, footnote, 1860, had correctly and lawfully appropriated that name for a genus of his *Ctenophoræ lobatæ*.

The only available substitute appears to be

*LEDLOULXIA*, Bourguignat.

In the *Helixarionidées de l'Afrique* Bourguignat proposed this name for a series of species, sinking *Martensia* as a synonym of *Trochonanina*. I am quite unable to understand Bourguignat's classification, judging the species from a conchological view-point. Under the genus-name *Trochonanina* he included *mozambicensis*, Pfeiffer, *jenynsi*, Pfeiffer, and some other species, naming as new (p. 9) a *Tr. anceyi*. On p. 12 he proposed *Ledoulxia*, the first species named being *L. albopicta*, based upon *Nanina mossambicensis*, var. *albopicta*, Mtns., the second *pyramidea*, Mtns., and five new species introduced.

Bourguignat contended that the introduction of *albopicta* as a variety of *mozambicensis* was due to a misinterpretation of the latter species by Von Martens. I cannot, however, generically separate either this or *pyramidea* from the type of *Martensia*, and Connolly, *Ref. List South African Non-marine Mollusca*, still retains (p. 103) *albopicta*, Mtns., as a variety of *mozambicensis*, and moreover considers *Trochonanina anceyi*, Bourguignat, as synonymous.

Tryon maintained *Martensia*, and conservatively suggested that *Ledoulxia* might temporarily be considered a synonym.

Connolly (*ibid.*, p. 101) quotes as synonym of *Martensia* "*Ledoulxia*, Bgt. 1885, *pars*". I would designate as type of *Ledoulxia* the first species, *L. albopicta*, Mtns., and thus make this exactly equivalent to the invalid *Martensia*.

I have collated all the apparent species referred to this genus, and though at first sight the genus appears polyphyletic, no conchological characters can be grasped for differentiation. The extremes such as *Martensia percivali*, Smith, and *Trochonanina germaini*, Cæsar Boettger, seem easily separable, but after careful consideration I feel that it must be the part of the anatomist to point out the differences.

The names of the species I have brought together may be here noted as a beginning for some African worker. My ignorance of the literature of this fauna prohibits the proposition of a complete list.

LEDOULXIA—

- mozambicensis*, Pfeiffer, P.Z.S., 1855, p. 91.
- var. *albopicta*, Martens, v. d. Decken's Reise, vol. iii, p. 56, 1869.
- var. *elator*, Martens, Mal. Blätt., vol. xiii, p. 92, 1866.
- ibuensis*, Pfeiffer, Symb. Hel. viv., iii, p. 66, 1846.
- jenynsi*, Pfeiffer, P.Z.S., 1845, p. 131.
- obtusangula*, Martens, S.B. Ges. naturf. Berlin, p. 125, 1895.
- tumidula*, Martens, Monatsbr. wiss. Berl., 1876, p. 256.
- leucograptæ*, Martens, ib., 1878, p. 290.
- plicatula*, Martens, Nachr. Malak. ges., 1869, p. 149.
- pyramidea*, Martens, v. d. Decken's Reise, iii, p. 55, 1869.
- mesogæa*, Martens, Deutsch Ost Afr., vol. iv, p. 50, 1898.
- var. *bohmi*, id., l.c.
- livingstoniana* (Ancey), id., l.c., p. 48.
- subjenynsi* (Ancey MSS.), id., l.c., p. 49.
- episcopalis*, Smith, Ann. Mag. Nat. Hist., vol. vi, p. 152, 1890.
- percivali*, Smith, Journ. Conch., vol. x, p. 317, 1903.
- permanens*, Smith, Journ. Malac., vol. viii, p. 94, 1901.
- consociata*, Smith, P.Z.S., 1899, p. 584.
- nyassana*, Smith.
- anceyi*, Bourguignat, Helix. Afr., 1885, p. 9.
- alfieriana*, Bourguignat, ib., p. 13.
- formosa*, Bourguignat, ib., p. 14.
- megastoma*, Bourguignat, ib., p. 14.
- insignis*, Bourguignat, ib., p. 15.
- unizonata*, Bourguignat, ib., p. 15.
- smithi*, Bourguignat, Moll. Afr. équat., 1889, p. 17.
- meruensis*, D'Ailly, Kilim. Meru Exp. 6, p. 13, 1911.
- busuensis*, Kobelt, Rev. Suisse Zool., vol. xxi, p. 59, 1913.
- entebbeana*, Pollonera, Torin. Boll. Mus. Zool., No. 561.
- germaini*, Cæsar Boettger, Proc. Malac. Soc., vol. x, p. 348, 1913.
- bowkeræ*, Preston, ib., vol. vii, p. 88, 1906.
- gwendolenæ*, Preston, Ann. Mag. Nat. Hist., vol. vi, p. 529, 1910.
- martensiana*, Preston, ib., p. 529.
- monozonata*, Preston, ib., p. 530.
- ? *shimbiense*, Preston, ib., p. 530.
- levistriata*, Preston, Rev. Zool. Afr., vol. iii, p. 48, 1913.
- nyiroensis*, Preston, ib., p. 48.
- voiensis*, Preston, ib., p. 49.
- inflata*, Preston, ib., p. 49.
- solida*, Preston, ib., p. 49.

This list may not be complete, nor is it critical, but is an association of the species grouped together as or under the generic name *Martensia*.

The species *tumidula*, Martens, does not seem congeneric, whilst others, such as *nyiroensis*, Preston, and *shimbiense*, Preston, need further consideration. Another correction may be here noted. Connolly, in his invaluable Reference List of South African Non-marine Mollusca (Annals South African Museum, vol. xi, 1912), introduced a new sub-family Trochonaninæ, which is represented in his list by the genera *Martensia*, *Trochomorpha*, *Trochozonites*, and *Thapsiella*. I do not consider that these African molluscs have any close relationship with *Trochonanina*, the type of which is *schmeltziana*, Mousson, a Pacific Ocean shell (cf. Gude, Proc. Malac. Soc., vol. x, p. 389, 1913). I would suggest that the sub-family name be altered to TROCHOZONITINÆ, the basis of which is the genus *Trochozonites*, proposed for an African shell, and the species of which closely resemble in conchological features the species of *Ledoulxia*.

*Trochomorpha*, used by Connolly (p. 103), following Melvill and Ponsonby, can have no place in the African list, the type being also a Pacific Ocean shell.

*Thapsiella*, at my suggestion, was altered to *Gudeella* by Preston, but acknowledgment was accidentally omitted; this genus does not seem to fall into my sub-family Trochozonitinae, and I would suggest to Connolly reconsideration of this association.

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## SOME MORE NOTES ON POLYPLACOPHORA. PART I.

By TOM IREDALE.

*Read 17th April, 1914.*

SOME time ago I contributed to these Proceedings some notes on Polyplacophora (vol. ix, pp. 90-105 and pp. 153-62, 1910), and in the last part (vol. xi, pp. 25-51, 1914) I furnished an account of the Chiton Fauna of the Kermadec Islands. During the intervening years I have accumulated some interesting notes, mostly on extra-Australian forms, and a larger number of notes, dealing with Australasian material, I hope to incorporate in a review of the Australasian Chiton Fauna I have in preparation. However, Dr. Thiele has written me that he is now preparing a monograph of the Polyplacophora for *Das Tierreich*, and I therefore consider it necessary that my notes should be made available so that they may be criticized in the production of Dr. Thiele's work. The succeeding notes are mainly nomenclatural, but are of more than usual interest, while some few are suggestive.

## CRASPEDOCHITON (THAUMASTOCHITON) MÖBIUSI, Thiele.

In the Report on the Marine Mollusca obtained by J. Stanley Gardiner among the Islands of the Indian Ocean (Trans. Linn. Soc. Lond., vol. xiii, p. 119, 1909) Melvill recorded—

“357. *Acanthocites (Loboplax) laqueatus* (Sowb.).

*Loc.* Amirantes: Station E 13, 20 to 25 fathoms, calcareous rubble.”

The specimen upon which this record is based is now in the British Museum, and at the first glance it seemed quite distinct from Sowerby's *laqueatus*. The shell is curled, and approximately measures 38 mm. × 15 mm. The girdle is produced in front and narrowed behind, and could be termed leathery, minutely sandy. Four pores are clearly observed before the head-valve, and seven at the sutures, and a peculiar feature is their presence behind the tail-valve. Here, apparently protected by the curling, the tufts are preserved, as is also a peripheral fringe, consisting in each case of long opaque-white spicules. The colour of the girdle is bright puce pink. The head-valve is sculptured with seven elevated ribs, the outside ones constituting the border. I note this, as in *Loboplax* usually only five ribs are indicated, no outside ones being developed. These ribs are not differentiated in any way, but appear simply as undulating elevations. The sculpture consists of rounded separated pustules of varied sizes. The lateral areas of the median valves are well raised, the sculpture consisting of rounded pustules closely packed; the median areas are covered with oval flat-topped pustules which become confused and merged into a continuous flattened rib on the jugum. The tail-valve is long, *the mucro posterior, very much elevated and recurved, then sloping backward, making a convex lateral area.* I have

seen no similar tail-valve yet in any other Chiton. The upward curve of the tail-valve of *Plaxiphora* (*Frembleya*) *egregia* (H. & A. Adams) is recalled, but this instance much exaggerates it. Besides, in that case there is no convex lateral area, which is clearly shown in this. Upon dissection the tail-valve was found to possess, instead of an insertion-plate, simply a callused ridge showing faint striations. In his Revision des Systems der Chitonen (Chun's Zoologica, Heft lvi), Thiele (p. 34) introduced for a Mauritian shell *Craspedochiton* (*Thaumastochiton*, n.subgen.) *möbiusi*, n.sp.

Beautiful figures are given on Taf. iv, figs. 36-48, and the *Amirantes* shell certainly falls into the sub-genus *Thaumastochiton*, though it may specifically differ from Thiele's Mauritian form. The tail-valve in the latter, judging from Thiele's figures, does not show such an upcurved mucro, nor possess such a well-defined, convex, lateral area.

As the *Amirantes* would geographically fall into the Mauritius area, and further, as only one specimen is available, I would minimize the observed differences and record this shell under Thiele's species-name. On account of the interest this sub-generic form must have to all Chiton students, I have brought forward this alteration, and would note the rejection of *laqueatus*, Sow., from the *Amirantes* fauna. Thiele (p. 116) under *Thaumastochiton* made a footnote "Dahin gehört wahrscheinlich 'Onithochiton' *isipingoensis*, Sykes (P. Malac. Soc. London, vol. iv, p. 259) von Sud-Afrika". This induced the examination of Sykes' species, the type of which is preserved in the British Museum. It was obviously no *Onithochiton*, judging from the description alone, and was as certainly a *Craspedochitonoid* shell. Thiele's suggestion proved correct, since, though '*O.*' *isipingoensis*, Sykes, differed altogether in sculpture from the *Amirantes* shell, the tail-valve agreed minutely in structural characters. Sykes' description of the tail-valve is here reproduced: "Posterior valve similarly sculptured, but having a dorsal area; it is concave above and the mucro is posterior. . . . The insertion plate of the posterior valve is flattened behind, and appears to be without any slit, the tegmentum overhanging, and the valve being obtusely beaked behind."

#### CHITON PETASUS, Reeve.

This species is described in the Proc. Zool. Soc., 1847, p. 25, and figured in the Conch. Icon. *Chiton*, and also in the Zoology of the *Samarang*. In the Man. Conch., vol. xiv, p. 311, Pilsbry placed this species in the genus *Placiphorella*, with the note "Referred to this genus on account of the peculiar girdle". At that time the genus *Craspedochiton* was imperfectly known, and consequently it was a forgivable error to overlook the undoubted relationship of Reeve's species to that genus. However, quite recently Nierstrasz, determining the Chitons of the Siboga Expedition (p. 43, 1905), has introduced a new species of *Craspedochiton* with the name *tesselatus*, which, coming from the same locality, seems to be the long-lost Reevean species. It should be observed that in the same paper

(p. 111) Nierstrasz catalogued *Placiphorella petasa*, Reeve, as being on record, from the locality, with the remark "*Placiphorella petasa*, Reeve, von Stroomen Kap, N. W. Celebes stellt ebenso eine isolierte Form dar". The recognition of *Chiton petasus*, Reeve, as referable to *Craspedochiton*, and not to *Placiphorella*, removes one of the few apparent geographical anomalies present when the distribution of the Polyplacophora is studied.

In this place I might point out that Nierstrasz (p. 23) introduced a new species of *Ischnochiton* with the species-name *variegatus*. I cannot see that amendment has yet been made, though one of the commonest Australian *Ischnochitons* bears that species-name, and has the prior right. Reverting to geographical anomalies, I would cite a paper by Nierstrasz in the Tijdschr. der Nederl. Dierk. Vereen, ser. II, vol. x. In that paper Nierstrasz, through the acceptance of inaccurate Museum records, has perpetuated some incorrect generic determinations, and introduced others. These will mostly be dealt with in their places, but the admission of *Cryptoplax* to the Neozelanic Fauna, the reference to *Maugeria* of specimens from the Straits of Magellan and the Cape of Good Hope, as also *Tonicia* from New Zealand, will be refused without the slightest hesitation until perfectly authenticated examples are procured.

Nierstrasz also referred to *Heterozona* the species Hedley described (Proc. Linn. Soc. N.S.W., vol. xxiii, p. 100, 1898) under the name *Ischnochiton araucarianus*.

Thiele (Revision, p. 96) suggested the reference of this species to *Sclerochiton*. Judging from figures I agreed, and it seemed difficult to separate this from *Chiton (Sclerochiton) miles*, Pilsbry, described from Torres Straits. With his usual generosity, Mr. Hedley forwarded me paratypes of his species, and without doubt it is very close to *S. miles*. I have received a fair collection of *Chitons* made by my friend Mr. Robin Kemp at Cape York, Torres Straits, and therein was included many specimens of *S. curtisianus* (Smith), proving that that species extends from Port Curtis northwards to Cape York, thus apparently confirming my subjection of Thiele's *S. aruensis* (Proc. Malac. Soc., vol. ix, p. 103, 1910). Nothing like Pilsbry's *S. miles* has yet been seen from Torres Straits, so that it is quite possible the locality is erroneous, and that the shell may have come from New Caledonia. I hope to revert to this matter again soon.

Two other incorrect determinations may be here rectified. In the Report on the Polyplacophora of Ceylon (Ceylon Pearl Oyster Fisheries Suppl. Reports, p. 178, 1903) Sykes recorded *Callochiton platessa*, Gould? This would seem to be confirmed by the admission by Smith into the Fauna of the Maldives and Laccadives, p. 619, of the same species, *C. platessa*.

This species is fairly familiar to me, as I have collected it both in New Zealand and Australia, and though both Smith's and Sykes' shells, which I have examined, are undoubtedly referable to the genus *Callochiton (sensu lato)*, they are just as certainly not specifically identical with Gould's *C. platessa*.

## CHÆTOPLEURA NOBILIS, Pilsbry.

In the Man. Conch., vol. xiv, p. 30, 1892, Pilsbry included a species *Chætopleura nobilis*, citing it as of Reeve, basing it upon "*Chiton nobilis*, Gray, Reeve, Conch. Icon., pl. xxi, fig. 139, May, 1847. Not *Chiton nobilis*, Gray; *Chætopleura nobilis*, Rv., Cpr. MS." Reeve's figure is reproduced on Pilsbry's pl. xiv, fig. 80.

The species is included upon Carpenter's MS. notes which Pilsbry quotes. Some extraordinary confusion has here occurred, as part of the note reads: "The above is written from the type specimen which Rve. described as the *C. nobilis* of Gray, and which Mr. Adams most kindly submitted to my examination." I have been unable to fathom the connexion of Mr. Adams with the type-specimen, as Reeve described his *Ch. nobilis*, Gray, from a specimen in the British Museum, which is still preserved with the data upon the back of the tablet. This shell is undoubtedly the New Zealand *Eudoxochiton nobilis* (Gray), so that we are confronted with the problem of Adams' shell. As its whereabouts are unknown, it would seem necessary to write off, as indeterminable, the species *Ch. nobilis*, Pilsbry. The Reevean reference and figure pass correctly into the synonymy of the New Zealand shell, whilst the citation of Pilsbry's name in connexion with the missing *Chætopleura* keeps the latter in perspective, so that its rediscovery may be looked for. The unknown locality, of course, handicaps the investigator.

## The genus-name ACANTHOCHITONA.

In the London Medical Repository, vol. xv, 1821, John Edward Gray published "A Natural Arrangement of Mollusca, according to their internal structure". Dealing with the genus-name *Chiton*, Pilsbry (Man. Conch., vol. xiv, p. 150, 1893) quoted the matter dealing with Chitons, but did not dispose of the questions offered by that excerpt. Inasmuch as Pilsbry incorrectly quoted that extract, it is possible he was indebted to second-hand information for his knowledge of the paper.

If the concluding paragraph of Gray's article (p. 239) be studied, the procedure is quite simple. This reads: "The genera that are here given mostly contain many sub-genera, and are what are called by several modern naturalists natural families; but I prefer to call them genera, and their subdivisions sub-genera, because then either name can be used separately, and so suits both opinions, for the genera may be made into families by changing the termination as from limax to limacidæ, and because I think that it is easier to recollect limax arion hortensis than arion hortensis alone, as genera are now become so numerous that naturalists really want something to let them know to what part of natural history they belong." With this in front of us we know how to deal with the following nomination on p. 234—

## "Ord. 10. POLYPLACOPHORA.

(Description of animal, etc.)

a. Plates placed on the back of the mantle.

1. Gymnoplax or gymnoplacidæ. Acanthochitona, Chiton fascicularis, Lepidochitona, Chiton marginatus."



When Pilsbry quoted this extract he wrote *Leptochitona*, which is quite a different name. There can be no other conclusion than that the name *Acanthochitona* is correctly introduced as a sub-generic name for the species grouped with *Chiton fascicularis*. Though never hitherto used, it claims every right to usage, and fortunately little confusion will be caused by giving the name its due. The name commonly in use is *Acanthochites*, which date from Risso, 1826. Risso introduced it from Leach's MS., and it is probable that Gray was also influenced by Leach's proposition. It might be noted that Risso's spelling has been amended to *Acanthochates*, *Acanthochitus*, and even *Acanthochiton*, whilst the species are commonly called *Acanthochitons* as a vernacular term.

Though not recorded in Scudder's Nomenclator, Gray's genus-name appears in the synonymy of *Acanthochites*, Risso, in H. & A. Adams' Genera Recent Mollusca, vol. i, p. 482.

#### The genus-name LEPIDOCHITONA.

The consideration of this name naturally follows the preceding discussion. However, here rather radical alterations are necessary. The only species mentioned in conjunction with the name is *Chiton marginatus*, and this consequently becomes the type by monotypy. Pilsbry (Man. Conch., vol. xiv, p. 67, 1892) included this species in the genus *Ischnochiton*, placing it in the sub-genus *Trachydermon*, Carpenter, 1863, citing as a synonym *Craspedochilus*, G. O. Sars, 1878. The succeeding year, however, Pilsbry (Man. Conch., vol. xv, p. 63, 1893) admitted that *Trachydermon* was generically distinct from *Ischnochiton*, and named as type *T. flectens*, Carpenter. *Craspedochilus*, G. O. Sars, was proposed for *C. marginatus* alone, and in the List of British Marine Mollusca, prepared by a Committee of the Conchological Society (Journ. Conch., vol. x, p. 10, 1901), *Craspedochilus*, probably at Sykes' suggestion, was given generic rank, as independent of *Trachydermon*. *Lepidochitona* will therefore displace *Craspedochilus*, being exactly equivalent to it.

Thiele (Revision, p. 116, 1909) makes *Trachydermon* a genus of his family Callochitonidæ, ranking *Craspedochilus* as subordinate, with sectional rank; his family Callochitonidæ is divided into two sub-families, *Trachydermoninæ* and *Callochitoninæ*. The acceptance of Thiele's classification and the recognition of *Lepidochitona* would necessitate the following alterations:—

Family LEPIDOCHITONIDÆ.

vice CALLOCHITONIDÆ.

Sub-family LEPIDOCHITONINÆ.

vice TRACHYDERMONINÆ.

Genus *Lepidochitona*, Gray, 1821 (= *Craspedochilus*, G. O. Sars, 1878).

vice *Trachydermon*, Cpr., 1863.

Sub-genus *Trachydermon*, Cpr., 1863.

In the Proc. Zool. Soc. Lond., 1847, p. 127, Gray introduced the new genus *Leptochiton* with three species, *cinereus*, *hanleyi*, and

*cajetanus*. The first-named was designated, as type, on p. 169. This cannot be considered the same name as *Lepidochitona*, the two roots having entirely different meanings. *The group by the type species will be an exact synonym of Lepidochitona.*

The genus-name *AMICULA*.

Pilsbry in the *Man. Conch.*, vol. xv, p. 63, 1893, gives, as the primary introduction of this genus-name, Gray, *Proc. Zool. Soc. Lond.*, 1847, pp. 66, 69, 169, and notes the *Syn. Brit. Mus.*, 1840, usage as earlier, but without diagnosis. In the *Proc. Malac. Soc. Lond.*, vol. x, pp. 294-309, 1913, I gave the results of my investigation of the Synopses British Museum. There I showed that in 1840, on p. 148, appeared the new generic name *Amicula*. On p. 302 I showed that in the 1840 A edition, p. 127, the following note was given: "*Acanthochetes* is peculiar for having a bundle of bristles placed on each side of the valves; and *Chitonellus* and *Amicula* only differ in having the valves nearly hidden in the mantle of the animals." I would agree with Pilsbry that there can be no determination about a name introduced in this manner.

In Dieffenbach's *Travels in New Zealand*, vol. ii, p. 246, 1843, Gray included as a New Zealand shell "*Amicula monticularis*. *Chiton monticularis*, Quoy et Gaim., *Voy. Astrol.*, iii, 406, t. 73, f. 30-36". This is the first time *Amicula* is generically used as a recognizable group, and consequently that name falls as a synonym of *Cryptoconchus*.\* *Cryptoconchus* is rejected by Pilsbry as of Burrow, 1815, and dated from Guilding, 1829.

In the *Elements of Conchology*, 1815, Burrow described a shell under the name *Chiton porosus* (p. 189), and figured it, pl. xxviii, fig. 1, giving "Habitat uncertain, probably New South Wales". On p. 190 he wrote: "They (this and the succeeding species) have been examined by Dr. Blainville, of Paris, by whom a communication respecting them has, it is understood, been made to the French Philomatic Society. The names he has affixed to the two species are *Cryptoconchus porosus* and *C. larvæformis*." According to the Opinions rendered by the International Commission on Zoological Nomenclature, *Cryptoconchus* must be recognized as from this introduction. If it were not it might be argued that it should fall as a substitute name for *Cryptoplax*, Blainville. This genus-name introduced in the *Dict. Sci. Nat.* (Levrault), vol. xii, p. 124, 1818, contained the same two species, but both genus-name and one species-name were changed; thus *Cryptoplax larviformis*, Blainville = *Cryptoconchus larvæformis*, Burrow, ex Blainville MS., and *Cryptoplax depressus*, Blainville = *Cryptoconchus porosus*, Burrow, ex Blainville MS. Blainville states that *Cryptoplax* was "Sous-genre de l'ordre des oscabrions, établi par M. H. de Blainville, dans le Supplément à l'Encyclopédie d'Edinbourg". It would appear that Blainville's articles concerning these molluscs were too advanced to meet with approval by the powers that were concerned in the publication, as neither in the *Bulletin of the French Philomatic Society* nor in the Supplement to the *Encyclopædia Britannica* are they included.

*The northern shells which have been called Amicula will take the name of Asymmetroglyphus (Midd) Chemn. 1859. Type C. pallasii Midd.*

Moreover, it would seem that Blainville himself got disgusted at the treatment of his genus, as in his monumental monograph on the Chitons in the Dict. Sci. Nat. (Levrault), vol. xxxvi, p. 519 et seq., 1825, he discarded it, and included the species in the genus *Chiton*, but once again changing their names. Here, on p. 553, *Chiton vermiformis*, Blainville = *Cryptoplax larviformis* of seven years earlier, and *Chiton leachi*, Blainville = *Cryptoplax depressus* of seven years previous. Pilsbry preferred *Acanthochites*, Risso, 1826, to *Cryptoconchus*, Guilding, 1829, and based his family name on that, separating the *Cryptoplax* species into a separate family, Cryptoplacidae. Thiele has amalgamated these two families, ranking them as sub-families only, and using the name Cryptoplacidae on account of the earlier introduction of the genus-name *Cryptoplax*.

The conclusion that *Cryptoconchus* must date from 1815 makes this the oldest genus-name, and consequently the family name would become Cryptoconchidae. I am at present inclined to agree with Thiele that *Cryptoplax* is not able to be considered as separable as a family.

#### The genus-name MACANDRELLUS.

This name was introduced ex Carpenter's MS. by Dall in the Proc. U.S. Nat. Mus., vol. i, p. 299, 1878, where the type is designated as *Macandrellus costatus*, Adams & Angas. Pilsbry rejected it in the Man. Conch., vol. xv, p. 32, 1893, as Dall's genus was not the same as that of Carpenter, and also "The first use of the name (as above) being unaccompanied by a diagnosis must fall". In my investigations I constantly meet with such statements by authors, and Dall wrote (Journ. Conch., vol. xi, p. 294, 1906), "It is an unfortunate fact that the abrogation of the original rule requiring a diagnosis to validate a genus." I will admit there may have been such a rule, but the abrogation appears to have been useful as long ago as 1847, and probably earlier. For we have Gray in the Proc. Zool. Soc., 1847, when he drew up his epoch-marking "List of the Genera of Recent Mollusca, their Synonyma and Types", introducing new generic names without a diagnosis. We have the commonly utilized Catal. Yoldi Collection, 1853, by Mörch, and I note Fischer in his Man. Conch. in 1880-7 also indulging in the same practice; this is only to quote the very first works that occur to memory. Judging from Risso's genera, where the generic diagnosis disagrees with the identifications of the species named, it would have been better had the abrogation commenced earlier.

To come back to *Macandrellus*, there is now no lawful reason for its non-acceptance, and it must replace the name *Loboplax*, Pilsbry, introduced in the Nautilus, vol. vii, p. 32, 1893, with *Chiton violaceus*, Quoy & Gaimard, cited as type. This species and Adams and Angas' *costatus* are undoubtedly congeneric in the strictest restriction.

In my paper in these Proceedings (vol. ix, p. 101, 1910) I noted the extreme difficulty of determining the divisions of *Acanthochites*. I showed Thiele had been puzzled, and admitted my own difficulties. I, from further study, now consider the admission of the following

generic terms will be more helpful in discriminating these difficult shells when dealing with the Australasian forms: *Acanthochitona*, *Cryptoconchus*, *Cryptoplax*, *Notoplax*, *Macandrellus*, and *Craspedochiton*.

The Neozelanic shell commonly known as *Acanthochites violaceus* (Quoy & Gaimard) would become *Macandrellus violaceus* (Quoy and Gaimard), and the second Neozelanic species *M. mariæ* (Webster). *Craspedochiton* would also be credited with two New Zealand forms, *C. rubiginosus* (Hutton) and *C. cuneatus* (Suter). It is a somewhat remarkable coincidence that both these species, at an interval of almost forty years, should have been described as *Tonicia*, a genus without the slightest resemblance in any way to these species. It is exactly parallel with Sykes' reference of a similar shell to *Onithochiton*, as previously noted.

Although the genus *Tonicia* is unknown from New Zealand, I have recorded the existence of a small species of *Lucilina* (= *Tonicia*) at the Kermadecs.

#### SOME MISUSED SPECIFIC NAMES.

I pointed out in my last paper (these Proceedings, p. 46) that Pilsbry, in his monograph (Man. Conch., vols. xiv-xv, 1892-3), did not accept the present usage regarding preoccupied names, and that consequently some alterations were necessary. To those interested I would suggest the following I have noted:—

On pp. 196-8, vol. xiv, Pilsbry admitted *Tonicia elegans*, based upon *Chiton elegans*, Fremby, Zool. Journ., vol. iii, p. 203, 1827; as sub-species were included *chilensis*, Fremby, *ibid.*, and *lineolata*, Fremby, *ibid.* *Ch. elegans*, Fremby, is unavailable on account of the prior *Ch. elegans*, Blainville, 1825, whilst *lineolata*, Fremby, is also later than Blainville's *lineolata*, 1825. This would leave the species-name as *chilensis*, Fremby, 1827, if Pilsbry's association be correct.

On p. 280 *Nuttallina scabra*, based upon *Ch. scaber*, Reeve, Conch. Icon., pl. xvii, fig. 106, Mch., 1847, must be changed, as Blainville had appropriated that specific name in 1825. There appears to be a substitute ready in *Acanthopleura fluxa*, Carpenter. On p. 283 a Mediterranean shell is called *Nuttallina cinerea*, Poli, though Poli's species is admitted to be both a mixture and also a misinterpretation of Linné's *Ch. cinereus*. There can be no reason urged against the rejection of Poli's specific name, but, as Pilsbry pointed out, some authorities have selected *caprearum*, Scacchi, 1836, and another *crenulatus*, Risso, 1826. Pilsbry regarded both these as indeterminate, and indicated *corrugatus*, Reeve, as the earliest certain name.

In these Proceedings (vol. ix, p. 91, 1910) I showed that *Ch. sulcatus*, Quoy & Gaimard, from examination of the type, was the shell commonly known as *Ischnochiton decussatus*, Reeve, and, as it had priority, advocated its use. In this case also Quoy and Gaimard's name is invalid through the prior *Ch. sulcatus*, Wood, 1811. I must apologize to my Australian friends who have freely adopted my nomenclature for thus misleading them, as it is now necessary to revert to the familiar Reevean *decussatus*.

A North Queensland shell needs a new name, for *Ch. pictus*, Reeve, Conch. Icon., pl. xv, fig. 79, 1847, from Raine's Island, Torres Straits, is invalid through the prior *Ch. pictus*, Blainville, 1825. The types of Reeve's species are in the British Museum, but it appears to be a somewhat rare shell. I propose for this species the new name

LUCILINA SHIRLEYI, nom. nov.

It is named after Dr. John Shirley to mark my thanks for his generosity in forwarding me his collection of Chitons for examination.

Whilst checking these notes I find that in the Manual, vol. xiv, p. 195, *Tonicia crenulata* is included, based upon *Ch. crenulatus*, Broderip, Proc. Zool. Soc., 1832, p. 27. But, as above noted, there is a prior *Ch. crenulatus*, Risso, 1826. A good substitute is ready in ? *Tonicia forbesii*, Carpenter, Mazatlan Cat., p. 193, 1856.

DESCRIPTION OF A NEW RECENT *PHOLADOMYA*  
(*PH. TASMANICA*).

By C. HEDLEY and W. L. MAY.

*Read 17th April, 1914.*

THE antiquity of this genus and the small number of survivors lend an interest to any new member of *Pholadomya*, especially when it appears in a fresh region.

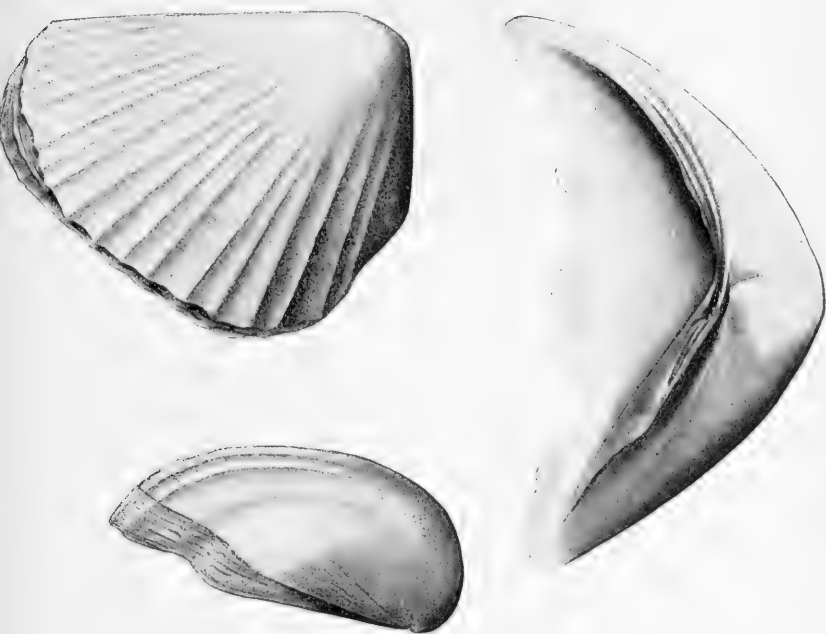
This southern form is readily distinguished from the half-dozen recent species by the remarkable shortness of the anterior side. Judging from literature, it approaches nearest to *Ph. arata*, Verrill and Smith (Trans. Conn. Acad., vol. v, p. 567, pl. lviii, fig. 3, 1882), from the North-Eastern United States, and *Ph. africana*, Locard (Zool. Travailleuse & Talisman, Moll., vol. ii, p. 167, pl. vii, figs. 42-5, 1898), from the North-West of Africa. These were included in a genus *Panacca*, proposed by Dr. W. H. Dall (Nautilus, vol. xviii, p. 143, 1905).

In Torres Strait occurs *Pholadomya haddoni*, Melvill & Standen (Journ. Linn. Soc., Zool., 1899, p. 202, pl. xi, fig. 22), which is perhaps better ranked as a genus apart, *Parilimya*. The Australian Tertiary *Ph. australica*, Tate (Journ. Roy. Soc. N.S. Wales, vol. xxii, p. 187, pl. xii, fig. 2, 1893), is quite unlike the recent Tasmanian shell. *Ph. arenosa*, Hedley (Proc. Linn. Soc. N.S. Wales, vol. xxix, p. 197, pl. ix, figs. 26-7, 1904; vol. xxxi, p. 464, 1906), doubtfully referred to this genus, is smaller, shorter, and more equilateral than *Ph. tasmanica*.

*PHOLADOMYA TASMANICA*, n.sp.

Shell faintly nacreous, thin, fragile, semi-translucent, sub-trigonal, inflated, very inequilateral, the posterior end being four times the length of the anterior, posteriorly rounded, anteriorly truncate, dorsal and ventral margins nearly straight. Colour buff. Sculptured by narrow ridges radiating from the umbo, parted by broad shallow furrows, growing closer and weaker posteriorly, in number eighteen on the shell figured, but about thirty on a fragment of a larger specimen. Anterior side with a single broad radial fold. Entire surface roughened with fine dense grains, usually packed in lines of growth. Umbo unbroken, elevated, incurved, directed anteriorly. A groove on the anterior hinge-margin suggests that the edge of the unseen left valve is here received as a lateral tooth. Chondrophore narrow, posterior to the umbo. Interior very glossy; adductor scars distinct, low down; pallial sinus well developed, the apex of its

angle reaching to the ninth radial from the anterior end. Length 24, height 19, depth of single valve, 20 mm. A second broken specimen indicates a length of 34 mm.



*Hab.*—One entire right and a portion of a larger left valve were dredged by W. L. May in 50 fathoms, 3 miles off Port Arthur, Tasmania. Type in the Australian Museum, Sydney.

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CHARACTERS OF THREE NEW SPECIES OF *ENNEA* FROM  
SOUTHERN NIGERIA.

By H. B. PRESTON, F.Z.S.

*Read 13th March, 1914.*

THE species described in the present paper have been kindly handed to the author for examination by Major A. J. Peile, R.A., who writes that they were "found by Lieut. L. Rees, R.A., serving with the Lower Nigerian Regiment, when clearing a village about 50 feet above the surrounding swamps; the shells were lying in the open". The actual locality is Onoha (marked as Lokar on the map), and is approximately situated in latitude  $4^{\circ} 45'$  N. and longitude  $7^{\circ} 10'$  E. Having duly searched all the available, though somewhat scanty, literature on the region, the author has come to the conclusion that they have hitherto escaped notice, hence the diagnoses given below.

*ENNEA PEILEI*, n.sp.

Shell perforate, cylindrically ovate, yellowish-white; whorls 8, the first six regularly increasing in length and breadth, the seventh increasing in length, but not in breadth, the eighth also increasing in length, but very slightly diminishing in breadth, the apical whorls smooth, the remainder sculptured with moderately closely-set and rather oblique, transverse costulæ, the last whorl bistrangulate nearly throughout its latter half; suture well impressed, umbilicus extremely narrow; columella-margin descending in a curve; labrum white, outwardly reflexed, granular in texture, the converging margins



united by an outwardly spreading, but well-defined, granular, parietal callus; aperture somewhat laterally set, sub-quadrate, armed with a weak parietal lamella situated near the junction of the outer lip with the parietal wall, an also somewhat weak projection on the inner margin of the outer lip, and two very interiorly situate, entering ridges corresponding to the strangulations visible on the outside of the shell. Alt. 4.75, diam. maj. 2.5 mm. Aperture: alt. 1, diam. .5 mm.

*Hab.*—Onoha or Lokar, Opobo District, S. Nigeria (Lieut. L. Rees, R.A.).



## ENNEA OPOBOENSIS, n.sp.

Shell perforate, ovate (in dead condition grayish-white), whorls 6, the first four regularly increasing, the fifth increasing in length, but not so much in breadth, the sixth also increasing regularly in length, but diminishing in breadth, the upper whorls smooth, the remainder sculptured with moderately, closely-set, oblique costulæ, which become rather more distant on the last convolution; suture impressed; umbilicus very narrow, deep; columella-margin a little obliquely descending; labrum pure white, narrowly outwardly expanded; aperture taking the form of an inverted and truncated triangle, armed



with a large, broad, projecting, somewhat claviform, parietal tooth, a broad and bifurcated tooth on the inner margin of the labrum, of which the lower furcation is the weaker, a small, slightly interiorly situate, basal denticle, a well-marked, upwardly tending lamella on the median part of the columella, and, above this, a minute denticle at the point of its junction with the parietal wall. Alt. 3.75, diam. maj. 2.25 mm. Aperture: alt. .75, diam. .5 mm.

*Hab.*—Onoha or Lokar, Opobo District, S. Nigeria (Lieut. L. Rees, R.A.).

## ENNEA REESI, n.sp.

Shell perforate, cylindrically claviform, rather thin and vitreous, pale yellowish-green; whorls  $7\frac{1}{2}$ , the first four and a half regularly



increasing, the fifth increasing in length, but proportionately less in breadth, the last two also increasing in length, but decreasing in

breadth, the upper whorls sculptured with transverse and distant, spiral, scratch-like striæ, the lower obliquely, transversely costulate, the costulæ being much more marked in the sub-sutural region, except on the last whorl, where they become finer, more closely set and well marked throughout its whole length; suture impressed; umbilicus moderately narrow; columella-margin obliquely descending; labrum white, narrowly expanded, the converging margins joined by a thickish and well-defined parietal callus; aperture obliquely sub-triangular, armed with a projecting, parietal, lamella-like tooth, two denticles on the inner margin of the columella lip, the lower in each case being the stronger. Alt. 6·25, diam. maj. 3 mm. Aperture: alt. 1·75, diam. 1 mm.

*Hab.*—Onoha or Lokar, Opobo District, S. Nigeria (Lieut. L. Rees, R.A.).

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A LIST OF AUSTRALIAN MACTRIDÆ, WITH A DESCRIPTION OF  
A NEW SPECIES.

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

Read 17th April, 1914.

MR. H. H. BLOOMER recently very kindly sent to the British Museum a few specimens of a *Mactra* from Queensland, asking me to give him the name of the species, or, if unnamed, to publish a description of it.

Not finding it in the collection in the British Museum, it became necessary to study the literature bearing upon this group of Mollusca, and more particularly that portion of it relating to the Australian fauna. In doing this it seemed advisable to get together and publish a list of the known Mactridæ of Australia, which it is hoped may prove of some use to authors and collectors on that continent. Forty different species are now recorded, but some of these, namely, *decora*, Desh., *olorina*, Phil., *ornata*, Gray, and *sericea*, Desh., require confirmation as being Australian.

A few other species described or quoted as Australian are beyond recognition, such as *antiquata*, Spengler (= *chemnitzii*, Gray), *australis*, Sow., *decussata*, Menke, and *rotundata*, Gmelin.

The last-named (Syst. nat., vol. vi, p. 3257) was founded upon two figures representing totally different species, and consequently had better be regarded as unrecognizable. Its habitat was unknown to Gmelin, but in Paetel's Catalogue (vol. iii, p. 33, 1890) Australia is given.

No attempt has been made to give complete synonymy and references, but only those are quoted which seemed necessary or of special importance.

The species are arranged in alphabetical order for easy reference, the sectional names, where present, being placed in brackets, and I would here observe that some of the sub-genera and divisions which have been proposed appear to be of little or no use. Reeve's monograph in the *Conchologia Iconica*, vol. viii, 1854, and that by Weinkauff in the *Conchylien Cabinet* (1880-4) are referred to in the following list, for the sake of brevity, merely under those authors' names.

1. MACTRA ABBREVIATA, Lamareck. B.M.<sup>1</sup>

*Mactra abbreviata*, Lamareck, Anim. sans Vert., vol. v, p. 477, 1818;  
Mabille in Hedley, Proc. Linn. Soc. N.S. Wales, vol. xxvii,  
p. 597, 1903.

*M. obesa*, Deshayes, P.Z.S., 1853, p. 16; Reeve, fig. 19; Weinkauff,  
p. 48, pl. xvi, figs. 3-4.

var. = *M. meretriciformis*, Deshayes, l.c., p. 16; Reeve, fig. 18;  
Weinkauff, p. 58, pl. xx, figs. 3-3a.

*Hab.*—Torres Straits (Deshayes for *obesa*), north-east coast of  
Australia (J. B. Jukes in Brit. Mus.), Cape York (Brit. Mus.), Port

<sup>1</sup> The letters B.M. indicate that the species is in the British Museum.

Essington (Deshayes for *meretriciformis*), Port Curtis (Brit. Mus. for *meretriciformis*).

The locality "Port Jackson" given by Lamarck is doubtful, or at all events requires confirmation. Without the aid of the description of *M. abbreviata* given by M. Mabilie it was quite impossible to recognize the species. I believe that Lamarck's types are merely half-grown examples of the species named *M. obesa* by Deshayes. The form, "obtuse trigona, transversim abbreviata," the colour, "alba," and the character of the dorsal areas, "ano vulvaque eleganter plicatis," are quite features of *obesa*. The proportion of height to length corresponds to the measurements given by Mabilie. I agree with Weinkauff's suggestion (p. 49) that *M. obesa* and *M. meretriciformis* are merely varieties of one and the same species. They agree in every detail, excepting that the latter is bluish towards the umbones, and purplish within the valves.

The shell figured by Hedley (Proc. Linn. Soc. N.S. Wales, vol. xxvii, pl. xxix, figs. 1-3) certainly cannot be the true *abbreviata*, and I am inclined to think that it belongs to *M. pura* as suggested by Pritchard & Gatliff (Proc. R. Soc. Victoria, vol. xii, p. 106, 1900).

*M. abbreviata*, Lamarck, is quoted by Menke<sup>1</sup> from West Australia, and by Gray in P. P. King's *Narrative of a Survey of the Coasts of Australia*, vol. ii, Appendix, p. 474, but it is impossible to say what species those authors had before them.

Since the foregoing was written I sent a valve of this species to Dr. E. Lamy, of the Paris Museum, and he has most kindly confirmed my identification. He writes: "Il n'y a pas de doute possible: la valve est bien conforme aux deux types de *M. abbreviata*, Lk. Votre valve par ses caractères de forme, de sculpture (ano vulvaque plicatis), de dent cardinale, de sinus pallial me paraît absolument conforme aux types de *M. abbreviata*."

## 2. MACTRA ACHATINA, Chemnitz. B.M.

*Mactra achatina*, Chemnitz, Conch. Cab., vol. xi, p. 218, pl. cc, figs. 1957-8; Reeve, fig. 51; Weinkauff, p. 50, pl. xvii, figs. 3-4; Hedley, Rep. Aust. Assoc. Adv. Sci. 1909, p. 351, 1910.

*Hab.*—Ceylon or Nicobar Islands (Chemnitz), Philippine Islands (Reeve), Manila (Hidalgo), Red Sea (?), coast of Bengal, East Africa, China (Weinkauff), Queensland (Hedley).

Placed in the Australian list on Mr. Hedley's authority. This species and *M. ornata* (Gray) may have been confounded.

## 3. MACTRA (SPISULA) ADELAIDÆ, Angas. B.M.

*Spisula adalaidæ*, Angas, MSS., Proc. Zool. Soc., 1865, p. 697.

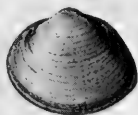
*Hab.*—Port Adelaide Creek, South Australia (Angas). Type in Brit. Mus. Adelaide (C. J. Wigram in B.M.).

In his diagnosis Angas omitted to state that the sculpture consists merely of the fine lines of growth, and the interior of the shell is not referred to. The valves are white within, and the pallial line is

<sup>1</sup> Moll. Novæ Hollandiæ, 1843, p. 45.

practically *without any sinus*, a feature which distinguishes it from the other small species of Mactridæ from the Australian coast.

The lateral teeth are long, and smooth within and without, but the single tooth on each side in the left valve is roughened or microscopically granular on the edge. There is a single solid triangular  $\Lambda$ -shaped cardinal tooth in this valve, in front of the resilium pit, and a minute denticle above the point of the  $\Lambda$ . A similar  $\Lambda$  tooth is in the right valve, the posterior phlange of the



$\Lambda$  forming the boundary of the resilium pit. The triangular resilium reaches to the umbones, causing a slight break in the dorsal margin. The external ligament is feeble, thin, marginal, and scarcely anything more than a hair-like line.

Tate (Trans. R. Soc. S. Aust., vol. ix, p. 84, 1887) united this species with *M. ovalina*, Lamarek, but that form is a very different shell according to Delessert's figure.

#### 4. MACTRA (STANDELLA) ÆGYPTIACA, Chemnitz. B.M.

*Mactra ægyptiaca*, Chemnitz, Conch. Cab., vol. xi, p. 218, pl. 200, figs. 1955-6; Dillwyn, Cat., p. 145; Reeve, pl. xx, fig. 112.

*Spisula ægyptiaca*, Gray, Mag. Nat. Hist., i, p. 373, 1837.

*Merope ægyptiaca*, Angas, Proc. Zool. Soc., 1871, p. 100.

*Hab.*—Port Essington and Port Curtis (Brit. Mus.), North Australia (Mrs. Ince in Brit. Mus.), Red Sea (Chemnitz), Ceylon (Reeve), Lake Macquarie, New South Wales (Angas), whole of Queensland coast (Hedley).

The Port Essington specimens were collected by Mr. John Gould, the ornithologist, and J. McGillivray, and consequently the locality may be relied upon as correct. This species may be, as suggested by some authors, the *M. nicobarica* of Gmelin, founded on a figure in Chemnitz (vol. vi, pl. xxiv, fig. 237).

#### 5. MACTRA ALTA, Deshayes. B.M.

*Mactra alta*, Deshayes, Proc. Zool. Soc., 1854, p. 347; Weinkauff, p. 113.

*Hab.*—North-east coast of Australia (Brit. Mus.), Australia (Weinkauff and Deshayes).

Length 70, height 63, diam. 39 mm.

Allied to *M. abbreviata*, but differing somewhat in form, being more equilateral, less produced posteriorly, and higher in proportion

to the length. The dorsal margin is regularly curved or arched on both sides of the umbones. The hinge also offers some differences, the teeth being rather more delicate, and the posterior lateral passes into the lower edge of the chondrophore and not upwards towards



the dorsal margin. The hinder adductor scar is rather smaller, and the pallial sinus a little deeper. There is very little difference in the external sculpture.

6. *MACTRA* (*SPISULA*) *AMYGDALA*, Crosse & Fischer. B.M.

*Mactra amygdala*, Crosse & Fischer, Journ. de Conch., vol. xii, p. 349; vol. xiii, p. 426, pl. xi, fig. 3; Weinkauff, p. 81, pl. xxviii, fig. 1.

*Trigonella amygdala*, Angas, Proc. Zool. Soc., 1865, p. 645.

*Hab.*—Spencer's Gulf, South Australia (Angas).

7. *MACTRA* (*MACTRINULA*) *ASPERSA*, Sowerby. B.M.

*Mactra aspersa*, Sowerby, Tankerville Catalogue, Appendix, 1825, p. 11; Reeve, pl. xiv, fig. 65; Weinkauff, p. 77, pl. xxvi, fig. 5.

*M. tenera*, Wood, Index test. Suppl., p. 4, pl. i, fig. 4.

*Spisula tenera*, Gray, Mag. Nat. Hist., vol. i, p. 373, 1837.

*Hab.*—Torres Straits (Mus. Cuming), Attagor Islet, Torres Straits, (J. B. Jukes in Brit. Mus.), Philippine Islands (Reeve and Hidalgo), New Caledonia (Weinkauff), Van Diemen's Land (Wood), Queensland (Hedley).

8. *MACTRA AUSTRALIS*, Lamarck. B.M.

*Mactra australis*, Lamarck, Anim. sans Vert., vol. v, p. 475, 1818.

*M. polita* (Chemnitz), Reeve, pl. x, fig. 39; Weinkauff, p. 14, pl. iv, figs. 5, 6.

*Trigonella polita*, Angas, Proc. Zool. Soc., 1865, p. 645.

*Hab.*—Port King George, South-Western Australia (Lamarck), Spencer's Gulf and Encounter Bay, South Australia (Angas), Swan River (Reeve), Port Denison (Weinkauff), Holdfast Bay, South Australia and Adelaide (Brit. Mus.), St. Vincent and Spencer Gulfs, Fowler Bay and Head of Great Australian Bight (Tate), Gellibrand Coast, Cape Bridgewater, Portland, Victoria (Pritchard and Gatliff).

*Mactra australis* in Dillwyn, 1817 (Cat., p. 141) is the *Mya australis*, Gmelin (Syst. nat., p. 3221) = *Mya novæ zelandiæ*, Chemnitz. That shell, however, is a *Mesodesma*.

9. *MACTRA (MACTRINULA) COMPLANATA*, Deshayes. B.M.

*Mactra complanata*, Deshayes, Proc. Zool. Soc., 1853, p. 14; Reeve, pl. xii, fig. 54; Weinkauff, p. 27, pl. ix, fig. 3.

*Hab.*—Australia (J. B. Jukes in Brit. Mus.), Indian Ocean (Deshayes and Reeve), Ceylon (Weinkauff).

10. *MACTRA CONTRARIA*, Deshayes. B.M.

*Mactra contraria*, Deshayes, Proc. Zool. Soc., 1854, p. 62; Reeve, pl. xvii, fig. 86.

*Trigonella contraria*, Angas, Proc. Zool. Soc., 1867, p. 316.

*Mactra rugifera*, Dunker, Novitat. Abth., ii, p. 41, pl. xiii, figs. 1-3.

*Hab.*—? (Deshayes), Port Jackson (Angas), Richmond River, New South Wales (J. Brazier in Brit. Mus.), Swan River (Dunker).

11. *MACTRA (OXYPERAS) COPPINGERI*, Smith. B.M.

*Mactra (Oxyperas) coppingeri*, Smith, Rep. Zool. Coll. Alert, 1884, p. 100, pl. vii, figs. d-d 2.

*Hab.*—Thursday Island, Torres Straits, 4-6 fathoms (Brit. Mus.), Queensland (Hedley).

12. *MACTRA CUVIERI*, Deshayes. B.M.

*Mactra cuvieri*, Deshayes, Proc. Zool. Soc., 1853, p. 17; Weinkauff, p. 117.

*Mactra cumingii*, Reeve, fig. 24; Weinkauff, pl. xxv, figs. 3, 3a.

*Hab.*—Moluccas (Deshayes and Reeve), West Australia, Swan River (Brit. Mus.).

As pointed out by Weinkauff, this species was described by Deshayes under the name *cuvieri* and not *cumingii* as stated by Reeve.

13. *MACTRA DECORA*, Deshayes. B.M.

*Mactra decora*, Deshayes, Proc. Zool. Soc., 1854, p. 63; Weinkauff, p. 39, pl. xii, figs. 8, 9; Reeve, fig. 80.

*M. pulchra*, Gray, Mag. Nat. Hist., vol. i, p. 372, 1837, name only; Reeve, sp. 60, fig. 63, 1854; Weinkauff, p. 56, pl. xix, figs. 5, 6.

*M. jickelii*, Weinkauff, p. 54, pl. xix, figs. 1, 2.

*Hab.*—New South Wales (Weinkauff for *decora*), ? (Deshayes), Red Sea (Reeve for *pulchra*), also Weinkauff, Banda Island, Aden and Muscat (Brit. Mus.), Red Sea (Weinkauff for *jickelii*).

This common species is included in the Australian list merely on the authority of Weinkauff. I fail to discover any distinguishing features of importance between *M. pulchra* and the present species. The former may be a trifle more rostrate behind, like *olorina*, Phil., in that respect.

14. *MACTRA DECUSSATA*, Menke.

*Mactra decussata*, Menke, Moll. Novæ Hollandiæ, 1843, p. 46.

*Hab.*—West Australia (Menke).

This species is not referred to by Reeve, Weinkauff, or Conrad in their monographs. It was not figured by Menke, and from his brief Latin diagnosis I am unable to recognize it among the species since described.

15. *MACTRA DISSIMILIS*, Deshayes. B.M.

*Mactra dissimilis*, Deshayes, Proc. Zool. Soc., 1854, p. 63; Reeve, pl. xiii, fig. 59; Weinkauff, p. 113.

*Hab.*—Australia (Deshayes and Reeve), Cape York (J. B. Jukes in Brit. Mus.), Inkerman, near Townsville, North Queensland (W. Stalker in Brit. Mus.), Queensland (Hedley), Port Curtis (Brit. Mus.)

16. *MACTRA EXIMIA*, Deshayes. B.M.

*Mactra eximia*, Deshayes, Proc. Zool. Soc., 1853, p. 16; Reeve, pl. viii, fig. 31; Weinkauff, p. 99, pl. xxxiii, fig. 6 (copied from Reeve).

*Hab.*—Moreton Bay (Deshayes), Port Curtis, Port Denison, and north-east coast of Australia (Brit. Mus.), Queensland (Hedley).

This may be the shell quoted by Menke (Moll. Novæ Hollandiæ, p. 45) as *M. helvacea*, Chemnitz, a European species.

17. *MACTRA (MACTRINULA) EXPLANATA*, Deshayes. B.M.

*Mactra explanata*, Deshayes, Proc. Zool. Soc., 1854, p. 66; Reeve, pl. xiv, fig. 70; Weinkauff, p. 90, pl. xxxi, fig. 1 (copied from Reeve).

*Hab.*—Swan River (Deshayes and Reeve).



18. *MACTRA INCARNATA*, Deshayes. B.M.

*Mactra incarnata*, Deshayes MSS.; Reeve, pl. xiii, fig. 61; Weinkauff, p. 108, pl. xxxvi, fig. 5; Smith, *Challenger* Lamellibranchiata, p. 58.

*Trigonella incarnata*, Conrad, Amer. Journ. Conch., vol. iii, Appendix, p. 37.

*Hab.*—Swan River (Reeve), Philippine Islands (Smith).

19. *MACTRA JACKSONENSIS*, Smith. B.M.

*Mactra jacksonensis*, Smith, *Challenger* Lamellibranchiata, p. 62, pl. v, figs. 9–9b.

*Trigonella pusilla*, Angas (*nee* Adams), Proc. Zool. Soc., 1867, p. 916.

*Hab.*—Port Jackson (*Challenger*), Port Darwin (Brit. Mus.), Mast Head Reef, Capricorn Group, Queensland (Hedley), Hog Bay, Kangaroo Island, and Streaky Bay, Great Australian Bight (Tate), off Rhyll, Western Port, and off Portsea, Victoria (Pritchard and Gatliff).

20. *MACTRA LUZONICA*, Deshayes. B.M.

*Mactra luzonica*, Deshayes, Proc. Zool. Soc., 1854, p. 64; Reeve, fig. 81; Weinkauff, p. 49, pl. xvii, figs. 1, 1a, 2, 2a.

*Trigonella luzonica*, Angas, Proc. Zool. Soc., 1867, p. 916.

*Mactra apicina*, Deshayes MSS.; Reeve, fig. 111; Hedley, Rep. Aust. Assoc. Adv. Sci. 1909, p. 351, 1910.

*Hab.*—Luzon, Philippine Islands (Deshayes and Hidalgo), Middle Harbour and Botany Bay, Sydney (Angas), Queensland (Hedley for *apicina*).

*M. apicina* is not a white variety of *M. opposita*, Deshayes, as suggested by Weinkauff, but merely the young of the white variety of *M. luzonica*.

21. *MACTRA MACULATA* (Chemnitz), Gmelin. B.M.

*Mactra maculata*, Chemnitz, Conch. Coll., vol. vi, pp. 208, 217, pl. xxi, figs. 208, 209; Gmelin, vol. vi, p. 3260; Reeve, fig. 56; Weinkauff, p. 10, pl. iii, figs. 4, 5; pl. xvi, figs. 5, 6.

*Hab.*—Nicobar Islands (Chemnitz), Philippine Islands (Reeve, Hidalgo, and Weinkauff), Port Essington, Torres Straits, and Claremont Island, North Queensland (Brit. Mus.), Goram Island, Molucca Group (Brit. Mus.), Mast Head Reef, off Queensland (Hedley).

The single specimen from Torres Straits is entirely white excepting the characteristic brownish stain within the valves at the hinder end.

22. *MACTRA MATTHEWSI*, Tate. B.M.

*Mactra matthewsi*, Tate, Trans. Roy. Soc. S. Aust., vol. xi, p. 60, pl. xi, fig. 4.

*Hab.*—Royston Head, Spencer's Gulf, South Australia (Tate and Brit. Mus.).

23. *MACTRA MERA*, Deshayes. B.M.

*Mactra mera*, Deshayes, Proc. Zool. Soc., 1853, p. 16; Reeve, fig. 82; Weinkauff, pl. xxxvi, fig. 7.

*M. antiquata*, Reeve (*non* Spengler), Conch. Icon., sp. 22; Weinkauff, p. 41, pl. xiii, figs. 4, 5.

*Hab.*—Sydney (J. McGillivray in Brit. Mus.), Bay of Manila (Reeve), Philippine Islands, several localities (Hidalgo), Singapore and Australia (Weinkauff), Singapore and North Borneo (Brit. Mus.), Chinese Sea (Deshayes for *mera*).

This species is not, I think, the *M. antiquata* of Spengler founded on a description and figure in Chemnitz (Conch. Cab., vol. xi, p. 217, pl. cc, fig. 1954). The shell then described was 4 inches in length and white, both *within and without*, and purplish at the umbones.

The species now under consideration is more trigonal, and does not appear to attain such a large size, the largest specimen I have seen being only  $3\frac{1}{4}$  inches long. It is invariably of a rich purplish-brown within, and marked externally with brown radiating lines or stripes.

The *M. antiquata* of Spengler is probably the same as *M. cornea*, Deshayes,<sup>1</sup> of which *M. spectabilis* of Lischke<sup>2</sup> from Japan is a synonym.

*M. cornea* was described as coming from the "Chinese Sea", one of the localities given by Chemnitz in the original description. The type is only a half-grown shell, but the species attains a very large size, a specimen from Japan in the Museum collection being nearly 5 inches long. It is uniformly whitish externally beneath the thin periostracum, excepting the purple or violet umbones. The interior also is whitish excepting the upper part, which is a kind of pale flesh tint.

The type of *M. mera* is very faintly rayed, but this feature is not noticed either by Deshayes or Reeve. This, however, is not surprising, since the rays are only just traceable when the shell is carefully examined, and might otherwise be easily overlooked.

24. *MACTRA OLORINA*, Philippi. B.M.

*Mactra olorina*, Philippi, Abbild., vol. ii, p. 72, pl. ii, fig. 2, 1846; Reeve, fig. 35; Weinkauff, p. 39, pl. xii, figs. 4-6.

*M. semisulcata*, Deshayes MSS.; Reeve, fig. 48; Weinkauff, p. 59, pl. xx, figs. 4, 4a.

*Hab.*—Red Sea (Philippi, Reeve, Weinkauff for *olorina*), Australia (Reeve and Weinkauff for *semisulcata*), Persian Gulf (Fischer, J. de Conch., 1891, p. 229).

Allied to *decora*, but larger, differently coloured within and without, and with rather finer sulcation on the anterior portion.

Only known as Australian on Reeve's authority.

<sup>1</sup> Proc. Zool. Soc., 1853, p. 16; Reeve, fig. 75.

<sup>2</sup> Japan. Meeres-Conch., Theil ii, p. 120, pl. xi, figs. 1, 2; Weinkauff, pl. xv, figs. 1, 2.

25. *MACTRA ORNATA*, Gray. B.M.

*Maetra ornata*, Gray, Mag. Nat. Hist., vol. i, p. 371; Reeve, fig. 58; Weinkauff, p. 37, pl. xii, figs. 1-3.

*Hab.*—Australia (Weinkauff), China (Gray, Reeve), Ceylon (Brit. Mus.), Queensland (Hedley).

Recorded as Australian on the authority of Weinkauff and Hedley.

26. *MACTRA (MACTRINULA) OVALINA* (Lamarck). B.M.

*Maetra ovalina*, Lamarck, Anim. sans Vert., vol. v, p. 477, 1818; Reeve, fig. 66; Delessert, Recueil, pl. iii, figs. 7a, b.

*M. depressa*, Spengler, Skrivt. Naturhist.-Selsk., vol. v, Heft ii, p. 118, 1802 (?); Reeve, pl. xiv, fig. 67; Weinkauff, p. 98, pl. xxxiii, fig. 4; Smith, *Challenger* Lamellibranchiata, p. 57.

*Maetrinula angulifera*, Smith (*non* Deshayes), Report *Alert* Collections, 1884, p. 101.

*Hab.*—Middle Port, Melbourne (Brit. Mus.), Australia (Reeve), Port Curtis (Smith), Port Jackson (*Challenger* and Angas), Port Phillip (Angas and Brit. Mus.), Hobson's Bay, Port Phillip, and Western Port (Pritchard & Gatliff), Philippine Islands (Hidalgo).

The Australian specimens are sometimes of a pale reddish tint, especially towards the umbones.

It is doubtful what the unfigured *Maetra depressa* of Spengler, from the coast of Guinea, may have been, but the shell figured and described by Reeve under that name is certainly this Australian species. The *M. ovalina* of Lamarck, from an unknown locality, judging by Delessert's figures (Recueil, pl. iii, figs. 7a, b), is more equilateral. However, this difference may be due to an inaccuracy on the part of the artist, for Dr. Gaston Mermod, of the Geneva Museum, informs me that none of the three Lamarckian shells agrees exactly with Delessert's figure, and the form of the pallial sinus, alike in all three specimens, is not accurately depicted.

He very kindly compared a specimen which I sent him with the Lamarckian types, and he also sent me plaster casts of two of the valves from that historic collection. He writes: "La coquille que vous nous avez envoyée ressemble beaucoup aux exemplaires de Lamarck. Cependant, il existe de petites différences." As these slight differences may only be individual, I am inclined, at present, to accept Reeve's identification of *M. ovalina*, as figured in the *Conchologia Iconica*.

It is placed by Carpenter in the synonymy of *M. fragilis* of Chemnitz, another ill-defined and doubtful species, quoted by Chemnitz from the Nicobar Islands, by Reeve from Honduras, and by other authors from the West Indies, Brazil, etc. What the *M. ovalina*, Lamarck, quoted by Gray (King's *Narrative of a Survey of the Coast of Australia*), may have been, is very doubtful, as I have not been able to trace the specimens he had before him.

Lamarck in 1818 described a *M. depressa* from "les mers de l'Inde", quoting Chemnitz (Conch. Cab., vol. vi, pl. xxiv, fig. 234) as representing it. This figure, however, had already in 1790 been

appropriated by Gmelin as illustrating his *M. pellucida* (Syst. Nat., vol. vi, p. 3260). Chemnitz gave the locality as coast of Guinea.

A single specimen from Port Curtis, Queensland, which I named *Matrinula angulifera*, Deshayes, in the *Alert* Report, I now regard as belonging to the present species, since it lacks the sculptured umbones of *angulifera*, "tenue et regulariter plicatis" (Deshayes, Proc. Zool. Soc., 1854, p. 70).

The umbones in *M. ovalina* are smooth, excepting the delicate growth-lines. There are other differences between these species besides the character of the umbones. In *angulifera* the posterior oblique carina is more pronounced, and forms a distinct terminal angle, and the general form is more triangular.

#### 27. MACTRA (MACTRINULA) PARKESIANA, Hedley.

*Matra parkesiana*, Hedley, Proc. Linn. Soc. N.S.W., vol. xxvii, p. 8, pl. i, figs. 5-9, 1902.

*Hab.*—Port Jackson, New South Wales, and Queensland (Hedley).  
"Belongs to the Section *Matrinula*" (Hedley).

#### 28. MACTRA (SPISULA) PARVA, Petit. B.M.

*Gnathodon parvum*, Petit, Journ. de Conch., 1853, p. 358, pl. xiii, figs. 9, 10; Sowerby, Conch. Icon., vol. xix, pl. i, fig. 6.

*Synonyms and Varieties.*<sup>1</sup>—*Matra rostrata*, Reeve (*non* Spengler); *M. corbuloides*, Deshayes; *M. cretacea*, Angas; *Spisula producta*, Angas; *M. (Spisula) fluviatilis*, Angas.

*Hab.*—Moreton Bay (Petit, also Reeve for *rostrata*), Port Jackson (Angas and Brit. Mus. for *producta*), Port Stephen (Angas for *cretacea*), Hawkesbury River (Angas & Brazier for *fluviatilis*), Port Jackson and Moreton Bay (Angas for *corbuloides*), Victoria (Pritchard and Gatliff and Brit. Mus.).

Notwithstanding the considerable difference in form displayed by some of the so-called species mentioned in the above synonymy, I agree with Hedley<sup>2</sup> and Pritchard & Gatliff<sup>3</sup> in considering them variations of one very variable species. The types of all these forms, with the exception of that described by Petit, are in the British Museum, and a careful examination of the hinges shows that they are essentially the same in all. Presuming the Moreton Bay *rostrata* to be full-grown, the species appears to vary much in size, since specimens from Port Phillip are more than double their dimensions, being 26 mm. long, 20 in height, and 14 in diameter.

Conrad and Weinkauff have erroneously placed *M. corbuloides* of Deshayes in the synonymy of *M. lateralis*, Say, from the east coast of the United States. In form and general external character they are

<sup>1</sup> For references see Pritchard & Gatliff, Proc. Roy. Soc. Victoria, vol. xvi, p. 108, 1903.

<sup>2</sup> Proc. Linn. Soc. N.S.W., vol. xxvi, p. 707, pl. xxxiv, figs. 2, 3, hinge, 1902.

<sup>3</sup> Proc. Roy. Soc. Victoria, vol. xvi, p. 108, 1903.

very similar, but the lateral teeth of the American shell are not striated, and the pallial sinus is narrower and deeper.

The true *M. rostrata* of Spengler<sup>1</sup> is altogether a different species,  $2\frac{1}{2}$  inches long, and said to have come from the coast of Guinea.

29. MACTRA (SPISULA) PINGUIS, Crosse & Fischer. B.M.

*Macra pinguis*, Crosse & Fischer, Journ. de Conch., vol. xii, p. 349; vol. xiii, p. 427, pl. xi, fig. 2; Weinkauff, p. 80, pl. xxvii, figs. 5, 5a; Smith, Journ. Linn. Soc., vol. xii, p. 562, pl. xxx, fig. 25, 1876.

*Mulinia pinguis*, Angas, Proc. Zool. Soc., 1865, p. 645.

*Macra (Mulinia) pinguis*, Tate, Trans. Roy. Soc. S. Australia, vol. ix, p. 84.

*Hab.*—Port Lincoln (Angas), South Australia (Weinkauff), Tasmania (J. Brazier in Brit. Mus.).

30. MACTRA (MACTRINULA) PLICATARIA, Linné. B.M.

*Macra plicataria*, Linné, Reeve, fig. 26; Weinkauff, p. 7, pl. ii, figs. 4-6.

*M. (Macrinula) plicataria*, Smith, *Challenger* Lamellibranchiata, p. 57.

*Hab.*—Cape York, North Australia (*Challenger*), Java, Sumatra, Tranquebar, off the Gangetic Delta (Brit. Mus.), Queensland (Hedley).

I still have some doubt with regard to the identification of the *Challenger* specimen, only about half an inch in length.

31. MACTRA PURA, Deshayes. B.M.

*Macra pura*, Deshayes, Proc. Zool. Soc., 1853, p. 15; Reeve, pl. xii, fig. 53; Weinkauff, p. 26, pl. ix, figs. 1, 1a.

*Trigonella pura*, Angas, Proc. Zool. Soc., 1865, p. 645.

*M. virgo*, Deshayes, op. cit., 1854, p. 66; Reeve, fig. 62; Weinkauff, p. 91, pl. xxxi, fig. 2 (copy of Reeve).

*Hab.*—Australia (Deshayes), Spencer's Gulf, Hardwick Bay, South Australia (Angas), Green Island, off Cairns, Queensland (Hedley), West Australia and Adelaide (Brit. Mus.), Swan River (Deshayes for *virgo*), St. Vincent and Spencer Gulfs, Fowler Bay, Head of the Great Bight, and Eucla. Also King George Sound and Tasmania (Tate).

*M. virgo*, founded on a single shell in the Cuming Collection, differs only from the type of *M. pura* in being a little more acuminate at the hinder end. This I regard merely as an individual variation. The external sculpture, character of the hinge, and the pallial sinus are exactly similar.

*M. australis*, Sowerby, from Swan River, has been referred to the present species by some authors. Judging by the figure (Zool. Beechey's Voy., pl. xlix, fig. 6), the anterior end is too acute. I must

<sup>1</sup> Skrivt. Naturhist.-Selsk., vol. v, Heft ii, p. 115, 1802.

confess, however, it approaches nearer to *M. pura* than any other of the known Australian species.

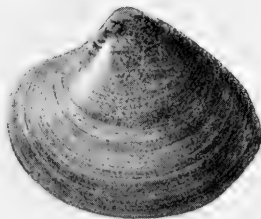
32. *MACTRA PUSILLA*, A. Adams. B.M.

*Mactra pusilla*, A. Adams, Proc. Zool. Soc., 1855, p. 226; Smith, *Challenger* Lamellibranchiata, p. 60, pl. v, figs. 8-8c.  
non *Trigonella pusilla*, Angas, Proc. Zool. Soc., 1867, p. 916 = *M. jacksonensis*, Smith.

*Hab.*—Moreton Bay (Adams), Port Jackson (Smith), Brisbane Water, New South Wales (J. McGillivray in Brit. Mus.), Queensland (Hedley).

33. *MACTRA QUEENSLANDICA*, n.sp. B.M.

Testa trigono-ovata, inæquilateralis, mediocriter convexa, dilute griseo-purpurea, apicem versus purpurascens, pallide zonata, postice anguste hians; valvæ tenues, lineis incrementi tenuiter striatæ, supra umbones fortius striatæ; margo dorsi utrinque declivis, anterior leviter incurvatus, posterior leviter vel vix convexus, ventralis valde arcuatus; latus anticum rotundatum, posticum magis acuminatum; umbones paulo ante medium siti, fera contigui; lunula



depressa, cordiformis, linea impressa circumdata; area dorsalis postica excavata, lanceolata, carina tenui marginata; pagina interna purpurascens, ad marginem ventralem flavescens, radiatim tenuissime striata; cicatrices subæquales, antica piriformis, postica ovalis; sinus pallii brevis, rotundatus; dens cardinalis valvæ sinistræ  $\Lambda$ -formis, lamina tenui pone instructus; dentes laterales tenues, breves, prope cardinales. Long. 35, alt. 29, diam. 17 mm.

*Hab.*—Sandgate, near Brisbane, Queensland.

A thin shell of a purplish colour within, excepting the ventral edge, which is yellowish. Externally it is greyish-purplish, but marked with lighter zones, but towards the umbones it is more distinctly purplish. Besides the fine keel marking off the dorsal escutcheon, there is a second faint angle at the posterior end of the valves radiating from the umbones to the hinder extremity.

The line circumscribing the lunule is not incised, but merely faintly impressed, and the marginal ligament, as usual, is distinct

from the resilium. The lateral teeth are thin and short, and conspicuously near the cardinals.

#### 34. *MACTRA RUFESCENS*, Lamarck. B.M.

*Mactra rufescens*, Lamarck, Anim. sans Vert., vol. v, p. 476, 1818; Reeve, pl. iii, fig. 9; Weinkauff, p. 88, pl. xxx, figs. 4, 5; Pritchard & Gatliff, Proc. Roy. Soc. Victoria, vol. xvi, p. 106, 1903.

*Trigonella rufescens*, Angas, Proc. Zool. Soc., 1865, p. 644.

*Hab.*—New Holland (Lamarck), Van Diemen's Land (Reeve, also R. Gunn in Brit. Mus.), Encounter Bay, near mouth of the Murray River, South Australia (Angas), various localities in Victoria (Pritchard & Gatliff), Shark Bay to Tasmania (Tate), Queensland (Hedley).

#### 35. *MACTRA SERICEA*, Deshayes. B.M.

*Mactra sericea*, Deshayes, Proc. Zool. Soc., 1854, p. 65; Reeve, fig. 10; Weinkauff, p. 54, pl. xviii, figs. 4, 4a(?); Paetel, Cat. Conch., Samml. Abtheil., iii, p. 33, 1890.

*Hab.*—? (Deshayes, Reeve, and Weinkauff); Australia (Paetel). Quoted as Australian solely on the authority of the Paetel Catalogue.

I feel rather doubtful whether the shell figured by Weinkauff really belongs to this species, although his description agrees with it.

#### 36. *MACTRA (CYCLOMACTRA) TRISTIS*, Deshayes. B.M.

*Mactra tristis*, Deshayes, Proc. Zool. Soc., 1854, p. 69; Reeve, pl. xiv, fig. 69; Weinkauff, p. 93, pl. xxxi, fig. 6 (copy of Reeve).

*M. (Cyclomactra) tristis*, Dall, Trans. Wagner Inst. Sci., vol. iii, p. 876, 1898.

*Hab.*—Moreton Bay, Queensland (Deshayes, Brit. Mus., and Reeve), New South Wales (Weinkauff), Queensland (Hedley).

This species attains a larger size than the type shell figured by Reeve. The largest specimen in the Museum measures 68 mm. in length, 54 in height, and 28 in diameter. It is much browner externally than the shells described by Deshayes.

#### 37. *MACTRA TURGIDA*, Gmelin. B.M.

*Mactra tumida* seu *inflata*, Chemnitz, Conch. Cab., vol. vi, pp. 208, 218, pl. xxi, figs. 210–12.

*M. turgida*, Gmelin, Syst. Nat., 1790, p. 3260; Weinkauff, p. 11, pl. iii, figs. 6–8.

*M. tumida*, Spengler, Skrivt. Naturhist.-Selsk., vol. v, Heft ii, p. 108, 1802; Reeve, fig. 21.

jun. = *M. cordiformis*, Deshayes MSS.; Reeve, fig. 6; Weinkauff, pl. xxii, figs. 1, 1a(?).

*M. (Cœlomactra) turgida*, Dall, Trans. Wagner Inst. Sci., vol. iii, p. 875, 1898.

*Hab.*—North Australia.

I include this species in the Australian list on the strength of a remark written on the back of the tablet containing the type of *M. cordiformis*. In pencil it is written "N. Australia fide specimen in Sydney Museum". *M. cordiformis* is without any doubt merely the young of *M. turgida*, since it agrees with it in every detail, even to the violet umbones, a feature not mentioned by Reeve. The hinge-dentition is identical, and the sculpture of the dorsal areas and the rust-red streaks on both are quite similar.

The locality of *M. turgida* is rather uncertain, since it has been quoted from Tranquebar (Chemnitz), St. Thomas, West Indies (Reeve), also Ceylon (Hanley), and Panama (Bernardi), the last two localities *fide* Weinkauff.

St. Thomas and Panama certainly must be eliminated.

### 38. *MACTRA* (*SPISULA*?) *VERSICOLOR*, Tate.

*Hemimactra versicolor*, Tate, Trans. Roy. Soc. S. Aust., vol. ix, p. 64, pl. iv, fig. 12, 1887.

*Mactra* (*Hemimactra*) *versicolor*, Tate, op. cit., p. 84.

*Hab.*—Lake MacDonnell, Great Australian Bight, south coast of Australia (Tate).

### 39. *CYPRICIA* *GRAYI*, H. Adams. B.M.

*Raeta grayi*, H. Adams, Proc. Zool. Soc., 1872, p. 13, pl. iii, fig. 23.

*Labiosa grayi*, Hedley, Rep. Aust. Assoc. Adv. Sci. 1909, p. 351, 1910.

*Hab.*—Borneo (Adams), Queensland (Hedley).

The genus *Labiosa*, Schmidt, first appeared in print in an article by Möller in Oken's *Isis*, 1832, p. 136, and all he states is "*Labiosa*, Schm., *Anatina*, Shum." No description is given, and no species cited. We can therefore only *infer* that the shell referred to belonged to the same genus as the species described and figured by Schumacher in his *Nouv. Syst.*, p. 126, pl. viii, fig. i.

On the other hand, Gray in 1853 (*Ann. Mag. Nat. Hist.*, vol. xi, p. 43) gives a short description of his genus *Cypricia*,<sup>1</sup> quoting *C. recurva* as a type, *Mactra recurva*, Wood, *Index Test. Suppl.*, p. 4, pl. i, fig. 2, 1828. This species is the same as the well-known *lineata*, Say, originally described as a *Lutrarina* in 1821. It becomes then a question whether the genus *Cypricia* should not be retained rather than *Labiosa*.

I fail to discover any features in *Raeta* which can distinguish it even sub-generically from *Cypricia*.

### 40. *CYPRICIA* *MERIDIONALIS*, Tate.

*Raeta meridionalis*, Tate, Trans. Roy. Soc. S. Aust., vol. xi, p. 61, pl. xi, fig. 3.

*Hab.*—Aldinga Bay, S. Australia (Tate).

<sup>1</sup> Proc. Zool. Soc., 1847, p. 185, No. 565.



## REFERENCE LIST OF SYNONYMS.

- angulifera*, Smith (*non* Deshayes), see *ovalina*, Lamarck.  
*antiquata*, Reeve (*non* Spengler), see *mera*, Deshayes.  
*apicina*, Reeve, see *luzonica*, Deshayes.  
*australis*, Sowerby, see *pura*, Deshayes.  
*corbuloides*, Deshayes, see *parva*, Petit.  
*cordiformis*, Deshayes, see *turgida*, Gmelin.  
*cretacea*, Angas, see *parva*, Petit.  
*cumingii*, Reeve, see *cuvieri*, Deshayes.  
*depressa* (Spengler?), Reeve, see *ovalina*, Lamarck.  
*fluviatilis*, Angas, see *parva*, Petit.  
*helvacea*, Menke (*non* Chemnitz), see *eximia*, Deshayes.  
*jickelii*, Weinkauff, see *decora*, Deshayes.  
*meretriciformis*, Deshayes, see *abbreviata*, Lamarck.  
*nicobarica*, Gmelin, see *ægyptiaca*, Chemnitz.  
*obesa*, Deshayes, see *abbreviata*, Lamarck.  
*polita* (Chemnitz), Reeve, see *australis*, Lamarck.  
*producta*, Angas, see *parva*, Petit.  
*pulchra*, Gray, see *decora*, Deshayes.  
*rostrata*, Reeve (*non* Spengler), see *parva*, Petit.  
*rugifera*, Dunker, see *contraria*, Deshayes.  
*semisulcata*, Deshayes, see *olorina*, Philippi.  
*tenera*, Wood, see *aspersa*, Sowerby.  
*tumida*, Spengler, see *turgida*, Gmelin.  
*virgo*, Deshayes, see *pura*, Deshayes.
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# Malacological Society of London.

(Founded 27th February, 1893.)

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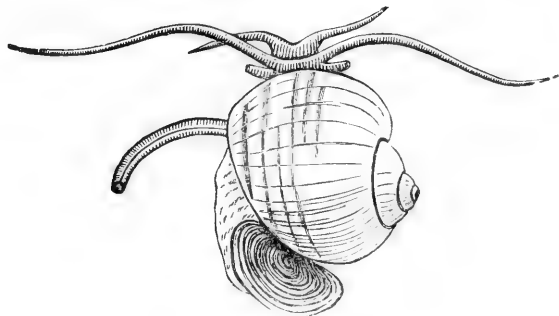
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## ORDINARY MEETING.

FRIDAY, 8TH MAY, 1914.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

The following communications were read:—

1. "On *Helix (Macularia) ogdeni*, n.sp., from the Pliocene (Red Crag) of Ramsholt, Suffolk." By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S.
2. "On the Radulæ of the British Helicids." Part IV. By the Rev. E. W. Bowell, M.A.
3. "Descriptions of new species of *Melania* from Yunnan, Java, and the Tsushima Islands." By Hugh C. Fulton.
4. "Description of a new species of *Strophocheilus (Borus)* from Peru." By Hugh C. Fulton.
5. "Description of a new Helicoid from South Australia." By G. K. Gude, F.Z.S.

Mr. H. C. Fulton exhibited an interesting series of *Plicatula*, illustrating how the sculpture of other shells to which they attach themselves is reproduced on the upper or left valve.

## ORDINARY MEETING.

FRIDAY, 12TH JUNE, 1914.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

The following communications were read:—

1. "Occurrence of *Chondrula quadridens* (Müller) in Britain." By B. B. Woodward, F.L.S.
2. "On a Sinistral Monstrosity of *Purpura lapillus* (Linn.)." By the Rev. A. H. Cooke, M.A., Sc.D., F.Z.S.
3. "On *Sulcobasis concisa* (Fér.) and its nearest allies." By Cæsar R. Boettger.
4. "On the Radula and Maxilla of *Oxystyla undata* (Brug.)." By the Rev. E. W. Bowell, M.A.
5. "On some Invalid Molluscan Generic Names." By Tom Iredale.
6. "Description of a new species of *Cassidea*." By Tom Iredale.
7. "On the relative claim to priority of the names *Helix fruticum*, Müller, and *H. carduelis*, Schulze." By G. K. Gude, F.Z.S.

Mr. B. B. Woodward, F.L.S., exhibited living specimens of *Patulastra flavida*, Ziegler, taken in Glasnevin Botanic Gardens, Dublin, by Mr. R. Welch, probably introduced with plants; a photograph of *Pisidium zugmayeri*, Weber, from a lake in the western confines of Tibet; and *Crepidula fornicata*, obtained by Mr. Pyecraft at Birchington, Kent, the first record of the species south of the Thames.

## NOTES.

---

ON A SINISTRAL MONSTROSITY OF *PURPURA LAPILLUS* (LINN.). (*Read 12th June, 1914.*)—So far as I am aware, there are only two examples of the sinistral form of *Purpura lapillus* (Linn.) whose existence in this country is publicly known. Further examples may occur in private collections or in museums abroad, but I have not come across any record of them. The two examples above referred to are, firstly, a specimen in the collection of the late Mr. Bean, of Scarborough, and now in the museum of that town. The circumstances under which this specimen was procured are related in Jeffreys, Brit. Conch., vol. iv, p. 278. A second occurs in the collection of Dr. A. M. Norman, now in the British Museum, and the note attached states that it came from "Llanfairfechan, N. Wales, 1875 (Mrs. Stebbins)". The shell is 'dead', but perfect. I have the pleasure to show to the Society a third specimen which has very recently come into my hands. It was received from a correspondent at La Rochelle, and occurred, unnoticed by the sender, in a parcel of between eighty and ninety specimens. It is not quite mature, the outer lip showing no sign of thickening, but is perfect in all other respects. It is regularly spirally ridged, ridges somewhat flattened, ground colour dirty white, with orange and brown colour-bands. Length 23 mm., breadth 15 mm.

A. H. COOKE.

---

OCCURRENCE OF *CHONDRULA QUADRIDENS* (MÜLL.) IN BRITAIN. (*Read 12th June, 1914.*)—A few days ago Mr. Lindley H. Jones, of Norwich, sent me for determination a specimen taken on the outskirts of Whittingham Wood, near Norwich, that Mr. G. K. Gude kindly identified as *Chondrula quadridens* (Müll.). One naturally suspected some box had been employed when collecting that had previously done service abroad and had secreted some of its contents in its recesses. Mr. Jones, however, in reply to inquiries, states that he was using a glass tube, so that accidental previous inclusion was out of the question, but he adds the very pregnant suggestion "that as a large number of pheasants are reared in Whittingham Wood, it [the shell] might possibly have been introduced with their food. The place where I found it is quite half a mile from the main road". This explanation seems to me not only to elucidate the occurrence in question, but also to clear up the finding in similar situations at Church and near Stoneyhurst (Lancashire) of *Abida quinquedentata*.

B. B. WOODWARD.

---



ON *HELIX* (*MACULARIA*) *OGDENI*, N.SP., FROM THE PLIOCENE  
(RED CRAG) OF RAMSHOLT, SUFFOLK.

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

*Read 8th May, 1914.*

SHELL imperforate, depressed conic, showing traces of oblique lines of growth; whorls 5, convex, regularly increasing; apex obtuse; suture linear, moderately impressed; body-whorl about half the size of the shell, scarcely dilated, convex below, and impressed in the umbilical region, deeply deflexed anteriorly; aperture broadly lunate, margins distant; outer lip narrowly expanded, having a slight thickening within; columella margin deflected, with reflected callus concealing the umbilicus. Diam. max. 16·4, min. 14 mm.; altitude 10·8 mm.; mouth 6·7 × 8·8 mm.

*Formation*.—Pliocene (Butleyan Red Crag).

*Locality*.—Ramsholt, Suffolk.



This unique example was obtained by Mr. W. E. Ogden, of Upper Clapton, from a small exposure of Red Crag in a low cliff at Ramsholt, near the River Deben, and was kindly sent to us by Mr. A. Bell for determination. It is obviously new to the English Pliocene fauna, and we have failed to identify it with any Continental species, either recent or fossil. Mr. G. K. Gude informs us that its nearest living ally is *Helix* (*Macularia*) *oberndoerferi*, Kobelt.

The present is the first record of this sub-genus in these Islands, and furnishes additional evidence of the 'Southern' affinities of the English Pliocene non-marine Mollusca. We have great pleasure in associating with this interesting specimen the name of the finder, who has, by his enthusiastic researches in the Pliocene deposits of Suffolk, added greatly to our knowledge of the fauna.

## ON THE RADULÆ OF THE BRITISH HELICIDS. PART IV.

By Rev. E. W. BOWELL, M.A.

Read 8th May, 1914.

THREE parts of this paper appeared in vol. viii of these Proceedings. Part III, together with the present contribution, will be found to contain figures of all the species referred by Dr. Gwyn Jeffreys to the genus *Helix*.<sup>1</sup> All the larger species, except *Theba cartusiana* and *Hygromia fusca*, have already been figured and described.

*THEBA CARTUSIANA*.—The central and admedian unci differ in the following minor points from those of *Th. cantiana*:—

1. The central uncus is proportionally larger.
2. The ectocones are less prominent.
3. The apices are shorter and have less sinuosity of outline. In the more lateral admedians the apices tend to become pointed. The apical fossa is not conspicuous.
4. The posterior margins are decidedly less prominent.
5. There is a well-marked indentation of the lacinia.



The external unci are remarkably different in appearance. This is, however, mainly due to their cones being produced into regular styloid processes. If the average proportion of width to length be represented as about 2 : 3 in *cantiana*, in *cartusiana* it reaches 1 : 4. Also, the apices are markedly triangular. The median part of each uncus overlaps the lateral part of the next, but there is no fusion.

The diagnosis of *cartusiana* is therefore easily made, but it is clearly of the same type as *cantiana*. The great difference between the proportions of the external cones furnishes another instance of the principle that prominence in any given character takes the forms of excess and defect in allied species. On comparing these two forms I am disposed to think *cartusiana* to be the earlier, because there is a distinct tendency to thickening of the cone elements, especially on the externals, in the more developed forms. The embryonic *cantiana* exhibits externals more nearly resembling those of *cartusiana*.

It may be suggested that habitat and food have played their part in determining the form of these unci. I have only once found *cartusiana*: the animals were feeding upon thistles in an exposed

<sup>1</sup> The radula of *Vallonia pulchella* (Müll.) has not been figured, as I was unable to obtain specimens from shells which belonged without doubt to this species.

place near the seashore. On other plants in the vicinity none was to be found, though *cantiana*, *virgata*, and *itala* were abundant. But a reference to Part III will show that all these species have radulæ sufficiently distinct.

*HELICELLA GIGAXIL*.—I have not yet examined with sufficient minuteness. Boycott & Standen have given an account of its radula (Journ. Conch., vol. xiv, p. 165).

*HYGROMIA FUSCA* is nearer to *granulata* than to any other of our species; it differs from *granulata* in the following respects:—

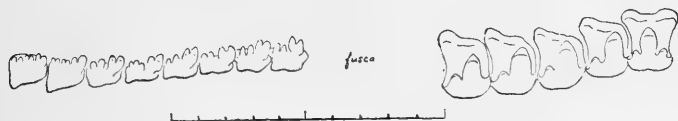
1. All the unci are relatively wider: centrals and admedians roughly equal in length and breadth; externals markedly oblong.

2. The lateral curve of the admedian basal plate is much more pronounced.

3. The apices are blunter.

4. External ectocones are more nearly equal in length to the corresponding mesocones. The prevailing number is two, but there may be three, or the original two may be subdivided to form four. These external cones, regarded as groups, show less tendency to slant laterally and anteriorly than those of any allied species.

Sometimes it is quite difficult to see the medial cusp of the external mesocone, owing to the very regular overlapping which occurs here. If this cusp is not observed, it may easily be supposed that the radula belongs to the type found in the commoner *Hygromia*.



It is, however, always present, i.e. this mesocone is undoubtedly bifid. This radula is very distinct. The very short external cones are remarkable. A similar type occurs in *Helix spirorbis*, Lowe, from Madeira.

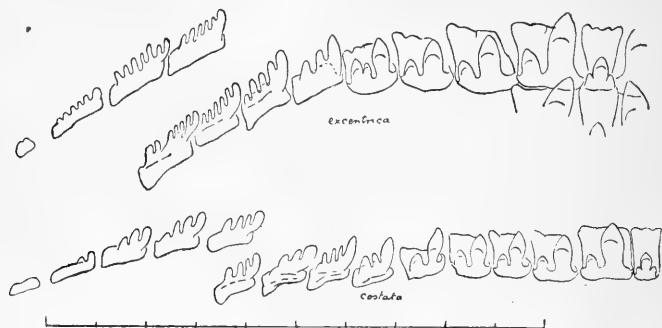
The bifid external mesocone is found in *pomatia*, *aspersa*, *nemoralis*, *hortensis*, *arbustorum*, *obvoluta*, *lapidica*, *caperata*, *itala*, *barbara*, *granulata*, and *fusca*. It also occurs in *Vallonia* and *Acanthinula*. In the allied groups *Clausilia* shows it, and it is present, though less marked, in *Cacilioides*. Whether it is really present in the *Pyramidulæ* will be discussed under those species.

Mr. Reynell kindly gave me the remains of an *EULOTA FRUTICUM*. The radula is very similar to that of *H. hortensis*, so that in the possible event of abnormal specimens of *Th. cantiana* being mistaken for *fruticum*, a ready and certain means of differentiation exists in this character of bifid external mesocones.

We have so few described species among the smaller *Helices* that comparative descriptions are not required. The *Vallonia* or *Acanthinula* radula can be distinguished at a glance; *rotundata*, *rupestris*, and *pygmæum* have striking individual peculiarities.

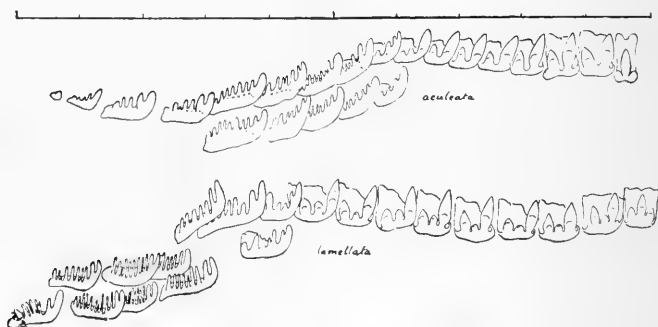
The *VALLONIE* differ from all other *Helicids* in the marked diminution of size of the centrals compared with the admedians, and

the concomitant enlargement of the first (or first and second) admedian. Of the two species most prevalent in this country *excentrica* exhibits the large admedian best, and *costata* the small central. The first three or four basal plates are sub-quadrated. The admedians have the shape of a capital L, i.e. there is a diastema between mesocone and ectocone. This is characteristic of many Pupidæ. One or two rows of transitionals are present; there are



three typical admedians in *excentrica* and four in *costata*. The externals (not counting the first or last) have six rounded pectinations in *excentrica* and four in *costata*. They have a strong lateral and posterior inclination, the basal plates being obtuse-angled parallelograms. The more median cones are considerably larger than the others.

*Cæcilioides acicula* has a somewhat similar radula; but here the admedians have well-developed endocones, which do not occur in any

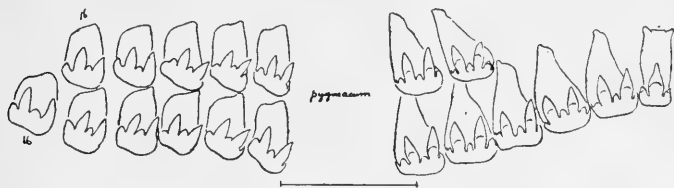


Helicid, so far as I am aware. The externals also are more numerous, oblong, and regularly pectinated, if one may use that term in describing cones so extremely short and rounded. Nevertheless, the resemblance seems very well worth noting.

In ACANTHINULA we also have squared admedian basal plates. The admedians number six or seven. The most salient character is the curved combined median and anterior margin of the external

mesocones and basal plates, for at this margin no line of demarcation can be drawn between them. In consequence the external pleuræ present the appearance of numerous little crescents, sloping away from the admedian regions, and there is a good deal of overlapping, on account of the unusual convexity of the radular membrane. There is apparently a tendency to true longitudinal fusion of these externals. The externals are highly pectinate, the pectinations being more frequent and more filiform in *lamellata*.

This genus also shows great variation in the form and proportion of the central and admedian cones. *Lamellata* can be known at once by the presence of an additional small cone between the admedian mesocone and its ectocone. (Similar structures are found in *Punctum*; they are extremely prevalent in the genus *Succinea*.) The mesocones of the more lateral admedians of both species are long and lancet-shaped, and have a tendency to slant inwards. *Aculeata* has a very narrow central, that of *lamellata* being distinctly wide. They closely resemble those of *Punctum pygmæum* and *Vertigo moulinsiana* respectively. As in the *Vallonia* and in *Punctum*, the actual number of unci on each side of the central is small—from thirteen to sixteen in adult specimens.

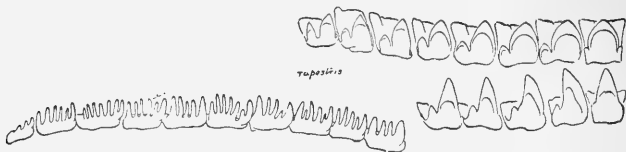


With regard to *rotundata*, *rupestris*, and *pygmæum*, it may be repeated that each has a most characteristic radula, and each exhibits a distinct type. If we examine the basal plates we find that in *PUNCTUM PYGMÆUM* the centrals are like those of a *Succinea*, and this resemblance is continued as we trace the rows outwards on the pleuræ. All the basal plates are sub-triangular, the inner side being slightly convex and having a tendency to be slightly notched; and the size of the basal plate of the first admedian and that of the last (sixteenth) unci is approximately the same. A secondary pleural appearance, probably not indicating a true pleural division, is found after the ninth row from the centre. The ninth admedian is the last which has its basal plate pointing straight backwards to the unci of the succeeding row; that of the tenth admedian points to the space between the tenth and eleventh unci of the row behind it; the eleventh points straight at the twelfth succeeding unci, and this new parallelism is maintained to the end, so that the sides of the radula acquire a fan-like appearance. Simultaneously the angle of insertion of the cones is varied so as to increase the illusion. This arrangement is quite typical in *Succinea*. It is also found in *Orthalicus*. In the *Vertiginidæ* we find some radulæ quite close to that of *Punctum*, closely allied species having the organ developed

very much after the *Acanthinula* pattern, so that, although these two are distinct enough as types, yet the intermediate forms are found.

I have figured the *Punctum* radula as possessing no external unci. It is, however, possible to find at the extreme margin in some specimens one or two rows which forsake the oblique direction above described, and appear to have wider basal plates bearing pectinations. Pectinated externals are quite commonly found in the embryonic radulæ of more highly developed forms; they may be seen, for example, in the embryonic radula of *Agriolimax levis*; thus one may be sure that the aculeate external is a later development.

PYRAMIDULA RUPESTRIS has a radula which is superficially very much like that of the young *Helicigona lapicida*. The cones are low and fairly uniform in length; the external basal plates are long and narrow; there is even an indication of the bifid external mesocone so characteristic of the larger Helices. Also the radula itself is (as in *lapicida*) rather abruptly divided into a central and two pleural regions; consequently it is rather difficult to make it lie flat on a microscope slide. The radulæ of *Punctum* and *Orthalicus* can be spread out quite easily, although they are very broad relatively to the size of the head.

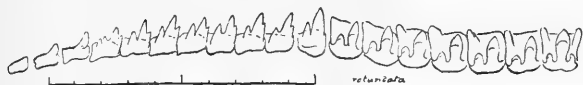


The rounding of the cones in the central region of this radula is perhaps due in some way to the habitat of the species. They are not rubbed down to this shape; if a different view be taken of them they may even appear lanceolate, as in the second row shown in the figure. This is true of *lapicida* also. A view of the entire radula shows the aspect of rounded cones as normal, the lanceolate appearance being seen in displaced rows.

In the larger Helices the oldest and most anterior part of the radula is found to taper to a point, so that if the specimen is entire the first row consists of one central uncus alone, or one central and an admedian on each side. If great care be taken to dissect them out, one may occasionally find one or two surviving pectinate unci beside these. Now and then (especially in *Th. cantiana*) one may find a regular pectinated row external to the normal externals on one or both sides of the radula throughout its length. In the small species which normally have pectinate externals in the adult stage there is little or no tapering of the anterior end; the first row may contain as many unci as the last. This is the case with *P. rupestris*, and therefore I think it is rightly placed with the Pupiform Helices, though at the same time I regard it as a very specialized form.

Our last species is PYRAMIDULA ROTUNDATA. This certainly does not belong to the pectinate group. The serrations upon its externals are very regular and unlike those of any other British Helicid. The

embryo of *Arion hortensis* shows very similar externals and admedians. *Rotundata* appears to show a bifid external mesocone, but I do not think the structure is homologous with that of the larger Helices. It is not constant, specimens occurring with this cone (or rather blade) simple. This radula does not show close affinity with that of any other of our species, but it is much nearer to that of *Hygromia hispida* than *P. rupestris*. Several of the apparently allied foreign forms which I have examined have turned out to have radulæ of the *Hygromia* type.



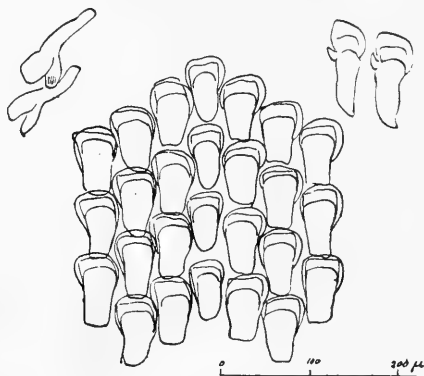
The magnification of each of the accompanying figures may be ascertained from the scale. The two *Vallonia* are drawn to the same scale; the *Acanthinula* and *P. rupestris* may be measured by the scale shown with the figure of *A. aculeata*. In every case each division of the scale represents  $10\mu$  (one-hundredth part of a millimetre).

ON THE RADULA AND MAXILLA OF *OXYSTYLA UNDATA*  
(BRUG.).

By Rev. E. W. BOWELL, M.A.

Read 12th June, 1914.

IN a specimen of this species<sup>1</sup> placed at my disposal by Mr. B. B. Woodward the extended radula is 10·2 mm. long and 8·5 mm. wide. It has 162 transverse rows of unci, and the middle row has 120 on each side of the central. The posterior margin is convex, the sides parallel, and the anterior margin semicircular. In consequence of the convexity the rows begin early to take an oblique direction, and a line of arrested growth in the anterior third of the specimen shows that all unci in each row become operative at the same time, so that the part presenting in the oral cavity has the appearance of an inverted V. The maxilla is sharply arched below in correspondence with this form; it is composed of imbricated plates in two series, a fundamental row with vertical direction as in normal Helicids, and a superimposed oblique row; the central or sub-central lamella of this row forms the triangular piece described by Binney as characteristic of Orthalicinæ.



The fusion in my specimen was very thorough, none of the plates being separable after maceration in hypochlorite solution. This form of maxilla is probably secondary to the wide oblique-rowed radula, and I suggest that this is the essential Orthalicine character. The radula precedes the maxilla in developmental history.

The appended sketch shows the curious unci of *Orthalicus*. The enlargement of the apices seems to have brought about the obliquity of the rows; enlargement of the alæ is found in cases where the opposite kind of obliquity occurs (e.g. in *Succinea*, *Punctum*). And this enlargement of apices may be directly occasioned by the breadth and bluntness of the cones; no apex, but extended ala, is found in the numerous multicuspoid unci of *Pectinibranchs* and small *Pulmonates*.

<sup>1</sup> Often referred to as *Orthalicus zebra* (Müller).



DESCRIPTIONS OF NEW SPECIES OF *MELANIA* FROM YUNNAN,  
JAVA, AND THE TSUSHIMA ISLANDS.

By HUGH C. FULTON.

Read 8th May, 1914.

*MELANIA INTREPIDA*, n.sp.

Shell elongately conic, solid, pale yellowish-brown, with one or two oblique brown streaks on the last whorl; spire eroded,  $4\frac{1}{2}$  whorls remaining; suture rather deep; first two remaining whorls obliquely ribbed, lower ones with very fine oblique striæ crossed by spirals, which are more conspicuous on the earlier whorls and at base of the



last; aperture sub-oval, bluish-white within; peristome thin, expanded at columellar margin. Alt. 28, diam. maj. 9 mm.

*Hab.*—Java (Frühstorfer).

This species is of similar form to *M. artecava*, Mouss., but easily distinguished by its pale colour and smooth appearance.

*MELANIA SCRUEA*, n.sp.

Shell elongately conic, rather solid, blackish-brown, apex eroded, nearly four whorls remaining; spire ornamented by raised noduled plicæ, crossed by weaker spirals, lower half of last whorl with three



raised spiral cords; aperture oval, bluish-white within, peristome simple. Alt. 21, diam. maj. 9 mm.

*Hab.*—Yunnan-fu.

Compared with *M. lauta*, Fulton, this species is smaller, thicker, and easily separated by its strongly cancellated sculpture.

*MELANIA SCRUPEA*, var. *DEBILIS*, n. var.

Compared with typical *scrupea* this variety is somewhat narrower in form, but chiefly characterized by its much weaker sculpture, the



oblique plications and spiral cords being much weaker, characters which are constant in the large number of specimens examined by me.

*MELANIA VULTUOSA*, n. sp.

Shell ovately conical, smooth, covered by a blackish-brown cuticle which is minutely roughened by erosion; spire eroded, about  $4\frac{1}{2}$  whorls remaining; aperture oval, acuminate at upper part, bluish-white, with some streaks of dark brown in the direction of the lines



of growth; peristome simple, very slightly thickened, and edged with black, margins joined with a slightly raised callus; operculum normal. Alt. 16, diam. maj. 8 mm.

*Hab.*—Yunnan-fu.

The *Planaxis*-like form and absence of sculpture separate this from any other species known to me.

*MELANIA TSUSHIMANA*, n. sp.

Shell sub-oval, solid, dark brown, spire eroded, leaving three remaining whorls; these are encircled by numerous flat spiral cords that are somewhat obsolete above the suture, but stronger below, and at the base of the last whorl; aperture elongately oval, bluish within;



peristome thin, effuse at base, and slightly expanded at the columellar margin. Alt. 30, diam. maj. 16 mm.

*Hab.*—Tsushima Islands (Frühstorfer).

Allied to *M. glans*, Busch, but readily separated by its narrower form and spiral sculpture.

DESCRIPTION OF A NEW SPECIES OF *STROPHOCHEILUS*  
(*BORUS*) FROM PERU.

By HUGH C. FULTON.

*Read 8th May, 1914.*

*STROPHOCHEILUS* (*BORUS*) *INDIGENS*, n.sp.

Shell ovate-oblong, yellowish-brown, moderately solid; spire about 13 mm. longer than the aperture; whorls  $6\frac{1}{2}$ , apex smooth, the second and third whorls with prominent oblique plications, last two volutions polished and apparently smooth, but under the lens are seen to be



Reduced about  $\frac{1}{3}$ .

finely granulated, the granulation being strong on the middle whorls, and gradually becoming weaker towards the aperture, the lower whorls have also some irregular and almost obsolete plications; aperture sub-oval, whitish within; peristome thickened and very slightly expanded, white, margins joined by a moderately thickened white callus. Alt. 110, diam. maj. 47 mm.

*Hab.*—Peru.

The nearest species to this is *S. (Borus) huascari*, Tschudi, which is broader, has a wider aperture, a rougher and duller surface, and its apical plications are much finer and closer together than in *indigenes*.

## DESCRIPTION OF A NEW HELICOID FROM SOUTH AUSTRALIA.

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

*Read 8th May, 1914.*

ONE of our Australian members, Mr. E. H. Matthews, recently forwarded to Mr. Robson twenty specimens of a small Helicoid, with the request to submit them to me for examination. He stated that they had been collected for him by Mr. J. A. Mayer amongst the Melaleuca swamp of the south-east portion of South Australia, near Millicent, a place not far from the coast, some 200 miles south-east from Adelaide. Mr. Matthews was at first inclined to think they had found *H. penolensis*, Cox, but on comparison he came to the conclusion that he was unable to identify the specimens.

After a careful scrutiny of all known species from the southern portion of the Australian Continent, I have satisfied myself that the shell in question pertains to an undescribed form. It certainly has no affinity with *H. penolensis*. I have been considerably exercised in my mind, moreover, as to its generic position, since I do not know any Australian form with which to class it, and I was struck with its general resemblance to the Palæarctic species *Helicella* (*Candidula*) *conspurcata* (Drap.), recorded from Portugal, the Balearic Islands, the South of France, Italy, Sicily, Malta, Dalmatia, Greece, Tunisia, Algeria, and Morocco. As the members of this genus are noted for their ability to withstand protracted periods of drought, the possibility of their having been transported from some Mediterranean port and introduced into South Australia in this manner is by no means excluded, especially as the spot where they were taken is only some 20 miles from the nearest seaport. As several of the shells contain the animal, Mr. Robson has kindly undertaken to examine their anatomy, and it will be interesting to learn whether my surmise will be borne out by his investigation. Under these circumstances I propose tentatively to refer this form to the section *Candidula* of *Helicella*.

While its general resemblance to *H. conspurcata* possibly affords a clue as to its generic position, the South Australian shell is sufficiently distinct to warrant its being regarded as a new species. It is more elevated in the spire, the whorls are more tumid, the aperture is higher in proportion to its width, and the bristles are more crowded and shorter.

I propose to dedicate the new species to its discoverer.

*HELICELLA (CANDIDULA) MAYERI*, n.sp.

Shell moderately umbilicated, conoid, dull, pale fuscous, variously ornamented with darker bands more or less interrupted by pale ochraceous transverse streaks or blotches, rufous corneous behind the aperture; the first whorl shining and smooth, the remainder lustreless, finely striated, densely covered with short bristles. Spire rather

elevated, apex blunt, suture deep. Whorls 5, rather tumid, evenly rounded, increasing slowly and regularly; aperture slightly oblique, nearly semicircular, margins acute, straight, columellar margin



Magnified about 4 times.

dilated and slightly overhanging the moderate, deep umbilicus. Diam. maj. 6.5, min. 5.75 mm.; alt. 4.75 mm.

*Hab.*—Millicent, South Australia (? introduced).

Type in the Adelaide Museum. Co-types in the British Museum.

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ON THE RELATIVE CLAIM TO PRIORITY OF THE NAMES  
*HELIX FRUTICUM*, MÜLLER, AND *H. CARDUELIS*, SCHULZE.

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

*Read 12th June, 1914.*

My attention has been drawn to a paper by Herr Hans Honigmann in *Abh. Ber. Mus. Nat. Heim. Kunde*, ii, 1909, in which, on p. 44, the author once more resuscitates the name *Helix carduelis*, attributed to Schulze (1770). According to the rules of nomenclature the latter in reality dates from 1855, when it was adopted by T. Reibisch in a paper dealing with the Mollusca of the Kingdom of Saxony, published in *Allgem. Deuts. Naturh. Zeit. Ges. Isis*, Dresden, Neue Folge, i, p. 415, 1855, in preference to the name *H. fruticum*, described by Müller in *Verm. terr. fluv.*, ii, p. 71, 1774.

Although several German authors have already dealt with the matter in a somewhat cursory manner, I consider it advisable to place the facts of the case on record, especially since the serial in which Schulze's paper appeared is not accessible to everyone, the only copy in London apparently being at the British Museum, Bloomsbury, and as, moreover, Herr Honigmann has not seen the original. He introduces the subject by stating that Herr Vohland, of Leipzig, has called his attention to the fact that four years before Müller published his description of the species (1774) a paper by Schulze entitled "Nachricht von dem ohnweit Dresden befindlichen Zschonengrunde, und von den darinnen vorhandenen Seltenheiten der Natur" appeared in the seventh volume of the *Neues Hamburgischen Magazin* for 1770, in which a description of the present species is given, namely under the name of *H. carduelis*, but he admits that unfortunately this work has been inaccessible to him. He states nevertheless that in future the species must bear the name proposed by Schulze.

The copy in the British Museum of the volume of the serial in question, containing Schulze's paper, is not marked vol. vii. It contains six parts, each with a separate title-page, the first one being numbered thirty-seventh part. The last page, however, is marked as end of seventh volume. On p. 48 of this volume, under a reference to "Tabel 2, Fig. 4", the following paragraph occurs: "Die fünfte Art kommt in den meisten Stücken mit der beschriebenen *Helice nemorale* überein [here follows a comparative description of the species and its habitat] . . . Linnäus siehet diese Schnecke in der seiner Fn. S.N. 1294, beygefügtten Anmerkung für eine Art der *Helicis nemoralis* an. Sie verdienen aber, wegen der angezeigten Umstände, billig eine besondere Stelle, und man könnte Sie

*Cochleam umbilicatum*, *testa utrinque convexa*, *diaphana*, *apertura semicirculari*, oder auch

*Cochleam carduelem*, Die Distelschnecke nennen."

This may be rendered thus: "The fifth species agrees in the majority of specimens with the description of *Helix nemoralis* . . . Linné, in a note appended to his Fn. S.N. 1294, regards this shell as a form of *H. nemoralis*. It really deserves, however, on account of the circumstances indicated, special rank, and it might be named *Cochleam umbilicatum*, etc., or even *C. carduelem*, the thistle snail." It will be seen from the foregoing that in no sense can Schulze's paper be said to comply with the requirements of the rules of nomenclature. The name *carduelis*, consequently, can only be regarded as dating from 1855, and must remain a synonym of *H. fruticum*, Müller (1774).

The German authors alluded to as having previously dealt with the subject are: Adolph Schmidt, in Zeits. Gesamt. Naturw., viii, p. 121 et seq., 1856, who pronounces against *H. (Cochlea) carduelis*, Schulze, unearthed by Reibisch. L. Pfeiffer, in Malak. Blätt., iv, p. 78, 1857, when reviewing the preceding paper, states it is a doubtful case, but subsequently, in Mon. Helic. Viv., iv, p. 251, 1859, he relegates *carduelis* to the synonymy of *H. fruticum*. Von Martens, in Nachr. Blatt. Deuts. Malak. Ges., ii, p. 51, 1870, in dealing with the literature of the Mollusca of Germany, enumerates, *inter alia*, Reibisch's paper, and refers to *carduelis*, Schulze, 1770, adding in brackets ("the well-known *fruticum*").

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## ON SOME INVALID MOLLUSCAN GENERIC NAMES.

By TOM IREDALE.

*Read 12th June, 1914.*

WHILST engaged upon the verification of the generic and specific names to be used for molluscs from the Kermadec Islands, Lord Howe Island, Norfolk Island, and New Zealand, I have made quite a number of interesting notes. I here put on record some of those that are of more than local interest, and introduce some extra-limital corrections.

I wish here to draw attention to the very imperfect manner in which generic names given to Mollusca have been recorded, and, as I should think that the class in which we are interested does not form an exception, the grave danger there is in depending upon the usual Nomenclators when introducing new generic names. I find that a very large number of comparatively well-known molluscan names included by Fischer in his *Manuel de Conchyliogic* do not appear in Sharp's *Index Zoologicus*, Nos. i and ii. As a matter of fact, I conclude that it is due to the general familiarity of malacologists with Fischer that serious confusion has not been caused. With regard to *Miodon*, upon which I give a note, neither of the displacing names occur in the *Index Zoologicus*, though both appeared in the period 1880-1900. As an example of this imperfection I think it advisable to give the following extraordinary case. Referring to Fischer's *Manuel* I note the following names quoted and introduced, but omitted from the *Index Zoologicus*:—

- p. 850. *Talantodiscus*, Fischer, 1885.
- „ *Pyrgotrochus*, Fischer, 1885.
- „ *Perotrochus*, Fischer, 1885.
- „ *Chelotia*, Bayle, 1885.
- „ *Entemnotrochus*, Fischer, 1885.
- „ *Ptychomphalina*, Bayle, 1885.
- „ *Ptychomphalus*, De Koninck, 1883.
- „ *Gosseletina*, Bayle, 1885.
- „ *Gosseletia*, De Koninck, 1883.
- „ *Gosseletia*, Barrois, 1881.
- „ *Pithodea*, De Koninck, 1881.
- „ *Mourlonia*, De Koninck, 1883.
- „ *Agnesia*, De Koninck, 1883.
- p. 851. *Worthenia*, De Koninck, 1883.
- „ *Phanerotrema*, Fischer, 1885.
- „ *Rhineoderma*, De Koninck, 1883.
- „ *Yvania*, Bayle, 1885.
- „ *Baylea*, De Koninck, 1883.
- „ *Luciella*, De Koninck, 1883.

That *nineteen* unrecorded names should appear on two consecutive pages of Fischer's *Manuel* is of course extraordinary, but on almost



every page, wherever many names occur, I note unrecorded examples. As above stated, through the general usage of malacologists of Fischer's *Manuel*, we have not felt this omission deeply, but it is probable that other branches will have suffered, and I note *Agnesia* included in the *Index Zoologicus* as having been introduced by Michaelsen in 1898 for a Tunicate. The reverse case of course affects us, i.e. that names proposed in other classes of zoology have likewise been omitted from the *Index Zoologicus*, and that such may invalidate apparently unassailable names given by malacologists. I cannot suggest any remedy to provide for the protection of malacologists in such instances.

ADEORBIS, Searles Wood.

In these Proceedings (vol. ix, p. 259, 1911) I published a note drawing attention to Sacco's usage of "*Tornus*, Turton, 1829", in place of *Adeorbis*, Searles Wood, 1842, and asked for confirmation or otherwise. An immediate result was the receipt from Dr. W. H. Dall of a reference to *British Conchology*, vol. iv, p. 231, 1867, where Jeffreys wrote: "Searles Wood was anticipated in giving a name to the present genus. In an 'Enumeration of Marine Shells' found on the South Devon coast, published in 1829 (a copy of which was presented to me by Dr. Turton 'from the author'), the genus *Tornus*, signifying a turner's wheel or lathe, was characterized as follows:—'Shell orbicular, depressed, aperture oval or roundish; pillar none. Operculum horny. Includes *Helix subcarinata*.' This publication was anonymous, a circumstance which may deprive the author of the right of precedence according to the laws of scientific nomenclature. I therefore retain *Adeorbis*, although the other name is preferable."

At that time I could not trace the publication Jeffreys mentions, so the matter had to be shelved. Consequently Hedley, introducing the new genus *Naricava* (Proc. Linn. Soc. N.S.W., vol. xxxviii, p. 294, 1913), commented: "It has been indicated by Iredale that *Adeorbis* may be replaced by *Tornus*, but this is not established." It is with very great pleasure that I now complete my tale, and eliminate all doubt concerning the genus-name *Tornus*.

As long ago as 1903 Mr. B. B. Woodward had seen this name, but, comparatively uninterested in marine shells, had failed to note its significance. I obtained my clue from a footnote published by him in the *Journ. Conch.*, vol. x, p. 359, 1903, with regard to the genus-name *Odontostoma*. There will be found details practically as here given.

A book entitled *The Teignmouth, Dawlish, and Torquay Guide*, by N. T. Carrington and others, was published at Teignmouth, and also sold at Exeter, London, etc. Part ii bears on the title-page "The | Natural History | of | the District; | or, | Lists | of | the different species | of | animals, vegetables, and | minerals, | and their respective localities, | scientifically arranged; | with References to the best Standard Works in which | they are figured and described: | together with | a Geological Account | of | the rock strata, and the fossils | contained in them. | By | W. Turton, M.D., and J. F. Kingston."

There is no pagination to the pages, but conchology occupies about twenty-five pages, and this is succeeded by an article entitled "Conchology, arranged on the amended system". Therein the families are indicated with succinct diagnostic sentences; then the genera are also shortly described, whilst species belonging to each genus are named. In the present instance the matter reads thus:—

"*TURBINACIDÆ*. Pillar without plaits—shell conic or elongated; aperture roundish or oblong, never expanded, with the lips either united or separated.

"*Tornus*. Shell orbicular, depressed; aperture oval or roundish; pillar none. Operculum horny.

"Includes *Helix subcarinata*."

It will at once be observed that this is word for word the matter quoted by Jeffreys, and we can now assume that the "Enumeration" was identical with the conchology included in the Guide. So far I have not seen a copy of the "Enumeration", but under the present circumstances this does not matter much. It is seen that Jeffreys gives the date of the "Enumeration" as 1829; the Guide is undated, but Mr. Sherborn kindly made inquiries, with the result that 1830 can be safely taken as date of publication; this suggests that Turton's anonymous "Enumeration" was probably printed first. The inevitable conclusion is that

TORNUS, Turton & Kingston, 1830,

must replace *Adeorbis*, Searles Wood, 1842.

I carefully studied all the names given in this work, as no suggestion of novelty is attached to any, with the result that one other new introduction was noted. In this case, however, no change is necessary.

*Haminea* is generally quoted as of the Proc. Zool. Soc., 1847 (November, 1847), but I had noted that it appeared earlier in the Ann. Mag. Nat. Hist., vol. xx, p. 268, October 1, 1847, where it was spelt as *Haminæa*. I now trace it back to 1830, as this is included, thus: "*Haminæa*. Shell thin, somewhat globular, without spire; aperture narrow, as long as the shell. Includes *Bulla hydatidis*." We must therefore quote

HAMINEA, Turton & Kingston, 1830.

I have now acquired an interesting copy of this work, which shows that the natural history portion was also published separately. The title-page and contents are exactly as in the complete work, but no reference to the principal title-page, of which this is "Part II", is given. It is in the original cloth covers as published, and on the outside cover exactly the same wording with the exception of the words "Part II" is printed. Down the back, however, appears the following wording: "Guide | to the | Watering | Places. | Vol. II | The | Natural | History | of the | District | 1830. |"

This is again important, as we have here definite evidence of the date which was previously missing. There is no connexion here given with Carrington's Guide, so that such a copy would be easily quoted as "The Natural History of the District, by W. Turton and

J. F. Kingston". The limits of the "District" would rest in the imagination of the reader.

MODIOLARCA, Gray.

This genus-name first appears in the Synopsis of the Contents of the British Museum, 42nd ed., p. 151, 1840, where, associated with *Crenella*, the two genera constitute the family Crenellidæ. I have shown in my Collation of these Synopses (these Proceedings, vol. x, pp. 294-309, 1913) that here the genus-names are all absolutely *nomina nuda*. On p. 306 I noted that in the forty-fourth edition short diagnostic remarks were added, and quoted those referring to this generic name, which read "(p. 82) The *Crenellæ* are suborbicular and the *Modiolaria* ovate elongated shells", and added a "Note: *Modiolarca*, 1840, is thus a misprint for *Modiolaria*".

Further investigation shows this conclusion to have been incorrect, and that we have here another instance of Gray's juggling with names, as in the case of *Livona*.

In Dieffenbach's *Travels in New Zealand*, vol. ii, p. 259, 1843, Gray included

"*Modiolarca impacta*.

*Mytilus cor*, Martyn, U.C., t. 77.

*Myt. impactus*, Hermann, Naturf., xvii, 147, t. 3, f. 5-8, xix, 183;  
Wood, Cat., 59, f. 40.

*M. discors*, *Australis*, Chemn., viii, f. 768.

*Modiola discor*, Lam., vi, p. 16.

*Myt. lanatus*, Calonne, Cat., 43.

Inhab. New Zealand, Dr. Solander; Bay of Islands, Dr. Sinclair; East Cape, Dr. Dieffenbach."

This is the first recognizable introduction of the genus-name *Modiolarca*, and as it is associated with *impacta* it must fall as a synonym of the earlier *Modiolaria*. It is now obvious that the name was intended by Gray for the species now called *Modiolaria*, but that in 1847 when he drew up his List of the Genera of Recent Mollusca (Proc. Zool. Soc., 1847, p. 129 et seq.), recognizing Beck's prior name, he deliberately transferred his genus-name to a different group.

Sentimentally it grieves me to part with the genus-name *Modiolarca*, as it will ever be associated in my memory with my discovery of its existence on the mainland of New Zealand, and my personal acquaintance with it and its strange habits (Trans. New Zeal. Inst., vol. xl, 1907, pp. 386-7, 1908).

As a delightful recompense, however, I found the available substitute was none other than

GAIMARDIA, Gould, U.S. Expl. Exped., vol. xii, p. 459, 1852.

The loss of *Modiolarca* seems more than balanced by the restoration to active use of the genus-name given to honour one of the two most famous shell collectors that have ever visited the shores of New Zealand. It was my unfortunate lot to consign to synonymy the genus-name *Quoyia* (these Proceedings, vol. ix, p. 259, 1911), and I tried to make amends by the introduction of the genus-name *Quoyula*

(these Proceedings, vol. x, p. 221, 1912). That I should have the pleasure of reinstating *Gaimardia*, even at the loss of *Modiolarca*, seems a fitting reward for my unwilling, but inevitable, rejection of *Quoyia*.

I have just observed that Scudder, in his *Nomenclator Zoologicus*, pt. i, p. 215, 1882, noted the confusion, but interpreted it in the contrary manner to my explanation, thus: "*Modiolaria*, Gray., Syn. Brit. Mus., p. 82 (Err. typ. pro *Modiolarca*) 1842. Moll. Biv." Moreover, as usual, I see that Dr. Dall in his magnificent essay on the Tertiary Mollusca of Florida, published in the Transactions of the Wagner Free Institute of Science, Philadelphia, comments (vol. iii, pt. iv, pp. 804-5, 1898-9) on the spelling in Dieffenbach, which, however, he only knew at second-hand, quoting Hutton's misspelling as *Modiolaera*. Dall concluded that such a spelling could only be regarded as a typographical error. The facts, however, as now known and here presented, show, I think conclusively, that Gray really invented the name *Modiolarca* for the Crenelloid molluscs. If we accept the derivation of the name as *Modiola* and *Arca*, the name is quite applicable to these, whilst it as certainly would scarcely be suggested by the type species of the later-named *Modiolarca*, as I see little resemblance to either *Modiola* or *Arca* in this shell. However, it is little use theorizing as to the origin of any Grayian name, as I conclude that the systems upon which J. E. Gray made names are beyond the ken or the imagination of later workers.

#### PANDA, Albers.

According to Scudder's *Nomenclator*, *Panda*, Albers, is invalid through preoccupation. It is notorious that Albers introduced names quite commonly in use in other branches of zoology, and I could scarcely think such a case as this could have been overlooked.

*Panda* was introduced as of Albers by Martens in the second edition of *Die Heliceen*, 1860, p. 149, the type, by original designation, being *Helix falconari*, Reeve. Scudder noted a prior *Panda*, Van Heyden, 1826, and upon reference I find Van Heyden lawfully proposed the name in the *Isis* (Oken), 1826, col. 612.

In the Proc. Linn. Soc. N.S.W., vol. xxxvii, p. 254, pl. iv, figs. 1-4, 1912, Hedley described a most beautiful mollusc as *Panda whitei*, making, according to his conclusions, the fourth species of the genus, his revision of twenty years earlier having reduced the recognizable species to three only (Rec. Austr. Mus., vol. ii, p. 29, 1892), viz., *falconeri*, Gray, *atomata*, Gray, and *larreyi*, Brazier.

No generic synonymy being known to me, I referred to the Man. Conch., ser. II, vol. xviii, p. 122 et seq., 1900, where Pilsbry used *Panda*, and gave no synonyms. Reference to the famous vol. ix, p. 163, 1894, showed that Pilsbry made use of *Panda*, but extraordinarily enough he cited the prior usage of the name by Van Heyden, but did not rectify the error. As the invalidity of the name has thus been on record for exactly twenty years without action being taken, I propose to remedy the defect by renaming the genus

#### HEDLEYELLA.

The four species above named will constitute the genus, the type remaining as *H. falconeri* (Gray). It is not without misgiving that I thus transgress upon my fellow-worker's territory, but I have long wished the opportunity of associating the name of my friend Mr. Charles Hedley with some notable shell, and I do not anticipate such a splendid chance again. The genus comprises the most interesting and magnificent land shells of Australia, and I sincerely hope that my "industry will not prove abortive", to quote my friend's remarks on a like occasion.

#### PENION, Fischer.

In these Proceedings (vol. x, p. 223, 1912) I advocated the usage of *Penion* for the Austro-Neozelanic molluscs classed under *Siphonalia*, and rejected the transference of *Siphonalia maxima*, Tryon, to *Megalatractus*, declaring that species to be absolutely congeneric with *Fusus dilatatus*, Quoy & Gaimard.

Hedley in a paper on Mollusca from the Great Australian Bight (Biol. Rec. Fishing Exp. *Endeavour*, vol. ii, pt. ii, p. 73, 1914) has accepted my data, and has recorded *Penion maximus*, Tryon, and *P. waitei*, Hedley. I further find that Dr. Verco in the Trans. Roy. Soc. South Austr., vol. xxxvi, p. 221, 1912 (1913), has gone so far as to synonymize *Siphonalia maxima*, Tryon, with *Fusus dilatatus*, Quoy and Gaimard.

It has been decided that errors of transliteration may be amended: this decision, given by the International Commission on Zoological Nomenclature, has the effect of causing the rejection of *Penion*, as there is a prior *Penium*<sup>1</sup> (Philippi, Verh. Zool.-botan. Gesell. Wien, vol. xv, p. 741, 1865). These two names are simply the same, one being wrongly transliterated, and cannot both be maintained. I have therefore to propose the genus-name

#### VERCONELLA

to replace *Penion*, Fischer, and maintain the same type, *Fusus dilatatus*, Quoy & Gaimard. The name given is an attempt to express my appreciation of the work on Australian Marine Mollusca still being performed by Dr. J. C. Verco.

#### MONTROUZIERA, Souverbie.\*

Hedley has recently (Rec. Austr. Mus., vol. viii, p. 135, 1912) recorded the rediscovery of the interesting mollusc which Souverbie (Journ. de Conch., vol. xi, p. 282, pl. xii, fig. 5, 1863) introduced as generically and specifically new, under the name *Montrouziera clathrata*. I would point out that in honouring the brilliant Montrouzier, Souverbie had been anticipated by Bigot (Ann. Soc. Ent. France, 3rd ser., vol. viii, p. 224, 1860), and consequently the molluscan genus must be renamed. I would ask Mr. Hedley to undertake this task, as to him belongs the credit of the recognition of this long-lost form, and it is only fair that he should complete this item, especially as I have already interfered in his province in the case of *Panda*.

<sup>1</sup> Latinized from πένιον.

\* *Err. typ. = Montrouziera p. 135*

## HELIOMANES, Moquin-Tandon.

Mr. B. B. Woodward kindly allowed me to see a proof of the List of British Non-marine Mollusca prepared by A. S. Kennard and himself. I noticed as a sub-genus of *Helicella*, Férussac, appeared the name *Heliomanes*, Moquin-Tandon, 1855. I pointed out that according to the Nomenclators this name was invalid.<sup>1</sup> It was therefore replaced by *Heliomanes*, Férussac, 1821, which appears on p. 6. I had no interest in the subject, and nothing further would have been heard from me had the matter not cropped up again in a different direction. Conversing with Mr. G. K. Gude, he mentioned the genus-name *Pupoides*, Pfeiffer. I remembered Connolly (Revised Reference List South African Non-marine Mollusca, 1912, p. 176) had commented upon the validity of this name, whereupon Mr. Gude referred to that work. Connolly's remarks are: "There is, however, an earlier *Pupoides*, proposed by Férussac (Tabl. Syst., pt. 3, p. 61, 1821) as a section of *Cochlodina*, but on an equal footing with *Clausilia*, *Pupa*, and *Cyclostoma*." Mr. Gude and I then consulted Férussac's work, and our conclusions do not agree with Connolly's, and, moreover, *Heliomanes* occurs in the same place. Mr. Edgar A. Smith was then called in to advise, and I asked permission to put on record our results.

*Pupoides* occurs as quoted by Connolly on p. 61 of part iii of Férussac's Tabl. Syst., but on pp. 27-8 a synopsis is given entitled "Tableau Synoptique des subdivisions du genre Hélix, *Helix*, nobis". On p. 28 we have "Sixième sous-genre Helicelle, *Helicella*", which is divided into

" Les Lomastomes, *Lomastomæ*,  
 Les Aplostomes, *Aplostomæ*,  
 Les Hygromanes, *Hygromanes*,  
 Les Héliomanes, *Heliomanes*."

On the same page "Huitième sous-genre Cochlostyle, *Cochlostyla*", is divided into

" Les Lomastomes, *Lomastomæ*,  
 Les Aplostomes, *Aplostomæ*,"

and, further, "Quatorzième sous-genre Cochlodine, *Cochlodina*," is divided into

" Les Pupoides, *Pupoides*,  
 Les Tracheloïdes, *Tracheloides*,  
 Les Anomales, *Anomales*,  
 Les Clausilies, *Clausilia*, Draparn."

Other sectional names used are *Lamellatæ*, *Marginatæ*, *Turritæ*, *Umbilicatæ*, *Perforatæ*, etc.

It is obvious that such *cannot* be regarded as names available for generic or subgeneric usage. The fact that *Heliomanes* and *Pupoides* are Greek plurals, whereas most of the others are of Latin form, cannot legitimize these. The only conclusion possible is that *Heliomanes* cannot be quoted as of this introduction, and when later correctly utilized by Moquin-Tandon it had been appropriated

<sup>1</sup> *Heliomanes*, E. Newman, Ann. Nat. Hist., vol. v, p. 17, March, 1840.

previously in another sense; also *Pupoides* of this introduction has no status, and does not invalidate the later *Pupoides*, properly proposed by Pfeiffer (Mal. Blätt., i, p. 192, 1854), as suggested by Connolly, loc. cit.

It is interesting to note that when Pilsbry (Man. Conch., ser. II, vol. ix, p. 248, 1894) used *Helioamanes*, Moquin-Tandon, 1855, as a sectional name, he wrote "Helioamanes (Fér., Tabl. Syst., not used in a generic or subgeneric sense)", a conclusion with which we agree.

The genus-name *Miodon* and its substitutes.

Some years ago I noticed the following paragraph in the *Nautilus*, vol. xvi, p. 143, April, 1903: "In the revision of the CARDITACEA, lately printed by the Academy of Natural Sciences, I preserved the name *Miodon* for a form of *Venericardia*, found on the Pacific coast, and applied by Carpenter in 1864. For *Miodon*, Sandberger, 1870, given to a fossil form of *Cyrena*, the name *Miodontopsis* was proposed. In Sharp's Index Zoologicus, just received, I find *Miodon*, however, was used for an Ophidian in 1859 by Duméril, and therefore Carpenter's shell will have to have a new name also. In this case I would propose *Miodontiscus* for the Venericardian. W. H. Dall."

Admittedly uninterested, these remarks remained unwanted in my mind until a casual reference to Fischer's Manuel de Conchyliologie brought them back in connexion with the following sentence (p. 1187), the last words in the Manuel concerning Pélécypodes: "*Coripia*, de Gregorio, 1884. Ce genre, qui a pour type le *Cardita corbis*, Philippi, du Tertiaire supérieur, passe dans la synonymie de *Miodon*, Carpenter, 1864 (p. 1011), genre qu'il ne faut pas confondre avec une section des *Cyrena* nommée *Miodon* par Sandberger et dont on devra changer l'appellation en *Neomiodon*, Fischer, 1887." This would indicate that both Dall's names must be superseded as follows:

NEOMIODON, Fischer, Man. de Conch., p. 1187, 1887,

will replace *Miodontopsis*, Dall, *Nautilus*, vol. xvi, p. 143, April, 1903, and

CORIPIA,<sup>1</sup> De Gregorio, Bull. Soc. Malac. Ital., vol. x, 1884, p. 153, 1885,<sup>2</sup> will displace *Miodontiscus*, Dall, *Nautilus*, vol. xvi, p. 143, April, 1903.

TRITONIDEA, Swainson.

In these Proceedings (vol. x, p. 221, 1912), when introducing the genus-name *Quoyula*, I pointed out that *Polia* dated from 1834, not 1839, as usually accepted, and that its type, when first proposed, was by monotypy "*Triton undosus*, Lam." In consequence *Polia* was exactly equivalent to and antedated *Tritonidea*, Swainson, 1840. Since that date *Tritonidea* has still been used, so that I have thought it necessary to emphasize its invalidity whilst making a further contribution to this subject.

I have recently acquired a nice copy of Swainson's *Treatise on Malacology*, which is noteworthy in that the purchaser has inscribed

<sup>1</sup> A sub-genus of *Cardita*, for *Cardita* (*Coripia*) *unidentata*, Basterot=*corbis*, Philippi.

<sup>2</sup> In this work many unrecorded names appear. I have noted *Elegantula*, *Anfilla*, *Linga*, *Pirtus*, *Timbellus*, *Aplus*, and *Algrus*.

her name and date, the said date being "May, 1840". This date gives us the information that the book was published in or before that month, which is exceedingly valuable, as previously no exact date had been traced by me. Studying this work, I noted that on p. 74, when *Tritonidea* was first mentioned, Swainson added a footnote: "I have since learned that this genus is the same as *Pollia*, Gray, a name I should gladly have adopted, had it not previously been given to a genus of European *Lepidoptera*." On p. 302, where the genus is elaborated, a fuller explanatory footnote also appears to the same effect, Hübner and Treitsch being quoted as the authors of the Lepidopteran genus. No such genus occurs in Scudder's Nomenclator, though there is a "*Polia*,<sup>1</sup> Ochsenh. Lep., 1816 A" given on p. 257. This genus-name would appear to have been proposed as a dedication of Poli, and would not seem to clash with Gray's *Pollia*, which I would guess to have been suggested by the feminine name Polly. Gray also proposed *Fannya* and *Emma*, but note my remarks *re* Gray under *Modiolarea*.

#### VELORITA, Gray.

This name, generally quoted as Gray, 1840, is another of the "Synopsis B.M." names, where it is a *nomen nudum*. It apparently dates from the Proc. Zool. Soc. 1847 article. Full details of these papers have been given by me in these Proceedings (vol. x, pp. 294-309, 1913).

As a matter of fact, the name must be replaced by

#### VILLORITA,

as Griffith and Pidgeon, who contributed the molluscan portion of Griffith's edition of Cuvier's *Animal Kingdom*, vol. xii, had figured, on pl. xxxi, fig. 5, a shell under the name *Villorita cyprinoides*, and on p. 601, in an Alphabetical List of the Figures, gave the further information

"pl. 31, fig. 5, *Villorita cyprinoides*, Gray.

(*Cyrena cyprinoides*, Wood) Olive Green."

A note is given, which reads: "Most of the inedited shells figured in this work are from the collection in the British Museum." The plate is dated 1833, whilst, as the title-page indicates, the volume was completed in 1834. We can thus assume that as early as 1833, Gray, after the custom of his time, had labelled the shell in the British Museum with the name of *Villorita cyprinoides*, and that Griffith and Pidgeon introduced this into literature. Seven years later Gray apparently altered the spelling to *Velorita*, by which name it has since been known. The spelling *Villorita* does not occur in Scudder's Nomenclator, nor has it otherwise been recorded, though *Littoraria*, introduced in the same manner and place, is duly recorded. A peculiar circumstance has been noted, viz. that Fischer in his Manuel (p. 1092, 1887) dates *Velorita* of Gray back to 1834, which suggests that he had an inkling of Griffith and Pidgeon's usage.

<sup>1</sup> Huebner introduced it in 1806 as a *nomen nudum*, which was taken up by Ochsenheimer in 1816 and Treitschka in 1825. *Polia* was also proposed by Chiaje in 1827 for a member of the Order Vermes.



DESCRIPTION OF A NEW SPECIES OF *CASSIDEA*.

By TOM IREDALE.

*Read 12th June, 1914.*

THE circumstances surrounding the discovery of the shell here described seem worthy of record. Upon arrival at the Kermadecs inquiry was made of the only settlers on the island as to the shell fauna known to them. Mr. Roy Bell then brought me the specimen figured as having been picked up a few weeks before on the north coast. Ignorant of the Indo-Pacific fauna, it was simply noted as quite new to me, and was preserved, as, though not quite perfect, it was a readily determinable shell, and I have always worked upon the two mottoes, "A shell in the hand is worth fifty in the sea" and

 $\frac{1}{2}$  nat. size.

"An imperfect shell is better than none at all". It was placed on a shelf together with other large dead shells, such as pieces of *Mitra mitra* (Linné), *Alata aratrum* (Martyn), *Charonia rubicunda* (Perry), etc. During the year a few fragments were cast up on the beach, but no more perfect specimen was obtained. Therefore I had been justified in carefully (!) preserving this imperfect shell.

Upon asking Mr. Charles Hedley, in Sydney, what its name might be, my shock can be imagined when his reply was that it was quite unknown to him. He advised me to search at the British Museum, to which place I was bound, but that my Cassid was almost certainly undescribed. His suggestion proved correct, and the species is such a magnificent addition to the unarmed group that I can no longer withhold its nomination.

*CASSIDEA ROYANA*, n.sp.

Shell large, rather solid, smooth, very broadly ovate. Colour fawn and fawnish-white with broad spiral bands of darker colour, probably deep chocolate in fresh specimens. In the worn specimen described four bands can be distinguished on the last whorl, though all are only obscurely seen, and all placed below the noduled shoulder. On the outer lip, which is rolled backwards, these are more clearly marked, whilst a fifth is seen just above the shoulder. Whorls, three only remain, the apex being missing. No spiral sculpture can be discerned, but on the last whorl, which is strongly shouldered, twelve prominent regularly spaced nodules can be counted. No trace of these appears above the shoulder, but below they more or less develop into broad longitudinal ridges, much more distinct on the back than on the face of the shell. On the penultimate sixteen more obscurely marked nodules can be counted, whilst on the antepenultimate whorl, though still present, the shell is too worn to admit of the recognition of the separate nodules. Outer lip expanded and reflected backwards, though a narrow deep canal intervenes between the inrolled outer lip and the whorl itself. Columella smooth, with one marked plication. Inner lip expanded as a callus, and at the anterior extremity reflected, so as to leave a minute perforation. Canal short, broad, little recurved. Length 135, breadth 95 mm.

*Hab.*—Sunday Island, Kermadec Group.

Type to be presented to the Canterbury Museum, Christchurch, New Zealand.

With this magnificent shell, which needs comparison with none yet described, I associate the name of my friend Mr. Roy Bell, to still further mark my gratitude for his ever-ready help in investigating the molluscan fauna of the Kermadec Group.

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SULCOBASIS CONCISA (FÉR.), SUB-SPECIES RUBRA (ALBERS). FIGS. 1-12.

ON *SULCOBASIS CONCISA* (FÉR.) AND ITS NEAREST ALLIES.

By CÆSAR R. BOETTGER.

Read 12th June, 1914.

## PLATES IV, V.

IN working out a collection of shells from the Aru Islands, it became evident that the *Sulcobasis* of the *concosa* group from these islands, hitherto usually referred to *rubra*, Alb., is quite a different form. The whole group was therefore critically examined, with the following results.

The species to be discussed are *concosa*, Fér., *rubra*, Alb., and *cumingi*, Gude. It has been thought important to examine, as far as possible, the actual specimens described by the various authors, and thus to determine their correct status. Indeed, it is surprising how scanty the material is on which the authors based their descriptions, for the collectors who visited the habitats of these shells only brought home single specimens, and consequently they are of the greatest rarity in collections. I have been fortunate enough to study and to compare nearly all the specimens quoted in literature. This investigation shows that, though subspecifically different, they agree in so many characters that they must be considered to belong to only one species, which, according to priority, must be called *Sulcobasis concisa* (Fér.). This species, which is also well defined from a geographical point of view, may be divided into three sub-species.

The general diagnosis of *S. concisa* (Fér.), as restricted by me, runs as follows:—

Testa umbilicata, plus minusve depressa, solida, unicolor rufa aut rufo-castanea, striis incrementi regulariter striata, fere lævis, aut sulcis numero variis, plus minusve distinctis, obliquis, irregularibus incisa; spira conoidalis, aut subdepressa aut planiuscula; sutura impressa. Anfractus 6, convexiusculi aut convexi, regulariter accrescentes; ultimus rotundatus, antice plus minusve descendens, ad aperturam dilatatus; umbilicus pervius. Apertura obliqua, obovalis, intus alba, porcellana, colore externo translucente; peristoma vix incrassatum, album, reflexum, marginibus callo albo, arcuato junctis, columellari dilatato.

The three sub-species of the shell, known up to date, are: 1, *S. concisa rubra* (Alb.); 2, *S. concisa concisa* (Fér.); 3, *S. concisa cumingi* (Gude).

1. *SULCOBASIS CONCISA RUBRA* (Alb.). Pl. IV, Figs. 1-12.

1857. *Helix* (*Chloritis*) *rubra*, Alb. Albers, Malak. Blätt., Bd. iv, p. 93, Taf. ii, figs 1-3. Arrow Island? (Coll. Mousson).  
 1859. *Helix rubra*, Alb. Pfeiffer, Mon. helic. viv., vol. iv, p. 287. Arrow Island(?).  
 1860. *Helix* (*Chloritis*) *rubra*, Alb. Albers, Die Heliceen, 2. Ausgabe von Eduard von Martens, p. 162. Arrow Island.

1865. *Semicornu rubrum*, Alb. *partim*. Wallace, Proc. Zool. Soc., p. 410. Mysol (Wallace).
1868. *Helix rubra*, Alb. *partim*. Pfeiffer, Mon. helic. viv., vol. v, p. 374. Mysol (Wallace).
1876. *Helix rubra*, Alb. *partim*. Pfeiffer, Mon. helic. viv., vol. iii, p. 435. Aru Islands, Mysol.
1879. *Helix rubra*, Alb. *partim*. Dohrn, Syst. Conch. Cab. von Martini & Chemnitz, Die Familie der Heliceen, Th. iv, pp. 569-70. Mysol (Wallace), Aru? (Coll. Mousson).
1880. *Helix (Chloritis) rubra*, Alb. *partim*. Kobelt, Jahrb. Deutsch. Malak. Ges., Jahrgang vii, p. 15. Aru Islands.
1881. *Helix (Chloritis) rubra*, Alb. *partim*. Pfeiffer, Nomenclator Helic. viv., p. 183. Aru Islands, Mysol.
1883. *Helix (Sulcobasis) rubra*, Alb. Tapparone-Canefri, Ann. Mus. Civ. Storia Nat. Genova, vol. xix, p. 166. Aru Islands (Albers), Mysol (Wallace), Molucche (L. M. d'Albertis).
1883. *Helix (Sulcobasis) rubra*, Alb. Tapparone-Canefri, op. cit., vol. xx, p. 149. Molucche (L. M. d'Albertis).
1886. *Sulcobasis rubra*, Alb. Kobelt, Nachrichtenblatt Deutsch. Malak. Ges., Jahrgang xviii, p. 174. Mysol.
1886. *Helix (Sulcobasis) rubra*. Tapparone - Canefri, op. cit., ser. IIa, vol. iv, p. 197.
1890. *Helix (Chloritis [Sulcobasis]) rubra*, Alb. *partim*. Pilsbry, Man. Conch., ser. II, vol. vi, p. 260. Mysol, Aru Islands.
1894. *Chloritis (Sulcobasis) rubra*, Alb. *partim*. Pilsbry, op. cit., vol. ix, p. 120.
1897. *Chloritis (Sulcobasis) rubra*, Alb. Kobelt, Abhandl. Senckenberg. naturf. Ges., Bd. xxiv, pp. 75-6. Batjan (Kükenthal).
1903. *Chloritis (Sulcobasis) rubra*, Alb. *partim*. Gude, Journ. Malac., vol. x, pp. 91, 95, 96. Batchian, Aru Islands, Mysol.
1906. *Chloritis (Sulcobasis) rubra*, Alb. *partim*. Gude, Proc. Malac. Soc., vol. vii, p. 113. Mysol, Aru Islands.

The characters of this sub-species separating it from the others are : Differt ab subspeciebus aliis *Sulc. concisa* spira fere omnino plana, et parte ultima anfractus ultimi sæpe magis dilatata.

In 1857 Albers published an accurate description and good figures of this shell, the habitat of which was supposed to be the Aru Islands. But this statement is, no doubt, erroneous. When several years later Wallace brought home shells of the *concisa* group, both from the true habitat of *rubra*, Alb., and from the Aru Islands, he determined them all as *rubra*, Alb. In the first instance Wallace based his determinations on Albers' description and figures, and also on the statement of habitat, erroneously given by Albers. In fact, his shells from the Aru Islands are not specimens of the true *rubra*, Alb., but belong to a different form, described by Gude as *cumingi*. I have before me one of Wallace's specimens from the Aru Islands, handed over by its collector to the late Dr. H. Dohrn, whose collection now forms part of the Stettin Museum. It is this specimen which Dohrn figured in the Conchylien-Cabinet in 1879. Its examination was





SULCOBASIS CONCISA (FÉR.). FIGS. 1-6.

SUB-SPECIES CUMINGI (GUDE). FIGS. 7-12.



made possible by the kindness of Stadtrat Hahne of Stettin. Part of the authors, since Wallace, followed Albers' description and figures, and others his erroneously given habitat. All the notes referring to Albers' type, in the Mousson Collection, now in the Zürich Museum, are to be effaced from the fauna of the Aru Islands. But all notes in literature of *rubra*, Alb., alluding to Wallace's specimens from the Aru Islands are to be referred to *cumingi*, Gude. My examination of Albers' type of *rubra*, which I figure on pl. iv, figs. 1-3, is due to the kindness of Professor Dr. O. Stoll of Zürich. One of Wallace's specimens from Mysol, which was accessible to me through the liberality of the British Museum, and kindly sent by Mr. G. C. Robson, is figured on pl. iv, figs. 4-6. These Mysol specimens resemble somewhat in shape the shells of *S. concisa concisa* (Fér.), but are nevertheless to be assigned to *S. concisa rubra* (Alb.). Besides Wallace's accurate locality only two more statements of habitat of the true *rubra* have been mentioned in literature. These are the Moluccas (Tapparone-Canefri, 1883) and the island of Batchian (Kobelt, 1897). In both cases the shells mentioned are true specimens of *rubra*, Alb. The adult specimen from Batchian (an imperfect one was also collected) is figured on pl. iv, figs. 7-9. Besides these there is in the Berlin Museum, in Paetel's collection, a shell from Celebes, which was kindly lent me by Professor Dr. J. Thiele. It differs not at all from true *rubra*, Alb., as may be seen from my figures of it on pl. iv, figs. 10-12. Most probably this shell was taken in the north of Celebes, where there exist other representatives of the Moluccan fauna, but it does not occur in Southern Celebes, which is inhabited by elements of another fauna.

*Sulcobasis concisa rubra* (Alb.) is thus distributed from the island of Mysol (and most probably the adjacent islands) over the Halmahira group of the Moluccas to the north of Celebes. Accurate habitats are: Mysol (Wallace), Moluccas (Albertis) (probably the Halmahira group), Batchian (Kükenthal), Celebes (Coll. Paetel) (north of the island, no doubt). In any case, this sub-species must be eliminated from the faunal lists of the Aru Islands.

## 2. *SULCOBASIS CONCISA CONCISA* (Fér.). Pl. V, Figs. 1-6.

- 1822. *Helix concisa*, Fér. Férussac, Hist. nat. Moll. terr. et fluv., Atlas, tom. ii, pl. lxxviii, figs. 3, 4.
- 1824. *Helix concisa*, Fér. Quoy & Gaimard, Zoologie, vol. iii of L. de Freycinet, Voy. Uranie et Physicienne, Zool., vol. iii, p. 470. Rawak Island (Freycinet).
- 1828. *Helix concisa*, Fér. Wood, Supplement Index Test., p. 23, pl. vii, fig. 53.
- 1846. *Helix concisa*, Fér. Pfeiffer, Symbolæ hist. Helic., sect. iii, p. 78. Aru Islands (Coll. Cuming).
- 1848. *Helix concisa*, Fér. Pfeiffer, Mon. helic. viv., vol. i, p. 373. Rawak Island (Freycinet), Aru Islands (Mus. Cuming).
- 1850. *Helix concisa*, Fér. Férussac & Deshayes, Hist. nat. Moll. terr. et fluv., tom. i, p. 46. Rawak Island (Freycinet).

1850. *Helix* (*Ampelita*) *concosa*, Fér. Albers, Die Heliceen, p. 128. Rawak Island (Freycinet).
1852. *Helix concisa*, Fér. Reeve, Conch. Icon., vol. vii, pl. lxxxvi, species 466. Aru Islands (Mus. Cuming).
1853. *Helix concisa*, Fér. Pfeiffer, op. cit., vol. iii, p. 238.
1855. *Helix* (*Ampelita*) *concosa*, Fér. Pfeiffer, Malak. Blätt., Bd. ii, p. 137.
1855. *Macrocyelis* (*Ampelita*) *concosa*, Fér. H. & A. Adams, Gen. Rec. Moll., vol. ii, 203.
1859. *Helix concisa*, Fér. Pfeiffer, Mon. helic. viv., vol. iv, p. 287.
1860. *Helix* (*Chloritis*) *concosa*, Fér. Albers, Die Heliceen, p. 162. Rawak, Aru.
1865. *Semicornu concisum*, Fér. Wallace, Proc. Zool. Soc., p. 410. Waigiou (Wallace).
1868. *Helix concisa*, Fér. *partim*. Pfeiffer, op. cit., vol. v, p. 374. Waigiou (Wallace), Aru Islands (Mus. Cuming).
1876. *Helix concisa*, Fér. *partim*. Pfeiffer, op. cit., vol. vii, p. 435. Waigiou.
1880. *Helix* (*Chloritis*) *concosa*, Fér. Kobelt, Jahrbuch. Deutsch. Malak. Ges., Jahrgang vii, p. 12. Waigiou.
1881. *Helix* (*Chloritis*) *concosa*, Fér. Pfeiffer, Nomenclator Helic. viv., p. 183. Rawak, Aru Islands, Waigiou.
1883. *Helix* (*Sulcobasis*) *concosa*, Fér. Tapparone-Canefri, Ann. Mus. Civ. Storia Nat. Genova, vol. xix, pp. 165-6. Waigiou (Wallace), Aru Islands (Pfeiffer), Rawak Island (Freycinet).
1886. *Sulcobasis concisa*, Fér. Kobelt, Nachrichtenblatt Deutsch. Malak. Ges., Jahrgang xviii, pp. 174, 179. Aru Islands, Waigiou.
1886. *Helix* (*Sulcobasis*) *concosa*, Fér. Tapparone-Canefri, op. cit., vol. iv, p. 197.
1889. *Helix* (*Chloritis*) *concosa*, Fér. Paetel, Cat. Conchylien-Sammlung, 4. Neubearbeitung, 2. Abtheil., p. 119. Waigiou (Wallace).
1890. *Helix* (*Chloritis* [*Sulcobasis*]) *concosa*, Fér. Pilsbry, Man. Conch., ser. II, vol. vi, p. 262, pl. xlix, fig. 15. Waigiou, Aru Islands, Rawak Island.
1894. *Chloritis* (*Sulcobasis*) *concosa*, Fér. Pilsbry, op. cit., vol. ix, p. 120.
1903. *Chloritis* (*Sulcobasis*) *concosa*, Fér. Gude, Journ. Malac., vol. x, p. 96. Waigiou, Rawak.
1906. *Chloritis* (*Sulcobasis*) *concosa*, Fér. *partim*. Gude, Proc. Malac. Soc., vol. vii, p. 113. Aru Islands.

This sub-species is characterized as follows: Differt ab aliis sub-speciebus *Sulc. concisæ* spira subplana, anfractibus supra subplanis, sutura profunde impressa separatis, et sæpius sulcis obliquis distinctis.

In this form special importance has hitherto been attached to the furrows of the shell, a most unimportant and variable character. These furrows are found more or less in all specimens of all the sub-species in question. A shell of *concosa concisa*, the same which Pfeiffer described in 1848, belonging to the collection von dem Busch,

now in the Bremen Museum, and kindly sent me for examination by Professor Dr. H. H. Schauinsland, exhibits much shallower furrows than the type figured by Férussac. The depth of furrows is therefore by no means to be considered as a character of predominant value. It is possible that on certain islands *S. concisa concisa* shows a tendency to produce furrows in a greater degree than usual. This presumption could only be proved by a much larger amount of material, which unhappily is still wanting. Certainly there are specimens of the true *concisa concisa*, the furrows of which are by no means stronger than in the other sub-species. The type locality of *concisa* is the little island of Rawak, near Waigiou (Freycinet); from the island of Waigiou it was brought home by Wallace. Besides these there have been mentioned specimens of *concisa* from Cuming's collection, which were said to come from the Aru Islands and from New Guinea. All quotations in literature refer to these four finds. The shells from New Guinea, which Cuming placed in *concisa concisa*, are in fact very distinct from this sub-species. Gude separated it in 1906 as a new species, which he named *cumingi*. Thus all statements of habitat indicating *S. concisa concisa*, Fér., from New Guinea are based on Cuming's shells, and are to be referred to *S. concisa cumingi* (Gude). The statement which Gude made in 1906 of *S. concisa concisa* (Fér.) coming from New Guinea (after having separated *S. cumingi* from it) is also to be referred to *S. concisa cumingi*, for Gude's statement was only based on the quotations of literature of *concisa* from New Guinea, mentioned above. The specimens from Cuming's collection supposed to come from the Aru Islands and determined as *concisa* certainly belong to that sub-species.<sup>1</sup> One of these shells is figured in Reeve's monograph of *Helix* in 1852. Another shell was given by Cuming to von dem Busch. It is the specimen mentioned above, which was described by Pfeiffer in 1848, and which is now in the Bremen Museum. Its furrows are not so well developed as in the specimen figured by Reeve. Pl. v, figs. 4-6, in my paper represent this shell. The supposed locality is no doubt erroneous, for no specimen of *S. concisa concisa* (Fér.) exists on these islands, but it is replaced by *S. concisa cumingi* (Gude), as my treatment of *cumingi* will show.

This sub-species is distributed on Waigiou and adjacent islands, and it seems probable that it will also be found on some part of the neighbouring coast of New Guinea. Accurate localities of this sub-species are the islands of Rawak (Freycinet) and Waigiou (Wallace).

### 3. *SULCOBASIS CONCISA CUMINGI* (Gude). Pl. V, Figs. 7-12.

1865. *Semicornu rubrum*, Alb. *partim*. Wallace, Proc. Zool. Soc., p. 410. Aru Islands (Wallace).

1868. *Helix rubra*, Alb. *partim*. Pfeiffer, Mon. helic. viv., vol. v, p. 374. Aru Islands (Wallace).

<sup>1</sup> Messrs. G. K. Gude and G. C. Robson were kind enough to procure me photographs of one of Cuming's specimens of true *concisa*; they are reproduced on Pl. V, Figs. 1-3.

1868. *Helix concisa*, Fér. *partim*. Pfeiffer, op. cit., vol. v, p. 374. New Guinea (Mus. Cuming).
1876. *Helix rubra*, Alb. *partim*. Pfeiffer, op. cit., vol. vii, p. 435. Aru Islands.
1876. *Helix concisa*, Fér. *partim*. Pfeiffer, op. cit., vol. vii, p. 435. New Guinea.
1879. *Helix rubra*, Alb. *partim*. Dohrn, Syst. Conch. Cab. von Martini & Chemnitz, Die Familie der Heliceen, Abth. iv, pp. 569–70, Taf. 168, figs. 7–9. Aru Islands (Wallace).
1880. *Helix (Chloritis) rubra*, Alb. *partim*. Kobelt, Jahrb. Deutsch. Malak. Ges., Jahrgang vii, p. 15. Aru Islands.
1881. *Helix (Chloritis) rubra*, Alb. *partim*. Pfeiffer, Nomenclator Helic. viv., p. 183. Aru Islands.
1883. *Helix (Chloritis) rubra*, Alb. Paetel, Cat. Conchylien-Sammlung, p. 135. Aru Islands.
1889. *Helix (Chloritis) rubra*, Alb. Paetel, op. cit., 4. Neubearbeitung, 2. Abtheil., p. 178. Aru Islands.
1890. *Helix (Chloritis [Sulcobasis]) rubra*, Alb. *partim*. Pilsbry, Man. Conch., ser. II, vol. vi, p. 260, pl. xlviii, figs. 1–3. Aru Islands.
1894. *Chloritis (Sulcobasis) rubra*, Alb. *partim*. Pilsbry, op. cit., vol. ix, p. 120.
1903. *Chloritis (Sulcobasis) rubra*, Alb. *partim*. Gude, Journ. Malac., vol. x, p. 95. Aru Islands.
1906. *Chloritis cumingi*, Gude. Gude, Proc. Malac. Soc., vol. vii, p. 48, pl. v, figs. 1, 1a. New Guinea (Mus. Cuming).
1906. *Chloritis (Sulcobasis) rubra*, Alb. *partim*. Gude, op. cit., vol. vii, p. 113. Aru Islands.
1906. *Chloritis (Sulcobasis) concisa*, Fér. *partim*. Gude, op. cit., vol. vii, p. 113. New Guinea.
1906. *Chloritis (Sulcobasis) cumingi*, Gude. Gude, op. cit., vol. vii, p. 113. New Guinea.

*S. concisa cumingi* (Gude) may be distinguished from the other sub-species by the following characters: Differt ab aliis subspeciebus *Sulc. concisæ* spira altiore et elevatiore.

The specimens of this sub-species came with Cuming's collection to the British Museum, where they were labelled *Sulcobasis concisa*, Fér., and it was not before 1906 that Gude recognized them as new, and described them as *Sulcobasis cumingi*. All statements in literature concerning *concisa* as from New Guinea refer to Cuming's specimens quoted above, i.e. to *cumingi*, Gude. One of the three specimens of Cuming, a cotype of Gude's species, was kindly sent me for examination from the British Museum by Mr. G. C. Robson, and it is figured on pl. v, figs. 7–9. Comparing this cotype with shells of the *concisa* group coming without doubt from the Aru Islands, the curious fact became evident that there was no subspecific difference between them. It therefore results that either *S. concisa cumingi* (Gude) occurs on the Aru Islands and in the district of New Guinea opposite to them—Cuming gave no certain locality in New Guinea—or that Cuming's statement, the shell now bearing his name coming from

New Guinea, is based on an error, and *cumingi* is confined to the Aru Islands. As shown above under *S. concisa rubra* (Alb.) the misunderstanding of *cumingi* from the Aru Islands was caused by Albers, who quoted his *rubra* from an erroneous locality, i.e. the Aru Islands. Misled by this statement, Wallace (1865), followed by subsequent authors, treated the shells which really came from the Aru Islands as belonging to *rubra*, but these two forms, *rubra* and *cumingi*, are the very extremes of the group of *Sulcobasis concisa* (Fér.), as a glance at my figures clearly shows. I have before me three specimens of *cumingi*. The first is one of Gude's cotypes, mentioned above (pl. v, figs. 7-9). The second is in Paetel's collection, belonging to the Berlin Museum, and was very kindly sent me by Professor Dr. J. Thiele. It is represented on my pl. v, figs. 10-12. The other specimen was collected by Wallace and handed over by him to H. Dohrn, whose collection now belongs to the Stettin Museum; Stadtrat Hahne of Stettin kindly gave me an opportunity of studying it. In 1879 Dohrn figured this specimen as *rubra*, and in 1890 Pilsbry copied this figure under the same name.

*S. concisa cumingi* (Gude) thus occurs on the Aru Islands, from where certain specimens collected by Wallace are at hand. No certain locality in New Guinea for this sub-species has come to our knowledge, but, if Cuming's statement be correct, we may certainly suppose that it lives in the part of New Guinea opposite to the Aru Islands.

#### SUMMARY.

My investigations show that *Sulcobasis concisa* (Fér.), with its sub-species, is distributed over a bow formed by the Aru Islands, the north-western peninsula of New Guinea, Waigiou, Mysol, the Halmahira group of the Moluccas, and the northern part of Celebes. On the other hand, the species does not occur on another bow, the components of which are often situated very close to that of the bow mentioned above. This second bow, on which our species is wanting, is formed by the Tenimber Islands, the Key Islands, the Amboina group of the Moluccas, and Buru. On the first bow the sub-species of *Sulcobasis concisa* (Fér.) are distributed as follows: *S. concisa cumingi* inhabits the Aru Islands and possibly New Guinea (probably in the north-western district northward of the Aru Islands). *S. concisa concisa* (Fér.) is found in the island of Waigiou, in the little island of Rawak, and probably also in the neighbouring little islands. It is also possible that its distribution extends to the neighbouring coast of New Guinea. *S. concisa rubra* (Alb.) occurs on the bow westward from the island of Mysol; it lives on Mysol, on the Halmahira group of the Moluccas, and in the north of Celebes. A gradual flattening of the shell may be observed in specimens found on the bow from the Aru Islands to the west. *S. concisa cumingi* exhibits the highest, *S. concisa rubra* the lowest spire. The other sub-species graduate very conveniently between these two extremes.

## EXPLANATION OF PLATES IV AND V.

## PLATE IV.

FIGS. 1-3.	<i>Sulcobasis concisa rubra</i> (Albers).	From the type in the Zürich Museum.
„ 4-6.	„ „ „ „	From a specimen in the British Museum.
„ 7-9.	„ „ „ „	From a specimen in the Senckenberg Museum.
„ 10-12.	„ „ „ „	From a specimen in the Berlin Museum.

## PLATE V.

FIGS. 1-3.	<i>Sulcobasis concisa concisa</i> (Fér.).	From a specimen in the British Museum.
„ 4-6.	„ „ „ „	From a specimen in the Bremen Museum.
„ 7-9.	„ „ <i>cumingi</i> (Gude).	From a cotype in the British Museum.
„ 10-12.	„ „ „ „	From a specimen in the Berlin Museum.

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# Malacological Society of London.

(Founded 27th February, 1893.)

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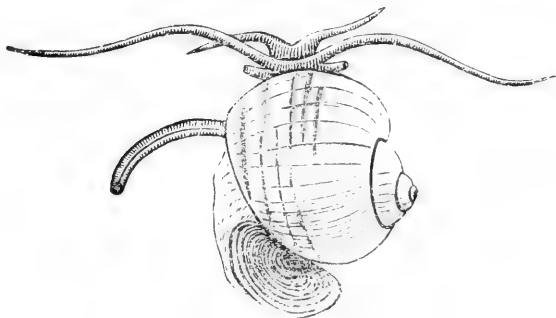
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## ORDINARY MEETING.

FRIDAY, 13TH NOVEMBER, 1914.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

The following communications were read:—

1. "The Geographical Distribution of *Purpura lapillus* (L.). Part I: In Palæarctic Waters." By the Rev. A. H. Cooke, M.A., Sc.D., F.Z.S.
2. "On the Extension of the Distribution of the American Slipper Limpet (*Crepidula fornicata*) in the English Coastal Waters." By J. H. Orton, Sc.D.
3. "Descriptions of Colour Varieties of *Conus quercinus*, Hwass, and *Cypræa lamarchii*, Gray." By H. O. N. Shaw, B.Sc., F.Z.S.
4. "Note on the Land and Freshwater Shells of Texel and Terschelling." By F. H. Sikes, M.A., F.L.S.

## ORDINARY MEETING.

FRIDAY, 11TH DECEMBER, 1914.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

Charles Ramsden and the Librarian, University of California, Berkeley, Cal., were elected members of the Society.

The following communications were read:—

1. "The Geographical Distribution of *Purpura lapillus* (L.). Part II: In Nearctic Waters." By Rev. A. H. Cooke, M.A., Sc.D., F.Z.S.
2. "On the Non-marine Mollusca of a Post-Pliocene Deposit at Apethorpe, Northamptonshire." By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S.

Mr. J. E. Cooper exhibited some monstrosities of *Littorina rudis* from the Fleet near Weymouth.

## ORDINARY MEETING.

FRIDAY, 8TH JANUARY, 1915.

B. B. Woodward, F.L.S., in the Chair.

Messrs. A. S. Kennard and F. W. Reader were appointed auditors.

The following communications were read:—

1. "Descriptions of five new Mollusca of the genera *Drillia*, *Marginella*, *Apicalia*, *Plesiotrochus*, and *Ringicula*, all from Ceylon; also Notes on the genus *Plesiotrochus*." By G. B. Sowerby, F.L.S.
2. "On some Opalized Shells from the Cretaceous Rocks of New South Wales." By R. Bullen Newton, F.G.S.
3. "Molluscan Notes." By H. C. Fulton.
4. "Description of a supposed new species of *Placostylus*." By H. C. Fulton.

Mr. A. Reynell exhibited a specimen of *Strombus pugilis*, remarkable for being devoid of spines on the spire.Mr. G. B. Sowerby exhibited a very fine shell of *Argonauta tuberculata*, from the coast of Victoria, Australia, measuring  $9\frac{3}{4} \times 7$  in., being probably the largest specimen known.

## NOTES.

ON THE EXTENSION OF THE DISTRIBUTION OF THE AMERICAN SLIPPER-LIMPET (*CREPIDULA FORNICATA*) IN THE ENGLISH COASTAL WATERS. (*Read 13th November, 1914.*)—The introduction and early spread of the American Slipper-Limpet on the Essex coast since about the year 1880 has already been described by Orton,<sup>1</sup> and later by Murie.<sup>2</sup> It is now of interest to record the progress of the invasion of English waters by this animal.

I have been informed by Mr. W. R. Butterfield, Curator of the Hastings Museum, that a few specimens of *Crepidula* have been taken in the Hastings locality, chiefly on shells of the common whelk, *Buccinum undatum*, from about the year 1908 or 1909.<sup>3</sup> Now it is well known that the tidal streams of the English Channel meet and separate in the Hastings district, thus this region forms an excellent new centre of distribution for the further spread of the invading limpet by means of its free-swimming larvæ. So far, however, there appear to be only three additional localities in the English Channel where *Crepidula* is known to occur.

At the request of Mr. G. C. Robson of the British Museum, Miss Florence Jewell in May, 1913, kindly sent me a living specimen of *Crepidula fornicata*, which was obtained from the harbour at Emsworth in Hampshire during the same month. This specimen was the smallest of a chain of four individuals, the largest of which then measured about 1½ inches long. Subsequently fishermen have brought in to Miss Jewell on five separate occasions fourteen other specimens from the same district. In Sussex, at Selsey Bill and Shoreham, Mr. Ronald Winckworth of Brighton has been good enough to inform me that he has found a fresh specimen in the former locality in December, 1911, and a living one in the latter, about March, 1912, at low-water mark, discoveries which no doubt indicate the presence of greater numbers of this animal in the neighbouring deeper waters. Thus there can be no doubt that the slipper-limpet is gradually extending its distribution westwards down the English Channel. It has undoubtedly effected a highly successful invasion of the English coastal waters,<sup>4</sup> for it is now to be found at various places between Mersea Island on the coast of Essex—in which region it was first introduced—to Emsworth in Hampshire. *Crepidula* therefore furnishes an excellent example of the efficacy of a free-swimming

<sup>1</sup> J. H. Orton, "On the Occurrence of Protandric Hermaphroditism in *Crepidula fornicata*": Proc. Roy. Soc., vol. lxxxi, B, pp. 468-84, text-figs., 1909.

<sup>2</sup> J. Murie, "'Slipper Limpet' or 'Boat Shell', *Crepidula fornicata*: its Introduction and Influence on Kent and Essex Oyster Beds": Zoologist, No. 845, November 15, 1911, pp. 401-15, pls. vi, vii.

<sup>3</sup> See also W. Ruskin Butterfield, Handbook to Collections in the Corporation Museum, Hastings, 1911, p. 36.

<sup>4</sup> I have obtained this year from the Essex coast chains of from two to nineteen individuals, whereas in 1909 the largest chain met with contained only thirteen individuals. This fact indicates that *Crepidula* had not attained a maximum of virility in 1909, and has since continued to extend its influence in these excellent feeding-grounds. Whether it has yet reached its maximum of development is still doubtful.

larva in extending the domain of a sea-dwelling animal, for, so far as I have been able to learn, no adults of this animal have been introduced into the coastal waters of either Sussex or Hampshire.

J. H. ORTON.

NOTE ON THE LAND AND FRESHWATER SHELLS OF TEXEL AND TERSCHELLING. (*Read 13th November, 1914.*)—When paying a visit to these islands in August, 1913, the following species of land and freshwater Mollusca were collected.

Texel seemed fairly productive of shells, twenty species being found there. I was interested to find a *Vertigo*, none of which genus had appeared in my exploration of Friesland some years ago.

*Helicella cantiana*, too, turned up unexpectedly, and could not, I think, have been imported, as I found it at Koog on the west side of the island, far from any harbour or place where boats land. Whether imported or not, it seems to have established itself in some numbers.

I also visited the intermediate island, Vlieland, but found no signs of Mollusca there.

#### TEXEL.

*Helix nemoralis*, L.  
*Pyramidula rotundata* (Müll.).  
*Theba cantiana* (Mont.), var. *cantianiformis*, Ancy.  
*Hygromia hispida* (L.), var. *hispidosa*, Mouss.  
*Cochlicopa lubrica* (Müll.).  
*Vallonia excentrica*, Sterki.  
*Vertigo antiverigo* (Drap.).  
*Limnæa pereger* (Müll.).  
     var. *maritima*, Jeff.  
     var. *balthica*.  
     var. *acuminata*, Jeff.  
     var. *ovata*, Drap.  
*Limnæa palustris* (Müll.).  
     var. *lacunosa* (Zgl.).  
*Limnæa truncatula* (Müll.).  
*Planorbis umbilicatus*, Müll.  
*P. spirorbis* (L.).

*P. contortus* (L.).  
*P. albus*, Müll.  
*Succinea elegans*, Risso, var. *longiscata*, Morelet.  
*Sphærium corneum* (L.).  
*Paludetrina ventrosa* (Mont.).  
*Pisidium nitidum*, Jenyns.  
*P. obtusale*, Pfr.  
*P. subtruncatum*, Malm.

#### TERSCHELLING.

*Limnæa pereger* (Müll.).  
*L. palustris* (Müll.).  
*Planorbis spirorbis* (L.).  
*Sphærium corneum* (L.).  
*Physa fontinalis* (L.).  
*Succinea putris* (L.).  
*Paludetrina stagnalis*, Bast.  
*Pisidium casertanum*, Poli.

F. H. SIKES.

THE GEOGRAPHICAL DISTRIBUTION OF *PURPURA LAPILLUS* (L.).  
PART I: IN PALÆARCTIC WATERS.

By the Rev. A. H. COOKE, M.A., Sc.D., F.Z.S.

Read 13th November, 1914.

It seems possible that investigation into the geographical distribution of some of our common littoral species may produce results of scientific value. The present paper on the distribution of *Purpura lapillus* (L.) is offered as a first contribution towards this kind of knowledge.

One preliminary remark may be made. The facts of geographical distribution may be established partly by positive, partly by negative evidence. Negative evidence as to distribution, in the case of a common species of wide extent, naturally operates at the extreme termini of its range, north or south, east or west, as the case may be. In the range of the species under investigation—and equally in the case of all littoral species occurring on the west coasts of Europe—negative evidence, by establishing the fact that it has not been found north or south of certain points, will warrant the conclusion that the northern and southern limits of its distribution have been at least provisionally arrived at.

No attempt has been made in this paper to deal with questions of synonymy, or to discuss the causes of variation.

We begin with the far north, in North-West Siberia. *P. lapillus* does not occur at the mouth of the Yenesei River, not having been found there by the Russian expedition sent in 1866 to investigate the corpse of a mammoth (Schmidt 107), or by Nordenskiöld's *Vega* Expedition of 1875–6 (Leche 65). It is not found in the Kara Sea (Collin 17, Pfeffer 98, Herzenstein 44, Dautzenberg & Fischer, Voyage of the *Belgica*, 1907, 25, Voyages of the *Hirondelle* and *Princess Alice*, 1898–1907, 27), nor did the Andrew Coats cruise of 1898 find it at Kolguev Island (Melvill & Standen 81). It does not occur in Franz Josef's Land (Melvill & Standen 81, Jackson Harmsworth Expedition of 1896–7). Frequent expeditions to Spitzbergen have failed to detect it (Torell 117, Mörch 87, McAndrew, Phipps, & Leach 76, Jeffreys 54, Friele 37, Hägg, Swedish Polar Expedition of 1900, 41, Krause 61, Pfeffer 99), and Knipovitch does not include it in his exhaustive *résumé* of the molluscan fauna of the island (58). Neither Friele (36), dealing with the Mollusca of the Norwegian North Atlantic Expedition of 1877, nor Becher (9a), nor Hägg (41), record it from Jan Mayen Island. There appears to be no record of collectors from Bear Island.

The most northern occurrence of the species is in Novaya Zemlya, where it was "captured at the shore of the Matotschin-shar" (or Matthew Strait, which cuts the great island in two) by the *Willem Barents* Dutch Expedition of 1878–9 (van Lidth de Jeude 67). The specimens, which belonged to the var. *imbricata*, Lam., were

placed in the Leyden Museum, and have since, I am assured by Dr. J. Vernhout, been unfortunately lost. It was not brought from the northern part of Novaya Zemlya in the collections made by Ivanoff (Dautzenberg 24), nor by the Mission Bénard in 1908 (Dautzenberg & Fischer 26), this latter expedition being mainly concerned with dredging work. Nor was it found by the *Isbjörn* in 1879, which dredged in very shallow water, but did no shore collecting (Smith 109a). The *Belgica* (Dautzenberg & Fischer 25) went through the Matotschin Schar in 1907, but did not stay to do any shore collecting, and the *Vega* Expedition of 1875-6 (Leche 65) dredged near the straits, but did not pass through them. The *Dymphna* (Collin 17) in 1882-3 visited several points in South-West Novaya Zemlya, but does not seem to have done any shore collecting.

Middendorff (82) states that he brought home specimens of *P. lapillus* from the White Sea, and is confirmed by Herzenstein (43), a much later authority. On the other hand, Professor N. Nasonov, the Director of the Zoological Museum, Imperial Academy of Sciences, St. Petersburg, writing to me, quotes the view of Dr. Knipovitsch : "Selon son opinion, la *Purpura lapillus* ne se rencontre nullement . . . dans la Mer Blanche même." Both views are possible. The northern limits of the White Sea are defined by Herzenstein (43) by a line drawn from Cape Kanin in the east to Swyatoi Noss (or Holy Cape) in the west. Within this line falls the most easterly point on the mainland of Northern Europe and Asia on which *P. lapillus* has hitherto been found,<sup>1</sup> viz. Trechostrow or Tri Ostrova (Three Islands), in 67° N. 40° E., near the mouth of the Ponoï River. On the other hand, it is quite possible to define the White Sea proper by a line drawn much further south, in the narrow neck, in which case Tri Ostrova falls outside the limits of the White Sea. Knipovitsch, in his memoir on the fauna of the Solovetsky Islands (57), does not mention *P. lapillus*.

The fact that *P. lapillus* occurs on the west coast of Novaya Zemlya, in 73° 20' N., and not in the interior of the White Sea, the main body of which lies between 66° N. and 64° N., well to the south of the Arctic Circle, is due to obvious causes. The water on the west coast of Novaya Zemlya is no doubt affected by the flow of the Gulf Stream past the northern coast of Norway, which raises its temperature to about 40° F. in the month of August. The White Sea is uninfluenced by any current of warm water; it is beset with ice for many months of the year, and its temperature, both at the surface, and at depths of 10, 40, and 75 fathoms, is known to be remarkably low (Herzenstein 43). Novaya Zemlya acts as an effectual barrier to the eastward advancement of any warm current, and the fauna of the Kara Sea, and no doubt of the eastern coast of Novaya Zemlya itself, is of an Arctic type.

<sup>1</sup> My authority is a letter from Professor Nasonov : "Le feu M. Herzenstein n'a rencontré cette forme qu'à Tri-Ostrova, c'est à dire à l'entrée-même de la Mer Blanche."

All along the Mourmane coast as far as the Varanger Fiord, *P. lapillus* occurs in suitable localities, where it is quite common. Specially may be particularized: Gavrilovo ( $69^{\circ} 20' N.$ ,  $36^{\circ} E.$ ), Lodenäia, Teriberka ( $69^{\circ} 20' N.$ ,  $35^{\circ} 10' E.$ ), the port and island of Jekaterinskaia Gavang in the Kola Fiord (all in Coll. A. H. C.). Pfeffer (99) records it from Ieretik Islands, Port Wladimir ( $69^{\circ} 40' N.$ ), and the Mourmane coast generally. In East Finmark it is recorded from Vadsö in the Varanger Fiord (Norman 91, de Guerne 29, Coll. A. H. C.), with the var. *imbricata*, Lam., and in North Finmark from the Porsanger Fiord (Friele 38, Coll. A. H. C.).

The general facies of many specimens from the extreme north is very characteristic, and would amply warrant those who are fond of naming varieties in applying to them the name of var. *borealis*. The shell is comparatively thin, long and rather narrow, spire elevated, mouth very long oval, outer lip scarcely at all thickened, sculpture a number of raised concentric rings, which in some cases tend to disappear altogether, colour light to very dark brown. The extreme form of this variety occurs in the Kola Fiord and on the Mourmane coast; specimens from Vadsö and the Porsanger Fiord are similar in shape and more compact in structure. The same form of shell occurs in North-West Norway at Tromsö (Coll. A. H. C.) and at least as far south as Lödingen ( $68^{\circ} 30' N.$ ), where it is much more massive and solid, one specimen measuring over 1.625 in. in length.

*P. lapillus* is common on the Norwegian coasts from the North Cape (M. Sars 106, Lovén 72) to the Naze, and exhibits many of the same variations of form which are to be observed on our own coasts. Specimens from Trondhjem recall a form from Newquay or South Wales, from Aalesund a form common on the West of Scotland, from Finsnes a form from Loch Swilly. It is noted from the Lofoden Islands (G. O. Sars 105) and from Bergen (Lamy 64), and is found in every suitable locality on the northern shores of the Skagerak up to the outer waters of the Christiania Fiord, becoming more scarce as we move north. Asbjørnsen (5) distinctly states that it is not found in the narrow waters of the fiord, but only in the open sea, naming such places as Randoer, Bollaererne, and Faerder Islands, where it occurs, seldom living, at a depth of 10–20 fathoms. Jeffreys (52), for instance, did not get it at Dröbak. On the south-west coast of Sweden, Malm (79) records it from the Vaderö Islands, and, with Théel (116), also from Christineberg, on the western shore of Bläbergholm, in Bohuslän. But a very short distance further south it becomes scarce, and Malm (80) records that near Göteborg it occurs only on the outer side of Vinga Islands, where it was so rare that he was only able to collect one single living specimen, but in the trawl he got a few dead shells. The British Museum possesses two specimens labelled "Coast of Sweden", which were dredged by Dr. Thudén and presented by him on October 13th, 1863. The shells are small, not quite mature, the largest measuring .875 inch in length, surface slightly imbricate, concentrically corded with raised lines, spire prominent, colour dirty white.

In the Southern Kattegat, Lilljeborg (68) recorded *P. lapillus* from



the Kullen Peninsula. It may be doubted whether the record can stand. Professor Ad. S. Jensen, after remarking that Helsingborg and Kullen were named as localities by Lovén and Oersted, says, in a letter to me: "In all probability the statements refer to semi-fossil specimens from the (query?) *Tapes* or *Littorina* period. It does not live in the inner Danish seas (the Great and Little Belt and the Baltic)." No writer on Baltic Mollusca has ever recorded it.

On all the mainland coasts of Denmark *P. lapillus* scarcely occurs. Christensen (5) says: "*P. lapillus* is very rare, and apparently only locally in the north; thus it appears at Hirtsals, where the bottom is full of stones." Mörch (88) mentions the following localities: Hornaes, Skagen, and between Skagen and Hirtshals, common at Hirtshals (Majborg); Frederikshavn (Steenstrup). To quote again from Professor Jensen's letter: "The only place in which it has been found with certainty living is the northern part of the west coast of Jutland (Hirshals, Blockhus). From old time there is in our museum [at Copenhagen] a specimen (with animal) which is said to have been taken at Frederikshavn (east coast of Jutland), but in modern time no living specimen has been found there. C. G. Johs. Petersen records a 'recently dead' shell at Gerrild Klint, near Grenaa, on the east coast of Jutland." By the courtesy of the Professor I possess two specimens from Hirtshals. They are labelled "from the mole: C. G. Johs. Petersen leg. 1889", and represent a short stout type of shell common in Britain. I have also a specimen labelled "fossil from the *Dosinia* beds (the last stage of the warm *Littorina*-time), near Frederikshavn, Jutland; V. Nordman leg. 1904".

Collin (16) reports that *P. lapillus* does not now live in the Lim Fiord, which runs through Denmark, from the Kattegat to the North Sea. He found two dead but recent specimens in Odde Sound, but they were probably introduced from the North Sea by fishing gear. The species occurs sub-fossil at several places on the fiord. The sandy west coast of Denmark does not offer many suitable localities for the species.

Frey and Leuckart (35) record it from Heligoland. From Holland I have specimens, in no way remarkable, from Domberg, Walcheren Island, at the mouth of the Scheldt.

On the Belgian coast the species no doubt occurs in all suitable localities. Lameere (63) and Gilson (39) both place it in their list of the marine fauna of Belgium, and Pelseneer (96) has it from Blankenberghe.

The range of *P. lapillus* in Iceland is strictly confined to the warm west and south coasts; on the colder east and north it is not found living, though Bardáson records it in a fossil state from some of the northern fiords, deducing from the fact a higher temperature for those shores during the corresponding geological period (Ödhner 92). No better illustration could be found of the fact that the absence of a current of warm water tends to cut off the range of certain species. *P. lapillus* occurs all round the North Cape and Mourmane coast, many miles north of the Arctic Circle, and even as far north as Novaya Zemlya, and yet cannot exist in the cold area of the coasts of

Iceland, practically all of which island lies south of the Arctic Circle. The surface temperature of the water on the north coast of Iceland appears never to rise above  $41^{\circ}$  F., while in winter it sinks to  $32^{\circ}$ ; the water on the south-west of Iceland is never colder than about  $40^{\circ}$ , and in summer rises to between  $50^{\circ}$  and  $60^{\circ}$  F.

Mohr (89), G. O. Sars (105), Verkrüzen (119), Johansen (55), all record the occurrence of the species in Iceland. My collection contains specimens from Reykjavik, the Islands of Vithey, Hafnafiord, Stykkisholmr, and Flatey Island in the Breidifjord, Dyrafiord in the extreme north-west, as well as from two places not marked in my maps, Skerjafiord ( $1\frac{1}{2}$  to 2 fathoms, sandy bottom, A. C. Johansen) and Heymaey (A. C. J.). In form the specimens vary greatly, some being stout and thick-lipped, and recalling forms from our own coasts, some (from Reykjavik) thin-lipped and rather degenerate, colour a peculiar slaty-grey, interior strongly iridescent, others, from the Breidifjord, resemble a form from Vadsö, while those from the Dyrafiord, the furthest north, closely recall a form described above from the Mourmane coast.

Specimens from the Faroe are large and very solid: the broadly banded form also occurs there (Coll. A. H. C.). The species is in Mörch's catalogue (86).

In the British Islands, which appear to be the metropolis of this species, it occurs in abundance in every form of coast on which it can find a lodgment.

Locard (71) gives the following comprehensive list of French localities:—English Channel: Dunquerque (Le Nord); Wimereux, le Boulonnais (Pas de Calais); Dieppe, Fécamp (Seine Inf.); Normandy; Langrune, Granville (Calvados); Cherbourg, Valogne (La Manche); St. Malo, Cancale (Ille et Vilaine). Atlantic Ocean: Armorican and Aquitanian regions: Brest, Roscoff (Finistère); Impairs, Pouliquen, Ker Cabalec, Pornichet (Loire Inf.); Ile d'Yeu, Sables d'Olonne (La Vendée); La Rochelle, Royan, Ile de Ré (Charente Inf.); Cordouan, Vieux Soulac (Gironde); St. Jean de Luz (Basses Pyrénées). The var. *imbricata*, Lam., is given by the same author as occurring at many places from Dunkirk to Royan. In reviewing a collection from French localities one is struck by the marked declination in size of shell as compared with specimens from our own shores, and this is particularly the case with specimens from the Atlantic coasts. Shells are massive and well formed, but they do not appear to approach ours in length. The var. *imbricata* seems to be relatively abundant.

On the northern coasts of Spain, *P. lapillus* is recorded from Santander, San Vincente de la Barquera, and Gijon (Hidalgo 45, 47), from Asturias and Galicia generally (McAndrew 74), from Rio de Betanzos and Corunna (Hidalgo 45 and McAndrew and Woodward 78), from Vigo (Hidalgo 45 and McAndrew 74, 75), from Caramelas, Bayona, and all Galicia from the frontier of Portugal to Rivadeo (Hidalgo 46).

In Portugal *P. lapillus* is fairly abundant on the rocks of the northern coast. In the west, it is common only on the rocks of Vianna do Castello, at the mouth of the River Limia in Minho, and

northward as far as the frontier. It is rather rare on the coast of Oporto, and becomes scarce towards the south (Nobre 90). There are specimens in the Oporto Museum from Foz do Douro and Leça da Palmeira (Anon. 3). Nobre found one worn example at Portimão, 25 miles E.N.E. of Cape St. Vincent, in Algarve, N. lat.  $37^{\circ} 10'$ . In my collection, from the same spot, are included a number of specimens collected by Dr. H. Gadow "at a small rock near the harbour entrance". "Thence eastward," continues Dr. Gadow in a private letter, "e.g. Faro and Oldhão, the coast is sandy, flat, and with lagoons of muddy bottom, or protected by sandbanks; the same unsuitable conditions extend right up to Cadiz. West of Portimão, round Cape St. Vincent, the coast is rocky and suitable."

At Cadiz the species does not occur. It is not found in the lists of Cadiz Mollusca by Hidalgo (48) and Maxwell Smith (110), and I have collected there myself without finding it. Nor does it appear to occur at Tangier, where the shore conditions are wholly suitable. It seems reasonable, therefore, to conclude that Portimão in Algarve is the southern limit of the distribution of this species. Specimens from this locality are dwarfed but compact, mostly rich chocolate to brown, or blue-grey throughout, sometimes banded with white, mouth large, last whorl very large in proportion to rest of shell, sculpture none, or a few indistinct concentric rings. My largest specimen measures no more than .8 in. in length.

*P. lapillus* has been occasionally, but, it would appear, mistakenly reported from the Mediterranean. Locard (71) remarks: "*Le P. lapillus* est indiqué dans la Méditerranée à Nice par Risso et à Cannes par M. Dautzenberg. Mais M. de Monterosato (Conch. Médit., art. prin., p. 4) met en doute cette assertion." Hidalgo (45) notes: "? Minorca (Ramis)." Weinkauff (123) does not include it in his list. Kobelt (59) and G. O. Sars (105) omit the Mediterranean in their list of localities.

R. T. Lowe (73) includes *P. lapillus* in "A list of the shells observed . . . at Mogador . . . in April, 1859". After referring to the fact that Adanson (2) in his History of Senegal includes *P. lapillus* in his list, Lowe continues: "The abundant occurrence of a dwarf state or variety of this shell at Mogador renders it not at all improbable that it may be also found still further down the coast, and therefore possibly in Senegal. Fresh observations to decide this point would therefore be extremely interesting." M. Paul Pallary has the credit of resolving what would otherwise have been the inexplicable difficulty, that *P. lapillus* should occur at Mogador, more than 400 miles south of its southernmost European locality, without at the same time occurring on the intervening coasts. No search along the Moroccan shores has revealed the presence of *P. lapillus*, although they are in many places favourable for its occurrence. There can be little doubt that the shell described by M. Pallary (95) as *Ocenebrina purpuroidea* is the so-called dwarf form of *P. lapillus*, said by Mr. Lowe to be common at Mogador. The species, which might easily be mistaken for a small *Purpura*, occurs also at Rabat and Tangier. I noticed a single specimen in the McAndrew Collection

in the British Museum, from Santa Cruz, Canaries, on a tablet labelled "*Purpura?*", at the back of which Jeffreys had written in pencil "*Not Purpura*".<sup>1</sup>

Adanson's "*Le Sadot*" is *P. lapillus*. He not only figures the species himself, but makes reference to figures of Lister's "*Buccinum Anglicum*". "*J'ai observé,*" he continues, "*ce coquillage dans le port de l'Orient, à l'île de Ténérif des Canaries, à celle de Fayal, l'une des Asores; et je sçai qu'elle se trouve fréquemment sur toutes les côtes de la Bretagne.*" It is curious that he never definitely states that he has seen specimens from Senegal. But there can be no reasonable doubt that he was mistaken in regarding it as an inhabitant of that coast, or of the Canaries or Azores.

Mr. Tomlin has kindly given me two specimens of *P. lapillus* ex Coll. Watson, taken at Grand Canary. I have seldom seen shells more beach-worn. They must be considered as 'ballast' specimens. No writer for 150 years has recorded the species as living in the Atlantic islands.

I owe to Mr. Tomlin three other specimens, also ex Coll. Watson, from Madeira, no doubt the actual specimens to which Watson (122) refers when he places *P. lapillus* in a list of species "dredged by me or brought to me as Madeiran, but which I reject".

On the strength of two specimens of unknown locality from the Cape, Krauss (62) allowed himself to include *P. lapillus* in his list of South African marine Mollusca. G. B. Sowerby (112) has "received no confirmation of its living there".

M. Sars (106), G. O. Sars (105), and Pfeffer (98) give Behring's Sea as a locality for *P. lapillus*, but not on the authority of their own collecting. Crosse (19), cataloguing (after Dall 20) the Mollusca of Behring's Strait and the neighbouring parts of the Arctic Ocean, records no other *Purpura* but *canaliculata*, Ducl., from Plover Bay, Norton Sound, and the Aleutian Islands. Krause (60), whose collecting was chiefly done on the Tschuktschen Peninsula, in the far north of the Gulf of Anadyr, found no *Purpura* in Behring's Sea. In the Pribiloff and Commander Islands, Behring's Sea, Dall (23) found only *P. lima*, Mart., a form with which *canaliculata*, Ducl., is identical.

Middendorff, both in his *Beiträge* and *Reise* (82, 83), gives *P. lapillus* from the Sea of Ochotsk, and mentions the islands of Sitcha and Urup (in the Kuriles) as further localities. He says that in the Sea of Ochotsk it is rare, the majority of examples being rather thin, and he describes a form intermediate between *lapillus* and *freycinetii*, Desh.

<sup>1</sup> Search among Lowe's Mogador shells in the Natural History Museum failed to reveal his specimens of '*P. lapillus*'. But Mr. Tomlin has placed in my hands a box labelled in R. B. Watson's hand "*Pisania, Mogador*". It contains numerous examples of *Ocenebrina purpuroidea*, Pallary. When one knows that many, if not most, of Lowe's marine shells passed into Watson's possession, it appears extremely probable that we have here the actual specimens which Lowe took at Mogador, and mistook for a "dwarf state of *P. lapillus*".

When we come to detailed investigation of the Japanese seas, there is still less evidence for the occurrence of *P. lapillus* in Far Eastern waters. Schrenck, Reisen in Amur Lande (108), omits it from his list; Lischke (70) does the same. Pilsbry's (100) catalogue admits it only on the authority of Stearns from Hakodate, and of E. A. Smith (below). A. Adams (1) mentions *P. lapillus* from different points in Japanese seas, from Saghalien southward, but when we find that he includes in his synonymy *freycinetii*, Desh., *attenuata*, Reeve (?), *analoga*, Forbes, and *squamosa*, Lam., his evidence ceases to possess value. E. A. Smith (109) included *P. lapillus* in a list of Gastropoda brought from Japan by Commander St. John, R.N., remarking that "the Japanese forms of this Protean shell are as varied as those in European seas". The actual specimens are in the British Museum, and undoubtedly belong to *freycinetii*, Desh.

The truth appears to be that there is no reason to believe that the species which we call *lapillus*, L., occurs in any part of Eastern Asia or North-West America. All the specimens from these seas hitherto referred to *lapillus* belong either to *freycinetii*, Desh., or to one or other of the West American *Purpura* which will be mentioned below. It is quite conceivable that a relationship, more or less close, exists between these groups and *lapillus*. When Northern Asia enjoyed a milder climate, opportunity would be given for the passage of littoral forms from the North Atlantic to the North Pacific, and vice versa. This may be held sufficient to account for the presence of closely allied, or even of identical species, in both these areas at the present day. Even as it is, experts find it no easy matter to distinguish between *lapillus* and certain forms of *freycinetii*, and between certain forms of *saxicola*, Val., and *lapillus*. Middendorff goes so far as to remark: "It can hardly fail to be the case that on the coasts of the North American Ice Sea passage-forms between *P. lapillus* and *P. freycinetii* will be found in the future." But a sufficient time seems to have elapsed since the passage via Northern Asia was closed for the forms on both sides to harden into what we agree to call species, just as we find a number of 'homologous forms' on the two sides of the Isthmus of Panama.

Aurivillius (6) distinguishes *freycinetii* from *lapillus* by the prominence of the last whorl and the great size of the mouth, but remarks on the similarity between certain forms of the two species. Middendorff speaks of the long aperture, short spire, and more impressed sculpture. Lischke particularizes, as points of difference, the narrowing of the mouth in front, running into a long canal, the strongly marked spiral ridges, the irregular longitudinal foldings on the upper part of the whorls. He thinks Adams' *lapillus* is *freycinetii*. Dunker (32) remarks that the description and figures of the type of *freycinetii* are so different from certain Japanese specimens which are before him, that he cannot believe they are *freycinetii*. Among the specimens are several which he cannot separate from certain varieties of *lapillus*, and accordingly he refers all his specimens to that species, confessing himself still ignorant what *freycinetii* is. The truth is, that, as Lischke has pointed out, Deshayes' type of *freycinetii* was

described from an extreme variety of this very variable shell.<sup>1</sup> Mr. G. Hirase, in whose catalogue of Japanese marine Mollusca *lapillus* finds no place, has supplied me with a sufficient number of specimens of *freycinetii* to illustrate the fact that *freycinetii* is nearly as variable as *lapillus* itself, and at the same time to establish the complete distinctness of the two species. Dunker's *P. leysiana* is a form of *freycinetii* in which the spiral ridges are deeply cut by longitudinal laminæ or foliations.

The geographical range of *freycinetii* appears to be as follows: Behring's Sea, Aleutian Islands, and Sea of Ochotsk (Middendorff); Kamschatka (Deshayes, Chiron, Schrenck); West Saghalien, Castries Bay, at Wjachtu and Dui, East Saghalien, at Manuë (Schrenck); Urup (Middendorff, as *lapillus*, L.); Etrup or Etorō, and Kunashiri in the Kurile Islands (Coll. A. H. C.); N. Yesso, at Teshiwo (as *saxicola*, Val., teste Pilsbry), Kushiro and Hidaka (Coll. A. H. C.); S. Yesso, Hakodate (Schrenck); N.E. Nippon, the southernmost locality I know (Stimpson). For some unexplained reason, *freycinetii* does not occur in Pilsbry's catalogue of Japanese marine Mollusca.

No satisfactory record exists of the occurrence of *P. lapillus* on any part of the west coast of North America. Cooper's *P. lapillus* is *emarginata*, Desh. (see p. 203).

## PART II. IN NEARCTIC WATERS.

*P. lapillus* is recorded as an inhabitant of Greenland by Fabricius (33), Gould (40), Mörch (85), Möller (85), G. O. Sars (105), and others, the majority only repeating Fabricius' statement. According to Fabricius, "*Tritonium lapillus* habitat in littoribus arenosis: in Sinu Nerrutiksok dicto e regione boreali colonix Friderichshaab copiosum" (Friederikshavn is in about the latitude of South Iceland). Posselt (101) remarks that it appears to be found fairly locally, and that its possible range is from the extreme south to about 69° N. lat., at Jacobshavn, where he found one specimen. The majority of examples belong to the var. *imbricata*, Lam.

Drygalski (31), cataloguing the Mollusca of the Berlin expedition of 1891-3, did not find it at Karajak and Umanak Fiords, N. lat. 71°, nor was it found by H.M.S. *Valorous* in 1875 at Godhavn on Disco Island (Jeffreys). Professor Jensen writes to me: "The few specimens in our [Copenhagen] Museum have no distinct locality, only the collective name 'Greenland', and they are all from old days; in modern times the species has not been brought to us, and the last expeditions have seen nothing of this species, nor have I found it myself on my three journeys to Greenland. I have therefore some doubts regarding this species as an inhabitant of the present Greenlandic shores." It has never been recorded from East Greenland.

By the courtesy of Dr. J. Vernhout, I have had the opportunity of examining the Greenlandic specimens belonging to the 'sRijks

<sup>1</sup> Deshayes, in his description (Rev. Zool. 1839, p. 360; Mag. Zool., ser. II, i (Moll.), pl. xxvi, 2 figs., 1839), specially mentions the *arched* columella. His locality is Kamschatka.

Museum of Natural History, Leiden. The shell is fairly solid, well developed, not dwarfed; length 1.25 inch, breadth .75; mouth .75 long (to front end of canal), shape long oval; canal broad, well marked; outer lip simple, not denticled; sculpture, a number of strong transverse cords or blunt ridges, about eleven on the body-whorl, suddenly ceasing, to form a sort of shoulder, some way below the suture; colour dirty white.

The British Museum has three specimens, dated 23rd June, 1843, labelled "Greenland", purchased from Dr. Möller, and with a label attached in his handwriting. The shell is solid, strongly corded, spire prolonged, aperture orange-coloured, outer lip simple, scarcely thickened, specimens heavier and more solid than the Leiden shells. They closely resemble specimens from various parts of Scotland.

Considerable uncertainty appears to prevail with regard to the extreme northern range of *P. lapillus* on the east coast of North America. It is certainly not found in Northern Labrador; it does not occur in a list of Mollusca from Ungava Bay and the adjacent Arctic seas (Dall 21). Hancock (42) did not find it on the west coast of Davis Strait. A catalogue of Mollusca dredged on the Labrador coast in 1882 (Bush 13) does not contain it, though such common species as *Littorina rudis*, Mat., and *L. littorea*, L., are included. The coast referred to lies between N. lat. 52° 48' and 51° 33', and thus includes part of the Gulf of St. Lawrence. Nor does it occur in a list by Packard (94) of shells obtained while coasting from Little Meccatura Island, in the Gulf of St. Lawrence, to Hopedale (in N. lat. 55° 25' on the East Labrador coast), and the same author (Packard 93), publishing a list of dredgings, etc., near Caribou Island, at the entrance of the Straits of Belle Isle, remarks that the "entire absence of any specimens of *Purpura lapillus* was inexplicable, though I searched for that shell". In the more sheltered waters of the western portion of the Gulf of St. Lawrence, *P. lapillus* occurs e.g. at Gaspé, in New Brunswick, on stones near the shore (Dawson 28), "on the whole coast below Little Metis, extremely common" (Bell 10), and at Anticosti, not very common (Packard 93), while Whiteaves (125) gives it in his list of marine Mollusca of East Canada, no doubt from this part of the gulf. It would thus appear that the whole of the East Labrador coast, and even the Canadian shores for some distance within the Straits of Belle Isle, offer no habitat for this species.

Verkrüzen (121) records a var. *ponderosa* from Notre Dame Bay in North Newfoundland (N. lat. 50°). If this approximates to the most northern point of its occurrence on the east coast of America, no better illustration could be afforded of the power of very cold water to bar back a species, for on the other side of the Atlantic the latitude of 50° just touches the Lizard. Accordingly Gould's (40) statement that *P. lapillus* "occurs on rocks everywhere from Greenland all through New England" will need some modification.

*P. lapillus* is extremely abundant on the northern coasts of Nova Scotia (Jones 56); at Grand Manan, New Brunswick, a large chocolate-coloured form occurs (Dr. Gratacap). Verkrüzen (120) records it from Annapolis, and Nova Scotia in general. On the coasts

of Maine it is abundant (Stimpson 114), e.g. at Eastport (Roper 103), at Frenchman Bay (Blaney 12), at North Haven (Jackson 50), at Boston (Stearns 113), where the var. *imbricata*, Lam., occurs. Ap-gar's (4) statement, that *P. lapillus* is abundant north of Cape Cod, local south of the cape, represents the facts exactly. At the point of Cape Cod it is found on the wharves at Provincetown (Winckley 127, Rathburn 102).

I am permitted to quote from a forthcoming work by Dr. Gratacap, curator of the Brooklyn Museum, the following localities south of Cape Cod: Nabsca Point, shores of Vineyard Sound, Cuttyhunk Island, and Watch Hill, Rhode Island. On the Connecticut coast the species becomes local at certain points only, and does not occur east of Stonington (Linsley 69), which lies close to long.  $72^{\circ}$  W. and in N. lat.  $41^{\circ} 30'$ . On Long Island it is abundant only in the extreme north-east, at Montauk Point (Wheat 124, Smith & Prime 111), and is not recorded from any other place. This is its extreme southern range. Balch (8) does not give it in his list of the Mollusca of Coldspring Harbor, nor does Perkins (97) in his catalogue of New Haven Mollusca, and it does not even occur in Sanderson Smith's (104) catalogue of the Mollusca of Little Gull Island, which lies off Oyster Point, close to Montauk.

Through the courtesy of Mr. Wheat, I am informed that a dead specimen was once found at the Narrows on Staten Island, but this was probably introduced among "oyster seed" from Connecticut. Hubbard & Sanderson (49) do not include it in their catalogue of the Mollusca of Staten Island. Dall's locality "New Jersey" (Dall 22) is not to be taken as implying that *P. lapillus* occurs on the shores of that State; "New Jersey" is merely his label, in the particular paper referred to, for a stretch of coast from New Jersey to Delaware and Long Island. Ford (34) does not include it in his list of the shells of the New Jersey coast. Letson (66) gives *P. lapillus* a place in his check-list of the Mollusca of New York, avowedly on the authority of De Kay (30). De Kay's authority becomes questionable when we observe his remark that *P. lapillus* "occurs along our coast from Cape Cod to Florida".

In conclusion, it will perhaps be interesting to direct attention to the extremely limited range of the species on the American coast, as compared with its extremely wide range on the eastern shores of the Atlantic. Leaving Greenland out of the question, the range of *P. lapillus* on the American mainland is no more than 10 degrees of latitude, from about N. lat.  $51^{\circ}$  to  $41^{\circ} 30'$ . In Europe, on the other hand, it extends from N. lat.  $71^{\circ}$  to  $37^{\circ}$ , or 34 degrees of latitude. Stated in miles, the range is in the one case about 690, in the other above 2,340. If we take in Greenland on the one hand and Novaya Zemlya on the other, the range in miles becomes 1,890 as compared with 2,480. On the American shore the northward range of the species is clearly restricted by the Labrador current, which flows steadily southward from the Polar basin throughout the year, and lowers the temperature of the water off East Canada, while the estuary of the St. Lawrence is blocked with ice for four or five



months. Its southward range is equally restricted by the influence of warm-water currents flowing northward from the Gulf of Mexico, and possibly also by the fact that south of Long Island the shore appears not very suitable for species requiring rocky lodgment.

That *P. lapillus* should be able to exist up to N. lat. 69° in Greenland, and unable to exist further north than about 51° in Labrador, is at first sight very remarkable, for, in other words, it occurs on the east of Davis Strait more than 1,200 miles north of its most northerly point on the west of that strait. But the western coast of Greenland has its climate softened by the influence of a warm southern drift from the Atlantic, which makes itself felt as far north as Baffin's Bay, and renders human habitation possible. The eastern shores of Greenland are swept by the ice-bearing Greenland current, flowing direct from the Polar basin.

#### NOTE ON THE NORTHERN GROUP OF WEST AMERICAN PURPURÆ.

This group exhibits, perhaps more than any other section of the genus, the tendency of *Purpura* to vary in shape, size, and sculpture. Some writers, e.g. Hemphill (Williamson 126), regard all these forms as mere varieties of *P. lapillus*. But P. P. Carpenter (14, p. 148) long ago sufficiently distinguished the three species under which the different forms must fall, and more recent authors, e.g. Taylor (115) and Vanatta (118), agree with him in essentials.

Thus we have (only a selection from the synonymy is given)—

1. *lima*, Martyn, 1784, Univ. Conch., ii, fig. 46 (*Buccinum*).  
     = *canaliculata*, Ducl., 1832, Ann. Sci. Nat., xxvi, p. 104, pl. i, fig. 1.  
     = *decemcostata*, Midd., 1849, Beiträge Malac. Ross., pts. ii, iii, p. 116, pl. ix, figs. 1-3.  
     + var. *attenuata*, Reeve, 1846, Conch. Icon., sp. 49, pl. x, fig. 49.  
     + var. *analoga*, Forbes, 1850, P.Z.S., xviii, p. 273, pl. xi, fig. 12.
2. *plicata*, Martyn, 1784, Univ. Conch., ii, fig. 44 (*Buccinum*).  
     = *lamellosa*, Gmelin, 1790, Systema, p. 3498, No. 173 (*Buccinum*).  
     = *crispata*, Chem., 1795, Conch. Cab., xi, pp. 84-5, pl. clxxxvii, figs. 1802-3 (*Buccinum*).  
     = *ferruginea*, Esch., 1829, Zool. Atlas, pt. ii, p. 10, pl. ix, fig. 2a-b (*Murex*).  
     + var. *lactuca*, Esch., 1829, Zool. Atlas, pt. ii, pl. ix, fig. 3a-b (*Murex*).  
     + var. *septentrionalis*, Reeve, 1846, Conch. Icon., sp. 50, pl. x, fig. 50.
3. *emarginata*, Desh., 1839, Rev. Zool., p. 360; Mag. Zool., ser. II, i (Moll.), pl. xxv, 2 figs., 1839.  
     = *conradi*, Nutt. MSS.  
     = *lapillus*, Cooper (non Linné).  
     + var. *fuscata*, Forbes, 1850, P.Z.S., xviii, p. 274, pl. xi, fig. 13.  
         = *saxicola*, auctt. (non Val.).  
     + var. *ostrina*, Gould, 1852, Otia, p. 225 = Moll. U.S. Expl. Exped., Wilkes, xii, p. 244, fig. 310.

One of three specimens in the British Museum no doubt represents the type of *attenuata*, Reeve; no locality is marked, the shells are Cuming's. The form is closely allied to *canaliculata* (= *lima*), but is larger, broader, somewhat less solid, sculpture more conspicuously laminated, spiral ridges more numerous and smaller, shell without the deep 'channel' below the suture, which gives the name to *canaliculata*. No type of *analoga*, Forbes, seems to be preserved.

The type of *septentrionalis*, Reeve, is similarly represented in the British Museum by one of several specimens; the shell is massive, without flounces, and there is a variety with one broad white band on the body-whorl.

Vanatta (118) has pointed out—and he is undoubtedly right—that *P. saxicola* of Valenciennes (Voy. Vénus, Atlas, pl. viii, figs. 4, 4a) is a form of *freycinetii*, Desh. In the case of the *Vénus* Mollusca, there is no description to accompany the pictures in the Atlas. *Emarginata*, Desh., therefore becomes the type of the species, and the form hitherto represented by the name *saxicola*, Val., will become *fuscata*, Forbes. The type of *fuscata* is the larger of two specimens in the British Museum, collected by Captain Kellett and Lieutenant Wood, R.N., and erroneously said to come from the Sandwich Islands. The spire is elevated, and the spiral ridges well marked. The form *ostrina* has a low spire, with whorls almost or altogether destitute of spiral ridges.

Deshayes must have named his *emarginata* from a malformed specimen with a marked indentation in the outer lip, hence his name. He lays stress on this 'échancrure', which "corresponds to the second row of tubercles on the last whorl, and is comparable to the impression which the finger-nail might have left on the edge, had it been softened". His locality is "New Zealand", but there can be little doubt that his shell is the form which has been commonly recognized as *emarginata*.

As regards distribution, the *lima* group is found, in the far north, in Plover Bay, North-East Siberia, and Norton Sound, North-West Alaska (Dall 20, as *canaliculata*), in the Pribiloff and Commander Islands, Behring's Sea (Dall 23), and southward to Monterey (Berry 11).

The *plicata* group extends from Sitcha and Kandjak Islands, Konyagen (Middendorff, as *Murex lactuca*) and Alaska (Coll. A. H. C.), through all British Columbia (Taylor 115), to the neighbourhood of San Francisco, but apparently not so far south as Monterey (Berry 11). I have a specimen from Hidaka, Yesso (Hirase).

The *emarginata* group extends from Ounalaska (Cooper 18, as *saxicola*) to Margarita Bay, Lower California (Pease in Carpenter 14, p. 152), in the form *ostrina*.

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DESCRIPTIONS OF COLOUR VARIETIES OF *CONUS QUERCINUS*,  
HWASS, AND *CYPRÆA LAMARCKII*, GRAY.

By H. O. N. SHAW, B.Sc., F.Z.S.

Read 13th November, 1914.

*CONUS QUERCINUS*, var. *ALBUS*, n.var.

I HAVE thought it worth while to note this variety of *Conus quercinus*, Hwass, for which I propose the varietal name *albus*, on account of the following peculiarities. In the first place, the colour is snow-white. The apex of the spire is a warm rose-brown, and the shell is entirely devoid of the usual fine thread-like, transverse brown markings. With regard to form, the shell, for its length, is wider across the shoulder of the last whorl than is usually the case, while the shoulder is more angular, and the spire very much flatter. The spiral striations of the latter, and on the body-whorl, particularly on the upper half, are coarser and more deeply engraved than on typical examples of the species. The shell, which is in excellent condition, was collected at Aden. Length 58 mm., max. breadth 34 mm.

*CYPRÆA LAMARCKII*, var. *PHYLLIDIS*, n.var.

I have recently received from Aden four specimens of what appears to be a new variety of the above species. They are in different stages of growth and size, the largest being a perfect example, 40 mm. long. This variety is more elongate, less ventricose, and the dorsum less humped than in the typical *C. lamarckii*, Gray, while the base and teeth are fairly normal, though the two anterior labial teeth are slightly less accentuated. The colour and markings are entirely different. The sides are slightly thickened and pure white. The whole of the dorsal surface is a pale translucent yellow-brown extending down to the white sides. This colouring is punctuated on each side by numerous fine red-brown spots, which extend upwards on each side to the dorsal surface, where they are less distinct. It may indeed be said that the whole of the sides and dorsal surface are covered with these fine brown spots. The apex of the dorsum is suffused with a faint patch of pink. From the foregoing, the features not occurring in the typical shell will be seen, and they may be further accentuated by saying that the large deep-brown spots on each side, the brown colouring of the dorsal surface, the pale dorsal space, the innumerable white spots (sometimes ocellated), and the brown markings of each extremity, all characteristic of a typical specimen, are in this variety entirely absent. There is not a single white spot on any of the four shells before me. For this beautiful and striking variety I propose the name *phyllidis*.

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ON THE NON-MARINE MOLLUSCA OF A POST-PLIOCENE DEPOSIT  
AT APETHORPE, NORTHAMPTONSHIRE.

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

Read 11th December, 1914.

WE have twice recorded *Vertigo parcedentata* (A. Braun) as occurring in a fossil state at Stamford, Lincolnshire (Proc. Malac. Soc. Lond., vol. vii, pp. 119-20, 1906, and Quart. Journ. Geol. Soc., vol. lxxviii, p. 236, 1912). This record was based on examples which had been found in shell marl given to one of us some years ago by the late Professor T. Rupert Jones, the box containing the marl being labelled "Stamford, from S. P. Woodward". In the course of correspondence with Mr. W. R. Horwood, of the Leicester Museum, he kindly pointed out that this is without doubt the material described by the donor in 1881. The account is as follows: "From the grey marl of an old lake-floor in a valley near Apethorp, not far from Stamford, on which a Roman station (discovered in 1859) had been established, though subject to inundation; the following freshwater shells and other organisms were found by Mr. John F. Bentley. They were named by Dr. S. P. Woodward," and a list of thirty-two species is given (Proc. Geol. Assoc., vol. vi, p. 213, footnote, 1880).

Although the amount of material was small, yet we have been able to determine thirty-eight species, viz. :—

- Vitrea crystallina* (Müll.), 6 examples.
- Polita cellaria* (Müll.), 7 examples.
- P. radiatula* (Alder), common.
- Zonitoides nitidus* (Müll.), 1 example.
- Euconulus fulvus* (Müll.), 5 examples.
- Punctum pygmaeum* (Drap.), 10 examples.
- Pyramidula rotundata* (Müll.), common.
- Helicella itala* (Linn.), 2 examples.
- Hygromia liberta* (West.), common.
- Acanthinula aculeata* (Müll.), 5 examples.
- Vallonia pulchella* (Müll.), common.
- V. costata* (Müll.), common.
- V. excentrica*, Sterki, common.
- Arianta arbustorum* (Linn.), 4 examples.
- Cochlicopa lubrica* (Müll.), common.
- Ceciloides acicula* (Müll.), 4 examples.
- Pupilla muscorum* (Linn.), common.
- Vertigo antivertigo* (Drap.), 10 examples.
- V. substriata*, Jeff., 4 examples.
- V. pygmaea* (Drap.), 5 examples.
- V. parcedentata* (A. Braun), common.
- V. pusilla*, Müll., 1 example.
- V. angustior*, Jeff., 1 example.

- Clausilia laminata* (Mont.), 2 examples.  
*C. bidentata* (Ström), 1 example.  
*C. rolphii*, Leach, 2 examples.  
*Succinea elegans*, Risso, 6 examples.  
*Carychium minimum*, Müll., common.  
*Limnaea pereger* (Müll.), 3 examples.  
*L. palustris* (Müll.), 1 example.  
*L. truncatula* (Müll.), common.  
*Planorbis leucostoma*, Millet, common.  
*P. crista* (Linn.), 2 examples.  
*Physa fontinalis* (Linn.), 2 examples.  
*Bithynia tentaculata* (Linn.), common.  
*Valvata cristata*, Müll., 1 example.  
*Acicula lineata* (Drap.), 6 examples.  
*Pomatias elegans* (Müll.), 4 fragments.

Two species previously recorded, *Hygromia striolata* (Pfr.) (= *Helix rufescens*, auct., non Penn.) and *Bithynia leachii* (Shepp.), are missing, and these records are very doubtful. All the larger forms are represented either by immature examples or by fragments, but the large size of the smaller species is noteworthy, showing clearly that the environment was congenial to the Mollusca. The comparative abundance of *Vertigo parcedentata* is interesting, since in the three other British deposits in which it occurred it was decidedly rare. No stratigraphical evidence is available to fix the age of the deposit, so one must rely solely on the Mollusca. There is only one extinct species, *V. parcedentata*. In these Islands it is only known elsewhere from Elie, Fifeshire, and Ponders End and Angel Road, Middlesex. The first-named is early Holocene, the two latter, really one deposit, late Pleistocene. The whole facies of the Apethorpe Mollusca is so different from that of the Lea Valley beds that it cannot be correlated with them, whilst the great difference in the latitude prevents any comparison with the Scotch deposit. We are, however, inclined to think it is late Pleistocene, and belongs to some part of that vast period of time which elapsed between the deposition of the Crayford brickearths and the Glacial Period, which latter marks the end of the Pleistocene.

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DESCRIPTIONS OF FIVE NEW SPECIES OF MOLLUSCA OF THE  
 GENERA *DRILLIA*, *MARGINELLA*, *APICALIA*, *PLESIO-*  
*TROCHUS*, AND *RINGICULA*, ALL FROM CEYLON; ALSO  
 NOTES ON THE GENUS *PLESIO-TROCHUS*.

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

Read 8th January, 1915.

*DRILLIA PRÆCLARA*, n.sp.

Testa fusiformis, argenteo-nitens, fusco strigata; spira acuminata, acuta, ad apicem obtusiuscula; anfractus 8, apicales ( $1\frac{1}{2}$ –2) læves, rotundati, cæteri longitudinaliter costati, costis crassis, superne intersectis; anfractus ultimus spiram fere æquans, leviter convexus,



sinistrorsum varicosus; apertura oblonga, breviter canaliculata, labrum extus valde incrassatum, ad marginem acutum, postice profunde sinuatum. Long. 9, diam. maj. 3 mm.

*Hab.*—Trincomalee, Ceylon.

A bright shining little shell, of an almost nacreous lustre.

*MARGINELLA CARTWRIGHTI*, n.sp.

Testa minuta, oblongo-ovata, utrinque leviter attenuata, alba, translucida; spira callosa, contexta; apertura angusta, arcuata; columella callosa, antice plicis sex perminutis instructa; labrum



leviter arcuatulum, extus rotundatum, læve, intus minutissime denticulatum. Long. 2, diam. 1 mm.

*Hab.*—Trincomalee, Ceylon.

I found it rather difficult to determine the generic position of this little shell; it has much the appearance of a very minute *Amphiperas* (*Ovulum*), but the minute columellar plaits seem to prove it a *Marginella*. The exceedingly minute denticulation of the outer lip is only perceptible under a powerful lens.

*MUCRONALIA EXQUISITA*, n.sp.

Testa minuta, cylindracea, translucida, nitens, transversim rufo-fusco lineata; spira leviter convexa, ad apicem mucronata; anfractus 6, primi 2 (apicales) minuti, elevati, cæteri læves, planulati, transversim bilineati, sutura vix impressa sejuncti; anfractus ultimus oblongus, vix convexus, trilineatus, ad basim leviter attenuatus; apertura oblongo-ovata; columella tenuis, rectiuscula; labrum acutum. Long. 3, diam. maj. 1 mm.

*Hab.*—Trincomalee, Ceylon.



Of this elegant little species I have only seen a single specimen. It is a very characteristic *Mucronalia*, the mucronate apex consisting of two small elate whorls; the next three whorls have each two narrow light-brown bands, one about the middle, and the other just above the suture; the last whorl exhibits a third band at the base, not shown in the figure.

*RINGICULA TRUNCATA*, n.sp.

Testa subglobosa, crassa, lævis, alba; spira brevis; anfractus 3, convexi, læves, sutura angustissima sejuncti; anfractus ultimus latus, convexus, ad basim truncatus; apertura longiuscula, postice angustata, antice latior; columella callosa, triplicata, plicis validis, postica lata, acuta, media obliqua, antica oblique contorta; labrum



crassum, leviter complanatum, intus minutissime denticulatum, extus arcuatum, postice angustius, leviter sinuatum. Alt. 2, diam. maj. 2 mm.

*Hab.*—Colombo, Ceylon.

A very solid convex smooth shell, truncated at the anterior end.

*PLESIOTROCHUS CEYLONICUS*, n.sp.

Testa parva, imperforata, conica, albida; spira elata, acuta, anfractus 6, apicales 2 læves, cæteri planato-declives, infra acute unicarinati, spiraliter exiliter striati, hic illic longitudinaliter irregulariter pauciplicati, sutura impressa minute crenulata sejuncti;



anfractus ultimus  $\frac{3}{4}$  longitudinis testæ æquans, leviter ventricosus, ad peripheriam bicarinatus, infra concavus; apertura lata, antice breviter canaliculata; columella leviter contorta; labrum tenue, arcuatum. Long. 3, diam. maj. 2 mm.

*Hab.*—Ceylon.

Compared with *P. pagodiformis*, Hedley, this shell is smaller, less elately conical, less longitudinally plicate, whorls less concave, and base more ventricose.

Referring to Hedley's interesting comments on this genus (Proc. Linn. Soc. N.S.W., vol. xxxii, p. 499, 1907), I have no doubt that he is right in placing it in the family Cerithiidae, and also in including in Fischer's genus several forms formerly called *Cerithium* and *Bittium*.

In my opinion the names *Cerithium eludens*, Bayle, and *dubium*, G. B. Sow., are synonyms of *Plesiotrochus monachus*, Crosse. This much less trochiform species forms an interesting link between *Cerithium* and the typical *Plesiotrochus*.

1. *PLESIOTROCHUS EXILIS* (Pease).

*Trochus exilis*, Pease, Amer. Journ. Conch., vol. iii, p. 286, pl. xxiv, fig. 7, 1867.

*Plesiotrochus souverbieanus*, Fischer, J. de Conch., vol. xxvi, p. 212, 1878.

2. *PLESIOTROCHUS IMPENDENS* (Hedley).

*Cerithium impendens*, Hedley, Mem. Aust. Mus., Mem. iii, pt. vii, p. 434, fig. 23, 1899.

3. *PLESIOTROCHUS PAGODIFORMIS*, Hedley, Proc. Linn. Soc. N.S.W., vol. xxxii, p. 498, pl. xvii, fig. 16, 1907.4. *PLESIOTROCHUS MONACHUS* (Crosse & Fischer).

*Cerithium monachus*, Crosse & Fisch., J. de Conch., vol. xii, p. 347, 1864; vol. xiii, p. 45, pl. iii, figs. 17, 18, 1865.

*C. dubium*, Sow., Thes. Conch., vol. ii, p. 864, pl. clxxxii, fig. 120, 1855 (*non* Sow., Min. Conch., vol. ii, p. 108, 1816).

*C. eludens*, Bayle, J. de Conch., 1880, p. 245.

## 5. PLESIOTROCHUS OOSIMENSIS, Watson.

*Bittium oosimense*, Challenger Rep., Zool., vol. xv, p. 548,  
pl. xxxix, fig. 1, 1886.

6. PLESIOTROCHUS FISCHERI, Smith, Proc. Malac. Soc., vol. viii,  
p. 370, fig., 1909.

## 7. PLESIOTROCHUS UNICINCTUS (A. Adams).

*Ziziphinus unicinctus*, A. Ad., Proc. Zool. Soc., 1851 (1853),  
p. 167.

*Plesiotrochus unicinctus*, Hedley, Proc. Linn. Soc. N.S.W.,  
vol. xxxviii, p. 291, pl. xvii, fig. 63, 1913.

## 8. PLESIOTROCHUS CEYLONICUS, Sowerby (herein described).

Add to these two unnamed species mentioned by Nevill (Hand  
List Moll. Ind. Mus., 1884, p. 158) from Mauritius and the  
Andamans, and probably *Bittium scalatum*, Dunker, from Japan  
(Index Moll. Maris Japon., 1882, p. 108).

ON SOME MOLLUSCAN REMAINS FROM THE OPAL DEPOSITS  
(UPPER CRETACEOUS) OF NEW SOUTH WALES.

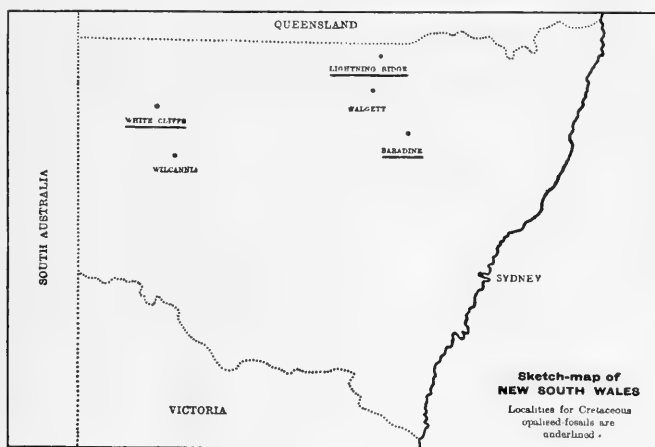
By R. BULLEN NEWTON, F.G.S.

*Read 8th January, 1915.*

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PLATE VI.

DURING a recent visit to Australia, as a member of the British Association, I was fortunate in obtaining from a curio-merchant at Sydney a few of the rare opalized fossils of Upper Cretaceous age found in the opal-bearing strata of White Cliffs, New South Wales, some 65 miles N.N.W. of the township of Wilcannia, comprising the remains of both marine and freshwater shells, as well as a small phalangeal bone of a Plesiosaurian (*Cimoliosaurus*). These fossils



Scale: 265 miles to the inch.

now enrich the palæontological collection of the Rev. F. St. John Thackeray, M.A., F.G.S., the Vicar of Mapledurham, near Reading, to whom I am indebted for the privilege of describing them on this occasion. But, as well as considering Mr. Thackeray's specimens, the opportunity will be taken of referring to similarly opalized shells from the same beds contained in the Geological and Mineral Departments of the British Museum, which have been on exhibition for some years, bearing more or less provisional identifications, a new study of which, it is hoped, will lead to a more accurate knowledge of their relationships.

The British Museum (Geological Department) also possesses two Pelecypods of freshwater habits from the Lightning Ridge opal-field, situated in the parish of Wallangulla, county Finch, near the Queensland border, and distant about 50 miles from Walgett in

a northerly direction, which are of interest, as no determined molluscan remains have hitherto been recorded from this area. The deposits have, however, yielded Dinosaurian bones which have been referred to in literature by Dr. A. S. Woodward. Another locality in New South Wales for opalized fossils has quite recently come into prominence through the discovery of *Ceratodus* remains at Baradine, situated some 90 miles S.S.E. of Walgett, which Mr. Chapman has just described, a fact of much interest, since this is a genus of fish which still survives in Queensland rivers.

*List of the recognized Cretaceous opalized fossils from New South Wales, including the new species of Pelecypoda described in the present paper.*

## PLANTÆ.

*Araucarioxylon* sp., Gürich.

## CRINOIDEA.

*Isocrinus australis*, Moore, sp.

## PELECYPODA.

*Unio white-cliffsensis*, n.sp.

*Unio* sp. indet.

*Unio jaqueti*, n.sp.

*Cyrenopsis australiensis*, n.sp.

*Cyrenopsis* (?) *elongata*, n.sp.

*Cyrenopsis meeki*

*Cyrenopsis opallites* } Etheridge, jun.

*Corbicula corrugata*, Tate, sp.

*Fissilunula clarkei*, Moore, sp.

*Maccoyella barklyi*, Moore, sp.

*Inoceramus* sp.

*Modiola dunlopensis* } Etheridge, jun.

*Modiola tatei*

*Modiola* sp. indet. }

*Trigonia* sp. cf. *moorei*, Lycett (Gürich).

*Gresslya* sp. cf. *gregaria*, Goldfuss (Gürich).

*Teredina opalina*, Gürich.

## GASTROPODA.

*Euspira variabilis* (*reflecta*), Moore, sp.

*Viviparus* (?) *alba-scopularis*, Etheridge, jun.

## CEPHALOPODA.

*Belemnites canhami*, Tate } *Actinocamax*, according to

*Belemnites kleini*, Gürich } G. C. Crick.

*Ammonites*.

## PISCES.

*Ceratodus* (*Metaceratodus*) *wollastoni*, Chapman.

## REPTILIA.

*Cimoliosaurus leucoscopus*, Etheridge, jun.

*Polyptychodon* (H. Woodward's determination).

Dinosaurian remains of a Megalosaurian type (A. S. Woodward).



The evidence of these fossils, consisting of terrestrial, freshwater, and marine organisms, clearly proves the estuarine origin of the opal deposits of New South Wales, and their association with the opalized coniferous wood (*Araucarioxylon* sp. of Gürich) further accentuates this view. Although the fauna, so far as we know it, is quite endemic, yet it is of interest to point out that a somewhat similar assemblage of forms characterizes some of the estuarine deposits occurring in the Cretaceous strata of North America. For instance, the Judith River group of rocks in the Wyoming region of the United States, which are of the latest Cretaceous age, have yielded both *Corbicula* and Dinosaurian remains in association. Then, again, there are the Belly<sup>1</sup> River deposits of Canada (Alberta), of somewhat similar age, which contain Plesiosaurian (*Cimoliosaurus*) and Dinosaurian bones, as well as Unioniform shells, *Corbicula*, *Viviparus*, etc., and those of marine habit like *Pteria*, *Mytilus*, *Ostrea*, etc. (Whiteaves, Geol. Nat. Hist. Surv. Canada, vol. i, p. 55, 1885). The Belly River and Judith River beds are recognized as belonging to the Montana epoch (see Chamberlin & Salisbury, *Geology*, vol. iii, p. 152, 1906), which represents very high Cretaceous, or probably what may be the equivalent of the Danian of Europe. It is, therefore, possible that the opalized deposits of Australia were laid down at nearly the end of Cretaceous times. It often happens that these mineralized shells, before they reach the palæontologist, have been polished by the lapidary to intensify their opalescent characters, an operation which of course is very much to the detriment of the finer structures of the fossils, although among the specimens to be noticed are those which have escaped such treatment and in which the details of sculpture have been preserved.

I wish to record my indebtedness to Mr. Spencer for giving me facilities to examine Australian opalized shells in the Mineral Department of the British Museum, to Messrs. E. A. Smith and G. C. Crick for information on certain of the Mollusca, as also to Drs. A. S. Woodward and C. W. Andrews for suggestions in connexion with the vertebrates found in the same deposits.

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The opal deposits of White Cliffs were first noticed by Mr. W. Anderson<sup>2</sup> in 1892, who described them as very siliceous, horizontally bedded sandstones of Upper Cretaceous age, and the probable equivalent of the Desert Sandstone of Queensland; in close proximity were vertical Silurian slates and horizontally bedded Devonian conglomerates and sandstones. Reference was also made to the original structures of the Mollusca, wood, Encrinites, etc., found in the beds being replaced by opaline matter. Mr. Anderson regarded opal as a secondary product of igneous rocks, sandstones, limestones, etc., which is usually the result of deposition from opal-silica solutions percolating through the rocks.

<sup>1</sup> According to the latest information from Canada, this river is now to be known as the Lethbridge River.

<sup>2</sup> "Notes on the Occurrence of Opal in New South Wales": Rec. Geol. Surv. N.S.W., vol. iii, pt. i, pp. 29-32, 1892.

In the following year Mr. J. B. Jaquet<sup>1</sup> offered a fuller account of the deposits at White Cliffs, and similarly regarded them as Upper Cretaceous and contemporaneous with the Desert Sandstone of Queensland (an extensive formation originally described by Daintree,<sup>2</sup> who, in the absence of accurate fossiliferous evidence, wrongly considered it as part of the Kainozoic system). The opal beds were referred to as resting on Palæozoic rocks, and consisting of conglomerates and kaolin, the fossils found in them being mentioned as Mollusca, *Belemnites*, and wood. Scattered throughout the deposits were "enormous waterworn boulders" of a vitreous-looking sandstone which, when broken open, exhibited thin veins of opal as well as "impressions of characteristic Devonian Mollusca and other invertebrates". These boulders were stated to have been derived from Palæozoic conglomerates and sandstones occurring to the westward of the opal-field. It was further mentioned that "the occurrence of nodules and veins of opal, the replacement of the remains of Mollusca and other organisms by opal, and the deposition of opaline quartz in the interstices of the conglomerate belonging to this formation, and the foreign boulders of sandstone which are found in it, would seem to indicate that at some period the beds had siliceous waters running through them. The presence of hydrous silica in various forms seems characteristic of these beds wherever they have been observed".

Mr. F. G. de V. Gipps<sup>3</sup> in 1894 referred briefly to some opalized organisms he had found at White Cliffs, which included Plesiosaurian bones, crinoid arms, and wood; and the following Mollusca determined by Mr. Etheridge, jun.: *Maccoyella reflecta*, *Tellina* sp. indet., *Modiola*, *Natica variabilis*, and *Belemnites canhami*.

During 1895 Dr. Henry Woodward<sup>4</sup> exhibited at the Geological Society some "opalized Cretaceous fossils, consisting of a tooth of *Polyptychodon* [now in the Geological Department of the British Museum, R. 2614], the guard of a *Belemnitella*, and a bivalve shell, from New South Wales", and "precious opal having the form of a *Natica*"; they presumably came from White Cliffs, although no particular locality was stated in this brief announcement (see R. Etheridge, jun., Mem. Geol. Surv. N.S.W., Palæontology, No. xi, p. 6, 1902).

Interesting observations on the opalization of fossil organic remains from White Cliffs were published by Mr. Etheridge, jun.,<sup>5</sup> in 1897, when describing some reptilian remains (*Cimoliosaurus*) from that locality. He referred to the occurrence in those beds of "Crinoid remains, the shells of Pelecypoda and Gastropoda, portions of Belemnite guards, Sauropterygian bones, and an Ammonite wholly

<sup>1</sup> "On the White Cliffs Opal-field": Ann. Rep. Dept. Mines Agric. N.S.W. for 1892-3, pp. 140-2.

<sup>2</sup> "Notes on the Geology of Queensland": Quart. Journ. Geol. Soc., vol. xxviii, p. 275, 1872.

<sup>3</sup> Trans. Australasian Inst. Min. Eng., vol. ii, pp. 70-80, 1894.

<sup>4</sup> Quart. Journ. Geol. Soc., vol. li, Proc., p. iii, 1895.

<sup>5</sup> "An Australian Sauropterygian (*Cimoliosaurus*) converted into Precious Opal": Rec. Australian Mus., vol. iii, No. 2, pp. 19-27, pls. v-vii, 1897.

converted into precious opal (6 inches in diameter), unfortunately since destroyed in a conflagration, but which was once in the Geological Survey Museum of New South Wales. The preservation of some of these fossils is excellent, although all are not alike in this respect, and the extent to which the opalization has at times been carried is remarkable". Considerable colour effects are visible by reflected light, Mr. Etheridge having noticed "principally blue, red, green, and yellow, with their various shades and combinations, not the least pleasing being an ever-varying degree of red and blue-tinted purple".

In the succeeding year two opalized Pelecypods from White Cliffs were described by the late Professor Ralph Tate<sup>1</sup> as *Lucina* (?) *bonythoni* and *Platopsis* (?) *corrugata*, both being regarded as new species and of Upper Cretaceous age. The late Professor H. G. Seeley<sup>2</sup> referred in the same year to the humerus of a Plesiosaurian from the opal-mines of White Cliffs, in which "the substance of the bone was almost entirely replaced by opal"; this specimen, it is interesting to state, is now in the Mineral Department (No. 83630) of the British Museum. Mr. G. Gürich,<sup>3</sup> of Breslau, next published an account of some Mollusca, a vertebra of *Plesiosaurus*, and fossil wood (*Araucarioxylon* sp.) from the same opal deposits, and regarded them as of younger Jurassic age, the molluscan species being as follows:—

*Avicula barklyi*, Moore.  
*Trigonia* sp. cf. *moorei*, Lycett.  
*Cyrena* (?), n.sp.  
*Teredina opalina*, Gürich.  
*Gresslya* sp. cf. *gregaria*, Goldfuss.  
*Natica variabilis*, Moore.  
*Belemnites kleini*, Gürich.

The more complete account, however, of the palæontology of the White Cliffs opalized beds was that contributed by Mr. Etheridge, jun.,<sup>4</sup> in 1902, which included a bibliography, as well as descriptions and figures of new and little-known species of Mollusca embracing the establishment of two new genera of Pelecypoda, viz. *Fissilunula* and *Cyrenopsis*. The list of species included the following forms:—

CRINOIDEA.

*Isocrinus australis*, Moore, sp.

PELECYPODA.

*Maccoyella barklyi*, Moore, sp.  
*Inoceramus* sp.  
*Modiola dunlopensis*  
*Modiola tatei*  
*Modiola* sp. indet.  
*Cyrenopsis opallites* } Etheridge, jun.

<sup>1</sup> Trans. R. Soc. S. Australia, vol. xxii, pt. ii, pp. 77-9, text-figures, 1898.

<sup>2</sup> Quart. Journ. Geol. Soc., vol. liv, Proc., p. cvi, 1898.

<sup>3</sup> Neues Jahrb., Beilage Band xiv, pl. xix, pp. 484-500, 1901.

<sup>4</sup> Monograph of the Cretaceous Invertebrate Fauna of New South Wales (Mem. Geol. Surv. N.S.W., Palæontology, No. xi, 1902).

*Cyrenopsis* (?) *corrugata*, Tate, sp.

*Teredina opalina*, Gürich.

*Fissilimula clarkei*, Moore, sp.

#### GASTROPODA.

*Pseudamaura variabilis* } Moore, sp.

*Pseudamaura reflecta* }

*Viviparus* (?) *alba-scopularis*, Etheridge, jun.

#### CEPHALOPODA.

*Belemnites canhami*, Tate.

*Belemnites kleini*, Gürich.

In some prefatory remarks to Mr. Etheridge's memoir, Mr. E. F. Pittman introduced a detailed section of the deposits at White Cliffs, and supported their Upper Cretaceous age, which was first pronounced by Anderson, as against Gürich's view that they should be considered younger Jurassic. A comparatively new opal-field at Lightning Ridge, New South Wales, was reported upon in 1906 by Mr. J. B. Jaquet.<sup>1</sup> From a geological section (text-figure) accompanying the account, it is seen that the Upper Cretaceous or Desert Sandstone beds of this area consist of "white powdery siliceous rock, with opal", beneath being the Lower Cretaceous or Rolling Downs deposits, and surmounting the whole is a capping of "quartz pebble conglomerate". There is no reference to the occurrence of fossiliferous remains, although Mr. Jaquet regarded the beds as identical in their modes of structure with those at White Cliffs. The locality is famous for the much-coveted 'black opal' which is found in association with opals of ordinary character.

A new interest was given to the Lightning Ridge Beds<sup>2</sup> in 1910, when it was announced by Dr. A. S. Woodward that Dinosaurian bones had been discovered there, representing a small Megalosaurian animal now preserved in the Geological Department of the British Museum (R. 3716-18). The account stated that the specimens were opalized, and that they occurred with other bones and shells in a similar condition, their geological age being given as Upper Cretaceous.

A reference to the opalized deposits of New South Wales was made by Mr. C. A. Süßmilch<sup>3</sup> in connexion with both White Cliffs and Lightning Ridge. At the former locality he mentioned the occurrence of shells, reptilian bones, and fragments of fossil wood, wholly or partly replaced by precious opal; he regarded the beds as of Upper Cretaceous age, the opalization being referred to as of secondary origin.

<sup>1</sup> "The Wallangulla Opal Field": Ann. Rep. Dept. Mines N.S.W. for 1905, 1906, pp. 68-9.

<sup>2</sup> "On Remains of a Megalosaurian Dinosaur from New South Wales": 79th Rep. Brit. Assoc. for 1909, 1910, pp. 482-3.

<sup>3</sup> *An Introduction to the Geology of New South Wales* [Sydney], 1911, p. 125 (with coloured geological map).

Finally, Mr. F. Chapman,<sup>1</sup> Palæontologist of the National Museum at Melbourne, has quite recently described an opalized tooth of *Ceratodus* from the Upper Cretaceous opal deposits of Baradine, some 90 miles S.S.E. of Walgett, New South Wales, and has determined it under a new sub-genus and species as *Ceratodus* (*Metaceratodus*) *wollastoni*. It is of interest to state that *Ceratodus*, although chiefly characteristic of Trias and Jurassic times, has been recognized by E. W. Cope in the Fort Union Beds of Montana, United States (Proc. Acad. Nat. Sci. Philadelphia, 1876, pp. 259-60), which are regarded as uppermost Cretaceous or oldest Eocene, as well as in the later Cretaceous deposits of Patagonia, by Ameghino. Dr. A. S. Woodward has further recorded the occurrence of *Ceratodus* and a Dinosaurian in the Lower Jurassic rocks of Gippsland, Victoria, Australia (Ann. Mag. Nat. Hist., ser. VII, vol. xviii, pl. i, pp. 1-3, 1906).

AN ACCOUNT OF THE OPALIZED MOLLUSCA CONTAINED IN THE COLLECTIONS OF THE BRITISH MUSEUM AND THE REV. F. ST. J. THACKERAY.

PELECYPODA.

Fam. CYPRINIDÆ.

*Fissilunula clarkei*, Moore, sp.

*Cytherca clarkei*, Moore, Quart. Journ. Geol. Soc., vol. xxvi, p. 250, pl. xiii, fig. 1, 1870.

*Cyprina expansa*, Etheridge, Quart. Journ. Geol. Soc., vol. xxviii, p. 338, pl. xix, fig. 1, 1872.

*Cytherca clarkei* (= *Cyprina expansa*), Tate, 1st Rep. Australasian Assoc., 1888-9, p. 230.

*Cyprina clarkei*, Etheridge, jun. : Jack & Etheridge, jun., Geology and Palæontology of Queensland, 1892, pp. 474, 568, pl. xxvii, fig. 9; ? pl. xxvi, figs. 18, 19; ? pl. xxvii, figs. 10, 11.

*Fissilunula clarkei*, Etheridge, jun., Mem. Geol. Surv. N.S.W., Palæontology, No. xi, pp. 36-7, pl. vi, fig. 3; pl. ix, fig. 1; pl. x, figs. 1, 2; pl. xi, figs. 1, 2; 1902.

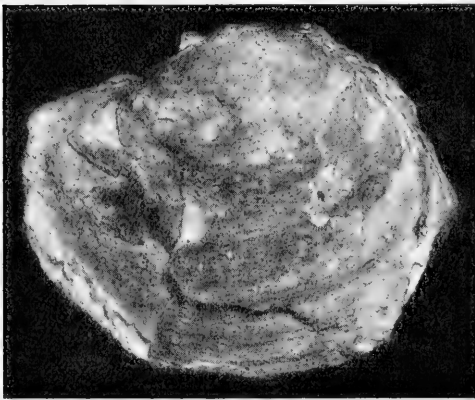
*Description* (*original*).—Shell large, thick, rather compressed, transversely ovate, inequilateral, moderately convex; umbones flattened, incurved over a large and rounded lunule; anterior and posterior ends and dorsal margin rounded; surface of the shell with broad irregular transverse bands of growth.

*Remarks*.—The specimen referred to this species has parts of both valves preserved in the closed condition, so that no internal characters are exposed, besides which the umbones are, unfortunately, absent.

<sup>1</sup> "On a new species of *Ceratodus* from the Cretaceous of New South Wales": Proc. Roy. Soc. Victoria, N.S., vol. xxvii, pp. 25-7, pl. v, 1914. The genus *Ceratodus* was reported by Krefft as occurring with *Diprotodon* remains in the Alluvial deposits of Queensland (*Nature*, vol. ix, p. 293, 1874), being regarded as an extinct form under the name of *C. palmeri*, a determination subsequently set aside by C. W. De Vis, who recognized its identity with the recent *Ceratodus forsteri* of Queensland rivers (Proc. Roy. Soc. Queensland, vol. i, p. 40, 1884).

It is of small and very medium size when compared with the more adult forms from Queensland, which sometimes reach 9 inches in length; the valves are well inflated and covered with wide and rounded growth bands bearing intervening concentric striations; the posterior region is subangulate and furnished with strongly oblique lines of growth, whereas anteriorly the valves are slightly compressed and narrow in the direction of the outer margin; the lunular excavation appears to be rather shallower than usual, probably on account of the absence of the umbones.

*Dimensions (approximate).*—Length 60, height 50, diameter 35 mm.



A



B

*FISSILUNULA CLARKEI* (Moore).

A = Left lateral view of specimen.

B = Ventral aspect of same, showing well-inflated valves.

*Loc.* White Cliffs. British Museum (Geol. Dept., L. 21274).

Moore's original description of the Queensland shell was based upon very imperfect material, but from the later studies of Mr. Etheridge, jun., of better preserved examples the real affinities of the species came to be more accurately known. From a delineation of the hinge-characters and other important internal structures, that author was able to prove fairly close relationships to *Isocardia*, and thus he made the species the type of his new genus *Fissilunula*. The present fossil compares favourably with a partially testiferous cast originally collected by Mr. H. Y. L. Brown from the Cretaceous region north of Lake Eyre, South Australia, and which he presented to the British Museum (Geol. Dept., L. 9682), where it was determined years ago by Mr. Etheridge, jun., as Moore's *Cytherea clarkei*. That specimen, however, is rather more compressed, but allowing for certain

variations which exist in the species, it would appear reasonable to regard the example from White Cliffs as belonging to the same form.

*Locality*.—White Cliffs, New South Wales.

*Collection*.—British Museum (Geol. Dept., L. 21274).

*Distribution*.—Lower Cretaceous: New South Wales, Queensland, and South Australia. Upper Cretaceous: Queensland and South Australia (Lake Eyre region).

Fam. PTERIIDÆ (= Aviculidæ).

*MACCOYELLA BARKLYI*, Moore, sp. Pl. VI, Fig. 19.

*Avicula barklyi*, Moore, Quart. Journ. Geol. Soc., vol. xxvi, p. 245, pl. xi, figs. 1, 2, 1870.

*Avicula alata*, Etheridge, Quart. Journ. Geol. Soc., vol. xxviii, p. 342, pl. xx, fig. 8, 1872.

*Monotis barklyi*, Tate, Trans. Roy. Soc. South Australia, vol. iii, p. 179, 1880.

*Maccoyella barklyi*, Etheridge, jun.: Jack & Etheridge, Geology and Palæontology of Queensland, 1892, p. 455, pl. xxii, figs. 1-5; pl. xlii, figs. 4-6; pl. xxiii, figs. 1-2; Mem. Geol. Surv. N.S.W., Palæontology, 1902, No. xi, p. 17, pl. ii, figs. 3-5; pl. iii, figs. 4, 5; pl. iv, figs. 3, 4.

*Description (original)*.—Shell slightly inequilateral, orbicular, large valve convex, small valve flattened, umbones prominent; auricles rather small, nearly equal. The large valve slightly produced posteriorly and ornamented with 24 radiating costæ, which are more raised and appear spinous on the posterior margin. The small valve slightly convex with a very distinct ornamentation from the larger, the costæ being much finer, and about 44 in number. The costæ are decussated by numerous regular concentric lines of growth, which, when they meet, give them a nodulated aspect. The lines of growth have been reflected or folded over the anterior auricle and side, which gives the shell a very peculiar appearance. The small valve possesses a large and deep groove for the passage of a byssus. The punctate structure of the Aviculidæ may be clearly distinguished, by aid of the lens, in this species.

*Remarks*.—The specimen referred to this species exhibits an external view of a left valve which is so attached to the matrix that all internal characters are concealed. It is of medium size, slightly convex, with an umbo well above the dorsal line; the margins are fractured and imperfect, especially posteriorly, while the ventral border is rounded. Although much eroded the surface has still preserved some thirteen equidistant, primary, radial costæ, an obscure secondary rib dividing equally the intercostal spaces being occasionally present, and seen only in the later development of the shell, and which is not observable on the umbonal region. Numerous close, concentric striations form part of the ornament of the valve, and where they cross the radial costæ minute nodulations are produced.

*Dimensions (approximate)*.—Length 40, height 38 mm.

We are indebted to Mr. Etheridge, jun., for our later knowledge of this species, which he made the type of his genus *Maccoyella* (Jack

and Etheridge, *The Geology and Palæontology of Queensland*, 1892, p. 451), including therein further species from the Queensland Cretaceous, all of which were described by Moore under the genus *Avicula*. It was pointed out that the chief peculiarities of *Maccoyella* were connected with the hinge-structure of both valves, which widely differed from those characterizing *Avicula*; but, unfortunately, the specimen from White Cliffs is too much buried in matrix to allow of the comparison of internal characters; from external features, however, it may be said to resemble the published figures of this shell, especially *Avicula alata* of Etheridge, sen., from the Desert Sandstone of Queensland, recognized as a synonym of the present species, and a kaolinized cast of a valve from White Cliffs figured by Mr. Etheridge, jun. (pl. iv, fig. 4), in his last account of this species.

*Locality*.—White Cliffs, New South Wales.

*Collection*.—British Museum (Geol. Dept., L. 21272).

*Distribution*.—Lower Cretaceous: South Australia (Peak Creek and Lake Eyre district); Queensland; New South Wales. Upper Cretaceous: Queensland (Maryborough); New South Wales (White Cliffs).

#### Fam. CYRENIDÆ.

CYRENOPSIS MEEKI (Etheridge, jun.). Pl. VI, Figs. 13, 14.

*Mastra meeki* and *Unicardium* (?) *meeki*, Etheridge, jun.: Jack and Etheridge, jun., *Geology and Palæontology of Queensland*, 1892, pp. 472-3, pl. xxvii, figs. 2, 3; pl. xxvi, figs. 13-15.

*Cyrena meeki* and *Corbicula* (?) *meeki*, Etheridge, jun., *Mem. Roy. Soc. S. Australia*, vol. ii, pt. i, pp. 30-1, pl. vi, figs. 8-13, 1902.

*Cyrenopsis*.—Type *Mastra* (vel *Corbicula*) *meeki*, Etheridge, jun., *Mem. Geol. Surv. N.S.W., Palæontology*, No. xi, p. 28, 1902.

*Description* (author's diagnosis of 1902).—Shell obtusely triangular, somewhat cuneiform, and posteriorly produced, moderately convex. Cardinal margins considerably arched, the anterior shorter than the posterior; ventral margins rounded throughout, curving rapidly upwards anteriorly, but less curved posteriorly; anterior margins well rounded; the posterior-ventral extremities produced, but obtusely rounded. Umbones moderately large, obtuse and contiguous; anterior and posterior diagonal slopes obtusely rounded, posterior area ill-defined, ligament short and strong. A large, robust, projecting, triangular, submedian cardinal tooth in each valve; anterior and posterior lateral teeth lamellar and projecting; sculpture of concentric lamellæ, of slightly variable width, and on the anterior slopes gathered in bundles; the lamellæ bear numerous very fine and regular concentric lines.

*Remarks*.—There is only one specimen in the British Museum which may be referred to this species. Its valves, in the closed condition, are, however, fragmentary and without umbones, but its cuneiformity, triangular outline, rounded ventral margins, produced posterior margins, and abruptly truncated area, all agree with Mr. Etheridge's figures, especially 13 and 15 of plate xxvi of the Queensland memoir. Some slight additions may be made to the



ornamentation of the species as exhibited in this specimen. The sculpture is seen to consist of bold concentric depressed ridges and broad shallow sulcations covered with fine concentric lineations, but crossing them are numerous short, microscopical, vertical striations, as well as occasional longer and filamentous lines similarly directed, mostly confined to the ventral region, such as may be seen on the valves of both fossil and recent freshwater Pelecypoda, being sometimes present in *Corbicula cuneiformis* of J. Sowerby, from the older Eocene deposits of England and Europe, as also in further fossil species of that genus; it is besides seen on Unioniform shells, for which examples of *Unio tumidus* of Retzius in the Geological Department of the British Museum (L. 10032) may be quoted, which were obtained from the Post-Pliocene deposits of the Lea Marshes near London; and the character is also apparent in *Anodonta beeklesi*, which I described some years since before this Society (Proc. Malac. Soc., vol. ix, pp. 114-17, pl. i, 1910) from the English Wealden formation.

*Dimensions*.—Length 29, height 26 (approx.), diameter 15 mm.

This species forms the type of *Cyrenopsis*, Etheridge, jun., being at first regarded as a doubtful *Unicardium* and afterwards as an example of *Mactra*. A more complete study of the dentition enabled the author to see its close connexion with Cyreniform shells like *Corbicula*, from which it differed, however, in the possession of a triangular, submedian, cardinal tooth in each valve, making two instead of three teeth for both valves as in that genus.

*Locality*.—Lightning Ridge, New South Wales.

*Collection*.—British Museum (Geol. Dept., L. 21832).

*Distribution*.—Lower Cretaceous of Queensland (Walsh River) and South Australia (Lake Eyre Basin).

CYRENOPSIS OPALLITES, Etheridge, jun. Pl. VI, Figs. 11, 12.

? *Cyrena* (?), n.sp., Gürich, Neues Jahrb., Beilage Band xiv, p. 486, pl. xix, figs. 5, 6, 1901.

*Cyrenopsis opallites*, Etheridge, jun.: Mem. Geol. Surv. New South Wales, Palæontology, No. xi, p. 29, pl. v, figs. 12-17, 1902.

*Description (original)*.—Shell ovate, moderately inflated; cardinal margins arched, ventral margins well rounded; anterior ends somewhat flattened, with rounded margins; posterior ends slightly produced or nasute, the dorsal posterior margins straight and oblique, the ventral rounded; posterior slopes slightly flattened, narrow, and generally inconspicuous; umbones depressed, escutcheon long, deep, and narrow; ligament short. Articulus arched, longer on the posterior than the anterior; anterior cardinal of the left valve triangular, projecting, and slightly oblique, posterior cardinal of the same valve laminar; anterior lateral slightly curved, short, posterior lateral long, distant, and straight. Central upper cardinal of the right valve laminar and almost marginal, lower cardinal laminar and oblique; anterior lateral short and curved, posterior lateral long, distant, and straight. Adductor impressions and pallial lines very faint. Sculpture of concentric laminæ, with faint coincident lines.

*Remarks.*—There are two excellent examples of this species in the British Museum with the valves in the closed position, and therefore not exhibiting internal characters. They are of nearly orbicular contour, and would represent the type of the species as figured and described by Etheridge. The valves exhibit a moderate convexity over the umbonal region, but afterwards considerable compression; they are furnished with a fairly deep lanceolate escutcheon and a short ligament, while beneath the umbones in front is a slightly excavated area, although possessing no true circumscribed lunule. The ornamentation consists of more or less equidistant, flattened growth-bands which are covered with closely arranged, thread-like, concentric striations which are sometimes of slightly irregular design, especially near the ventral margin.

<i>Dimensions.</i>		<i>Type</i> (from largest figure).		<i>New examples.</i>
	Length . .	34		32 mm.
	Height . .	31		30 mm.
	Diameter . .	20		15 mm.

The specimen figured by Gürich, showing the dentition, which Mr. Etheridge, jun., includes under his species *opallites*, is of far larger dimensions than those mentioned above, and although no exact measurements can be made on account of the fragmentary state of the margins, it probably was nearly double the size of the largest form represented by Mr. Etheridge's figures; I have therefore queried its inclusion in this species.

*Locality.*—White Cliffs, New South Wales.

*Collections.*—British Museum (Geol. Dept., L. 21273; Mineral Dept., 80065).

*Distribution.*—Upper Cretaceous: White Cliffs, New South Wales.

CYRENOPSIS AUSTRALIENSIS, n.sp. Pl. VI, Figs. 9, 10.

*Description.*—Shell ovate, subtriangular, height less than length, umbones anterior; posterior region elongate, obliquely rounded at margin, with narrow lanceolate escutcheon bearing short ligament; anterior short, slightly excavated beneath the umbones; ventral margins round, and with rounded extremities; valves moderately convex umbonally, afterwards compressed; ornamentation consists of equidistant, concentric, periodical growth-bands furnished with fine and closely arranged concentric striations.

*Dimensions (with united valves).*—Length 33, height 24, diameter 11 mm.

*Remarks.*—The example described is the largest of three specimens, each of which is in good preservation, although no interiors are seen, as the valves are united and closed. The more or less triangulate and suboval contour, together with its anteriorly placed umbones, will suffice to separate this form from *C. meeki*, with which it is otherwise closely related. Among the specimens mentioned is one that has been highly polished by the lapidary, and is associated on a small piece of ferruginously tinted sandstone, with an example of *Euspira variabilis*.

*Locality*.—White Cliffs, New South Wales.

*Collections*.—British Museum (Mineral Dept. 1<sup>57</sup><sub>67</sub>; Geol. Dept., G. 19603).

*CYRENOPSIS* (?) *ELONGATA*, n.sp. Pl. VI, Figs. 17, 18.

*Description*.—Shell thick, robust, subtrigonal, oval, length nearly  $1\frac{1}{2}$  times the height, valves compresso-convex; umbones anterior, incurved; posterior region elongate, sloping, probably subangulate, anterior extremities rounded, short, ventral margins elongately curved; sculpture consisting of rather coarse, concentric, elevated, rounded growth-periods with fine concentric interlineations, crossing which are a series of short, equidistant, raised, filiform, vertical striations.

*Dimensions (closed valves)*.—Length 32, height 24, diameter 15 mm.

*Remarks*.—The shell of this specimen has been partially removed by fracture from the dorsal region, especially beneath the umbones, and posteriorly where the areal surface within the margins is quite lost. Otherwise it consists of a pair of valves in the closed condition, the left lateral surface showing a well-arched umbonal region, and the surface exhibiting interesting details of sculpture. The growth-bands are more or less raised and feebly convex, while the general surface is covered with fine concentric striations, except where erosion can be traced, when such markings have become obliterated. The short vertical striations, observable in the ventral region more particularly, are of filiform character, and like a similar structure noticed previously in *Cyrenopsis meeki*, Etheridge, jun.

I have no doubt at all as to the freshwater origin of this shell, and chiefly from the peculiar character of the ornament, which indicates a slight uncertainty or irregularity in the design of the concentric lineations, a similar phenomenon existing in most Pelecypod shells of the same habit, and in this way differing from marine forms, which generally show a greater decision in their sculpture markings. As no dental characters are preserved, this shell is associated provisionally with the genus *Cyrenopsis*; it appears to differ chiefly from other species in possessing a more elongately oval contour.

*Locality*.—White Cliffs, New South Wales.

*Collection*.—Rev. F. St. J. Thackeray.

*CORBICULA CORRUGATA*, Tate, sp. Pl. VI, Figs. 15, 16.

*Platopsis* (?) *corrugata*, Tate, Trans. Roy. Soc. S. Australia, vol. xxii, p. 79, text-figures, 1898.

*Cyrenopsis* (?) *corrugata*, Etheridge, jun., Mem. Geol. Surv. New South Wales, Palæontology, No. xi, p. 30, 1902.

*Description (original)*.—Shell transversely triangular, somewhat cuneiform, convexly depressed. Umbones large, obtuse, antemedian; lunule ill-defined. The dorsal slopes straight, inclined at an angle of  $95^\circ$ , the posterior considerably the longer; post-ventral extremity roundly pointed, the ventral margin nearly straight to beyond the middle line, thence curving rapidly upwards to form the well-rounded anterior extremity. The post-dorsal line is bounded by

a narrow declinous lanceolate area, and delimited on its inner aspect by an ill-defined obtuse ridge extending from the umbo to the post-ventral extremity. The inner margin of the valves is smooth at post-ventral extremity. The ornamentation consists of subacute concentric undulations of variable strength, and at variable distances, separated by shallow concave spaces wider than the ridges; coincident with the undulations are widely separated linear growth-lines; the concentric undulations are continued beyond the post-umbonal ridge as close-set growth-lines.

*Remarks.*—There is an excellent specimen to represent this species with united valves in situ and possessing complete margins, rather inflated and obtuse umbones, and straight ventral borders with rounded extremities. The triangularity of the valves is also well expressed, a shape considerably aided by the almost straight dorsal slopes of which the posterior is much the longest. In the lanceolate escutcheon-area reposes a short, thick ligament, and beneath the umbones in front it is only very slightly excavated. The ornamentation exhibits equidistant concentric bands of growth, with raised margins, and covered with extremely fine, close, concentric striations. No external characters are exposed. *Dimensions (with united valves)*: length 25, height 20, diameter 10 mm.

This species was originally regarded as marine, and doubtfully associated with *Platopsis* of Whitfield, from the Syrian Cretaceous, being thought to have possible affinities with *Astarte*; subsequently Mr. Etheridge, jun., considered it a probable form of his genus *Cyrenopsis*, although without knowledge of the dentition, as the type showed no internal characters. My opinion, however, is that the triangularity of the shell, in addition to the other external characters, is more in favour of its being regarded as a *Corbicula* than any other genus, and therefore, until further evidence is forthcoming, it is proposed to include the species under that genus.

*Locality.*—White Cliffs, New South Wales.

*Collection.*—British Museum (Mineral Dept. 76806).

*Distribution.*—Upper Cretaceous: New South Wales (White Cliffs).

#### Fam. UNIONIDÆ.

#### UNIO JAQUETI, n.sp. Pl. VI, Figs. 2-6.

*Description.*—Shell elongately oval, narrow; dorsal margin slightly sloping to posterior extremity; dorsal and ventral borders subparallel; umbones anterior, eroded; valves compresso-convex; posterior region produced, and slightly narrowing at end, anterior and ventral borders rounded; sculpture exhibiting concentric growth-lines, crossed by numerous, closely set, fine radial striations.

		<i>Lightning Ridge.</i>	<i>White Cliffs.</i>
<i>Dimensions (with closed valves).</i>	Length .	42	(about) 53 mm.
	Height .	20	22 mm.
	Diameter .	12	15 mm.

*Remarks.*—This species is represented by two specimens of somewhat imperfect condition, but their rarity as opalized Australian

fossils makes them important for reference. The more complete, so far as contour is concerned, and which was found at Lightning Ridge, exhibits both valves in the closed state, the margins of which are generally well defined, while the anteriorly situated summit region is very depressed, the umbones having been completely eroded away, the postero-dorsal characters being also without proper definition. The shell-structure is only very partially preserved, although sufficient remains to show the presence of concentric growth-lines and some obscure microscopical radial striations. The second example is from White Cliffs, also with closed valves, and is larger than the previous form. In this the umbonal regions have disappeared through erosion, and a fractured posterior end of the specimen prevents an exact knowledge of its original length, although this seems to have been about 53 mm. The dorsal view, however, exhibits a part of what would have been a fairly long lanceolate escutcheon with sharply angulate lateral borders, enclosing a well-rounded, lengthy ligament, bearing annulations of growth, and furnished with tapering extremities, the concentric growth-lines forming a fairly sharp angle where they meet the margins of the escutcheon. The radial striations are either absent or only very obscurely traceable, erosion having probably obliterated these finer details of sculpture.

I would wish to associate with this shell the name of Mr. J. B. Jaquet, who was the first geologist to describe the Lightning Ridge opal deposits, and who previously had furnished important details in connexion with the constitution of the beds at White Cliffs.

*Localities.*—Lightning Ridge and White Cliffs, New South Wales.

*Collections.*—British Museum (Geol. Dept., L. 21833); Rev. F. St. J. Thackeray.

UNIO WHITE-CLIFFSENSIS, n.sp. Pl. VI, Figs. 7, 8.

*Description.*—Shell of small size, with moderately inflated valves, length about  $1\frac{1}{2}$  times the height; umbonal regions anterior, coarsely rugose or marked with strong, widely V-shaped costæ; anterior margin rounded, posterior side with an elongate, abrupt, oblique, and narrow, angulate, ridged area, in front of which the valve is slightly excavated. Sculpture beyond the V-shaped costal rugosities of the umbonal area consists of periodical growth-divisions, and numerous, closely set, microscopical concentric striations, which at the posterior ridge become angulate, and take an upwardly oblique direction on the surface of the posterior area.

*Dimensions (with closed valves).*—Length 22, height 15, diameter 10 mm.

*Remarks.*—This specimen exhibits a pair of closed valves, which, however, are not quite in situ, having slightly shifted from each other during the process of fossilization. It is a well-marked form, with all the characters referred to properly defined; the umbones themselves are not present, but the rugose umbonal regions are quite definite and characteristic of Unioniform shells.

*Locality.*—White Cliffs, New South Wales.

*Collection.*—Rev. F. St. J. Thackeray.

## UNIO sp. indet. Pl. VI, Fig. 1.

*Description*.—Shell of oblong, oval contour, compressed, moderately and uniformly convex; dorsal margin elongate, declining slightly to the narrower posterior end, ventral margin nearly straight; umbonal region very anterior, extremities more or less rounded; sculpture consisting of fine concentric growth-lines with no evidence of radial striations.

*Dimensions (right valve)*.—Length 60, height 30, diameter 14 mm.

*Remarks*.—Only a small fragment of testiferous structure is obscurely preserved near the posterior end of this specimen, otherwise the lapidary, in developing its opalescent qualities, has destroyed all the original details of structure. The contour and general compression, however, may probably be relied on, although the marginal boundaries are a little uncertain. The shape appears to bear some resemblance to forms of *Unio* found in the Judith River Beds (= uppermost Cretaceous) of the United States, such as are figured in Meek's "Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country": United States Geol. Surv. Terr., vol. ix, pl. xli, 1876 (i.e. *Unio danæ*, Meek & Hayden), but without the radial striations that ornament the American shells. The specimen represents an external view of a right valve with the umbonal area wanting, the whole of the interior being filled with a moderately soft kaolinized sandy matrix.

*Locality*.—White Cliffs, New South Wales.

*Collection*.—Rev. F. St. John Thackeray.

## GASTROPODA.

## Fam. NATICIDÆ.

## EUSPIRA VARIABILIS (Moore). Pl. VI, Figs. 20-3.

*Natica variabilis* and *Delphinula reflecta*, Moore, Quart. Journ. Geol. Soc., vol. xxvi, p. 256, pl. x, figs. 15, 21, 1870.

*Natica lineata*, Etheridge, Quart. Journ. Geol. Soc., vol. xxviii, p. 342, pl. xxi, fig. 1, 1872.

*Delphinula* (?) *reflecta*, Etheridge, jun.: Jack & Etheridge, jun., Geology and Palæontology of Queensland, 1892, p. 485, pl. xxix, fig. 12; p. 573, pl. xxxi, figs. 2, 3.

*Natica variabilis*, Gürich, Neues Jahrb., Beilage Band xiv, p. 489, pl. xix, fig. 7, 1901; Etheridge, jun., Mem. Roy. Soc. S. Australia, vol. ii, pt. i, p. 42, pl. vi, figs. 15-17, 1902.

*Pseudamaura reflecta* and *Pseudamaura variabilis*, Etheridge, jun., Mem. Geol. Survey N.S.W., Palæontology, 1902, No. xi, pp. 40-3, pl. ii, figs. 9-12, 13-16.

*Descriptions (original)*: Of *variabilis*. Shell very thick, broader than high; spire of 3-4 volutions, somewhat depressed; body-whorl increasing rapidly, and extended; aperture ovate; umbilicus small.

Of *reflecta*. Shell rather small, turbinated; whorls 3-4, spire slightly elevated; volutions separated by an encircling sinus; body-whorl much increased; aperture circular, with a thick reflected lip.

*Remarks.*—Mr. Etheridge, jun., has carefully studied the merits of Moore's imperfectly defined species, *Natica variabilis* and *Delphinula reflecta*, and has acknowledged the difficulty of separating them on account of the similarity of their characters. He has alluded to the presence of an ovate aperture in the first-named, and one of rounder contour in the other, as of some importance, although an unfortunate slip in the text informs us that it is "ovate" in both. Apart from this, however, Mr. Etheridge's figures do not assist us as to the actual roundness of the aperture in the species *reflecta*, in which case it is thought that the apertures for both would be better diagnosed as more or less ovate, and consequently both species might with advantage be united, more especially as the remaining characters are very similar in each; it is, therefore, suggested to retain *variabilis*.

Well-preserved specimens are seen to be ornamented with fairly strong growth-lines, crossed by microscopically small, close, and spiral striations; one specimen, however, in the British Museum (Mineral Dept.) exhibits a series of thick, equidistant, vertical costæ on the penultimate whorl, which is a somewhat unusual structure, having a resemblance to what is occasionally seen on the spire of *Gyrodes pansus* from the Indian Cretaceous as figured by Stoliczka,<sup>1</sup> who regarded such markings as raised striæ of growth, while Mr. Etheridge, jun., has noted and figured the same ornament in an example of the species from the Lower Cretaceous deposits of South Australia, which, like the present specimen, has the general characters of *Natica variabilis* (see pl. vi, fig. 17, Mem. Roy. Soc. S. Australia).

Another difficulty presents itself as to the proper genus with which to associate this species. Mr. Etheridge, jun., recognized it as belonging to Fischer's *Pseudamaura*, of which the type is *Natica bulbiformis* of J. de C. Sowerby from the Austrian (Gosau) Cretaceous; but that seems an unsatisfactory determination, because the Austrian fossil has a much more elongate and tabulate spire, as well as possessing an extensive callus to the inner lip, and is besides without any indication of an umbilical opening. The Australian shell much more nearly approximates in spiral structure to the Cretaceous *Gyrodes*, although removed from it by the absence of a wide basal excavation which characterizes that genus. It is now suggested that Agassiz's *Euspira*<sup>2</sup> should include this species, which was founded on *Natica glaucinoides* of J. Sowerby from British Lower Eocene rocks, and which seems to embrace, in a more or less modified manner, the chief characters of the shell in question.

*Locality.*—White Cliffs, New South Wales.

*Collections.*—British Museum (Geol. Dept., G. 19602-3; Mineral Dept.,  $\frac{677}{1907}$ ,  $\frac{683}{1908}$ ); Rev. F. St. J. Thackeray.

*Distribution.*—Lower Cretaceous: South Australia; Queensland. Upper Cretaceous: White Cliffs, New South Wales.

<sup>1</sup> "Cretaceous Fauna of Southern India (Gastropoda)": Mem. Geol. Surv. India, Palæontologia Indica, vol. ii, pl. xxii, fig. 9a, 1868.

<sup>2</sup> Desor & Agassiz, Conchyliologie Minéralogique de la Grande Bretagne par James Sowerby, traduit de l'Anglais, p. 15, 1838.

## CEPHALOPODA.

Fam. BELEMNITIDÆ.

ACTINOCAMAX spp.

Belemnitifform guards are of rather frequent occurrence in these opalized beds of Australia (White Cliffs), having been first referred to by Dr. Henry Woodward as belonging to the genus *Belemnitella*, and by later authors as *Belemnites*, under the species *canhami*, Tate, and *kleini*, Gürich. Mr. G. C. Crick, of the British Museum, who has examined the evidence, is of opinion that such remains would be more accurately determined as *Actinocamax*, and that without question they denote an Upper Cretaceous age.

*Locality*.—White Cliffs, New South Wales.

*Collections*.—British Museum (Geol. Dept., C. 12086-7; Mineral Dept.,  $\frac{677}{1907}$ ); Rev. F. St. J. Thackeray.

## EXPLANATION OF PLATE VI.

The figures are of the natural size with the exception of 4, 14, and 23, which represent magnifications of sculpture.

FIG.

UNIO sp. indet.

1. An imperfect right valve with polished surface, exhibiting faint traces of concentric growth-lines in the posterior region.

*Loc.* White Cliffs. Rev. F. St. J. Thackeray Coll.

UNIO JAQUETI, n.sp.

2. Left lateral aspect.
3. Ventral view of same, showing the shallow, depressed valves.
4. Sculpture magnified, consisting of closely arranged radial striations.
5. Left lateral view of another specimen, imperfect posteriorly.
6. Dorsal view of same, exhibiting eroded umbones and a prominent ligament with annulations of growth.

*Loc.* White Cliffs. Rev. F. St. J. Thackeray Coll.

UNIO WHITE-CLIFFSENSIS, n.sp.

7. Left lateral view, showing the umbonal V-shaped rugosities.
8. Right lateral aspect of same, in which the posteriorly ridged area is seen.

*Loc.* White Cliffs. Rev. F. St. J. Thackeray Coll.

CYRENOPSIS AUSTRALIENSIS, n.sp.

9. Left lateral view of a slightly fractured example displaying the periodical growth-bands.
10. Dorsal aspect of same, showing shallow valves and a short ligament.

*Loc.* White Cliffs. British Museum (Min. Dept.,  $\frac{577}{1907}$ ).

CYRENOPSIS OPALLITES, Etheridge, jun.

11. Right lateral aspect, showing a nearly orbicular contour.
12. Dorsal position of same, exhibiting considerable umbonal convexity and elongate escutcheon.

*Loc.* White Cliffs. British Museum (Min. Dept., 80065).

CYRENOPSIS MEEKI, Etheridge, jun.

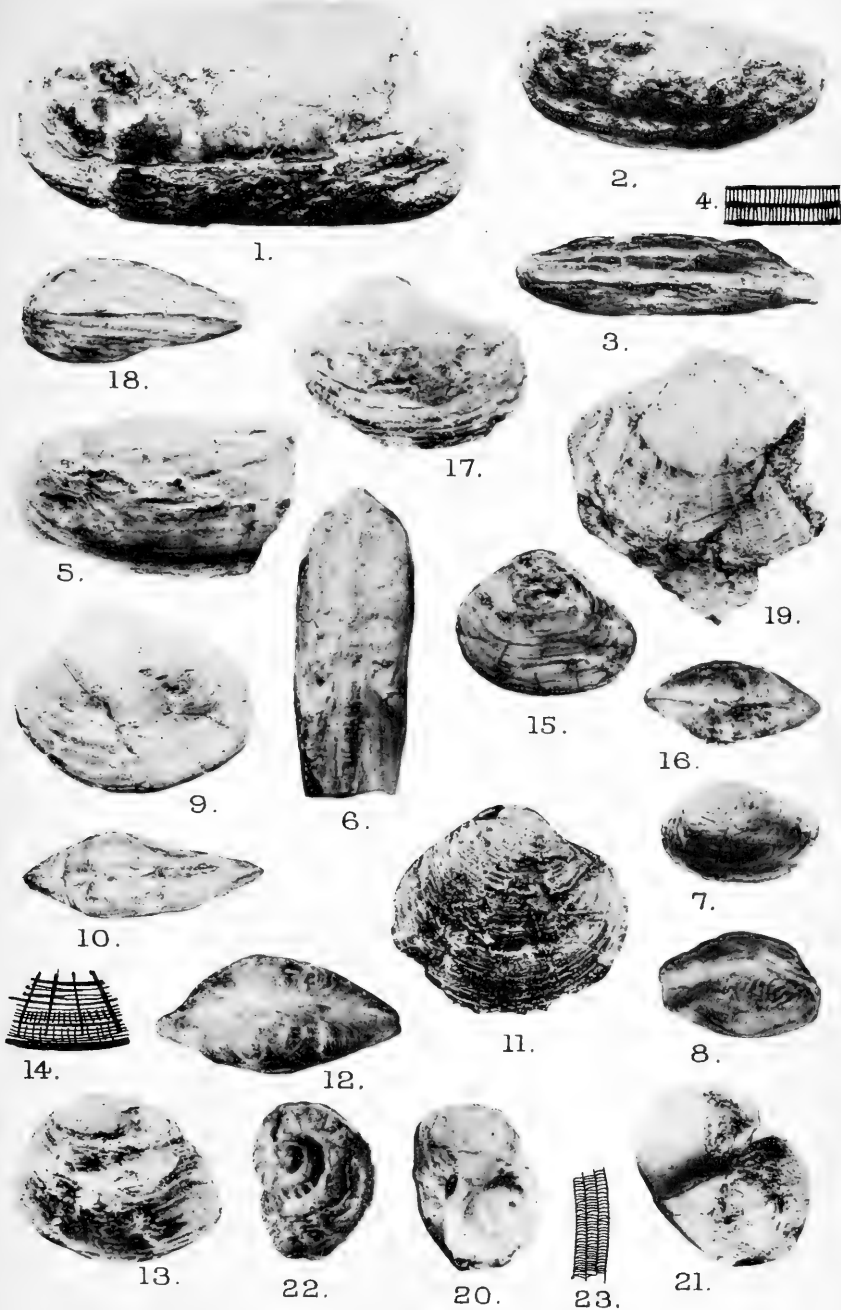
13. Left lateral view, showing a triangularity of contour.
14. Sculpture details magnified, in which the short and longer radial striations are seen crossing the concentric growth-lines.

*Loc.* Lightning Ridge. British Museum (Geol. Dept., L. 21832).









Huth coll.

CRETACEOUS SHELLS FROM THE OPAL DEPOSITS OF  
NEW SOUTH WALES.



FIG. CORBICULA CORRUGATA, Tate, sp.

15. Left lateral aspect, exhibiting well-marked dorsal slopes and equidistant concentric growth-bands. The opalescent characters of this specimen are particularly fine.

16. Dorsal view of same.

*Loc.* White Cliffs. British Museum (Min. Dept., 76806).

CYRENOPSIS (?) ELONGATA, n.sp.

17. Left lateral view, showing subtrigonal contour and the short vertical striations crossing the concentric growth-lines.

18. Ventral aspect of same, exhibiting considerable anterior convexity.

*Loc.* White Cliffs. Rev. F. St. J. Thackeray Coll.

MACCOYELLA BARKLYI, Moore, sp.

19. External aspect of a left valve displaying the equidistant radial costæ crossing the closely arranged concentric striations.

*Loc.* White Cliffs. British Museum (Geol. Dept., L. 21272).

EUSPIRA VARIABILIS, Moore, sp.

20. Front aspect, showing small elongate perforation and ovate aperture.

22. Summit surface of same specimen, containing sculpture ridges on the penultimate whorl.

*Loc.* White Cliffs. British Museum (Min. Dept., <sup>577</sup>1907).

21. Front view of a larger example which has been polished by the lapidary.

*Loc.* White Cliffs. British Museum (Geol. Dept., G. 19602).

23. Sculpture striations, magnified, as seen on well-preserved test of another specimen.

*Loc.* White Cliffs. Rev. F. St. J. Thackeray Coll.

## MOLLUSCAN NOTES.

By HUGH C. FULTON.

Read 8th January, 1915.

No. 1.—STENOPYLIS, Fulton, Ann. Mag. Nat. Hist., vol. xiv, p. 163, 1914.

IN my short paper quoted above, I omitted to note that Mr. Charles Hedley gave an account of the radula and jaw of *S. hemiclausula*, Tate, in the Appendix to Professor Tate's paper (Horn. Exped., Mollusca, 1896, p. 221). Professor Bavay informs me that his *S. microdiscus* has only  $3\frac{1}{2}$  whorls, not  $4\frac{1}{2}$  as depicted by the artist. As I can see no difference between this species and the previously described *S. hemiclausula* it falls into synonymy.

No. 2.—ENNEA AFFECTATA, Fulton, and E. ROSENBERGIANA, Preston.

Having had the opportunity of examining a co-type of *E. rosenbergiana*, Preston (Proc. Malac. Soc., vol. ix, p. 53, fig., 1910), I find it is identical with the shell described by me as *E. affectata* in vol. v, p. 32, 1902, of the same Proceedings. My specimens were obtained through Mr. Rosenberg, and formed part of the collection of the late Mr. A. Boucard, and were labelled "Zanzibar". Mr. Preston's specimens are said to have been collected in Angola, W. Africa, by Dr. Ansorge.

No. 3.—TOMIGERUS LÆVIS, Ihering.

I received from Mr. Dias da Rocha, collector of the type-specimens, some original specimens of *Tomigerus lævis*, Ihering (Proc. Malac. Soc., vol. vi, p. 197, 1905). I have no hesitation in pronouncing them to be simply dead and weathered examples of *Tomigerus clausus*, Spix (Testac. Brasil, 1827, pl. xv, figs. 4, 5). Although the corrugation on the last half-whorl is, owing to the worn condition, weaker than in *T. clausus*, it is clearly present in every one of the twelve specimens examined by me. The only difference between these two forms noted by von Ihering is that *lævis* is smooth and white. To me the loss of colour and smoothness has evidently been caused by weathering, and the type must have been a very worn specimen if it showed no signs of the corrugations characteristic of *T. clausus*.

No. 4.—CLAUSILIA FALCIFORMIS, var. MONTANA, Möllddf.

In the Nachr. deutsch. Malak. Gesell., 1901, p. 77, Dr. von Möllendorff described a Tonkin *Clausilia* under the above names. As no previous species has been described as *falciformis* I propose that the varietal name be dropped, and the species be known as *Cl. falciformis*, Möllddf. It is evident that Möllendorff intended to write *falcifera*, Bav. & Dtz. (Journ. de Conch., vol. xlvii, p. 290, pl. xii, fig. 10), a species to which *falciformis* is allied, but is, in my opinion, quite distinct; they are similar in form, but *falciformis* is much larger, of a darker coloration, and has a much coarser

crenulated suture; *falcifera* is almost smooth, whereas, under the lens, *falciformis* is seen to be very distinctly obliquely striated. The internal plaits are similar in both forms. This comparison has been made with original specimens of both species.

No. 5.—The Identity of *PTEROCYCLOS PRESTONI*, Bav. & Dtz., with  
*PTEROCYCLOS COCHINCHINENSIS*, Pfr.

Comparison of original examples of *P. prestoni*, received from Colonel Messenger, with the type of *P. cochinchinensis* demonstrates that these two forms are identical. The colour of both is light yellowish brown; darker specimens with some irregular wavy markings above and a peripheral narrow band of darker brown were named *P. prestoni*, var. *depicta*, Bav. & Dtz.; the larger specimens of this variety cannot, in my opinion, be distinguished from *Rhiostoma morleti*, Dtz. & Fisch.

Judging by shell characters and the manner in which various authorities have placed the same forms under different generic names, the position of the sutural tube, upon which character the genera *Pterocyclos*, *Rhiostoma*, and *Opisthoporus* were mainly founded, appears to be of little significance.

Synonymy of *Pterocyclos cochinchinensis*, Pfr.

1856. *Opisthoporus cochinchinensis*, Pfr., Proc. Zool. Soc., p. 337.

1865. *Pterocyclos cochinchinensis*, Pfr., Pneumonop. Viv., Supp., ii, p. 37.

1891. *P. planorbulus*, Morlet (*non* Lamk.), Journ. de Conch., vol. xxxix, p. 247.

1905. *Rhiostoma morleti*, Dtz. & Fisch., Journ. de Conch., vol. liii, p. 429, pl. x, figs. 1-4.

1908. *Pterocyclos prestoni*, Bav. & Dtz., Journ. de Conch., vol. lvi, p. 248.

1908. *P. prestoni*, var. *depicta*, Bav. & Dtz., Journ. de Conch., vol. lvi, p. 249.

*Hab.*—Cochinchina (Pfr.); Tonkin (Morlet, Mansuy, and Messenger); Laos (Massie).

No. 6.—ON DR. ANTON WAGNER'S MONOGRAPH OF HELICINIDÆ IN THE  
CONCHYLIEEN-CABINET, 1911.

Whilst looking through the above work I was surprised to find that many species have been omitted, and thought a list of such, with the correction of some errors, might prove useful to others when consulting that monograph. Probably some of the omitted species, which number more than 100, are the same as some of the numerous new species created by Dr. Wagner.

In proposing a number of new genera and sub-genera for various sections of the Helicinidæ, Dr. Wagner has ignored many of those of previous authorities, as may be seen by consulting the *Manuel de Conchyliologie*, 1887, of Dr. Paul Fischer. The sectional names *Oxyrhombus* and *Pyrgodomus* of Crosse & Fischer (Miss. Sci. Mexique, Moll., ii, p. 399, 1893) have also been omitted.

The figures that illustrate this monograph look as though drawn by some mechanical devices, and have a most unnatural appearance. The following are corrections of a few errors that I have met with:—

- p. 205. *H. pelevensis*, Shykes, should be *pelewensis*, Sykes.
- p. 48. *H. brownei*, Gray, is put as a sub-species of *palliat*a, Ad., although Gray's species has twenty-five years priority over *palliat*a.
- p. 147. *H. exserta*, Marts., should be *sundiana*, Ancey (= *exserta*, Marts., non Gundl.), as proposed by Ancey in the *Nautilus*, vol. xiv, p. 84, 1900.
- p. 217. Dr. Wagner gives *H. baudinensis*, Smith, and states in a footnote, "ich verwechselte diese Art früher mit *H. walkeri* vom Festlande Australiens." I am informed by Mr. Edgar A. Smith himself that he never described any *Helicina* as *baudinensis*. Dr. Wagner, in his "*Helicinenstudium*" (Denk. Akad. Wien, 1905, p. 430), gave the correct name for the species in question, viz., *Helicina walkeri*, Smith (Proc. Malac. Soc., vol. i, p. 90, 1894). The localities given by Smith were Queens, Baudin, and Parry Islands. This species should therefore read, *H. walkeri*, Smith (= *baudinensis*, Wagner).
- p. 248. *Helicina rufocallosa*. This is incorrectly ascribed to E. R. Sykes. The species is really *H. rabei*, Pils., *Nautilus*, 1897, vol. xi, p. 34. Although Ancey, in the *Nautilus*, vol. xi, p. 87, 1897, claimed to have described a *H. rufocallosa* prior to *H. rabei*, Pils., I am unable to find any record of its publication, and it does not appear in the list of Ancey's species given by Geret in the *Journ. de Conch.*, 1909, p. 1.
- p. 259. *H. zoe*, var. *gebeana*, Smith. Mr. Smith assures me that he has never given a *Helicina* the name of *gebeana*; it should therefore bear Dr. Wagner's name as author.
- p. 262. *H. diversicolor*, Cox. This should read *H. draytonensis*, Pfr. (not *dryatonensis* as Dr. Wagner puts it), P.Z.S., 1856 (= *diversicolor*, Cox, P.Z.S., 1866).
- p. 296. *H. ghiesbreghti* should be *H. ghiesbreghti*.
- p. 343. *Lucidella foxi*, Pils. Add reference, *Nautilus*, vol. xxiii, p. 56, 1899.

The following list of omitted species is taken from Pfeiffer's Monog. Pneumonopomorum Viventium, Supp., iii, 1876, and the Zoological Record from 1879 to 1913:—

- anaguana*, Weindl., J. B. Malak. Ges., vol. vii, p. 352, 1880.
- antoni*, Pfr., Zeit. Malak., p. 88, 1848. Honduras.
- baldwini*, Ancey, Proc. Malac. Soc., vol. vi, p. 126, 1904. Kauai Island.
- berniceia*, Pils. & Cooke, Honolulu Occ. Papers, Bishop Mus., 1910. Hawaii.
- biangulata*, Pfr., Zeit. Malak., p. 192, 1850. Hab. ?
- bicolor*, Pfr., P.Z.S., p. 146, 1852. Tahiti.
- bitaniata*, Hartm., Proc. Acad. Nat. Sci. Philad., p. 286, 1890. Society Islands.



- bourailensis*, Hartm., Proc. Acad. Nat. Sci. Philad., p. 93, 1889.  
New Caledonia.
- bulia*, Pfr., P.Z.S., p. 145, 1852. Hab. ?
- cacaguelita*, Pils. & Clapp, Nautilus, vol. xv, p. 136, 1902. Colombia.
- candeana*, Orb., Voy. dans l'Amérique Mérid., p. 360, 1837. Caraccas.
- carinata*, Orb., Synopsis in Mag. Zool., Moll., p. 28, 1835. Bolivia.
- chrysocheila*, Binney, Terr. Moll. U.S., vol. ii, p. 354, 1851. Mexico.
- consors*, Ancey, Bull. Soc. Malac. Fr., vol. iv, p. 41, 1887.  
Marquesas Island.
- cornea*, Sow., Thes. Conch., vol. i, p. 13, 1842. Hab. ?
- crassidens*, Tate, Trans. Roy. Soc. S. Aust., vol. xxiii, p. 247, 1899.  
South Australia.
- crassilabris*, Phil., Zeit. Malak., p. 125, 1847. Sandwich Islands(?).
- derepta*, Tapp.-Canefri, Ann. Mus. Genova, vol. xix, p. 278, 1883.  
New Guinea.
- diaphana*, Pfr., P.Z.S., p. 98, 1850. Honduras.
- dissotropis*, Ancey, Proc. Malac. Soc., vol. vi, p. 127, 1904. Oahu  
Island.
- ecuadoriana*, Miller, Malak. Blätt. (2). vol. i, p. 146, 1879. Ecuador.
- exigua*, Pfr., P.Z.S., p. 121, 1848. Honduras.
- flammea*, Quoy & Gaim., Voy. Astrol., Moll., vol. ii, p. 193, 1832.  
Tonga Island.
- goniostoma*, Sow., Beechey Voy., Zool., p. 145, 1839. Hab. ?
- gonochila*, Pfr., P.Z.S., p. 121, 1848. Venezuela.
- gossei*, Pfr., P.Z.S., p. 122, 1848. Jamaica.
- grayana*, Pfr. (*Trochatella*), Zeit. Malak., p. 85, 1848. Jamaica.
- grenadensis*, Smith, Proc. Malac. Soc., vol. i, p. 318, 1895.  
Grenada, W.I.
- halmaherica*, Kobelt, Abh. Senck. Ges., vol. xxiv, p. 39, 1897.  
Halmahera Island.
- hawaiiensis*, Pils. & Cooke, Honolulu Occ. Papers, Bishop Mus., 1910.  
Hawaii.
- leighwayana*, Dall, Smiths. Inst. Misc. Coll., p. 362, 1909. Brazil.
- hirsuta*, C. B. Ad., Ann. Lyc. N. York, vol. v, p. 49, 1852. Jamaica.
- japonica*, var. *echigoensis*, Pils., Nautilus, vol. xvi, p. 131, 1903. Japan.
- juddii*, Pils. & Cooke, Honolulu Occ. Papers, Bishop Mus., 1910.  
Hawaii.
- kauaiensis*, Pils. & Cooke, Honolulu Occ. Papers, Bishop Mus., 1910.  
Hawaii.
- kieneri*, Pfr., P.Z.S., p. 122, 1848. Caraccas.
- knudseni*, Pils. & Cooke, Honolulu Occ. Papers, Bishop Mus., 1910.  
Hawaii.
- lanieriana*, Orb., Moll. Cuba, vol. i, p. 245, 1841. Cuba.
- lens*, Lea, Observ., vol. i, p. 161, 1840-2. Fiji Islands.
- lenticularis*, Sow., Cat. Tank., App., p. viii, No. 1024, 1825.  
Pacific islands.
- leptalea*, Ancey, Le Naturaliste, p. 104, 1901. Bolivia.
- leucostoma*, Tapp.-Canefri, Ann. Mus. Genova, vol. xix, p. 275, 1883.  
New Guinea.
- leucozonalis*, Ancey, Journ. Conch., vol. vii, p. 95, 1892. Brazil.

- livida*, H. & J., Voy. Pol. Sud., Moll., p. 47, 1854. Solomon Islands.
- louisianensis*, Forbes, Voy. Rattlesnake, App., p. 382, 1851. Louisiana Islands.
- lutea*, Lesson, Voy. Coquille, Zool., vol. ii, p. 350, 1831. New Guinea.
- lymaniana*, Pils. & Cooke, Honolulu Occ. Papers, Bishop Mus., 1910. Hawaii.
- macilenta*, C. B., Ad. Contrib. Conch., No. 1, p. 13, 1849. Jamaica.
- maculata*, Sow., Thes. Conch., vol. i, p. 7, 1842. South America.
- margaritacea*, Lesson, Voy. Coquille, Zool., vol. ii, p. 350, 1831. New Guinea.
- maxima*, Sow. (Alcedia), P.Z.S., p. 6, 1842. Jamaica.
- merdigeri* (Salle), Pfr., P.Z.S., p. 102, 1855. Mexico.
- multicoronata*, Hedley, Proc. Linn. Soc. N.S.W., vi, p. 115, 1891. British New Guinea.
- nehoueensis*, Hartm., Proc. Acad. Nat. Sci. Philad., p. 93, 1889. New Caledonia.
- newcombiana*, Weinl., J. B. Malak. Ges., vol. vii, p. 351, 1880. Haiti.
- nobilis*, C. B. Ad., Ann. Lyc. New York, vol. v, No. 2, p. 49, 1852. Jamaica.
- novella*, Mabille, Bull. Soc. Autun, vol. viii, p. 400, 1896. New Hebrides.
- novoguineensis*, Smith (= *fischeriana*, var.), Ann. Mag. Nat. Hist., p. 425, 1887. New Guinea.
- nunanensis*, Pils. & Cooke, Honolulu Occ. Papers, Bishop Mus., 1910. Hawaii.
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- sanguinea*, Pfr., P.Z.S., p. 124, 1848. Honduras.
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- varians*, Sykes, Journ. Malac., vol. x, p. 67, 1903. Santa Cruz Islands.
- versilis*, Ancey, Bull. Soc. Malac. Fr., vol. iv, p. 42, 1887. Marquesas Islands.
- vestita* (Guild), Sow., Thes. Conch., vol. i, p. 14, 1842. North America.
- woodlarkensis*, Smith, Ann. Mag. Nat. Hist., vol. viii, p. 138, 1891. Woodlark Island.
- zebriolata*, Pfr., P.Z.S., p. 101, 1865. Lord Howe's Island.

When consulting the Zoological Record I noticed a *Helicina trochiformis*, Miller (fossil), Stuttgart Jahreshefte Ver. Natk., 1907, p. 452. Since this name is preoccupied by Sowerby, Proc. Zool. Soc., 1842, p. 7, I suggest it be changed to *milleri*.

As Mr. E. R. Sykes has noted in Proc. Malac. Soc., vol. iv, p. 260, 1901, a *Helicina suprafasciata*, Sow., and it also appears in the Paetel Catalogue, I may state that I have been unable to find any further reference or description of such a species.

There are also a good many typographical errors in the index of Dr. Wagner's monograph; for example, *joshiwarana* should be *yoshiwarana*, *inignis* is put for *insignis*, *rellei* for *rollei*, etc.

DESCRIPTION OF A SUPPOSED NEW SPECIES OF  
*PLACOSTYLUS*.

By HUGH C. FULTON.

Read 8th January, 1915.

*PLACOSTYLUS* (*CALLISTOCHARIS*) *SUBROSEUS*, n.sp.

SHELL very narrowly umbilicate, oblong-ovate, moderately solid, of a pale pink ground colour with a thin, pale greenish cuticle on the last half-whorl, the latter ornamented by irregular longitudinal markings of a darker green; apex somewhat obtuse; nucleus very finely punctured; whorls five, convex; aperture elongately oval, light orange colour within, of a deeper shade near the outer margin;



peristome expanded, whitish; columella white, triangularly expanded at the upper part; columellar plait rather flat and thin, not noded. Alt. 44, diam. maj. 20 mm.; height of aperture (with peristome) 26 mm.

*Hab.*—Viti Islands (Godeffroy Museum).

Similar in form to *P. gracilis*, Brod., but a little narrower, and with decidedly weaker sculpture. The aperture is relatively longer than in *P. guamensis*, Garr., and shorter than that of *gracilis*; it differs from both in coloration and in the shape of its columellar fold or plait.

**For information concerning the**  
**MALACOLOGICAL SOCIETY OF LONDON**

**See page iv of this wrapper.**

# Malacological Society of London.

(Founded 27th February, 1893.)

Officers and Council—elected 12th February, 1915.

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**Vice-Presidents** :—A. S. KENNARD, F.G.S.; R. BULLEN NEWTON, F.G.S.;  
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By kind permission of the Council of the LINNEAN SOCIETY, the **MEETINGS** are held in their apartments at BURLINGTON HOUSE, PICCADILLY, W., on the **SECOND FRIDAY** in each month from **NOVEMBER** to **JUNE**.

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

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

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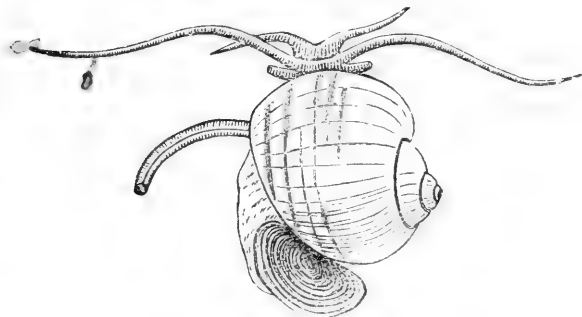
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# PROCEEDINGS

## OF THE

# MALACOLOGICAL SOCIETY

## OF LONDON.



EDITED BY

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

*Under the direction of the Publication Committee.*

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# MALACOLOGICAL SOCIETY OF LONDON.

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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 23, 1915.

A. S. KENNARD } Auditors.  
FRANCIS W. READER }

## ANNUAL GENERAL MEETING.

FRIDAY, 12TH FEBRUARY, 1915.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

Mr. C. P. Crick and Mr. F. W. Reader were appointed scrutineers.  
The following report was read:—

“Your Council, in presenting their twenty-second Annual Report, have much pleasure in recording once more a year of steady progress.

“The papers printed during last year, while somewhat less voluminous than those of the few preceding years, have maintained their usual standard of excellence.

“It is with considerable regret your Council have to record the loss by death of a distinguished member, Mr. A. J. Jukes-Browne, F.R.S., while, owing to resignation and other causes, five more names have been removed from the Society’s roll.

“During the year two new members have been elected, so that the membership of the Society on December 31st, 1914, stood as follows:—

Ordinary members . . . . .	71
Corresponding members . . . . .	90
	<hr/>
Total . . . . .	161

“The financial state of the Society is fairly satisfactory. We have no liabilities, while on the other hand we retain £20 on the Special Account, still possess £50 in Metropolitan stock, and commence the year with a small credit balance.

“As usual three parts of the ‘Proceedings’, Vol. XI, parts 1–3, have been published during the past year. They comprise 188 pages of text, illustrated with 5 plates and 62 text-figures.

“The following authors have very kindly assisted in the cost of these illustrations, or have provided drawings or photographs for reproduction: C. R. Boettger, the Rev. E. W. Howell, H. C. Fulton, C. Hedley, T. Iredale, A. S. Kennard, H. B. Preston, E. A. Smith, and B. B. Woodward.

“Further, the thanks of the Society are especially due to the Council of the Linnean Society, through whose kindness it has been permitted, as in former years, to hold its meetings in Burlington House.”

On the motion of Mr. Charles Oldham, seconded by Mr. C. P. Crick, the above was adopted as the Annual Report of the Society.

The following were elected Officers and Council for the year 1915:—  
*President*.—The Rev. A. H. Cooke, M.A., Sc.D., F.Z.S.

*Vice-Presidents*.—A. S. Kennard, F.G.S., R. Bullen Newton, F.G.S., H. B. Preston, F.Z.S., J. R. le B. Tomlin, M.A.

*Treasurer*.—J. H. Ponsonby, F.Z.S.

*Secretary*.—G. K. Gude, F.Z.S.

*Editor*.—E. A. Smith, I.S.O.

*Other Members of Council.*—G. C. Crick, F.G.S., T. Iredale, G. C. Robson, B.A., F. H. Sikes, M.A., F.L.S., E. R. Sykes, B.A., F.L.S., B. B. Woodward, F.L.S.

On the motion of the Rev. E. W. Bowell, seconded by Mr. E. Collier, a vote of thanks was passed unanimously to the Retiring Officers and Members of the Council, and to the Auditors and Scrutineers.

#### ORDINARY MEETING.

FRIDAY, 12TH FEBRUARY, 1915.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

The President delivered his Annual Address, entitled "The genus *Clausilia*: a study of its geographical distribution, with a few notes on the habits and general economy of certain species and groups".

Mr. A. S. Kennard proposed and Mr. Charles Oldham seconded a vote of thanks to Dr. Cooke for his address, and requested him to allow the same to be printed *in extenso* in the Society's Proceedings.

#### ORDINARY MEETING.

FRIDAY, 12TH MARCH, 1915.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

The following communications were read:—

1. "On *Helicella* (*Candidula*) *crayfordensis*, n.sp., from the Pleistocene deposits of South-Eastern England." By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S.

2. "On the Mounting of Radulæ for microscopic examination." By the Rev. E. W. Bowell, M.A.

3. "Note on *Hygromia hispida*, v. *nana*, Jeff." By the Rev. E. W. Bowell, M.A.

4. "Notes on Swainson's *Exotic Conchology*." By C. Davies Sherborn and Alexander Reynell.

Mr. A. Reynell exhibited proof plates of Sowerby's sale catalogue of the Tankerville Collection. These plates were quarto size, the catalogue having been issued in octavo size.

#### ORDINARY MEETING.

FRIDAY, 9TH APRIL, 1915.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

Mr. A. E. Salisbury was elected a member of the Society.

The following communications were read:—

1. "On *Ranella leucostoma*, Lamarek." By E. A. Smith, I.S.O.

2. "Note on *Nautilus mokattamensis*, A. H. Foord, from the Eocene of Egypt." By G. C. Crick, F.G.S.

3. "Some more misused Molluscan Generic Names." By Tom Iredale.

4. "On Humphrey's *Conchology*." By Tom Iredale.

Mr. A. S. Kennard exhibited vol. ii of the second edition of Ross' *Voyage of Discovery to the Arctic Regions*, in which the section relating to shells, by Leach, contains diagnoses of some genera and species occurring as *nomina nuda* in the first edition, both editions bearing the date 1819.

The Secretary, on behalf of Mr. Y. Hirase, exhibited part ii of *The Illustrations of a Thousand Shells*, published by the latter in Kyoto. The work, which is issued without text, contains numerous exquisite figures reproduced from wood-blocks and coloured by hand.

Mr. A. Reynell exhibited India proofs of the woodcut illustrations to Broderip's article on the Conchacea in Knight's *Penny Cyclopædia*, issued about 1833.

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## OBITUARY NOTICE.

WITH deep regret we have to chronicle the death of A. J. JUKES-BROWNE, which took place at Torquay on August 14 of last year, in his 64th year. He was a nephew of the distinguished geologist, Professor J. Beete Jukes, F.R.S., from whom he derived his compound name. Educated at Cholmondeley School, Highgate, and later at St. John's College, Cambridge, he obtained his B.A. degree in 1874, and in the same year received an appointment on the Geological Survey of Great Britain, under Sir Andrew Ramsay, which he held for twenty-seven years, retiring through ill-health in 1901. He became a Fellow of the Geological Society in 1874, being awarded the Lyell Fund in 1885 and the Murchison Medal in 1901 for meritorious services to geological science. In 1909 he was elected to the Fellowship of the Royal Society. He was a prolific writer on geology in all its branches, and one of our principal authorities on British Cretaceous rocks, his memoirs being mainly published by the Geological Survey, the Geological Society, and in the *Geological Magazine*. He also issued some important treatises on geology, including *The Students' Handbook of Historical Geology*, *The Building of the British Isles: A study in Geographical Evolution*, and *The Students' Handbook of Stratigraphical Geology*; so popular were these works that they sometimes reached two and three editions. While his writings dealt exhaustively with stratigraphy he never neglected the value of palæontological details, being convinced that only by strict zonal work on the fossils characterizing the different strata could accuracy be attained in the classification of the sedimentary deposits. He saw the necessity, therefore, of dividing the Chalk formation into zones, using, as previously suggested by Dr. Barrois and other workers, molluscan species, among other organisms, as index-fossils for the different beds concerned. He wrote, also, on the geology of Barbados in association with J. B. Harrison, and on Cyprus with C. V. Bellamy, while his last published paper, undertaken in conjunction with the present writer, revised the determinations of some Devonian fossils from Torquay made in one of the late Rev. G. F. Whidborne's memoirs, which appeared in the *Geological Magazine* for August last year, just two weeks before he passed away.

Jukes-Browne became a member of the Malacological Society in 1899, and two years later joined the Conchological Society of Great Britain and Ireland. Although unable to attend meetings on account of chronic constitutional weakness, he nevertheless contributed some important and critical essays on the Pelecypoda, both recent and fossil, which treated chiefly of hinge and other internal structures in connexion with the family Veneridæ. He took a warm interest in the vexed question of nomenclature and was always strongly opposed to the use of Bolten's names, which, however, are now very generally adopted by the leading conchologists of the world. He will be remembered by many of us as a voluminous correspondent, because being debarred from visiting museums or collections to examine

types, on account of bodily infirmity, he was obliged to obtain assistance from his co-workers in this direction, before finally presenting a paper for publication. It is no exaggeration to say that such inquiries were often of so analytical a character that a week's research work would sometimes be necessary before a suitable reply could be prepared. As one who was always struggling with impoverished health, it is not a little surprising that he should have accomplished so much, but being fortunately gifted with strong and active mental powers he was enabled to overcome the difficulties attendant upon physical weakness, and in the end to leave an honoured name as an earnest investigator in the realms of natural science.

His papers published in the Proceedings of the Malacological Society are as follows:—

- "A Review of the Genera of the family Mytilidæ": vol. vi, pp. 211-24, 1905.
- "The Application of Poli's Generic Names": vol. viii, pp. 99-103, 1908.
- "On the Genera of Veneridæ represented in the Cretaceous and Older Tertiary Deposits": vol. viii, pp. 148-77, pl. vi, 1908.
- "The Application of the names *Gomphina*, *Marcia*, *Hemitapes*, and *Katelysia*": vol. viii, pp. 233-46, pl. x, 1908.
- "On *Petricola*, *Lucinopsis*, and the family Petricolidæ": vol. ix, pp. 214-24, 1910.
- "On the Names used by Bolten and Da Costa for genera of Veneridæ": vol. ix, pp. 241-52, 1911.
- "The Nomenclature of the Veneridæ: a Reply to Dr. W. H. Dall": vol. x, pp. 36-8, 1912.
- "The genus *Dosinia* and its Divisions": vol. x, pp. 95-104, 1912.
- "On *Dosinia lucinialis* (Lamk.) and its Synonyms": vol. x, pp. 214-16, 1912.
- "On *Tivela* and *Grateloupia*": vol. x, pp. 266-73, 1913.
- "On *Callista*, *Amiantis*, and *Pitaria*": vol. x, pp. 335-47, 1913.
- "A Synopsis of the family Veneridæ": vol. xi, pp. 58-74, 1914.
- "A Synopsis of the family Veneridæ," Part II: vol. xi, pp. 75-94, 1914.

Further molluscan papers published in other journals include—

- "On some questions of Nomenclature": Journ. Conch., vol. xi, pp. 97-103, 1904.
- "*Tapes aureus* and its Allies": Journ. Conch., vol. xi, pp. 275-81, 1906.
- "On a New Species of *Clementia*": Ann. Mag. Nat. Hist., ser. VIII, vol. xii, pp. 58-62, pl. i, 1913.
- "On the Shells known as *Gemma*, *Parastarte*, and *Psephidia*": Ann. Mag. Nat. Hist., ser. VIII, vol. xii, pp. 473-80, 1913.
- "Note on *Clementia subdiaphana*, Carp.": Ann. Mag. Nat. Hist., ser. VIII, vol. xiii, pp. 338-9, 1914.

R. BULLEN NEWTON.

## PRESIDENTIAL ADDRESS.

*Delivered 12th February, 1915.*THE GENUS *CLAUSILIA*: A STUDY OF ITS GEOGRAPHICAL DISTRIBUTION, WITH A FEW NOTES ON THE HABITS AND GENERAL ECONOMY OF CERTAIN SPECIES AND GROUPS.

By the Rev. A. H. COOKE, M.A., Sc.D., F.Z.S.

THE genus *Clausilia* is as interesting a group as any among the land Mollusca. It is well characterized, and stands, to a certain extent, isolated. To the systematist it offers problems of classification, based, in the main, on an examination of the complicated processes which it has developed for closing the mouth of the shell. To the student of distribution, the sphere and limits of its occurrence, which are well marked, may contribute, if handled with reasonable care, evidence bearing on the question of the ancient connexion of lands now widely separated.

An authority on the genus, as great as any who have ever lived, Dr. O. Boettger, regarded *Balea*, with its sinistral spire, its lack of clausilium, lamellæ, and plicæ, and its occasional rudiment of a parietal tubercle, as the progenitor of the Clausiliidæ, and he considered the living *Balea* of the present day, with their very remarkable geographical distribution (Europe, Tristan d'Acunha, South Africa, New Zealand), as salvage from the wreck of the ancient genus strong enough to resist the lapse of ages. *Clausilia* first appears in the Lower Eocene (*Oospira*, *Pseudonenia*) and Upper Eocene (*Disjunctaria*, *Albinaria*?), and is common in the Miocene (*Triptychia*, *Canalicia*, *Eualopia*, *Serrulina*, *Constricta*). Boettger's view was that from an original type possessing neither clausilium, plicæ, nor lamellæ, the present-day forms, with their elaborate oral armature, developed in more or less regular sequence. In confirmation of this view, he pointed out that there occur, in Tertiary formations, *Clausilia* without a clausilium (certain recent *Alopiæ* being probably relics of these), *Clausilia* with rudiments of lamellæ, or with undeveloped plicæ in place of a lunule, and *Clausilia* possessing other indications of developmental stages, and showing transitions from a less to a more specialized form.

H. A. Pilsbry, whose views on *Clausilia* carry great weight, holds (47) that the East Asiatic Clausiliidæ (*Phædusa*) are much more closely related to early Tertiary than to modern European groups. (Boettger indeed suggests that *Eualopia* may be the *Balea*-form originating *Phædusa*.) There is reason to believe that, as in the case of the Belogonous Helicidæ, a common stock of Clausiliidæ spread over Asia and Europe, at least as early as the Eocene period. Subsequent evolution in the East and West has been, he holds, along independent lines, and, as in the Helicidæ, the European stock has forged ahead, while the Oriental, on the whole, looks backward, many groups retaining their old characters.

*Habits and Economy.*—The habits and mode of life, the food and general economy of the genus have been very imperfectly studied. It would seem incredible, were it not the fact, that although scores of fine and handsome species of *Clausilia*, from e.g. Japan, China, and Tongking, have been discovered and named, scarcely a single word has ever been written on the conditions of life under which even one of them exists. Over fifty species of *Nenia* have been described from South America; all that is known of their life is that one species (*steeriana*, Sykes) lives “on the plains, under stones”, and another (*pampasensis*, Dall) “on cactus and mimosa trees”. It may be hoped that a time is coming when it will be regarded as a sound contribution to scientific knowledge to accumulate facts bearing on the life-history of the Mollusca.

Some groups, *Alopi*a for instance, are found exclusively on limestone rock, and not on all limestone, but only on limestone of a particular formation. *Medora* and *Agathylla* are also rock-loving groups, but while *Alopi*a is extremely partial to shade, and rarely ventures into the sunlight, many species of *Medora*, *Agathylla*, and *Albinaria* hang their white or blue-grey shells in the full rays of the sun. The group *Marpessa*, smooth and lustrous shells, to which our own *laminata*, Mont., belongs, lives on smooth tree-trunks, such as the beech, ash, and sycamore, and I have observed, in the Carpathian forests, that such *Marpessa* as *orthostoma*, Menke, and *marginata*, Zgl., prefer the trunks of young trees, and seldom occur on old ones. Although the forests of Transylvania often grow right up to the face of a cliff, on which *Alopi*a may be swarming in hundreds, you will never find an *Alopi*a on the trees, nor a *Marpessa* on the cliffs. The reason is, that the *Alopi*a devour the decomposed surface of the limestone, on which they find some minute vegetable food, while *Marpessa* and other tree-loving groups find their nutriment on the equally minute organisms which grow on the bark, or in the mosses which gather in the cracks of the trunks. Pine-trees are seldom climbed by *Clausilia*, the resinous nature of the bark probably being disliked, but I have noticed a *Pseudalinda* (*cana*, Held) and a *Pirotoma* (*dubia*, Drap., var.) quite exceptionally on pine-trees 6 feet from the ground.

Again, some species are ground-loving, and seldom venture off the level. Such is our own *Pirotoma rolphii* (Gray), but we must not conclude that all *Pirotoma* are ground-loving; on the contrary, *plicatula*, Drap., and *parvula*, Stud., live habitually on rocks and trees. *Euxina mæsta*, Fér., near Beirût, buries itself among loose stones and earth to a depth of several inches, but probably not all *Euxina* have this habit, although a species (*corpulenta*, Friv.) I met with at Brussa in Asia Minor lives habitually on banks at the roots of grass. A species of *Pseudalinda* (*fullax*, Rossm.), common in the East of Europe, is also a ground-loving shell, living at the roots of bushes and nettles, often under layers of dead leaves, on which it feeds, and seldom mounting rocks. A tiny *Graciliaria* (*filograna*, Zgl.) conceals itself under dead leaves and in cracks on the ground. One notices that species which crawl on the ground and do not hang suspended are often of corpulent habit, while many species which hang are narrow and produced:



mechanical causes may contribute to this result. The group *Siciliaria*, peculiar to Sicily, contains many species remarkable for their latticed ribbing, a feature characteristic of most of the group *Agathylla*. Yet, while *Agathylla* adheres to steep rocks, *Siciliaria* is habitually found under loose and flat stones, often decollated, and disfigured with clay. I am inclined to attribute the frequent decollation of adult specimens of this group to its particular habitat, and shall be surprised if a common Himalayan species, *Cylindrophædusa cylindrica* (Pfr.), which is always decollated, does not live in a similar way.

Two species at least, *Euphædusa tatsui*, B. & S., from Hupé, and *Pirostoma ventricosa*, Drap., from North Europe, are known to be ovoviviparous.

*Clausilia* is intolerant of extreme cold, a fact which is indicated, not only by its hibernation, even in temperate climates, but also by its general geographical distribution. Early in September, 1913, I was seeking a particular species of *Alopiæ* on the top of a mountain between 6,000 and 7,000 feet high, in Roumania, and was disappointed to find nothing but a few dead shells. At last I discovered plenty of living specimens buried from 6 to 9 inches deep in the soil at the foot of the rocks on which they ought to have been climbing, and it then occurred to me that two or three days before an unusually heavy snowfall had covered the range, and the shells must have concluded that winter was upon them, and disappeared accordingly. No doubt all *Alopiæ* which live at a high altitude (and one species lives at the top of the Butschetsch, 8,230 feet) inter themselves deeply in the earth or in the cracks of the cliffs during the winter months. *Albinaria* æstivates by secreting a paper-like epiphragm, by which it glues itself to the underlying rocks, and prevents evaporation. Like many *Xerophila* and some *Buliminus*, it has a black body beneath a white shell, a fact which no doubt serves some purpose in the animal's economy.

Piaget (45) has made some interesting investigations into the altitude to which certain Swiss species can attain. He found that *parvula* and *ventricosa* do not, as a rule, ascend higher than 1,500 m., *cruciata* and *plicatula* than 1,700, while *dubia* and *laminata* can sustain life at 1,850 m. In warm climates these altitudes are greatly exceeded. *Euphædusa waageni*, Stol., is recorded from Murree, West Himalayas, at 9,000 feet, while *Nenia raimondi*, Phil., is found in Peru at over 10,000 feet, in the Cordilleras. All these heights are surpassed by *sennariensis*, Pfr., which is stated by Bourguignat to occur on the Abouna Yousef, in Abyssinia, at 4,024 m.

The genus falls, geographically and conchologically, into three great divisions:—

- I. *Clausilia* proper, inhabiting Europe, South-Western Asia, North Africa, and the Madeira group.
- II. *Phædusa*, inhabiting South and East Asia and certain of the East Indian islands.
- III. *Nenia*, inhabiting South America and one West Indian island.

I. *CLAUSILIA* PROPER.

In Northern, Western, and Central Europe *Clausilia* is poorly represented both in sub-genera and species, while in South and South-East Europe (Austria-Hungary, the eastern shores of the Adriatic, Italy, the Balkan Peninsula, Greece and the Archipelago, and Asia Minor (the sub-genera are numerous and often handsome, while individual species abound.

Four hardy sub-genera, *Marpessa*, *Alinda*, *Cusmicia*, *Pirotoma*, have spread over practically the whole of Europe, from Russia to West France and even Portugal, and from Norway to the Mediterranean. On the other hand, the richness of the *Clausilia* fauna of South-East Europe may be estimated from the following enumeration of the principal sub-genera which find their centre there: *Alopi*, *Triloba*, *Idyla*, *Herilla*, *Delima*, *Dilataria*, *Medora*, *Agathylla*, *Pseudalinda*, *Strigillaria*, *Graciliaria*, and others. *Albinaria* is characteristic of Greece and the islands, *Papillifera* inhabits South Europe, especially the coast lands, *Siciliaria* is peculiar to Sicily.

Within the European region there are four well-marked centres of Clausilian development, quite distinct from one another, and all lying to the south or south-east. It is noticeable that three of these are in close proximity to the sea. They are: (1) Dalmatia, (2) Greece and the islands, (3) Transylvania, (4) Asia Minor, Caucasasia, and Syria. A very rough estimate gives about 450 species belonging to these four centres, as compared with about 230 species from all the rest of the region.

One is struck by a fact, which could be illustrated from other groups of Mollusca, and no doubt from other branches of zoology. Outlying species of a sub-genus will be found, which have either penetrated into regions far from its centre of occurrence, daring pioneers, as one might regard them, of a possible future extension of range, or in some cases relics of a once wider but now contracting distribution. Thus *corynodes*, Held, reaches East France, though *Graciliaria* finds its metropolis in Eastern Europe; a single *Cristataria* (*stussineri*,<sup>1</sup> Bttg.) occurs in Thessaly, though its metropolis is Syria, and even Asia Minor contains practically no *Cristataria*. *Albinaria* exhibits a remarkable extension both east and west; *degregorii*, Plat., occurring in Malta, and *lopedusæ*, Calc., in Lampedusa Island, while *filumna*, Pfr., is a solitary *Albinaria* in Lebanon. An *Agathylla* (whose metropolis is Dalmatia) is found in Syria, a remarkable record, for *Agathylla* is not otherwise found east of Herzegovina, except for one doubtful record in Macedonia. A species of *Serrulina* (*collasi*, Stur.), a group characteristic of Armenia and Caucasasia, has recently been discovered in a cave in Corfu, a clear case of survival, *Serrulina* being only found European in the Miocene. The occurrence of a *Pseudalinda* (*denticulata*, Oliv.) in certain of the North Cyclades is illustrative of the same phenomenon; von Möllendorff regards the species as a *Strigillaria*.

<sup>1</sup> Von Möllendorff regards this species as a *Carinigera*, to be classified with *eximia*, Mdf., and *lophauchen*, Stur.

*British Isles*.—In Britain we have five species of *Clausilia*, belonging to the four sub-genera *Marpessa* (*laminata*, Mont.), *Alinda* (*biplicata*, Mont.), *Cusmicia* (*dubia*, Drap., *bidentata*, Str.), *Pirotoma* (*rolphii*, Gray). The present distribution<sup>1</sup> of these species in Britain is—

*laminata*: All England except Cornwall and Hunts, but only in three of the twelve counties of Wales, viz. Glamorgan, Merioneth, Denbigh; Edinburgh, Fife and Kinross, Mid and North Perth, Kincardine; Ireland in six counties only, stretching north-west and south-east from Sligo to Wicklow.

*biplicata*: Surrey, Middlesex, Herts, Cambs (all adjacent counties), Gloucester East. Rapidly becoming extinct.

*dubia*: I omit, the range being still under question.

*bidentata*: All British islands from Jersey to Shetland.

*rolphii*: All south and south-east counties south of Thames (except Dorset, Somerset, Cornwall), Herts, Northants, Monmouth, Salop, Lincoln (furthest north). Not in Ireland.

The following species, now living on the Continent, have been found fossil only in England: *parvula*, Stud. (Pliocene, Hunts)<sup>2</sup>; *pumila*, Zgl., var. *sejuncta*, West. (Pleistocene, Cambs, Hunts); *ventricosa*, Drap. (Pleistocene, Hunts); *plicatula*, Drap., from Copford (S. V. Wood, Crag Mollusca, ii, p. 307), is a misidentification for *rolphii*. The following have not been identified with any Continental forms: *striatula*, Edw. (Eocene, Isle of Wight), *pliocena*, S. V. Wood (Coralline Crag, Suffolk).

*Scandinavia and Denmark*.—Norway and Sweden, from their close connexion with the Continent, are far richer in *Clausilia* than Britain. All our five species occur in one or the other, and Norway possesses three and Sweden four besides. No sub-genus is present which is not also British. The occurrence of a *Papillifera* (*nilssoni*, West.) in Sweden seems very doubtful. *C. rolfii* reaches Christiania,<sup>3</sup> *biplicata* and *plicatula*, Bergen, *laminata* has been found at Trondhjem, and *bidentata* as far north as Tromsö (69° 40' N.); *cruciata*, Stud., which reaches Sweden, has not yet been found in Denmark.

Denmark, on the whole, is not a very favourable country for *Clausilia*. Ten species are found, and all the sub-genera are still those of North Europe. Three species occur which are not in Norway and Sweden, viz. *parvula*, Stud. (Zealand, very rare), *pumila*, Zgl. (Zealand and Bornholm, doubtful from Scandinavia), *lineolata*, Held (South and East Fünen only). Schleswig-Holstein shows no addition to the list. There is no *Clausilia* in the North Frisian

<sup>1</sup> The facts are taken in the main from the official records of the Conchological Society, and are kindly furnished me by Mr. W. D. Roebuck. For *bidentata* in Shetland, see Jeffreys, Brit. Conch., i, p. 279.

<sup>2</sup> I am indebted to the kindness of Mr. A. S. Kennard for this information.

<sup>3</sup> The following seems interesting:—

	Furthest north in England.	In Norway.
<i>rolphii</i>	53° 30' N. lat.	60° N. lat.
<i>biplicata</i>	52° 30' „	61° „
<i>laminata</i>	57° „	64° „

islands. I have no record of any from the Faroe, nor is there any species in Iceland.

*France*.—Moquin-Tandon (39) in 1855 catalogued fourteen species as inhabiting France, including two found only in Corsica. France was not so large in 1894 as she was in 1855, but Locard (28) in 1894 enumerated ninety-six species of *Clausilia* from France (not including Corsica), besides four *Nenia*, without the slightest indication of any varieties. A more hopeless wilderness of nomenclature was never constructed.

One group strange to Britain, *Graciliaria*, reaches its western limit in East France (*corynodes*, Held). The group *Lamellifera* (Bourguignat's *Neniatlanta*, see p. 266) is peculiar to the south-west corner of the Pyrenees. *Papillifera* is represented by two or three species in the far south. *P. leucostigma*, Rossm. (a Central and South Italian form), occurs abundantly in the Arènes at Nîmes, evidently introduced some while ago. An Italian *Delima* (*itala*, Mts., var. *punctata*, Mich.), according to Mergier, has passed the frontier, and is advancing westward in Vaucluse. Except in the south, the whole fauna is North European.

Corsica possesses only three species, one peculiar (*porroi*, Pfr. = *meissneriana*, Sh.); the other two are the ubiquitous *laminata* and *bidens*.

*The Iberian Peninsula*.—Hidalgo (23) has catalogued twelve species in all from Spain and Portugal. Some of these are very doubtful. A careful scrutiny gives five species to Spain and perhaps three to Portugal, with one common to both. *Cusmicia* is the chief sub-genus. *Papillifera bidens* occurs on the Eastern littoral, and is also the only *Clausilia* in the Balearic Islands. Nobre (43) admits only two species in his list of Portuguese land Mollusca. Clearly the climate and soil of the peninsula are not favourable to the genus.

*Germany and Switzerland*.—When we reach Germany the fauna at once assumes a Central European character, which becomes more marked the further south and east we go. *Strigillaria*, *Fusulus* (an Alpine form), *Erjavecica* (in Bavaria), *Graciliaria*, and even *Delima* now appear, the latter only in the Bohemian and Silesian mountains, where *D. ornata*, Zgl., is the only true *Delima* found north of the Alps. *Pirostoma* has now seven species, *Marpessa* three. Half the species, which number about twenty-five to thirty, are widely distributed; about a third are 'Eastern' in origin.

The Alps in the south effectually block the way for the spread of any southern species, and the political distinction between Germany and Austria is calmly ignored by the Mollusca, Bohemia being essentially 'German' and Silesia equally 'Austrian' in character. The presence of a *Graciliaria* (*filograna*, Zgl.) in the Harz Mountains, of a *Strigillaria* (*cana*, Held) as far north as Rügen, and of *rolphii*, Gray, in the north-west only, are to be noted. The Prussian Rhine provinces nourish a *Clausilia* fauna essentially northern in character, and a list from this district by C. R. Boettger (2) scarcely differs from a list from South Sweden.

The *Clausilia* of Switzerland are, as would be expected, of a type

almost entirely northern; the greater altitude balancing the more southern latitude. One observes little that is characteristic in the lists that are published. *Marpessa orthostoma*, Zgl., penetrates to the cantons of Neuchatel, Berne, and Vaud, and is even found in the neighbourhood of Basel. One Alpine species, *Dilataria diodon*, Stud., appears to be peculiar to Canton Wallis. The fauna of the Swiss valleys to the south of the Alps naturally has a North Italian character; *Delima*, for instance, penetrates to the southern base of the mountains, and at Lugano *D. itala*, Mts., is abundant.

*Austria-Hungary*.—Clessin's work (18) excludes Bosnia, Herzegovina, and Dalmatia, and the group *Alopi*a will be treated of separately. Even with these subtractions the lists include sixty species (and more have since been added), classified as follows:—

Widely distributed species	.	.	.	11
Eastern species	.	.	.	22
Southern species	.	.	.	15
Alpine species	.	.	.	12

The principal features of this rich fauna are (a) the great increase of *Marpessa*, 13 spp., six of these being 'southern' and five 'eastern' forms; (b) the increase of *Cusmicia* (9 spp.), *Piostoma* (9 spp.), and *Graciliaria* (5 spp.); (c) the appearance of a couple of *Herilla* and *Idyla*, thoroughly East European groups; (d) the occurrence of *Pseudalinda* (4 spp.) and *Uncinaria* (8 spp.) in Transylvania, and of *Delima* (4 spp.) in South Tirol and other southern states. The limestone regions of Styria, Carinthia, Croatia, with the Banat in South Hungary, and the Siebenbürgen region in the Far East, are all rich districts, abounding in species. The Velebit range, separating South Croatia from North Dalmatia, is another thickly populated region, from which many new, and some dubious, species are described.

The occurrence of about seventy-two species, sub-species, and varieties of the sub-genus *Alopi*a, which crowd the cliffs of the East Carpathians, and have outliers as far west as Torna, not far from Buda Pesth, is one of the most striking features of the European *Clausilia* fauna. Sober considerations may reduce the species to about twenty; at least five of these are destitute of clausilium; some species are dextral, others sinistral, others indifferently dextral or sinistral. The range of individual species is singularly contracted, often to the limits of a solitary mountain-top, a ravine, a limestone cliff. Authors agree in placing the group in close relationship with the extinct *Triptychia* (which lacks clausilium) on the one side, and with *Eualopia* (Lower and Middle Miocene) and *Triloba* on the other. No one who has ever collected *Alopi*a can fail to be struck with its entire divergence, as regards general habits, from any other Clausilian group. A species has been reported from North Greece, and two others from Montenegro (see p. 256); further examination of their true position is desirable.

*Bosnia, Herzegovina, and Dalmatia* are rich in *Clausilia* beyond any other part of Europe. In North Bosnia we have the huge *Herilla bosnica*, Pfr., and *H. dacica*, Friv., which rank among the largest

European species. *Delima* (about ninety species), *Medora* (twenty-four species), and *Agathylla* (thirteen species) are the characteristic sub-genera, *Medora*, with its smooth, blue-grey shells, ranging from Carniola and Croatia to Cattaro, and (*punctulata*, Küst.) just reaching Italy, *Agathylla*, with its pretty latticed forms, being almost confined to the coast-lands and islands. *Dilatatoria* abounds in the Velebit region. The group *Heteroptycha*, West., is peculiar to Dalmatia. The common sub-genera of Central Europe are crowded out, and even *Papillifera* scarcely occurs. The whole district bears signs of an individual development hardly to be paralleled in any other region of Europe.

*Italy and Sicily.*—The Italian peninsula falls into three divisions, northern, central, and southern, while Sicily stands quite apart. Nowhere is there the same rich development, either of genera or species, as on the eastern coasts of the Adriatic. *Delima* is the characteristic group of North Italy; *Piostoma* and *Marpessa*, abundant in the north, fail in numbers as we go southward. *Papillifera*, on the other hand, is strongest in the south, and has only a few species in the north. *Alinda*, and even *Strigillaria*, pass the Alps, but do not seem to occur in Central or South Italy. The peninsula appears to have developed no characteristic group whatever. A single *Medora* (*punctulata*, Küst.), no doubt a migrant from the East Adriatic, reaches Central and South Italy.

Sardinia has two or three species of *Marpessa*, all peculiar; Elba has only two species of *Papillifera*.

Benoit (1) in 1881 catalogued twenty-five species from Sicily and the neighbouring islands. Since his time many have been added, by the labours of Monterosato and others, not all of which, perhaps, will stand the test of time. The characteristic sub-genus is *Siciliaria*, wholly peculiar to the island. *Papillifera* is common, and there are a few *Delima*, but *Medora*, *Alinda*, and even *Piostoma* and *Marpessa* appear to be entirely absent. Sicilian influence on North Africa is very marked (see p. 260).

The Maltese group contains some remarkable and peculiar forms of *Papillifera*, a single *Delima* (*imitatrix*, Bttg.), and even an *Albinaria* (*degregorii*, Plat.). The solitary island of Lampedusa has a form (*lopedusæ*, Calc.) generally assigned to this same group, and marking its furthest westward extension.

*Montenegro and North Albania*, whose fauna has been catalogued by Wohlberedt (61), are a meeting-ground for East European and Dalmatian influences. The elevated nature of the country differentiates the fauna from that of the North Adriatic littoral. *Medora* and *Agathylla* have only two species apiece, *Delima* has eighteen; on the other hand, there are *Alinda* (three species), *Herilla* (five species), *Pseudalinda* (one species), *Strigillaria* (two species; one is *vetusta*, the common *Strig.* of East Europe). *Triloba*, with two species, is peculiar to this region and Macedonia. The most remarkable fact is the occurrence of two species of *Alopiæ*, *baleiformis*, Bttg., and *durmitoris*, Bttg., the former of which has no clausilium. Boettger remarks: "Whether a special name is necessary for this group,

which connects the true Transylvanian *Alopi*a with the Hellenic *Guicciardi*, Roth, cannot be determined until more representatives have been discovered in the intervening mountains."

The chief points to notice in *Bulgaria*, *Macedonia*, *Servia*, and *Turkey* are the occurrence of *Idyla*, a group which touches South Hungary, *Triloba* (one species), and of *Herilla*. *Pirotoma* and *Cusmicia* are rare or wanting, but *Marpessa* (three species), *Alinda* (three), *Pseudalinda* (two), and *Strigillaria* (two) are still represented. East Servia has the peculiar sub-genus *Carinigera*, which shows relationship on the one side to *Cristataria*, on the other to *Papillifera*. The whole district will repay further exploration.

*Greece and the Islands*.—Characteristic of the Levant, and more particularly of the Greek islands, in which it finds its metropolis, is the section *Albinaria*. O. Boettger, in his well-known monograph (4), enumerates seventy-two species, ranging from (possibly) South Dalmatia to Cyprus, with outliers in Lampedusa to the west, and even in the Lebanon to the east. He remarks with joy that the school of Bourguignat has not yet made any incursion into Græco-Asiatic *Clausiliæ*; but that recently M. Letourneux returned from an expedition to the island of Santorin with three new *Albinaria*, all of which he (Boettger) promptly reduced to mere form or colour varieties of the common *cærulea*, Fér.

The section stands almost alone in Europe in the singularly restricted range of a large number of its species. Thus Crete has more than thirty species, all peculiar; Rhodes, Anaphi, and Skyro each possess their peculiar species; while another group is markedly characteristic of the Ionian Islands and the adjacent mainland. On the other hand, on the mainland, and even on the islands, certain species have a wider range, *cærulea*, Fér., e.g., occurring on almost every island of the Cyclades, and on Eubœa. Some species, particularly of the island groups, can be regarded with more or less certainty as derived from an original form still existent: thus *cærulea* in the eastern islands and *nævosa* in the western have probably given birth to races whose isolation has in time caused them to develop into what we now feel justified in calling distinct species.

Crete stands alone, and is almost isolated: its relation to the Cyclades is slight, with Asia Minor perceptible, with the Morea absolutely none.

*Albinaria*, especially in Crete, is a rock group, and is distributed by the mountains; *Papillifera* is more characteristic of the plains and low hills, which limit the range of *Albinaria*.

Northern Greece is distinguished by a rich development of the East European and Asia Minor sub-genus *Oligoptychia*, and by special groups of *Papillifera* and *Delima*. Two forms of *Agathylla*, a section essentially Dalmatian, occur, *incohata*, Bttg., in Epirus, and *albicosta*, Bttg., in Macedonia. *Medora* is wanting. The sub-genus *Olympia*, with its single species *olympica*, Friv., is peculiar to Mount Olympus. A single *Alopi*a (*guicciardi*, Roth) occurs on Parnassus. A *Pseudalinda* or *Strigillaria* (*denticulata*, Oliv) is found in the northern islands, and in Andros and Tinos. *Idyla*, a sub-genus confined to upland

forests, stretches from Asia Minor through Turkey and Macedonia to North and Central Greece and Eubœa. Boettger gives a striking proof of the former land connexion with Eubœa. On that island occur *Cl. bicristata*, *thessalonica*, *remota*, and *saxicola* in the mountain districts, *Cl. maculosa*, *negropontina*, and others in the hill lands. The former group is found in quite inseparable forms in the high Parnassus district of Central Greece, the latter in the hill lands of Attica. No doubt the *Clausilia* fauna here antedates the separation of Eubœa from the mainland.

*Russia*.—Politically speaking, the Russian Clausilias fall into two very distinct groups. Zoologically, it is preferable to regard the northern, or Sarmatian, group as quite separate from the southern, or Caucasian, and to leave the latter to be considered under Asia Minor. Practically no species is common to the two.

The Sarmatian group is simply an easterly or north-easterly extension of the commoner species which are distributed all over North Europe. None of the characteristic South-Eastern European sub-genera find their way into Russia. Species are scarce; most numerous in the north-west, in the Baltic provinces of Finland and Livland, but as we proceed east and south it is not a case of fresh species appearing, as these die out, but the whole Clausilian fauna slowly and steadily vanishes altogether. Thus Braun records fourteen species from the Baltic provinces, Slosarski eight from Poland, Milachevich eight from Moscow, Jelski five from Kief, von Rosen three from Kharkov and two from Nowyi Oskol. Further east still, in lists (Boettger 6, 7), from Poltawa (Perm), Ekaterinburg and Orenburg, which contain a fair number of land Mollusca, no *Clausilia* at all occurs; the genus simply dies out from unsuitability of environment.

I note that the hardy *laminata*, Mont., occurs in Finland, Livland, Petrograd, Kurland, Volhynia, Podolia, Moscow, Kharkov, Kurtk, Caucasus.

*Asia Minor, Armenia, Caucasus, the Crimea, North Persia*.—This vast district forms a linking region between Europe and Asia, but at the same time does not constitute common ground for the intermingling of western and eastern forms. On the contrary, it contains a *Clausilia* fauna wholly its own, with many peculiar sub-genera, the full investigation of which will doubtless do much to throw light on the problem of the connexion between the Mollusca of west and east.

European groups are barely represented at all. *Albinaria* occurs along the west and south littoral of Asia Minor, and in Cyprus, and even penetrates the higher ground of the interior provinces (*bicolor*, Pfr., *bigibbosa*, Charp.); a *Marpessa* and a *Papillifera* are found at Smyrna, an *Idyla* (*spretta*, Friv.) at Brussa; *Cusmicia pumila* penetrates to North Caucasus, *Alinda plicata* perhaps to Armenia: these are only casual infringements of territory. The one sub-genus of which any considerable number is common to Europe is *Oligoptychia*, which occurs from the South Caspian to Asia Minor, in North Greece, the North Sporades, and Macedonia. The characteristic indigenous sub-genera are *Euxinastra* (near Batum), *Aerotoma*, a group with



relations to *Phædusa*, but differing in the keeled cervix (Transcaucasia), *Mentissa* (peculiar to Crimea), *Euxina*, with nearly forty species (all Asia Minor, Armenia, Caucasia, North Persia, Syria, to Jerusalem), *Bitorquata*, two species (Syria only). Besides these we have *Cristataria*, which is almost confined to the limestone of Syria (twenty species are catalogued by Germain 20), *Micropontica* (Caucasus, three species), which is said by Hesse to have an outlier in the Central Rhodope district (*M. despotina*, Hesse), *Serrulina* (five species), the most eastern group of all, which, according to Nägele, just touches the Amanus Mountains of Asia Minor (*serrulata*, Pfr.) but is characteristic of Armenia, Caucasia, North Persia, and the Elburz Mountains south of the Caspian. Finally, a single species of *Hemiphædusa* (*perlucens*, Bttg.) is reported, on Boettger's authority, from Lenkoran in the Talysh district on the Caspian, and also, *teste* Lindholm, from the Tiflis province. The occurrence of this stray waif of the *Phædusa* group (possibly a survival of a once much wider extension) is a very remarkable fact, and it illustrates the tendency, already noticed, of single outlying species of a sub-genus to occur far from the general area of its distribution. The nearest relations of this outlier of the great *Phædusa* section are found in the North-West Provinces of India, and in two species of *Hemiphædusa* from Prov. Moupin, East Tibet.

*Northern and Central Asia*.—The vast extent of territory which falls under the comprehensive name of Northern and Central Asia, and measures perhaps 3,500 miles from west to east, and 3,000 from north to south, appears to be wholly destitute of *Clausilia*. Further investigation of these regions, where arid and trackless deserts alternate with cold and wind-swept plateaux, may perhaps discover a few stray species, but, so far, the evidence, which is not scanty, all tends in the opposite direction.

No *Clausilia*, for instance, occurs in a list of shells drawn up by von Martens (33) from East Russia, the Siberian plain, and the Altai district, nor in a list (von Martens 35) of Central Asiatic Mollusca from the mountain districts separating the South Siberian steppes and the Aralo-Caspian deserts from the central highland of Mongolia, and East Turkestan from the Pamirs and the neighbourhood of Lakes Ala-kul and Issik-kul, up to a height of 11,000 feet. The same author (von Martens 34), dealing with Central Asiatic Mollusca—the district including Altai, Changai, Balchash, Issik-kul, Russian Turkestan, Pamir Lakes, Yarkand, Kashgar, Ladák, Tarnur and Chami, and Kukanor—remarks that so far *Clausilia* has not been found there, nor are any recorded in his special memoir (von Martens 32) on the Mollusca of Turkestan. G. Nevill (42), recording the results of the second Yarkand Mission, records no *Clausilia* from East Turkestan and Ladák, nor from Kashmir, while Westerlund, dealing with Siberian land and freshwater Mollusca, under the headings of Siberia proper, east and west Baical region, Altai region, Amur district, Kamschatka, includes no *Clausilia* in his list. Even in a memoir on a district much nearer to Europe, Transcaspia, and Khorassan, a district lying roughly from the eastern shore of the

Caspian to 64° E. long. and from 42° to 35° N. lat., O. Boettger (8) records no *Clausilia*.

*Northern Africa*.—The fauna has received the attentions of Bourguignat and his school, and counsels are darkened accordingly. On the whole, the district is not favourable for *Clausilia*. Twelve species have been enumerated from Tunis, consisting of *Delima* (seven species, marking the connexion with Sicily), *Papillifera* (three), *Marpessa* (one), unknown (one). The list is susceptible of reduction; all the *Papillifera* are possibly varieties of the ubiquitous *bidens*. Sturany has described a *Delima* (*klaptoezi*) from Dernah, in Barca. The entire absence of *Siciliaria* appears to indicate that the development of that sub-genus in Sicily must have been later than the separation of Sicily from Africa. The genus, as on the north of the Mediterranean, dies out as we move westward, Algeria having fewer species than Tunis, Morocco than Algeria. *Cristataria boissieri*, Charp., from Syria, has been acclimatized at Algiers, and also near Alexandria.

Of the *Atlantic Islands*, the Madeira group alone contains any *Clausilia*. On the two islands of Madeira and Porto Santo three or four species occur, grouped under the sub-genus *Boettgeria*, which is regarded as having some relationship with *Agathylla*. The islands have evidently been separated from the mainland for a very considerable length of time, since their molluscan fauna exhibits marked peculiarities of its own.

*Central Africa*.—The occurrence of a small number of *Clausilia* in intropical Africa is a fact of extreme interest. Three species (*sennaariensis*, Pfr., *dystherata*, Jick., *rothschildi*, Neuv. & Anth.) have been discovered in the highlands of Abyssinia, in or near to Eritrea, and the latter authors (41) found, but did not describe, a fourth species from the same district. The two former species were placed by O. Boettger in his sub-genus *Macroptychia*. From the other side of the Red Sea von Martens has described a species (*schweinfurthi*) from Yemen, 7,500 feet, and Jousseume found an undescribed species in a ravine near Djeddah. Geographically speaking, these six species may be considered as belonging to the same group, since they all inhabit lofty mountains looking down on both sides of the southern Red Sea. The type of shell appears to be dwarfed and degenerate. Further specimens are much to be desired, but it seems probable that these species may represent the worn-out remains of a Clausilian fauna which may have been richer in past ages, and has dwindled and decayed under change of climate.

About 700 miles from the habitat of these six species, a seventh, apparently belonging to the same type, has recently been described (*degeneris*, Prest.) from between Rumruti and Mt. Kenia, almost on the Equator. From Mt. Kenia to the southern end of Lake Tanganyika is another 700 miles, and from Pambété Bourguignat in 1885 described yet another species (*giraudi*). It was found “dans les anfractuosités des rochers”, is well grown, and possesses a marked sub-columellar fold below and behind the lamella inferior. Bourguignat (14) remarks that “this new species, by its sub-columellar fold, which descends to the peristomal border, recalls certain Chinese forms like

*pluviatilis*, while by its outline and papilliform suture it has certain points of resemblance with *itala* or *punctata*''.

Whatever its affinities may be—and it has plainly no resemblance to the Abyssinian group—the occurrence of an African *Clausilia* in S. lat. 8°, at a height of about 3,000 feet, is a remarkable phenomenon. With this exception the *land* molluscan fauna of Tanganyika has, I think, shown no special feature of peculiarity. We must await the detection of further species.

Two expeditions to Ruwenzori have failed to discover *Clausilia* on its slopes (Smith 53, Pollonera 50). Nor does it occur in Socotra or in Swahililand (von Martens 30).

## II. PHÆDUSA.

*India and Further India.*—The *Clausilia* of India have recently been catalogued by G. K. Gude (21). India (with Ceylon), Further India, including Burmah, Arakan, Tenasserim, the Andaman and Nicobar Islands, and Indo-China (Tongking, Siam, Annam, and Cambodia), form practically a single zoological area, whose molluscan fauna is closely related to that of South China.

Mr. Gude has enumerated thirty species in all from India and Further India, belonging to the sub-genera *Euphædusa* (nine), *Pseudonenia* (twelve), *Oospira* (five), *Cylindrophædusa* (two), *Garnieria* (two). In India proper all the known species (only nine) cling to the mountain slopes of the north, and not a single species occurs between the Himalayas and Cape Comorin. Ceylon has a single *Euphædusa* (*ceylanica*, Bens.), which occurs at 4,500 feet in the central mountain mass. The Himalayan forms fall into two well-marked groups: (1) those inhabiting the Punjab and North-West Provinces, (2) those inhabiting Sikkim, Bhutan, and Assam. No species has as yet been recorded from Nepal, which covers a length of 500 miles between these two groups, and only one species (*Cylindrophædusa cylindrica*, Pfr.) is common to the two. *Euphædusa* has one species in the western group and three in the eastern. *Pseudonenia* has none in the western and three in the eastern. No *Clausilia* has been found in Kashmir proper, Afghanistan, or Beloochistan.

In Further India the *Clausilia* fauna becomes richer and more distinctly Chinese: of *Euphædusa* there are five species, and of *Pseudonenia* six; *Cylindrophædusa* disappears, but two new sub-genera occur, *Oospira*, with five species, and *Garnieria*, a form with a remarkable trumpet-shaped mouth, with two. The Nicobars, which belong geologically to Sumatra rather than to the mainland, have three species of *Pseudonenia*. One specimen, unnamed, is recorded in G. Nevill's Handlist as coming from the Andamans.

*Indo-China.*—Indo-China (Tongking, Siam, Annam, and Cambodia) becomes definitely Chinese so far as its *Clausilia* are concerned, Tongking, in the far north, being especially rich, and containing several 'Chinese' species. H. Fischer and Dautzenberg in 1904 (19) enumerated fifty-five species in all, and since that date at least twenty more have been added by Bavay & Dautzenberg, H. Fischer, and

others. *Garnieria*, with eleven species, here attains its maximum, and the other characteristic sub-genera of China are well represented, some by forms of remarkable size and beauty. The low-lying districts, drained by the Menam and Mekong Rivers, are practically destitute of species, all the finer forms coming from the high ground of Tongking.

*China*.—The *Clausilia* fauna of China is among the richest in the world, but is at present only imperfectly known. Certain portions of this vast empire have been worked with something approaching thoroughness, others have been occasionally visited by the collector, while others have never been visited at all. Under these circumstances it would be misleading to attempt to come to any conclusions, based upon apparent abundance or scarcity of *Clausilia* in any particular province, as compared with any other. But we do know enough to state broadly that the provinces watered by the upper and middle Yang Tse Kiang, East Sytschouan, and Hupé (Hubei), with Hunan to the north and Yünnan to the south-west, are exceedingly rich in *Clausilia*. Père Heude (22) in 1882–90 noted no less than seventy-one species, sixty-two of which were described as new. Many of these are among the largest and handsomest species of the genus, rivalling, but not surpassing, the giant forms produced by Japan. Since Heude's time great additions have been made to the list, notably by Bavay & Dautzenberg, by Gredler, Schmacher and O. Boettger, von Möllendorff, Sykes, and others. China is the metropolis of the fine sub-genera *Euphædusa*, *Formosana*, *Hemiphædusa*, and *Macrophædusa*, while *Pseudonenia* is well represented in the south, and *Garnieria* and *Oospira* reach the southern provinces. At least 120 species in all are known.

In the west and north-west *Clausilia* becomes relatively scarce. A fine species has recently been described (*Cl. cookei*, Prest.) from South Shensi, but, as von Möllendorff remarks (38), from the rich development of the genus in Hupé and the neighbouring East Sytschouan, it might have been expected that in the well-wooded and mountainous region of West Sytschouan a number of new species would have occurred. This, however, is not the case, and as a matter of fact the distribution of the genus dies out rapidly to the west and north-west. This is a fact of considerable zoogeographic importance. In the genera *Cathaica* and *Buliminus* the centre of distribution and richest number of species occur in Upper Amdo, still further west, but they rapidly fall off as we move east and south-east, and in South China die out almost altogether. The opposite is the case with *Clausilia*, which is strongest in South China; relatively only a few species reach North Sytschouan, none overpass the borders of Gansu, in spite of the fact that Gansu is otherwise very rich in land Mollusca.

In the colder and less mountainous regions of North-East China, *Clausilia* appears to be very infrequent. A list of Mollusca from Dschili (capital Pekin), drawn up by von Möllendorff, contains no *Clausilia*.

Three species from Province Moupin, East Tibet, were described many years ago by Deshayes. They have not yet been rediscovered,

but have been placed by von Möllendorff, *tibetana* in subg. *Formosana*, *serrata* and *gibbosula* in subg. *Hemiphædusa*. They represent, with one exception, the furthest known western outposts north of the Himalayas of the great *Phædusa* group.

*Japan*.—The *Clausilia* of Japan, while very closely related to those of China, exhibit in many respects an independent and characteristic development. The whole group has been worked out by H. A. Pilsbry with a thoroughness and originality which are quite beyond praise, and his writings form practically the sole material for a study of the genus as it exists in these islands.

Southern Japan and Formosa are separated from the mainland of Asia by a shallow sea, which in no place exceeds a depth of 200 m. The Loo Choo Islands, which link Japan with Formosa, are separated both from Japan and from Formosa by much deeper water, the archipelago to the south of Kiu Siu (Tanegashima and the Linschoten Islands) being practically part of that island, and separated by deep water from the Loo Choos proper. In the result we find that while the *Clausilia* of Japan and Formosa are closely related to those of China, those of the Loo Choos are markedly different, not only from China, but from Formosa and Japan. To quote from Pilsbry (46): "*Luchnophædusa* has been found nowhere else but on this group [one species on islands off Kiu Siu]. *Zptyx* extends into the southernmost provinces of Kiu Siu, and, probably borne by the Kuro Shiwo, has reached Hachijo, an islet 100 miles off Izu province. *Stereophædusa* and *Hemiphædusa* range further, being common throughout Japan . . . but the species of the Loo Choo Islands belong to a special group of *Hemiphædusa* which has not been found elsewhere. The sections *Euphædusa* and *Megalophædusa*, so characteristic of Japan, are wanting in the Loo Choos. As regards *species*, not one is common to the Loo Choos and any other land. No characteristic Formosan forms of *Clausilia* have been found in the Loo Choo group." "As a whole the *Clausilia* of this group are more specialised than those of China or Japan, and bear out the proposition that insular faunas age more rapidly than those of larger or continental areas" (Pilsbry 46).

The southern and central portions of Japan proper (Kiu Siu and its outliers, Shikoku, Southern and Central Hondo) are rich in *Clausilia*, some species of the sub-genus *Megalophædusa* being the largest and handsomest in the world. In Northern Hondo and Yesso the numbers appear to fall off rapidly, though probably exploration is not complete. Excluding synonyms and varieties, the total number so far recorded for the whole group is about 155, of which 107 occur in Japan proper, 33 in the Loo Choos, and 15 in Formosa.

	Japan proper.	Loo Choos.	Formosa.
<i>Hemiphædusa</i> group . . . .	77	12	9
<i>Zptyx</i> group . . . .	9	20	4
<i>Euphædusa</i> group . . . .	21	1	2
	107	33	15 <sup>1</sup>

<sup>1</sup> Including *Euph. aculus*, Bens., which also occurs in Japan.

The full classification is as follows:—

*Hemiphædusa* Group.

1. *Megalophædusa*.
2. *Hemiphædusa*.
3. *Formosana*.
4. *Tyrannophædusa*.
5. *Nesiophædusa*.<sup>1</sup>
6. *Luchuphædusa*.
7. *Oophædusa*.
8. *Stereophædusa*.

*Euphædusa* Group.

1. *Pseudonenia*.
2. *Euphædusa*.

*Zaptyx* Group.

1. *Hemizaptyx*.
2. *Heterozaptyx*.
3. *Zaptyx*.
4. *Stereozaptyx*.<sup>1</sup>
5. *Parazaptyx*.<sup>1</sup>
6. *Metazaptyx*.
7. *Diceratozaptyx*.<sup>1</sup>
8. *Oligozaptyx*.<sup>1</sup>
9. *Idiozaptyx*.<sup>1</sup>
10. *Selenozaptyx*.<sup>1</sup>
11. *Thaumatozaptyx*.

"In Korea, Japanese forms dominate over Chinese forms. The submergence of the straits between Kiu Siu and Korea is hence a geologically recent event, probably not earlier than the Pliocene period. All the genera and sub-genera of the Korean molluscan fauna occur in Japan. In the *Clausilias* all the species [five in number] of Quelpart and Korea belong to *Euphædusa*, a group of minor importance in Japan, but extending further north on the Asiatic mainland than any other group of *Clausilia*" (Pilsbry 48).

*Malay Peninsula and East Indian Islands*.—The Malay Peninsula forms practically the first of the group of great islands which is continued by Sumatra and Java. The fauna is not very well known, but the *Clausilia* belong only to those groups which occur on the islands. About four or five species, all *Pseudonenia* or *Euphædusa*, have been described from Perak, Penang, Kelantan, and elsewhere.

Further exploration of the great East Indian islands will no doubt add much to our knowledge of their Mollusca. But we already know enough to see that as we go eastward *Clausilia* steadily dies out. *Euphædusa* and *Pseudonenia* include the bulk of the species. *Acrophædusa*, Bttg., is peculiar to Java, and *Paraphædusa*, Bttg., to Celebes. Borneo contains two species of *Formosana*, a Chinese and Formosan group. No species appears to be common to any two islands, except *cumingiana*, Pfr., which in one or other of its varieties occurs in the Philippines, Sulu Islands, Celebes, Sangir, Halmahera, and Ternate, and *recondita*, Sykes, which is common to Sumbawa and Halmahera. It is remarkable that so far only one species has been discovered in the Philippines, which are not only nearest to Formosa but have also been better searched than any other group.

From Sumatra we have 7 species, Java 10, Borneo 4, Celebes 10, Philippines 1, Sulu 2, Sangir 1, Sumbawa 1, Halmahera and Ternate 2, Selangor 1. Molluscan lists from the following islands have been published, but do not contain any *Clausilia*: Lombok, Buru, Tenimber, Batchian. Nor has any species as yet been described from New Guinea, though the genus may well exist in the higher mountain ranges of that great island, and anything seems

<sup>1</sup> Peculiar to Loo Choo group.

possible after the discovery, by von Möllendorff, of *Carychium*, *Acanthinula*, and *Pyramidula*, on the high regions of Java.

A list of the known species is subjoined; the date is the date of description.

## SUMATRA.

- 1864.<sup>1</sup> *Pseudonenia sumatrana*, Mts.  
 1864. *P. excurrens*, Mts.  
 1867. *Euphædusa obesa*, Mts.  
 1891. *Pseudonenia alticola*, Mts.  
 1893. *Euphædusa enigmatica*,  
 Sykes.  
 1893. *E. melvilli*, Sykes.  
 1906. *E. robustior*, Bullen.

## JAVA.

1841. *Pseudonenia javana*, Pfr.  
 1842. *P. corticina*, Busch.  
 1842. *P. orientalis*, Busch.  
 1847. *Acrophædusa cornea*, Phil.  
 1847. *A. junghuhni*, Phil.  
 1847. *Pseudonenia heldii*, Küst.  
 1849. *P. heldii*, var. *moritzii*, Mouss.  
 1890. *P. salacana*, Bttg.  
 1897. *P. schepmani*, Mdff.  
 1897. *P. nubigena*, Mdff.  
 1897. *P. fruhstorferi*, Mdff.

## BORNEO.

1854. *Formosana borneensis*, Pfr.  
 1868. *F. schwaneri*, Herkl. (Pfr.).  
 1889-1901. *Euphædusa dohertyi*,  
 Bttg.  
 1903. *E. (?) filialis*, Mts.

## PHILIPPINES (I. Siquijor).

1845. *Euphædusa cumingiana*, Pfr.

## SELANGOR.

1845. *Euphædusa cumingiana*, Pfr.  
 1897. *E. cumingiana*, Pfr., var.  
*simillima*, Smith.

## CELEBES.

1845. *Euphædusa cumingiana*, Pfr.

1864. *E. cumingiana*, var. *molucensis*, Mts.  
 1883. *E. cumingiana*, var. *majuscula*,  
 Tapp.-Can.  
 1897. *E. cumingiana*, var. *simillima*,  
 Smith.  
 1912. *E. cumingiana*, var. *kabaënæ*,  
 Haas.  
 1896. *Paraphædusa subpolita*, Smith.  
 1896. *P. usitata*, Smith.  
 1896. *P. celebensis*, Smith.  
 1896. *Euphædusa alternata*, Mdff.  
 1897. *E. pyrrha*, Sykes.  
 1897. *E. makassarensis*, Sykes.  
 1897. *E. balantensis*, Sykes (= *celebensis*, Bttg., nec Smith).  
 1899. *E. bonthaiensis*, Sar.  
 1899. *E. minahassæ*, Sar.

## SULU ISLANDS.

1845. *Euphædusa cumingiana*, Pfr.  
 1864. *E. cumingiana*, var. *molucensis*, Mts.  
 1894. *Pseudonenia suluana*, Mdff.

## SANGIR.

1845. *Euphædusa cumingiana*, Pfr.  
 1864. *E. cumingiana*, var. *molucensis*, Mts.

## SUMBAWA.

1894. *Pseudonenia recondita*, Sykes.

## HALMAHEIRA AND TERNATE.

1845. *Euphædusa cumingiana*, Pfr.  
 1864. *E. cumingiana*, var. *molucensis*, Mts.  
 1894. *Pseudonenia recondita*, Sykes.

## III. NENIA.

*Clausilia* is conspicuously absent from the list of those genera which are described as 'circumpolar', and is thus entirely wanting in the Nearctic Continent. Although well represented in South America, even on the Equator, it has not succeeded in entering North or even Central America via the Isthmus of Panama. Probably the more low-lying and therefore hotter countries of this region are unsuitable

<sup>1</sup> The dates are the dates of the year in which the species or variety was described.

for a genus whose neo-tropical representatives appear to live at high altitudes.

The two outstanding facts which characterize the distribution of the genus as a whole are its occurrence in South America and its non-occurrence in North America, and perhaps, of the two, the latter is the more remarkable. In spite of the land connexion, more or less intimate, which must have linked Europe with North America, probably during the Miocene epoch, *Clausilia*, although abundant in Central Europe, and even occurring in England, during the Eocene period, did not make its way into North America. It is conceivable that *Clausilia* was originally an inhabitant of warm climates only, and that the sub-genera which now exist in the colder climates of North Europe were not then developed. *Marpessa*, *Alinda*, *Pirostoma*, and *Cusmicia* do not, as a matter of fact, occur earlier than the Pleistocene.

The shell of *Nenia* is invariably sinistral; the aperture is rounded and wide, set on a protraction, more or less pronounced, of the last whorl, and lies exactly in a line with the axis of the spire. Fifty species in all are known—forty-nine from the South American mainland, one from Porto Rico. On the mainland they range from the Sierra Nevada de Santa Martha, lat. 11° N., in the extreme north of Colombia, to about 17° S. lat., in Bolivia. Along the Cordilleras some species lie on the western slope, rather more on the eastern. I have noted one (*malleolata*, Phil.) from 79° W., not 100 miles from the Pacific, while the easternmost hitherto recorded lives in 63° W. lat. The north and south range is thus nearly 2,000 miles, while the eastern and western range is comparatively narrow.

Nine species occur in Colombia, two in Venezuela, one in Colombia, Venezuela, and Ecuador, one in Colombia and Peru, one in Upper Amazons, Peru, and ? Colombia, ten in Ecuador, twenty-one in Peru, two in Bolivia, two in "South America".

The occurrence of a single species in Porto Rico is a remarkable fact, and points to a former geological connexion, more or less intimate, between that island and South America. There can be little doubt that the connexion was via the Lesser Antilles, and not via the Peninsula of Yucatan. This view is supported by the presence, in Porto Rico and in one or other of the Lesser Antilles, of the genera *Leptinaria*, *Mörchia*, and *Peltella*, all of which are South American but not Central American genera. It would be interesting if *Nenia* were discovered in the highlands of San Domingo, an island closely connected with Porto Rico, and hitherto imperfectly explored.

The relation of the neo-tropical *Clausilias* with those of the Palæarctic region involves a zoological problem of the highest possible interest, the solution of which is at present quite undetermined. The group *Laminifera*, represented by one or two living species in the West Pyrenees, and by six or seven species in the Miocene and Oligocene of Germany, certainly exhibits points of similarity with *Nenia*, as was shown by Bourguignat long ago. He (12) regarded the two groups as standing in close relation to one another, naming the American *Nenia Neniastrum* and the French *Neniaatlanta*. A more prudent



view will regard *Laminifera* as a possible link between *Nenia* and the Clausilias of the Old World. It is conceivable that the now existing species of *Laminifera* represent the relics of a group whose progenitors were not only more widely distributed in Europe, but also succeeded in emigrating, by what route we are not in a position to say, into the region we now call South America. There can be little doubt that instances occur of similar survivals, which have, by taking refuge, as it were, in mountain fastnesses, victoriously defied (to use Boettger's phrase) the attacks of younger and better organized groups. In this connexion may be mentioned the group *Olympia* (Mt. Olympus), *Serrulina* (Armenia and North Persia, and fossil from the Miocene of Bohemia and Silesia), *Alopi*a (Carpathians), and possibly *Macroptychia* (Abyssinia).

The only other living group which shows a production of the last whorl, with a continuous peristome, is *Garnieria*, from Indo-China, a sinistral group, in which the mouth is set, as in *Nenia*, exactly in a line with the axis of the spire. The general facies of the group now inhabiting Madeira (*Boettgeria*) is not markedly akin to *Laminifera*, and therefore cannot be cited as supporting a theory of Atlantidean migration. Professor Gwatkin assures me that the radulæ of the few species of *Nenia* which he has been able to examine are of the same general type as that of the Palæarctic *Clausilia*. Further light may be thrown by a detailed examination of the clausilium.

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ON *HELICELLA* (*CANDIDULA*) *CRAYFORDENSIS*, N.SP., FROM  
THE PLEISTOCENE DEPOSITS OF SOUTH-EASTERN ENGLAND.

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

Read 12th March, 1915.

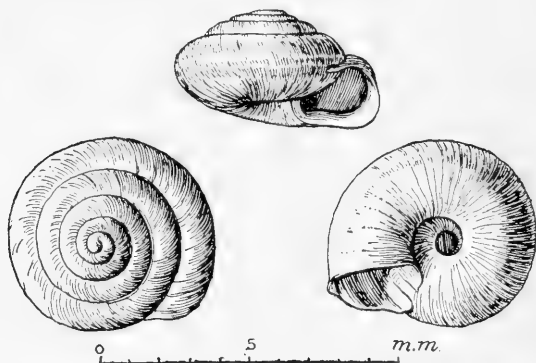
THE form we here describe has long been known from the Pleistocene deposits of South-Eastern England, as well as Northern France, but has always been assigned in faunal lists to *Helicella caperata* (Mont.).<sup>1</sup>

This determination had for a long time appeared to us unsatisfactory, and when better preserved forms were discovered at Woodston we were disposed to agree with the Rev. C. E. Y. Kendall<sup>2</sup> that the shell was more properly referable to *H. candidula* (Studer), and under that name we included it in our *List of British Non-Marine Mollusca*, 1914 (p. 6).

Further study has, however, convinced us that Mr. J. W. Jackson<sup>3</sup> is right, and that the form in question is in fact a new species. We therefore now describe it as such, taking the specific name from the British locality at which it was first and principally found.

*HELICELLA* (*CANDIDULA*) *CRAYFORDENSIS*, n.sp.

Testa umbilicata, globoso-depressa, confertim irregulariter costulato-striata, sed apice nitida, fasciis spiralibus ornata, vel albida; spira convexa, depresso-conoidea, anfractus  $4\frac{1}{2}$ , convexi, lente accrescentes,



ultimus antice vix deflexus, ad peripheriam subrotundus, vix carinatus; apertura diagonalis, quadrato-lunaris; peristoma acutum,

<sup>1</sup> Prestwich, Phil. Trans., cl, 1860, p. 286; Dawkins, Quart. Journ. Geol. Soc., xxiii, 1867, p. 100; Cheadle & Woodward, Proc. West London Sci. Assoc., i, 1876, p. 98; Woodward, Proc. Geol. Assoc., xi, 1890, table; Kennard & Woodward, op. cit., xvii, 1901, table.

<sup>2</sup> Journ. Conch., xiv, 1913, p. 88.

<sup>3</sup> "Notes on the *Candidula* section of *Helicella*": Journ. Conch., xiv, 1914, p. 199.

intus valde labiatum, labio remotiusculo, marginibus subconvergentibus, margine inferiori fere recto, columellari subrecte descendente, supra umbilicum pervium subexpanso. Diam. max. 6.5, min. 6 mm.; alt. 3.8 mm.; apert.  $2.8 \times 2.3$  mm.

*Horizon and Localities*.—Pleistocene at Crayford and Erith (Kent), Ilford and Clacton (Essex), Brentford (Middlesex), Barnwell (Cambridgeshire), and Woodston (Huntingdonshire).

The characteristic feature of the species is the flattened basal margin of the peristome that imparts a slightly quadrate appearance to the aperture, whilst the internal rib at this point is in some specimens so thickened as to suggest on casual inspection a tooth-like protuberance.

From *H. caperata* it differs in being smaller and more depressed, with the umbilicus eccentric as in *H. gigaxi*; whilst the striæ are less regular than in *H. caperata* and not so pronounced, the whorls are more convex, and the periphery not so keeled.

From *H. candidula* it is similarly distinguished, save in the matter of size. The whorls, moreover, in *H. candidula* increase more rapidly in size than they do in the new species.

From the small form of *H. gigaxi*, *H. crayfordensis* is at once separated by the irregular character of its striation.

Some of the specimens from Ilford and Woodston, judging by the dimensions cited by Mr. Jackson (loc. cit.), are slightly larger than those we have seen.

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## ON THE MOUNTING OF RADULÆ FOR MICROSCOPIC EXAMINATION.

By the Rev. E. W. BOWELL, M.A.

*Read 12th March, 1915.*

## PLATE VII.

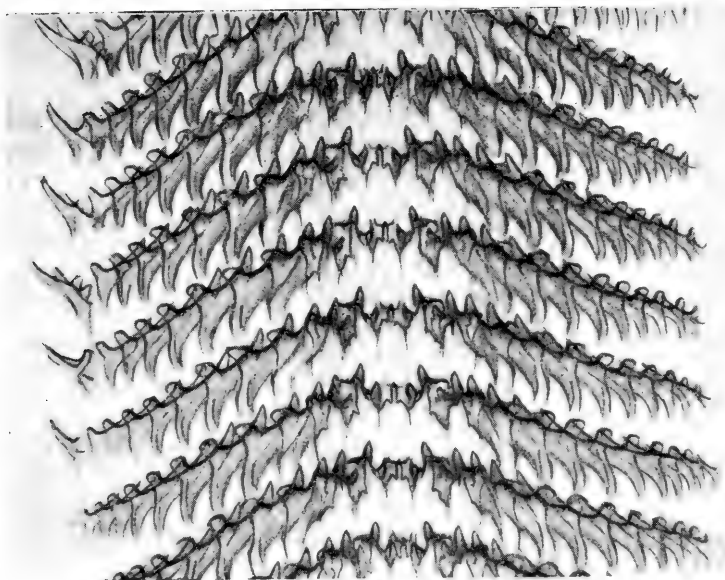
It is usual to mount objects destined for microscopical examination in some medium having approximately the same refractive index as the glass (or the average of the glasses) used in the construction of the lenses of the instrument. When this rule is transgressed the full resolving power of the microscope cannot be utilized. Radulæ are, in practice, usually mounted in a medium of lower refractive index than glass. This is done because otherwise they would be invisible, or nearly so, unless viewed by polarized light.

The polariscope method is very satisfactory with large species and low magnifications. The object is mounted in Canada balsam, and is barely visible on the slide, but with the aid of polarizer and analyser it shows up brilliantly. When, however, the smaller forms are reached, it is found that little can be seen, unless prisms of phenomenal size and transparency are employed, together with a powerful light. I therefore regard the polariscope method as ineligible.

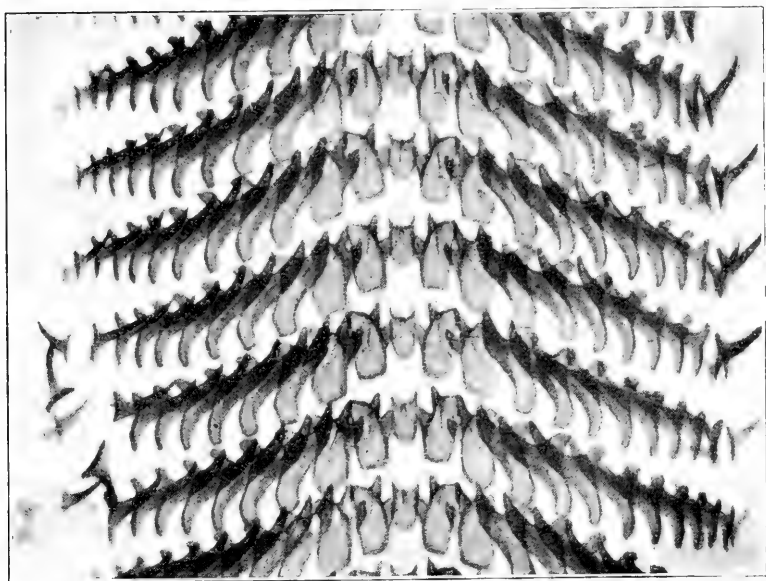
The ordinary preparations of radulæ in glycerin jelly are of varying visibility, because it is not possible to standardize the amount of water or glycerin included in the mount. I have successfully used in place of glycerin jelly Professor Gilson's euparal, an artificial resin of low refractive index. It is much easier to employ than glycerin jelly, requires no ringing, and has the advantage of not being an aqueous medium. But it has the optical disadvantages inseparable from a medium of low refractive index. Dr. Boycott uses Farrant's medium, by which results similar to those of glycerin jelly are produced. Oxidation eventually occurs.

Glycerin jelly has been advocated and used by practically all the highest authorities on the subject of radulæ. Therefore I have returned, time after time, to its use; only to be convinced each time that the optical disadvantages involved were real and insuperable. The camera is a severer critic of the microscopic image than the most fastidious microscopist, because it possesses no power of accommodation, and is incapable of ignoring distortion of form. And the camera, as I read its verdict, is plainly adverse to mounting in any but a homogeneous medium. Particularly bad are the results with high powers, for several reasons. The radulæ consist of fine serrated lines of structure, and these of themselves form diffraction gratings interfering with the normal diffraction system of the instrument. The apparent distance between the two layers of structure is greatly exaggerated, in addition to the exaggeration which naturally results from the use of a high numerical aperture, which is necessary for definition. And that aperture itself requires to be cut down in order to produce contrast, so that the efficiency of any objective is reduced

A.



B.



**RADULA OF POLITA SYDNEYENSIS.**

A. Mounted in glycerin jelly.

B. After staining and remounting in Canada balsam.





to about half of the normal. Further—and this is the most serious matter of all, since it is the real forms of objects that we require to trace, and not their spurious images—the particular structures that we have to deal with here are themselves capable of setting up definite disturbances of the image, by reason of their rounded or cylindrical shape. In a mass of low refractive index we have placed a number of rows of lenses of irregular form. They do not fail to present untrue appearances the moment that they are illuminated by any other than parallel beams. Thus, for example, the centres of the cones in a *Vertigo* necessarily appear black instead of white in a photograph taken at the critical focus; while if a false focus be substituted the result is indeed a dream, but different from reality. Even optically short spikes appear as rounded knobs when we have passed a certain measure of magnitude, necessitating a certain enlargement of numerical aperture to render the object distinctly visible.

I have experimented with many media for mounting radulæ—practically, I believe, with all that are available. Not to trouble you with a long catalogue of rejected methods, I may just mention that media of higher refractive index have most of the disadvantages already described, together with some special ones of their own.

But all this can be definitely and entirely avoided. The image with high powers can be made quite equal (except in the matter of depth) to that afforded by objectives of greater focal length. The full aperture and resolving power of the objectives can be employed. Eye-straining can be entirely obviated. The preparations may be made quite permanent, and very much more distinct in every outline, by the adoption of a process of staining and mounting in a homogeneous medium, such as is used in almost all professional scientific researches. Our difficulty is then only to find a method by which the radula can be stained in such a way that all its details are clearly visible.

Chitin itself, as it exists in the snail, cannot be stained by any known method. But it is by no means difficult to effect a modification of its chemical constitution so that it becomes coloured by intrinsic or extrinsic matter. The chitin of all radulæ—even the *Vertigos*—contains enough iron to give a Prussian blue tint when it has been partially or entirely separated from its organic connexion. Anything that promotes oxidation will in a long or short time turn the radula brown—the colour of the familiar iron-mould. This is very frequently to be observed in old specimens which have been preserved for many years in aqueous media. It denotes an excessive proportion of water present in a glycerin jelly preparation. It is very usually to be seen at the nascent end of a radula extracted by long boiling in caustic alkali. Noticing one day that this brown colour at the end was replaced in some of my radulæ by a green verging upon blue, I instituted inquiries and found that the tube used for washing them had been previously used for containing a solution of the red prussiate of potash. Experiments showed that not only green but strong blue coloration could easily be obtained upon yellow radulæ by the application of this familiar reagent. Strange to say, styrax preparations were found to have oxidized the radulæ to a considerable

extent. The blue stain thus obtained can be photographed by means of screens, but for precision it is not to be compared with that produced by additive dye-stuffs.

Rapid and thorough oxidation of the chitin, without damage to the radulæ, may be obtained by the application of an acidified solution of permanganate of potash. After blackening the unci with this fluid, I decolorize with oxalic acid. It is found that almost any of the ordinary stains will now take effect, but as my object is to produce a transparent staining, so that the outlines of one uncus may be clearly seen behind another, and that there may be no blocking out of light by dense shadows from the basal plates, I have provisionally selected dahlia as the best colour for the purpose. This gives good results with chromatic plates and a yellow or green screen, when it is desired to take a photograph.

It is also possible to hydrolyse chitin by prolonged boiling in dilute acid, and this process is more speedily accomplished in the presence of picric acid. The hydrolysed chitin is also amenable to treatment with many stains, notably with acid fuchsin and indigo carmine. But in this method there is the disadvantage that unless the structure is less compact than usual, permeation takes a long time; and the action begins at the basal plates, causing these to be most emphasized in the resulting stained slides. But if it be desired to have a demonstration of the hollow structure of the unci, upon which the cones are built up by superficially induced thickenings, valuable information may be derived from partially hydrolysed specimens.

The permanganate method will probably answer all requirements, though any other reagent which has the same effect might be substituted. I do not for a moment suggest that this process must supersede the well-known glycerin jelly method, which has been so industriously applied for many years by workers like Professor Gwatkin. But I claim that it gives a truer picture of the radula in all cases, and that the employment of a stain followed by mounting in Canada balsam is in accordance with the soundest principles of microscopy.

The accompanying plate represents the radula of *Polita sydneyensis*, Cox (*scharffi*, Kennard; *Hyalinia cellaria*, var. *compacta*, Jeff.?). The upper division shows the specimen in glycerin jelly, the lower division shows the same specimen after staining and remounting in Canada balsam.

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NOTE ON *HYGROMIA HISPIDA*, var. *NANA*, JEFF.

By the Rev. E. W. BOWELL, M.A.

*Read 12th March, 1915.*

MR. KENNARD recently pointed out to me a shell in my collection as a typical example of this form, which is said to be equivalent to *H. nebulata*, Menke. The specimen was taken at Leatherhead, and is now exhibited. Height 4 mm., major diameter 7.1 mm.

The genitalia showed four simple digitate glands on each side. Typical *hispida* may show six on each side, but it will generally be found that these are disposed in groups of two, so that they would be better described as three double digitations. I find, however, that there is considerable variation in the number of the glands, large specimens tending to possess more glands and more branching.



The radula, of which a sketch is here submitted, is 1.8 mm. long and 0.65 mm. wide. There are 88 rows of unci, distributed according to the formula 13. 10. 1. 10. 13. The more external admedians tend to become larger until the last two are reached, and these are very similar to the externals. The most striking feature about the radula is the length and narrowness of the mesocones, except in the external region. I do not find anything similar in young examples of typical *hispida*, while in adult specimens there is a marked tendency to vary in the opposite direction. In the present specimen the cones of the external unci are more than usually short; variation in this respect is common in *hispida*, but it is much more usual to find prolongation of these cones in the smaller examples.

I refrain from giving measurements of these small structures, because I do not yet possess a series mounted in balsam, and the trial measurements of glycerin jelly preparations have proved unsatisfactory, owing to the relatively high numerical aperture required to produce sharp outlines at the necessary magnification.

It seems possible that *H. nebulata* may be another of these barely distinct small *Helices*, and it may be worth while for those who have the opportunity to pay special attention to its economy and distribution.

NOTES ON SWAINSON'S *EXOTIC CONCHOLOGY*.By C. DAVIES SHERBORN<sup>1</sup> and ALEXANDER REYNELL.<sup>2</sup>*Read 12th March, 1915.*

For many years Swainson's *Exotic Conchology* has been a bibliographical puzzle. No one seemed to have seen what he could feel sure was a complete copy of the first edition, or knew what the first edition really contained. Three copies have come under our notice, those belonging to the Radcliffe Library, Oxford, Mr. Reynell, and Mr. E. R. Sykes; the first and second in four original parts as published. We have been waiting patiently for years for two more parts believed to be required to complete the work. All the evidence, however, now points to the fact that Edition 1 was published and completed (as far as it got) in four parts, each part containing 8 lithographed plates, coloured or uncoloured according to the price the subscriber could pay. The colouring is particularly good in most cases. With Part 1 were issued sixteen<sup>3</sup> pages of letterpress, consisting of a Title Page with the back as usual blank, except that the Printer's name is inscribed thereon, two pages of advertisement, and the succeeding pages occupied with descriptions of the species illustrated. No further text appears to have been issued.

Besides the Reynell copy, a second, with the front covers preserved, exists in the Radcliffe Library, Oxford, and we are much indebted to Sir Henry Miers for an exhaustive examination and very complete notes made for Mr. Sherborn in 1906. This copy appears to have two pages of the letterpress in duplicate, while four pages which should be there are missing. It also wants two plates from Part II, namely, *Murex regius*, Swn., and *Anodon sinuatus* (or *sinuosa*), Lamk.

A third copy, of which Mr. E. R. Sykes kindly sent particulars, is without covers, and complete with the exception that the four pages of text missing in the Radcliffe Library copy are here also missing. Our notes are based on the Reynell copy.

During 1834 and 1835 the book was reissued with an Engraved Title Page, and two other parts, each containing eight plates, were added. Of this reissue the British Museum, Bloomsbury, possesses 5 Parts in the original covers, once belonging to Major-General Thomas Hardwicke, who died on the 3rd of March, 1835, and therefore could not have received the sixth part. On the covers he fortunately noted the dates on which he received each part. Mr. Reynell has a complete copy in six parts with covers, but there are no manuscript dates on them. Apparently this set originally belonged to W. J. Broderip, as his name is written on one of the covers.

<sup>1</sup> By permission of the Trustees of the British Museum.

<sup>2</sup> Mr. E. R. Sykes, who contemplated a paper on this book, kindly withdrew in our favour, and handed over his copy for examination. Mr. Reynell has, very generously, allowed the British Museum (Nat. Hist.) to acquire his splendid copies of the first and second issues.—C. D. S.

<sup>3</sup> We do not know with which parts the text really appeared: in all probability pp. i-iv, 1-8 with part 1, and 9-16 with either part 3 or part 4.

In 1841 Sylvanus Hanley published a second edition of the forty-eight plates, with descriptions of the species illustrated (Title-page, Advertisement, and pp. 5-39). Many of the plates were redrawn, and the following note on p. 4 sufficiently explains the reason of the republication: "But few words are requisite to preface the second edition of the *Exotic Conchology*. Mr. Swainson on quitting England having left this beautiful work in an unfinished condition, to me has been committed the task of reducing the whole into systematic arrangement, of drawing up descriptions of species, and adding such synonyms as the advanced state of Conchological knowledge might require. This charge to the best of my power I have fulfilled, adopting that system of classification, to the establishment and elucidation of which so many years of the author's lifetime have been devoted. S. H." We will now proceed to the detailed description of the two issues of the First Edition.

First Edition,  
1821-1822.

As far as can be ascertained the first edition reached no further than Parts 1-4, which were published between August, 1821, and March, 1822. William Wood in his "*Catalogue of an Extensive and Valuable Collection of the Best Works on Natural History, etc.*", London, 1824, mentions parts 1-4 only, issued in three forms, i.e. (*a*) with plates uncoloured, (*b*) coloured, and (*c*) both coloured and uncoloured, and priced at 10s. 6d., 16s. 0d., and £1 1s. 0d. each part respectively.

The Title on each cover reads as follows:—

Exotic Conchology; | or | Figures and Descriptions | of | Rare, Beautiful, or Undescribed | Shells. | By | William Swainson, F.R.S., F.L.S. | Member of the Wernerian Society of Edinburgh, | Historic Society of New York, &c. |

[Part . . . | containing . . . ]

London: | Printed for William Wood, Strand; and J. and A. Arch, Cornhill. | Price [filled in in ink].

The Contents of each Part and Date of issue are as follows:—

Part 1, August, 1821.

[Text; Title] Exotic Conchology; | or | Figures and Descriptions | of | Rare, Beautiful, or Undescribed | Shells, |

Drawn on Stone from the Most Select Specimens; | The descriptions systematically arranged | on the principles of MM. Cuvier and de Lamarck, | with references to the Linnæan Classification. | By William Swainson, F.R.S., F.L.S. | Member of the Wernerian Society of Edinburgh, | the Historic Society of New York, &c. | Vol. 1. | London: | Printed for William Wood, Strand; and J. and A. Arch, Cornhill. | 1821. |

[Back of Title] Printed by Richard and Arthur Taylor, Shoe Lane.

Two pages of Advertisement [III] and IV followed by twelve, unnumbered pages of text.

The first page deals with the "Family, Volutæ. Genus *Voluta*". The latter is divided into three "Sections", Cymbeolæ, Musicales and Fusoidæ, whose characters are diagnosed.

The second page deals with *Voluta*, Sect. 1; *V. diadema*, Lam. and *V. tessellata*, Lam. are described.

The third page deals with *Voluta*, Sect. 2; and *V. nivosa*, Lam. is described.

The fourth page deals with *Voluta*, Sect. 2; *V. marmorata*, is described by W. Swainson as a sp. nov.

The fifth page deals with *Voluta*, Sect. 3; and *V. pacifica*, Chemn. and *V. tuberculata*, are described; the latter as a sp. nov. by Swainson, who mentions that there is a possibility of its being the *V. subnodosa*, of Dr. Leach.

The sixth page continues *Voluta*, Sect. 3; and *V. elongata*, and *V. angulata*, are described as spp. nov. by Swainson.

The seventh page goes back to *Voluta*, Sect. 1; and *V. æthiopica*, L. and *V. melo*, Lam. are described.

The eighth page continues with *Voluta*, Sect. 1; and *V. cymbium*, Lam. and *V. rubiginosa*, are described, the latter by Swainson as a sp. nov.

The ninth page continues with *Voluta*, Sect. 1; and *V. olla*, Gmel. and *V. porcina*, Lam. are described.

The tenth page continues with *Voluta*, Sect. 1; and *V. proboscidalis*, Lam. and *V. scapha*, Gmel. are described.

The eleventh page deals with *Pterocera* as a division of the Strombi, and *P. aurantia*, *P. nodosa*, Brug. and *P. robusta*, are described. The first is presumably Lamarek's species, and *Strombus scorpio*, Martini, is given as a synonym, the third is described as a sp. nov. by Swainson, and its nearest ally given as *P. nodosa*, Brug.

The twelfth page continues *Pterocera*, and *P. elongata*, *P. millepeda*, L. and *P. violacea*, Martini, are described. The first is separated from the second, and described as a sp. nov. by Swainson.

The text ends here; no more text seems to have been published until the second edition by Sylvanus Hanley in 1841.

Eight Plates follow, illustrating

<i>Voluta diadema</i> , Lam.	<i>Voluta angulata</i> (under side).
„ <i>marmorata</i> , Sw.	<i>Achatina maginata</i> , var.
„ <i>nivosa</i> , Lam.	<i>Modiola elongata</i> , Sw.
„ <i>angulata</i> , Sol.	<i>Unio alatus</i> , Lam.

[Latin names only given here.]

On the outside of the back cover is the following:—"This work is intended to contain accurate and faithfully coloured figures of some of the most beautiful and rare Shells that remain undescribed, or are imperfectly figured by former writers, and which, from their size, cannot conveniently be introduced in the 'Zoological Illustrations', now in a course of publication. The unreserved access to some of the principal cabinets in this Country, with which the author has been favoured, will enable him to select as subjects for the work,

many Shells of the greatest rarity and beauty; at the same time he will feel obliged by the intimation of any others, existing in cabinets he has not yet inspected, and which, if adapted to the work and intrusted to him, shall be most faithfully and expeditiously returned.

The Plates will be engraved on Stone by the Author, and afterwards carefully finished in colours under the superintendence of Mr. Graves. It is intended to be published (on a royal quarto size) in parts, to appear every two months, each containing eight plates, and the letterpress (which will be given in the course of publication) arranged systematically. The whole will be completed in two volumes; the price of each part, 10s. 6d. plain or 16s. coloured; or, with both plain and coloured impressions, One Guinea.

Printed by R. and A. Taylor, Shoe Lane, London."

## Part II, October, 1821.

Contains eight plates.

*Pterocera amantia*, Sw.

*Achatina sultana*, Fér.

*Strombus pugilus*, var. Lin.

*Voluta tessellata*, Lam.

„ *scapha*.

„ *pacifica*, Sol.

*Murex regius*, Sw.

*Anodon sinuatus*, on cover; *sinuosa*, Lam. on plate.

On the outside of the back cover is the following "Advertisement":

"It will be perceived from our Prospectus, that we have not pledged ourselves to give a portion of the Letter-press in every Part; for as we intend the Descriptions should follow in systematic order, this, under the form we have printed it, would be impossible. Our Subscribers will not, however, suffer beyond a little delay; for after a few Parts are published, they will find that all the Plates will be described, though the Descriptions will not accompany the contents of each particular Part."

"N.B. The Author will feel much indebted to any Collector for the loan of a small and fine specimen of *Voluta Neptuni*, Dillwyn's Catalogue, vol. i, page 578, also of *V. Corona*, Dill. 576. Martini 10. tab. 148. 1387 & 8, and *Voluta Junonia*, Martini 11. 177. 1703 & 4, and pledges himself to return them within three weeks of the time he may be favoured with them, if left in the care of Mr. Wood, No. 428, Strand, who, if required, will give a receipt for the same."

## Part III. December 1821.

(Contains eight plates.)

*Strombus pacificus*, Sw.

*Mitra glabra*, Sw.

*Fusus aruanus*, Sw.

*Voluta elongata*, Sw.

Do. (underside).

*Voluta melo*, Sol.  
*Achatina maculata*, Sw.  
*Hyria elongata*, Sw.

Part IV. March 1822.

(Contains eight plates.)

*Voluta porcina*, Lam.  
 „ *olla*, Linn.  
 „ *undulata*, Lam.  
 „ *rubiginosa*, Sw.  
 „ *tuberculata*, Sw.  
*Mitra pertusa*, Sw.  
*Strombus tricornis*, Humph.  
 „ *gallus*, Linn.

[The Plates are not numbered; but the name of each species or variety illustrated is given at the bottom of each plate, printed, or written in ink, with the Author's name attached and the source of the specimen.]

Reissue of first edition, in part redrawn; with two additional parts.

1834—1835?

This consists of six parts, the first four being a reissue with minor differences of the first issue, to which were added two new parts.

The Titles on the front covers of Parts I—III are as follows:—

“Exotic Conchology; | or | Figures and Descriptions | of | Rare, Beautiful, or Undescribed | Shells. | By | William Swainson, F.R.S. & F.L.S. | Member of the Wernerian Society of Edinburgh, | Historic Society of New York, &c. | Part I [2, 3] | containing [no contents are given] | London: | Printed for William Wood, Strand; and J. and A. Arch, Cornhill. | Price” [amount written in ink] |

There was a slip inserted in Part II referring to the first Series of the Ornithological Drawings, the ‘Birds of Brazil’, by W. Swainson. It also states “Exotic Conchology. After the Third Part, the Price of the succeeding will be raised to non-subscribers from 10s. 6d. to 14s.”

The Titles on the Front Covers of Parts IV—VI are as follows:—

“Dedicated | to | The Rev. Joseph Goodall, D.D. F.L.S. &c. | Provost of Eton. | Exotic Conchology; | or | Figures and Descriptions of Rare, Beautiful, or Undescribed | Shells. | By | William Swainson, Esq. M.P.S. Camb. | and of several Foreign Academies. | Part 4 [5, 6]. | London: | Published by Baldwin and Craddock, Paternoster Row; and J. and J. Arch, Cornhill. | Prices. Plain 7s. Coloured 10s. 6d. (Non-Subscribers 14s.) Double Plates (Subscribers) 15s. | Published every other Month, and to be completed in Six Parts.” |

At the end of W. Swainson's ‘Elements of Modern Conchology’, etc., London, 1835, appears the following Advertisement:—



“Exotic Conchology, or highly finished Drawings of some of the most rare costly or interesting Foreign Shells. Complete in *seven* parts. Royal Quarto each with 8 plates, price 10s. 6*d.* each part.”

This seventh part, if it ever appeared (? a printer's error), has not been seen.

The Contents and Dates of Publication of the 1834-5 reissue and continuation are as follows, the dates being taken from the endorsements on the covers of Major-General Thomas Hardwicke's copy in the British Museum (730 l. 24).

#### Part I. Jany 15th, 1834.

Engraved Title Page as follows:—

Exotic | Conchology | or | Drawings and Descriptions | of Rare,  
Beautiful or Undescribed | Shells. | By | William Swainson, Esq.  
FRS. LS. PS Camb. | and of several Foreign Academies [*sic*]. |  
London | Baldwin & Cradock J. & A. Arch. Treuttel. Würtz  
& Richter. W. Wood. | and by Robt. Havell, 77, Oxford St. |  
1834 |

[No letterpress, though it is possible that some copies were provided with loose text remaining over from the first issue.]

Contains 8 Plates Coloured and 8 Plates Plain, illustrating the same species as in the original issue; but they are not in the same order of arrangement.

#### Part II. April 1st 1834.

Contains 8 Plates Coloured and 8 Plates Plain, illustrating the same species as in the original issue with the exception of Plate 5, which is devoted to *Strombus alatus*, Gmel., instead of *Strombus pugilis*, var. Lin., as in the original issue.

On Plate 16 one reads *Anodonta sinuosis*, Swain., instead of *Anodonta sinuosa*, Lamk., as in the original issue, but the shell is the same in both.

#### Part III. June 2nd 1834.

Contains 8 Plates Coloured and 8 Plates Plain, illustrating the same species as in the original issue.

In Plate 20 the species illustrated is named *Cymbiola elongata*, Sw., and the other view *Voluta elongata*, Sw. In the original issue they both read *Voluta elongata*, Sw.

#### Part IV. Jany 12th 1835.

Contains 8 Plates Coloured and 8 Plates Plain, illustrating the same species as in the original issue.

#### Part V. Jany 12th 1835.

Contains 8 Plates Coloured and 8 Plates Plain.

Pl. 33. *Voluta Junonia*, Lam.

„ 34. „ *cymbium*, Lin., Mus. D. Bainbridge, on Plain Plate.  
*cymbium*, Mus. Domœ Bambridge, on Coloured Plate.

„ 35. *Cypræa pulchella*, Sw.

„ 36. *Anodon ovatus*, Sw.

- Pl. 37. *Anodon rotundatus*, Sw.  
,, 38. *Voluta maculata*, Sw.  
,, 39. ,, *æthiopica*, Linn.  
,, 40. ,, *lugubris*, Sw.

Part VI. [undated] but not earlier than March 1st 1835.  
Contains 8 Coloured and 8 Plain Plates.

- Pl. 41. *Voluta harpa*, Sw.  
,, 42. ,, *gracilis*, Sw.  
,, 43. ,, *pacifica*.  
,, 44. ,, *zebra*.  
,, 45. ,, *chrysostoma*, Sw.  
,, 46. *Strombus laciniatus*.  
,, 47. ,, *melanastomus*.  
,, 48. *Voluta scapha*.

The Plates of the first four parts of the reissue were nearly all, if not every one, redrawn, and differ, some very much, from those in the original issue; and one remarks that their colouring is not quite so good. The Plain Plates of the reissue are in the Reynell copy on India paper of a pale grey-brown tint, mounted on white paper. The Plates have no printed numbers, but in the Reynell copy they have been added in ink.

#### The Second Edition 1841.

As this is quite a common book, such notes as are necessary have been given in the introductory remarks.

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ON *RANELLA LEUCOSTOMA*, LAMARCK.

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

Read 9th April, 1915.

THE object of the present note is to find a permanent generic resting-place<sup>1</sup> for this well-known shell, which in the past has been shifted from one genus to another, and also to raise to specific rank a form from South Africa hitherto regarded as a variety of it.

In the year 1811 it was placed in the genus *Biplex* by Perry; in 1822 Lamarck, and Deshayes in 1830, called it a *Ranella*; in 1833 it was deemed a *Triton* by Quoy & Gaimard; in 1842, 1843, 1844, 1870, 1886, 1892, and 1903 it reverted to *Ranella* on the authority of Kiener, Deshayes, Reeve, Kobelt, Sowerby, and Martens; in 1857 Gray transferred it to *Apollon*; in 1853 and 1867 it reposed in *Bursa* (sub-genus *Apollon*) teste H. & A. Adams and Angas; in 1881 and 1885 Tryon and Watson regarded it as a *Ranella* of the sub-genus *Argobuccinum*; in 1888, on the authority of Pritchard & Gatliff, *Lotorium* (sub-genus *Argobuccinum*) claimed it; in 1901 and 1902 Hedley and Kesteven gave it a temporary resting-place in *Gyrineum*; in 1904 Hutton placed it in *Apollo*; in 1906 Smith referred it to *Septa*, and in 1912 and 1913 Verco and Suter located it in *Argobuccinum*.

In deciding the proper position of this species it all depends upon what characters should be regarded of generic importance. If it were merely a question of selecting the oldest name applied to the groups '*Triton*' and '*Ranella*', as understood by Lamarck, the matter would be comparatively simple, but in the present day the tendency is to multiply generic divisions, and consequently there is much more difficulty, in the present case at all events, of selecting the right genus.

Since *Ranella leucostoma* in shell characters has a greater general resemblance to the big '*Triton* shells' (e.g. *rubicunda*, Perry = *australis*, Lamarck) than to any other group, and the opercula are similar, I am inclined to place it along with them in the genus *Charonia* of Gistel. Dall<sup>2</sup> at one time considered this name synonymous with *Septa* of Perry, but it has since been pointed out by Matthews & Iredale<sup>3</sup> that this was a false conclusion. Iredale<sup>4</sup> subsequently clearly proved that the type of *Septa* of Perry is not the species selected by Dall, who at the time had not consulted Perry's earlier work, the *Arcana*, in which the first introduction of *Septa* appeared.

The external features of the animal of *Ranella leucostoma* have been described by Quoy & Gaimard,<sup>5</sup> and they are similar in general

<sup>1</sup> This is almost a hopeless task until the animals of the various groups of Tritons have been investigated.

<sup>2</sup> Smithsonian Misc. Coll., vol. xlviii, p. 134, 1904.

<sup>3</sup> *Victorian Naturalist*, vol. xxix, p. 9, 1912.

<sup>4</sup> *Nautilus*, vol. xxvii, p. 55, 1913.

<sup>5</sup> *Voy. Astrolabe*, Zool., vol. ii, p. 547.

character to those of typical forms of *Charonia*. Beyond a few words descriptive of the radula by the same authors nothing is known of it, and consequently one cannot compare it with the radulæ of '*Tritonium nodiferum*' and '*T. variegatum*' as described and figured by Troschel.<sup>1</sup> It is therefore simply on conchological characters that I now place this species in the genus *Charonia*. In a specific point of view this species has been more fortunate, having only twice received a trivial name.

Perry in 1811 was the first to describe it under the name *Biplex australasia*, and then Lamarek in 1822 designated it *Ranella leucostoma*, under which name it was commonly referred to until attention was directed to Perry's work by Mr. Hedley<sup>2</sup> in 1901, and since that date, with one or two exceptions, the name *australasia* has been accepted. In following this general practice I suggest emending the word by adding a terminal *na*, and thus making it a proper qualifying term, *australasiana*.

#### CHARONIA AUSTRALASIANA (Perry).

- 1811. *Biplex australasia*, Perry, Conchology, pl. iv, fig. 2.
- 1822. *Ranella leucostoma*, Lamarek, Anim. sans Vert., vol. vii, p. 150.
- 1830. *R. leucostoma*, Deshayes, Encycl. Méthod., Vers, vol. iii, p. 878.
- 1833. *Triton leucostomum*, Quoy & Gaimard, Voy. *Astrolabe*, Zool., vol. ii, p. 546, pl. xl, figs. 3-5.
- 1842. *Ranella leucostoma*, Kiener, Coq. Viv., p. 29, pl. ix, fig. 1.
- 1843. *R. leucostoma*, Deshayes, Anim. sans Vert., 2nd ed., vol. ix, p. 542.
- 1844. *R. leucostoma*, Reeve, Conch. Icon., vol. ii, pl. i, fig. 4.
- 1853. *Bursa (Apollon) leucostoma*, H. & A. Adams, Gen. Rec. Moll., vol. i, p. 106.
- 1857. *Apollon leucostomum*, Gray, Guide Syst. Distrib. Moll. Brit. Mus., pt. i, p. 42.
- 1867. *Bursa (Apollon) leucostoma*, Angas, Proc. Zool. Soc., p. 189.
- 1870. *R. leucostoma*, Kobelt, Conchyl. Cab., p. 127, pl. xxxviii, fig. 4.
- 1881. *R. (Argobuccinum) leucostoma*, Tryon, Man. Conch., vol. iii, p. 42, pl. xxiii, figs. 53, 54.
- 1885. *R. (Argobuccinum) leucostoma*, Watson, Challenger Gasterop., p. 401.
- 1898. *Lotorium (Argobuccinum) leucostoma*, Pritchard & Gatliff, Proc. Roy. Soc. Victoria, vol. x, p. 268.
- 1902. *Gyrineum australasia*, Hedley, Proc. Linn. Soc. N.S.W., 1901, vol. xxvi, p. 631.
- 1902. *G. australasia*, Kesteven, Proc. Linn. Soc. N.S.W., 1901, vol. xxvi, p. 713, pl. xxxvi, fig. 1, protoconch.
- 1904. *Apollo australasia*, Hutton, Index Faunæ Nov. Zeal., p. 75.
- 1912. *Argobuccinum australasia*, Verco, Trans. Roy. Soc. S. Austr., vol. xxxvi, p. 220.

<sup>1</sup> Gebiss der Schnecken, vol. i, pp. 232, 233, pl. xix, figs. 11, 12.

<sup>2</sup> Proc. Linn. Soc. N.S.W., 1901, vol. xxvi, p. 631, 1902.

1913. *A. australasia*, Suter, Man. New Zeal. Moll., p. 310, pl. xliii, fig. 5.

*Hab.*—East and South Australia, New Zealand (North Island), Kermadec Islands, Norfolk Island.

*CHARONIA POECILOSTOMA*, n.sp.

1886. *Ranella leucostoma*, var. (?), Sowerby, Journ. Conch., vol. v, p. 8.

1892. *R. leucostoma*, Lamarck, var., Sowerby, Marine Shells South Africa, p. 9.

1903. *R. leucostoma*, Lam., var. *poecilostoma*, Martens, Deutsch. Tiefsee-Exped. *Valdivia*, vol. vii, p. 56.

1906. *Septa leucostoma*, Smith, Ann. Natal Mus., vol. i, p. 41.

*Hab.*—Cape Colony and Natal.

As pointed out by Sowerby and Martens, this species differs from *Charonia leucostoma* in always having "dark-brown blotches" on the labrum, which in *leucostoma* is invariably pure white. In adult specimens this dark-brown colour also occurs on the outer edge of the callus, which is spread over the columella, and about the middle and above the tubercle on the upper part it forms large suffused blotches.

There does not appear to be any other marked feature to distinguish the two forms, but judging from six examples from South Africa and eighteen from Australia and New Zealand, the varices on the former, especially on the spire, are less raised and not so deeply pitted behind. Also the general form of the shell is a trifle broader.

NOTE ON *NAUTILUS MOKATTAMENSIS*, A. H. FOORD, FROM  
THE EOCENE OF EGYPT.

By G. C. CRICK, F.G.S., of the British Museum (Natural History).

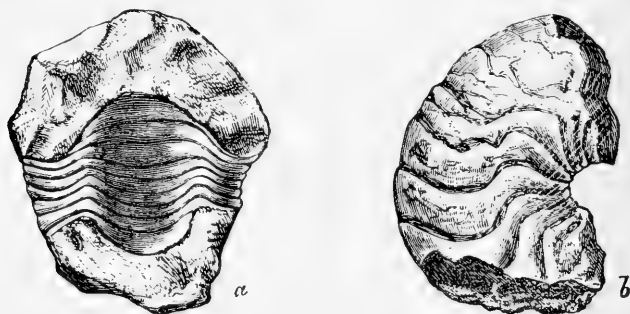
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Read 9th April, 1915.

PLATE VIII.

THE species *Nautilus mokattamensis* was founded by Dr. Foord<sup>1</sup> upon two fragments in the British Museum. Of these, one,<sup>2</sup> from the Eocene of the Mokattam range near Cairo, was figured, and may therefore be regarded as the type.

The species was described as follows: "Shell (cast) inflated, somewhat compressed on the sides, rather narrowly rounded on the periphery. Aperture very wide, semi-lunate. Umbilicus small, with steep sides. Septa approximate. Sutures flexuous, forming a conspicuous forwardly-directed lobe [saddle] in the umbilical region, then curved backwards in a broad and shallow sinus, and again a little forwards, and making a narrow [? shallow] but distinct sinus on the periphery. The position of the siphuncle is not seen. None of the test is present."



*Nautilus mokattamensis*.—*a*, front view of the type-specimen; *b*, lateral view of the same. Eocene: Mokattam range, near Cairo, Egypt. A little less than one-half of the natural size. Original in the British Museum Collection, Geol. Dept., register number 3404. (After Foord.)

The figures do not, however, give quite a correct idea of the fossil. The specimen consists of the natural cast of about one-half of a whorl of the septate portion of a shell; the outer portion of the anterior part of the specimen is very much eroded, more so than is shown in the side view given by the author (see fig. 1*b*), so that the form of the cross-section of the whorl is not quite correctly represented in the front view accompanying the author's description (see fig. 1*a*);

<sup>1</sup> A. H. Foord, Cat. Foss. Ceph. Brit. Mus., p. ii, 1891, pp. 329, 394, figs. 85*a*, *b*.

British Museum Collection, Geol. Dept., register number C. 3404.

the height of the whorl was originally relatively greater. A transverse section of the whorl at about the middle of the fossil has approximately the following dimensions: height, 50 mm.; thickness, 64.5 mm.; height above preceding whorl, 31 mm.; amount of indentation by preceding whorl, 19 mm. The septa are about 18 or 19 mm. apart at the centre of the periphery.

The specimen was presented to the National Collection by Sir Richard Owen, and from the fact that it has been labelled in Dr. Henry Woodward's handwriting: "*Nautilus Forbesi*, d'Arch."; it is doubtless the specimen referred to under that name by Professor Owen in his paper "On the Fossil Evidence of a Sirenian Mammal from the Nummulitic Eocene of the Mokattam Cliffs, near Cairo" (Quart. Journ. Geol. Soc., vol. xxxi, p. 103, 1875), as may also be inferred from both Dr. Foord's remarks, and the fact that Dr. Foord gives this reference in his synonymy of the species (*op. cit.*, p. 329).

Besides the type, the National Collection contains two other examples, both internal casts, labelled by Dr. Foord "*Nautilus mokattamensis*". One of these,<sup>1</sup> about one-half of the outer whorl of an example of about 90 mm. in diameter, exhibits a portion of the body-chamber, the last camera (or 'air-chamber') being only about one-half of the depth of the preceding chamber, a character from which it may be inferred that the shell belonged to an adult individual, so that the species does not appear to have attained a large size. The other specimen<sup>2</sup> in the collection is labelled "Egypt? Dr. Hooker"; it was transferred from the Museum of Practical Geology together with other foreign collections in 1880. It formed part of a larger shell than either of the other two, and consists only of the umbilical region, the side and part of the peripheral area of about three-fourths of the outer whorl, including a small part of the body-chamber. The umbilicus is very small, and may have been closed when the shell was present. The septa are relatively wider apart than in the other two specimens. The fossil is preserved in a whitish limestone, whilst the specimens from the Mokattam range are in a buff or yellowish-coloured limestone.

In 1901 M. Cossmann<sup>3</sup> described and figured, under the name *Nautilus nubari*, from the Mokattam escarpment near Cairo, a species which he subsequently admitted<sup>4</sup> was the same as Foord's *N. mokattamensis*.

In 1906 a very poor example and a detached septum, both from the Mokattam escarpment, but not from precisely the same locality, were figured, and referred to Foord's species, by P. Oppenheim,<sup>5</sup> who supplemented Cossmann's description, at the same time pointing out its resemblance to Sowerby's *Nautilus imperialis*.

<sup>1</sup> British Museum Collection, Geol. Dept., register number 83132.

<sup>2</sup> British Museum Collection, Geol. Dept., register No. C. 3403.

<sup>3</sup> M. Cossmann, "Additions à la faune nummulitique d'Égypte": Bull. Inst. Egypt., sér. IV, no. 1, p. 174, pl. i, fig. 8, 1900 (1901).

<sup>4</sup> M. Cossmann, Rev. crit. Paléozool., vii, p. 67, 1903.

<sup>5</sup> P. Oppenheim, Palæontographica, Bd. xxx, Abth. iii, Lief. 2, p. 344, pl. xxvii, fig. 15, text-figure (fig. 35), 1906.

Since Dr. Foord's original description of *Nautilus mokattamensis* appeared, the National Museum has received as a donation from H. Pearson, Esq., a so much better example of this species from the Mokattam escarpment, near Cairo, that it seems to merit description.

This specimen<sup>1</sup> (Pl. VIII, Figs. *a*, *b*), although smaller than either of the other examples in the collection, is a fairly complete internal cast of the septate portion of a shell, having the following measurements: diameter, 79 mm. (1); height of outer whorl, 45 mm. (0·569); ditto above preceding whorl, 29 mm. (0·367); greatest thickness, 62 mm. (0·784); width of umbilicus, 6 mm. (0·0759). The last two septa are 17·5 mm. apart at the centre of the periphery. Where the whorl is only 16 mm. high and its height above the preceding whorl 10·5 mm., the siphuncle is very near the dorsal (inner) edge of the septum, but with the growth of the shell the siphuncle gradually recedes from the dorsum until at the anterior end of the specimen, i.e., where the whorl is 45 mm. high, it becomes almost exactly median. Commencing suddenly near the median line of the peripheral area of the end of the penultimate whorl, and extending thence over the first sixth of the outer whorl, there is, a little on one side of the median line, a longitudinal fairly deep and broad groove; this ceases rather abruptly, and almost exactly on the median line of the periphery another narrow groove originates and extends over about another sixth of the outer whorl, broadening in its course and gradually disappearing; the median line of the peripheral area of the rest of the whorl is occupied by a fairly distinct raised line (the 'normal line'). The longitudinal groove is accompanied on each side by several obscure irregularly-spaced coarse backwardly-curved ribs, and is evidently the result of injury to the shell. The greatest thickness of the whorl is at about two-fifths of the height of the whorl from the edge of the umbilicus. No portion of the test is present; if it had been preserved the umbilicus would doubtless have been very small, or possibly even closed. The septa are moderately concave, and their dorsal margin is projected forward; there is no dorsal (annular or columellar) lobe even where the whorl is only 16 mm. high, and its height above the preceding whorl 10·5 mm.

The description of the species may therefore be emended as follows: Shell (cast) of medium size, ovate, moderately inflated, rather rapidly expanding; greatest thickness at about two-fifths of the height of the outer whorl from the edge of the umbilicus, about four-fifths of the diameter of the shell; height of outer whorl about four-sevenths of the diameter of the shell. Whorls (? number); inclusion almost complete; umbilicus small. Whorl semi-elliptical in transverse section, about one-third wider than high; indented to about one-third of its height by the preceding whorl; periphery not very broadly rounded, imperfectly defined from the sides, exhibiting 'normal line'; sides convergent, flattened, feebly convex; umbilical zone sloping towards the centre of the umbilicus, convex, with subangular margin. Length of body-chamber and aperture not seen.

<sup>1</sup> British Museum Collection, Geol. Dept., register No. C. 12426.



Chambers moderately deep, about two-ninths of the diameter of the shell in depth at the median line of the periphery, about sixteen in a whorl. Septa moderately concave, their dorsal (inner) margin projected forward. Siphuncle sub-dorsal in the nepionic stage, but gradually becoming median in the ephebic(?) stage. Suture-line with a sinus on the umbilical zone, a well-marked saddle on the outer side of the umbilical margin, a feeble sinus on the middle of the lateral area, a broad low saddle on the peripheral margin, an exceedingly shallow sinus on the peripheral area, and no dorsal (annular or columellar) lobe. Test not seen.

Though apparently closely related to D'Archiac & Haime's *Nautilus forbesi*,<sup>1</sup> of which the type-specimen came from the Eocene of Sind, India, that species is not only, as Dr. Foord pointed out, a "much narrower and more compressed shell", but compared with the Egyptian form its siphuncle is nearer the dorsal (or inner) edge of the septum. From *Nautilus imperialis*,<sup>2</sup> to which the Egyptian form has a considerable resemblance, and which has already been recorded<sup>3</sup> from the Mokattam Range, *Nautilus mokattamensis* is distinguished by its relatively greater thickness, the more nearly median position of its siphuncle, and the greater slope of the outer side of the saddle situated near the umbilical margin.

<sup>1</sup> Le Vicomte d'Archiac and Haime, "Description des animaux fossiles du groupe nummulitique de l'Inde," etc., livr. ii, p. 338, pl. xxxiv, figs. 12, 12a, 1854. The type-specimen, at one time in the Museum of the Geological Society of London, and bearing the No. R. 9591, is now in the British Museum. It is somewhat crushed, and consists of half of a whorl of the septate portion of the shell, 73.5 mm. (1) in diameter. Its other measurements are: height of outer whorl, 48 mm. (0.653); ditto above preceding whorl, 26 mm. (0.353); greatest thickness, 44 mm. (0.598); centre of siphuncle, 21.5 mm. from the ventral (peripheral) and 4.5 mm. from the dorsal (inner) margin of the septum. The siphuncle is 4.5 mm. in diameter. The umbilicus is obscured by matrix; it was probably nearly closed. There is a feeble umbilical shoulder just on the umbilical side of the saddle on the lateral area. It is obvious from D'Archiac and Haime's fig. 12a, which is fairly accurate (except that the outline of the umbilicus seems to have been added), that the lower part of fig. 12 has been restored.

<sup>2</sup> J. Sowerby, Min. Conch., vol. i, No. 1 (June, 1812), p. 9, pl. i, upper, right-hand (with septum in outline below), and middle figures; and J. de C. Sowerby, op. cit., vol. vii, No. 109 (February, 1843), p. 35, pl. dcxxvii, fig. 4. A completely septate example of this species in the British Museum Collection from the London Clay of Primrose Hill, Middlesex [register No. 50164], has the following dimensions: diameter, 54.6 mm. (1); greatest thickness, 38.8 mm. (0.71); height of outer whorl, 34.1 mm. (0.624); ditto above preceding whorl, 22.1 mm. (0.404); centre of siphuncle from the dorsal (inner) edge of the septum, 9.4 mm. The measurements of the present example of *N. mokattamensis* at a diameter of 56 mm. (1) are: thickness of whorl, 42.0 mm. (0.75), and the height of the outer whorl, 31.6 mm. (0.564); and at a diameter of 64.2 mm.: thickness of whorl, 47.8 mm. (0.744); height of outer whorl, 36.4 mm. (0.567); ditto above preceding whorl, 23.3 mm. (0.362); centre of siphuncle from the dorsal (inner) edge of the septum, 8.3 mm.

<sup>3</sup> R. Fourtau, Bull. Inst. Egypt., sér. IV, No. 1, p. 171, 1900 (1901).

*Nautilus imperialis* is referred by Hyatt<sup>1</sup> to his genus *Eutrephoceras*,<sup>2</sup> and *Nautilus mokattamensis* seems to be referable to the same genus.

#### EXPLANATION OF PLATE VIII.

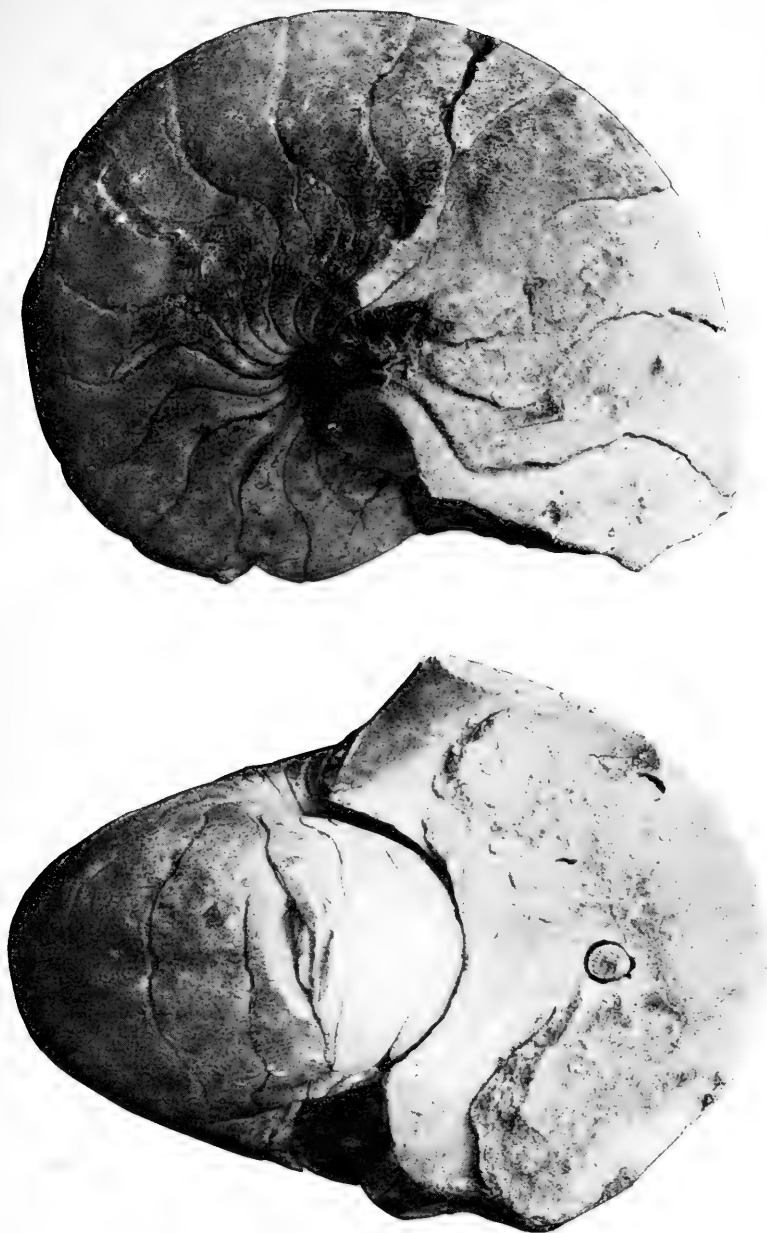
*Nautilus mokattamensis*.—*a*, lateral aspect of a natural internal cast showing the narrow umbilicus and course of the sutures; *b*, front view of the same showing the position of the siphuncle. Eocene: Mokattam range, near Cairo, Egypt. Drawn from a specimen in the British Museum (Natural History), Geol. Dept., register No. C. 12426. Somewhat enlarged.

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<sup>1</sup> A. Hyatt, "Phylogeny of an acquired characteristic": Proc. Amer. Philos. Soc., vol. xxxii, No. 143, p. 559, 1894.

<sup>2</sup> A. Hyatt, *ibid.*, p. 555. Genotype: *Nautilus dekeyi*, Morton (Synop. Org. Rem. Cret. Group, U.S., 1834, p. 33, pl. viii, fig. 4). Hyatt states that in this genus "There are no annular lobes at any stage of development", although in his description (p. 559) of *Eutrephoceras imperiale* (J. Sowerby) he mentions that "This species has an annular lobe which has no connection with the subdorsan siphuncle", though he adds in the next sentence: "I could not find any traces of these (annular lobes) in the older sutures." Of the examples of the species which the present writer has been able to examine, none shows any annular lobe, even where the height of the whorl is only 5.6 mm. (equivalent to a shell-diameter of 8.7 mm.), as in a specimen in the British Museum (No. 68905a) from the London Clay, near Chalk Farm, Middlesex.

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NAUTILUS MOKATTAMENSIS, A. H. FOORD.



## SOME MORE MISUSED MOLLUSCAN GENERIC NAMES.

By TOM IREDALE.

Read 9th April, 1915.

CONTINUING my verification of the generic names to be used for Antipodean Molluscs, I have noted some exotic names which seemed to call for rectification. I here give notes upon a few names of more than local interest, and am glad to find that my previous communications have been appreciated, both Messrs. Dall and Cossmann personally writing me with regard to some of the points I raised, for which I here thank them. I hope they will continue their kindly criticism, for by means of such help we shall sooner attain a fixity of our nomenclature.

## SKENE, Fleming.

In the last List of British Marine Molluscs, *Skenea*, Fleming, and *Delphinoidea*, Brown, are admitted as different genera, and the latter crept an entry into Suter's Manual of New Zealand Mollusca. I have rejected it as I did not consider the Neozelanic mollusc, so classed, as congeneric with the type of Brown's genus. I now find there has been a confusion between the two above-named genera, and here attempt to explain it, and clear up the matter. In the Edin. Philos. Journ., vol. xii, April, 1825, p. 246, footnote, Fleming discussed the status of some small shells and concluded, "Three species, *Helix depressus*, *serpuloides*, and *unispiralis* of Montagu . . . call for the construction of a new genus, which will in some respects have the same relation to *Cyclostrema* as *Turritella* bears to *Scalaria*. This genus I feel inclined to term *Skenea*."

In his Hist. Brit. Anim., 1828, p. 313, Fleming included the genus *Skenea*, giving as recent examples only *S. depressa*, *serpuloides*, and *divisa*.

In the meanwhile Brown, in the Illus. Conch. Gt. Britain, 1827, pl. li, figured a number of species of minute shells under the genus-name *Delphinoidea*, among them being *depressa*, *serpuloides*, and *divisa*, most of the others being indeterminable or fry.

No type of either *Skenea* or *Delphinoidea* was named by their authors, nor is any example tautonymic. Consequently, the first author to select a type *must* be followed, and this appears to be Gray, who in the Proc. Zool. Soc. 1847, p. 152, wrote:

*Skenea*, Fleming, 1824, 1828. *Delphinoidea*, T. Brown, 1827.  
*Helix serpuloides*.

Thus, as type of *Skenea*, one of the original species was named, and this finally fixes that genus. Unfortunately Forbes and Hanley (Hist. Brit. Moll., vol. iii, 1850, p. 155), when they admitted *Skenea*, wrote thus: "This genus was established by Dr. Fleming for the *Helix depressa* of Montagu, and some apparently allied shells . . . It is synonymous with the *Delphinoidea* of Brown. . . . The only one of the following shells which unquestionably should retain this

generic appellation is the *S. planorbis*, type of the genus." The "*S. planorbis*" mentioned was based on the *Turbo planorbis* of O. Fabricius, which was considered equivalent to and earlier than *Helix depressa*, Montagu.

H. and A. Adams (Gen. Rec. Moll., vol. i, p. 335, 1854 (March)) retained *Skenea* for *S. planorbis*, O. Fabricius, writing, "The other small, depressed British shells, usually associated with it . . . constitute the *Delphinoidea* of Brown." On p. 405 they placed *Delphinoidea*, Brown, as a synonym of *Cyclostrema*, Marryatt, noting "Should the smaller British species require to be separated from the more typical forms, they will take the name of *Delphinoidea*, Brown". However, later (vol. ii, p. 629, Nov., 1858), they corrected themselves as follows: "According to Dr. Gray, certain of the smaller species of *Cyclostrema*, included by Brown in his genus *Delphinoidea*, are *Vitrinellæ*. The name *Delphinoidea*, however, it would be more correct to add as a synonym of *Skenea*, and to transfer the species of *Cyclostrema* in question to the genus *Vitrinella*."

Jeffreys in the Brit. Conch., vol. iii, p. 287, 1865, referred the species to *Cyclostrema*, save *Skenea planorbis* of course, rejecting *Delphinoidea* as "both superfluous and heterogeneous". Jeffreys probably had not the least idea of *Cyclostrema*, as that would be the last disposition of the British shells to anyone acquainted with the type of *Cyclostrema*.

Miss K. Bush (Trans. Conn. Acad., vol. x, July, 1897, p. 100) has given an account of *Delphinoidea*, citing *D. serpuloides* (Montagu) as type, and retaining *Skenea* with *S. planorbis* (Fabricius) as type. She, however, observed that the name *Delphinoidea* was objectionable as being in use for a higher group in another branch of science. The only conclusion possible is that *Skenea* must be used for the British shells grouped around *Helix serpuloides*, Montagu, as type, and this result leaves the *planorbis* group nameless. I therefore propose

#### SKENEOPSIS, gen. nov.

naming *Turbo planorbis*, O. Fabricius, as type.

The family name will become Skeneopsidæ, and *Skenea* and the family Skeneidæ will replace the genus *Delphinoidea* and family Cyclostrematidæ of the British List. I have elsewhere urged the absolute rejection of *Cyclostrema*, Marryatt, as indeterminable, the type being lost and the species unrecognized.

#### STROMBIFORMIS, Costa.

This generic name has been ignored up to the present, but this laxity can no longer be maintained. The unfortunate construction of the word has in a great measure conduced to this disregard, but it appears that the name was not composed of *Strombus* (the generic name of certain well-known molluses) and *formis*, but was derived from *strombus*, a needle, and *formis*. Costa gives as the English equivalent, Needle-shaped shells. If this be borne in mind the dislike to the name may be lessened, *since the name must come into common use*. It was proposed in the British Conchology, 1778, p. 107, for a series of shells each one of which now bears a later generic name.

Consequently it is impossible to get rid of the name by citing it as a synonym. The only way to deal with it is to select as type the species which represents a genus the least extensive or little used.

I have been unable to trace any prior type designation, for which I am sincerely thankful, as any such would almost certainly have caused great confusion.

The species associated by Costa are—

<i>Strombiformis perversus</i>	=	<i>Clausilia</i> . 1805.
<i>bicarinatus</i>	=	<i>Turritella</i> . 1799.
<i>terebra</i>	=	<i>Turritella</i> .
<i>cinctus</i>	=	<i>Turritella</i> .
<i>clathratus</i>	=	<i>Epitonium</i> . 18
<i>albus</i>	=	? <i>Eulima</i> . 1826.
<i>glaber</i>	=	<i>Leiostraca</i> . 1805.
<i>reticulatus</i>	=	<i>Bittium</i> . 1805.
<i>costatus</i>	=	Indeterminable.

By elimination the choice would fall upon *Leiostraca*, and I designate as type of *Strombiformis*, Costa, 1778, the species (*S.*) *glaber*. *Leiostraca* is preoccupied and invalid, and I have replaced it by *Subularia*, Monterosato. By my present action *Strombiformis* will come into use for that genus, and, as I have stated above, if the meaning of the name be remembered, it may in time become almost pleasant. It is most appropriate to this genus, and here it may be again emphasized that *Strombiformis* must be accorded generic rank as distinct from *Eulima* (= *Melanella*), and not be considered subgeneric only.

In conversation with Mr. E. A. Smith, I.S.O., of the British Museum, he drew my attention to a discussion of the name twenty years ago by the Malacological Society of London (Proc. Malac. Soc., vol. i, pp. 31-3). The question as to the type was discussed, apparently *Clausilia* and *Turritella* being chosen as the most likely to be eliminated by the reintroduction of *Strombiformis*. Fortunately, however, without any definite result being achieved, the subject was dropped on the ground that Costa was not binomial.

This argument is unavailable, so that the preceding still holds good. I have also noted other workers have rejected Costa's genus as "heterogeneous"; all the earlier workers proposed genera which would fall under that term, and some present-day writers still make use of genera which are, to me, heterogeneous.

Mr. J. R. Le B. Tomlin recently gave me a copy of Costa's *Elements of Conchology*, 1776, which has often been quoted, but is now rejected as being non-binomial. I cannot understand why it came to be mentioned, since it is so obviously polynomial. As of historical interest, I would mention Costa's account, as it gives a clue to his nomination.

"p. 205. The fifth and last genus of Snails is what I shall call Cochleæ Strombiformes: (Clavicula tenue et longissima) for they are very long and slender shells, tapering to a sharp point, and therefore exactly resemble the Needles or Strombi, whence I have named them

*Strombiformes*. Pl. iii, fig. 9. These Snails have a perfect round mouth, well defined or bordered, by which particular alone they are immediately distinguished from the Strombi, whose length and slenderness they emulate; for the mouths of the Strombi are long, and have a very thick columella aside them, erect, and somewhat twirled; and many kinds besides prolong into a wry gutter, turning backwards, like the mouth of a Soal, or other flat-fish." This shows my earlier conclusion needs emendation, as Costa *did* make up his word from *Strombus*, a shell, and *formis*, but his *Strombus* is not the commonly accepted one, but is what we call *Cerithium*. On p. 212 he defines his Strombi, and figures a specimen on pl. iv, fig. 7. Costa's figures are really splendid, and his typical *Strombus* I would identify as the Australian shell called *Clava herculea*, Martyn.

#### TURRICULA, Herrmann.

In Sherborn's inestimable Index Animalium, 1902, p. 1007, appears "*Turricula* J. Herrmann, Tab. aff. Anim. ed. 2, 1783, tabula.—G". Such an entry demanded investigation, as this is the earliest use of the genus-name *Turricula*, and apparently it was proposed for a Gastropod mollusc. I therefore looked up the reference, and would put on record my conclusions for the benefit of those unable to personally verify such matters.

On the tabula quoted a scheme is given purporting to show the connexions between the varied molluscan families, genera, and species. No explanation is given, so that the table must be studied alone. The species names are in italics, the group names in roman. "*Turriculæ*" thus appears, and against it stands *Buccinum subulatum* in italics. This suggests at first sight that *B. subulatum* was an example of *Turricula*. Such a conclusion would mean the substitution of *Turricula* for *Terebra*, which is of later date. I would here digress and point out that *Terebra* is commonly ascribed to Bruguière, 1789. In the Encycl. Méthod. Vers, vol. i, p. xv, 1789, where this name is introduced by Bruguière, only a short diagnosis is given, and no species cited. I consider these diagnoses quite indeterminable, and practically *nomina nuda*, and would, therefore, recognize *Terebra* as of Lamarck, 1799, where in the Mém. Soc. Hist. Nat. Paris, p. 71, a diagnosis is given, and accompanied by the species *Buccinum subulatum*, L. To revert to *Turriculæ*. Examination of Herrmann's tabula dispels the conclusion that this was intended as a generic name for *B. subulatum*, and suggests rather that it was more probably the group name of a Stromb affinity, which Herrmann considered passed into *B. subulatum*. For preceding it is named Strombi digitati, and later on is noted Cypræa and Conus, then "*C. ventricosi*", followed by "*Vol. cylindroidæ*". This will suggest the confused and unintelligible state of the tabula, which is emphasized by the following extract: "*Buccinum* is opposed by *B. harpa*, and connected by a long line with '*Buccin. Cassidea*', against which stands '*Ner. elegans*, M.', while a continuation of the line ends in '*Buccina ampullacea*'." To me the "*Ner. elegans*, M." has nothing to do with "*Buccin. Cassidea*", but is relative to *Turbo*, which can be seen a long way above.



After due consideration I conclude that the names on this tabula have no systematic value, and need not concern any taxonomer further. Consequently *Turricula*, as far as Sherborn's researches have led us, was not legitimately proposed prior to 1800, and the earliest user after that date will claim priority, according to the Nomenclatural Laws now in use. Secondly, *Cassidea*, Herrmann, 1783, is comparable, and leaves *Cassidea*, Bruguière, 1792 (not 1789, n.n.) valid.

#### LIMACINA.

The authority for this name is generally given as Cuvier, but in the Règne Animal, vol. ii, 1817 (but really published December, 1816), p. 380, only the vernacular appears. Consequently a later legitimate user is required, and the earliest seems to be Lamarck, who, in the Anim. sans Vert., vol. vi, pt. i (February-June), 1819, p. 290, correctly introduced *Limacina*, with the sole species *L. helicalis* = *Clio helicina*, Gmel. = *Argonauta arctica*, O. Fabricius. No one seems to have hitherto worried about this, nor about Blainville's genus *Spiratella*. In the Dict. Sci. Nat. (Levrault), vol. xxxii, 1824, in his monumental article on the Mollusca, the basis of his later Manuel, Blainville used *Spiratella*, p. 284, with the "Observ. Nous avons tiré les caractères de ce genre surtout de l'ouvrage de M. Scoresby. Il est établi sur un animal presque microscopique des mers arctiques, dont M. Cuvier a fait son genre *Limacine*, adopté par M. de Lamarck".

In the 50th volume of the same Dictionnaire, published in 1827, at the word "*Spiratelle*. *Spiratella*", there is the following claim: "Genre de mollusques, établi pour le *clio helicina* de Linné, et que MM. Cuvier et de Lamarck ont nommé limacine: dénomination que M. de Blainville n'a pas adoptée, d'abord pour éviter la confusion que l'analogie de nom avec celui de limace pourroit occasioner, et ensuite parce qu'il avoit proposé celui de spiratelle avant la publication de l'ouvrage de M. Cuvier."

It was necessary to investigate Blainville's claim for priority, but I was unable to locate the name without recourse to Sherborn's MS. for the second part of his Index Animalium. I was gratified to find that, as usual, he had noted it in a place I had overlooked. For in the 9th volume of the same Dictionnaire, published in 1817, Blainville under the word *Clio*, after describing two species in detail, distributed the other species of known *Clio*, concluding (p. 407) with "Quant au *clio helicina*, j'en ai fait le genre SPIRATELLA. Voyez ce mot". Consequently Blainville's *Spiratella* has absolutely priority, and being exactly equivalent with Lamarck's *Limacina*, must displace it.

In the Journ. de Physique, vol. lxxxv, p. 391, November, 1817, after Lesueur's genus *Atlanta*, Blainville adds, "Ce genre nous paroît avoir beaucoup de rapports avec le *Clio helicina* de Gmelin, qui se trouve en si grande abondance dans les mers du Nord, et dont nous avons fait le genre Spiratelle dans notre *Genera Molluscorum* de l'*Encyclopédie Britannique*." It does seem unfortunate that such a valuable contribution should have been rejected by both French and English (including Scotch) authorities.

## FISTULANA.

There is so much confusion surrounding this name that I feel dubious about a perfect clearance.

As regards Malacology, the name appears to have been first introduced by Bruguière in the *Encycl. Méthod.*, Vers, vol. i, p. xii, 1789, with the following definition:—"Fistulane. *Fistulana*. Coquille tubulée, fusiforme, contenant deux valves dans sa cavité, une des extrémités perforée."

No species are attached, and in my opinion such an entry is incomplete and too indeterminate for acceptance. In the plates to the *Encycl. Méthod.*, Vers, vol. ii, published 1791, pl. 167 is headed "Taret. *Teredo*. Fistulane. *Fistulana*". Twenty-four figures are given, but none are named or referred to the two genera noted. Consequently we are no nearer what was meant by *Fistulana*. In the explanation of the plate given by Bory de Saint Vincent, thirty-six years afterwards, the identification read—

- "Figs. 1- 5. *Teredo navalis*, Lamk., v, 440.  
 ,, 6-15. *Fistulana gregata*, Lamk., v, 435.  
 ,, 16. *corniformis*, Lamk., v, 435.  
 ,, 17-22. *clava*, Lamk., v, 436.  
 ,, 23. *lagenula*, Lamk., v, 435."

This is merely of historical interest.

Cuvier in the *Tabl. Élém. Hist. Nat.*, 1798, p. 432, included "La Fistulane, Brug. (*Teredo clava*, Linn.)."

In 1799, Lamarck, in the *Mém. Mus. d'Hist. Nat.*, p. 90, wrote: "Fistulane. *Fistulana*. Coq. tubulée, en massue, ouverte à son extrémité grêle, et contenant dans sa cavité deux valves non adhérentes. *Teredo clava*. Gmel., *Syst. nat.*, 4, p. 3748."

We have here one of those puzzling problems where the type does not agree with the diagnosis, but further consideration may be deferred owing to the fact that the genus-name is invalid. Prior to Bruguière's proposal, the name *Fistulana* had been appropriated by O. F. Müller, who in the *Zool. Dan. Prodr.*, 1776, introduced it, *Add.*, pp. 275-82, as a new name for *Fistularia*, used by him in the body of the work. O. Fabricius (*Fauna Groenl.*, p. 441, 1780) accepted Müller's proposition, and uses the name without comment. Consequently Bruguière's name cannot be maintained at all. The preceding review is necessary, as Hedley (*Proc. Linn. Soc. N.S.W.*, vol. xxxiv, p. 436, 1909) recorded *Fistulana mumia* as new to Australia, and noted in his synonymy the usage of the same combination by Smith (*Proc. Malac. Soc.*, vol. vi, p. 185, 1905). Probably both these writers were governed by Dall's conclusion. In the *Trans. Wagner Free Inst. Sci. Philad.*, vol. iii, p. 826, April, 1898, Dall recorded: "Bruguière was the first to name *Fistulana*, though he did not describe it or cite any species. Cuvier supplied a type, and this was adopted by Lamarck. For some time later, however, *Fistulanas* and *Gastrochænas* were confounded in lists of the genus, while Gray injudiciously endeavoured to utilize *Chæna* as a name for this group. Tryon became badly confused on

the generic nomenclature of this group, which was rectified by Fischer in 1866."

According to Dall's argument *Fistulana*, as used by him, would be nameless, but before moving in this matter the genus name *Gastrochæna* must be re-investigated. This name was introduced by Spengler in the Nye. Saml. Vidensk. Selsk-Skrifter (Kjoben.), 1783, p. 174. Three species are named and figured: p. 179, *Gastrochæna mumia*, pl., figs. 3-6; p. 180, *Gastrochæna cuneiformis*, pl., figs. 8-11; p. 182, *Gastrochæna cymbium*, pl., figs. 12-16. No type was named, but the predominate species was *G. mumia*. Five years afterwards Retzius (Diss. Hist. Nat. Nov. Test. Gen., 1788, p. 19) proposed *Chæna* for the same series. I suggest that Bruguière's genus was coequal, but that does not matter. Spengler in 1793 used Retzius' name. Whether Cuvier's or Lamarck's action with regard to *Fistulana* affect *Gastrochæna* does not now concern us. They do not seem to have fixed a type of *Gastrochæna*, but rather seem to have ignored it or wished to discard it.

Gray in the Proc. Zool. Soc., 1847, p. 189, designates

*Chæna*, a, Retz., 1788.

*Ch. mumia*.

*Gastrochæna*, Spengler, 1780.

*Mya dubia*.

If the first designation were available, then that could be used as type of Spengler's genus, because *Chæna* was simply a substitute name; the second designation was invalid, as *Mya dubia* was not one of the Spenglerian species.

However, in the Gen. Rec. Moll., vol. ii, pp. 334-6, June, 1856, H. & A. Adams used *Gastrochæna*, noting as synonyms *Chæna*, Retzius, and *Fistulana*, Lamarck. They gave as example *G. mumia*, Spengler, and wrote: "The curious shell on which Spengler founded this genus is generally known under the name of *Fistulana clava*, Lamarck; it is also the type of the *Chæna* of Retzius."

This statement should be taken as absolutely fixing the type of *Gastrochæna*, and this name will displace *Fistulana* of recent authors, which is preoccupied, and we will revert to *Rocellaria* for the species recently known as *Gastrochæna*, but which for many years carried that name, and with which even we of the youngest school are familiar. The names would be then:

*Gastrochæna*, Spengler, 1783. Type, *G. mumia*, Spengler. = *Fistulana* of recent writers.

*Rocellaria*, Blainville, Dict. Sci. Nat. (Levrault), vol. lvii, 1828 (January 10, 1829), p. 244 (*ex* Fleuriau de Bellevue MS.). Type (by monotypy) *G. modiolina*, Lamk. = *Mya dubia*, Pennant.

BELA, Gray.

As a text for a sermon on "Pleurotomoid" nomenclature *Bela* will do as well as any other name. Probably every conchologist will agree with me that the family known so long as Pleurotomidæ is probably the most difficult of any to study in the whole class. Reasons are not difficult to provide for this: numerous in species, though few in specimens, and similarity of design, all tend to produce complex

problems. Consequently no family has suffered to such an extent, and the unparalleled confusion will only be dispelled by some conchologist making a patient and long, almost lifelong, study of the group. New species are commonly met with in almost every collection, made in almost any locality. These new species are elegant and beautiful in form, and compellingly demand description. To correctly generically locate such would mean long, careful, and slow work, and such has been consistently denied them. Almost every recent worker deserves more or less blame; I would scarce except one, and would indicate myself as a probable additional offender. For I also have new species to describe, and it is almost certain as much confusion will be added as I hope to clear up. Certain preliminary steps have, however, never been taken, and these deserve notice, as no excuse can be offered save carelessness or negligence. Kobelt (Icon. Europ. Meeresconch., vol. iii, pp. 233-80) monographed the European forms, and though little care was taken in connexion with the generic names utilized, Sykes (Proc. Malac. Soc., vol. vii, pp. 173-90, 1906) perpetuated most of the errors, though he was apparently aware of them. I will discuss these matters more fully in another place. I note, however, in the Zool. Record for 1912 that during that year Dall & Bartsch, Thiele, and Dautzenberg & Fischer all made use of *Bela*.

I have got together the data in connexion with this name as follows:—

*Bela* was first published by Gray as of the Leachian manuscript of British shells in the Ann. Mag. Nat. Hist., vol. xx, p. 270 (October 1, 1847), where the species named read—

<i>Bela nebula.</i>	<i>Murex</i> , Mont.
<i>    rufa.</i>	
<i>    cranchii.</i>	
<i>    minima.</i>	<i>Buccinum</i> , Mont.
<i>    septangularis.</i>	<i>Murex</i> , M.
<i>    attenuata.</i>	<i>Murex</i> , M.

In the same place appears

*Buccinum turricula*, *Murex*, M.

In the Proc. Zool. Soc., 1847, p. 134, published the following month, Gray designates as type *Murex nebula*. This introduction has commonly been given as the earliest one. In the Leachian Synopsis Moll. Great Britain, published by Gray in 1852 (preface dated February 12), the same association of species appears as in the Annals, 1847. In the Gen. Rec. Moll., vol. i, p. 92, June, 1853, H. & A. Adams made use of *Bela*, as of Leach, citing as example *B. turricula*, Montagu, and on p. 99 they quoted *nebula* as example of *Mangelia*, Leach. Apparently from these authors dates the misusage of *Bela*, which has persisted to the present day, though it should be remarked that several workers have called attention to it. As a comparatively recent one I would quote Harris, who, in the Cat. Ter. Moll. Brit. Mus., pt. i, April-May, 1897, wrote (p. 60):

"By some authors they (*Daphnella*, spp. Harris, Australia) would possibly be classified with *Bela*; that genus, however, appears to be much misunderstood. It does not seem to be recognized that the type of *Bela* (Leach MS.), Gray (Proc. Zool. Soc., 1847, p. 134), is *Murex nebula*, Montagu, which is practically synonymous with *Mangelia costulata*, Risso, the type of the genus *Mangilia* (em.)."

I have not, however, observed any author who has named an efficient substitute for *Bela*, auct. H. & A. Adams, in their synonymy, quote *Ishnula*, Clark, which does not appear to have been published by that author. It is unavailable, as when Gray named *Murex nebula* as type of *Bela* he indicated Clark's name as an absolute synonym in that connexion. In their corrections, at the end of vol. ii, H. & A. Adams, p. 654, November, 1858, noted "*Oenopota*, Mörch, is a synonym of *Bela*".

Reference to the Cat. Conch. Yoldi, pt. i, August, 1852, p. 73, showed that Mörch proposed *Oenopota* as a sub-genus of *Pleurotoma*, classing these—

"*Pleurotoma pleurotomaria*, Couth. Grönland.

*pingelii*, Beck.

*livida*, Möll.

*viridula*, Möll. (non Fabr.)."

These species all fall into *Bela*, auct., so that it is obvious *Oenopota* is the correct substitute for that name. It is worth noting that in a list of Icelandic Molluscs in the Vidensk. Meddel. naturh. Forh. Kjöbenhavn, 1868, p. 214, 1869, Mörch used *Bela* for *cinerea*, *violacea*, *pyramidatus* = *rufa*, and *pingelii*, and *Ischnula* for *turricula* (with vars. *maxima*, *nobilis*, *scalaris*, *exarata*) and *trevylliana*, having apparently eliminated *Oenopota* in deference to the general Adamsian usage of *Bela*. Is it too much to ask that from this date *Bela* should be consistently rejected in favour of

OENOPOTA,

and let an unfortunate confusion be finally cleared up?

ACOLUS, Jukes-Browne.

In the Ann. Mag. Nat. Hist., ser. VIII, vol. xii, p. 479, November, 1913, Jukes-Browne proposed *Acolus* as a subgeneric name, under *Gomphina*, for the shell Cooper & Preston had described as *Psephus foveolata* (Ann. Mag. Nat. Hist., ser. VIII, vol. v, 1910, p. 110). Previous to his death, I had pointed out to Jukes-Browne that the names *Callizona* and *Leucothea* were invalid, and he changed them, without acknowledgment, to *Tinctora* and *Aphrodora* respectively (these Proceedings, vol. xi, pp. 61-2, 1914). I had the present case in front of me for transmission when I heard of his unexpected decease. I believe I was the last conchologist to personally converse with him. I therefore take upon myself the responsibility of correcting his error, and propose

JUKESENA, nom. nov.,

for *Acolus*, Jukes-Browne, not Förster, Hymenopt. Stud., ii, p. 100, 1856.

## TORNATINA, A. Adams.

I cannot see how this name can be retained under the present usage as distinct from *Retusa*. This last name seems to have been much misunderstood. In the British List (Journ. Conch., vol. x, p. 23, January, 1901) *Tornatina* was used, one of the species being *obtusa*, Montagu. *Retusa* is not mentioned. Hedley recently (Proc. Linn. Soc. N.S.W., vol. xxxviii, p. 337, November, 1913) used *Retusa* for two species, one of which is a typical *Tornatina*, the other one is not. I cannot conclude whether he has recognized the true *Retusa* or not, but it seems that he may have. *Tornatina* was proposed by A. Adams in Sowerby's Thes. Conch., vol. ii, pt. xi, 1850, p. 554; the animal was figured on pl. cxix, fig. 3, but no name given to the species; the shells were figured on pl. cxxi, figs. 24-39, the species named being *voluta*, etc. *Utriculus* was recognized, and *obtusa*, Montagu, placed therein, but the animal was not figured. In H. & A. Adams, Gen. Rec. Moll., vol. ii, pp. 11, 12, September, 1854, we get the following information: "*Utriculus*, Brown. Syn., *Retusa*, Brown. Ex. *U. obtusus*, Turton. The genus is distinguished from *Tornatina* in the suture of the spire not being channelled, and in the simple inner lip. *Tornatina*, A. Adams. Ex. shell, *T. voluta*, Q. & G. This genus is composed of a group of small shells characterized by their elevated spire, channelled suture, and plicate columella." Fischer (Man. de Conch., p. 555, 1883, December 20) recognized that *Tornatina*, indicating *Utriculus*, Brown, was invalid, owing to its prior proposal by Schumacher, and then admitting it as a sub-genus, accepting A. Adams' differential characters. He added *Coleophysis* for *truncatulus*, Bruguière, but this does not seem generically separable. The following year Monterosato (Nomen gen. e spec. Conch. Medit., 1884, p. 143) proposed *Cylichnina* for the group above *umbilicata*, Montagu, and this seems a very distinct group from *Tornatina* = *Retusa*, Brown, 1827. *Retusa* was introduced by T. Brown in the Illus. Conch. Gt. Brit. & Ire., 1827, pl. xxxviii, where three species were figured, and named *plicata*, *discors*, and *obtusa*. These are all variations of *obtusa*, Montagu, and this species becomes, by monotypy, the type of *Retusa*. I am at present unable to separate so-called *Tornatina* from this species, the characters given by A. Adams being comparatively valueless. Consequently I would suppress the latter name, replacing it by *Retusa*. The correct name for the type does not appear to have been yet determined.

Montagu, when he introduced his *Bulla obtusa*, recorded as synonyms: "*B. regulbiensis*, Turt. Lin., v, p. 351. Adams, Micro., t. 14, fig. 28." Upon comparison I rejected this determination, the figure quoted seeming indeterminable. Montagu later, in the Suppl., 1808, p. 101, noted that Walker erroneously sent him *Bulla obtusa* under the name of *Voluta alba*. Referring to Walker I found a good figure there given, and can only conclude Montagu has confused the two names *regulbiensis* and *alba*. For, while the former, which Montagu recorded as his *obtusa*, is not that species, the latter, which Montagu denied, is undoubtedly this shell. I am not alone in this identification, as Forbes & Hanley, without doubt, quote

Walker's figure 61 for Montagu's species. Walker's book, the correct quotation for which is Boys & Walker, Test. min. rar., 1784, is non-binomial, but in the second edition of the Essays on the Microscope by G. Adams, Kanmacher added a chapter on minute shells, and stated that the correct names had been given him by Jacobs. A plate is given, and the figures are copies of those provided by Boys & Walker. There, on pl. xiv, fig. 27, appears a copy of their fig. 61, and in the text, p. 639, it is named *Voluta alba*. This is followed by *Bulla regulbiensis*, so even if it were concluded that these were the same, the former has priority.

The correct name for the type of *Retusa*, then, is *Voluta alba*, Kanmacher, Essays Micros. (G. Adams), 2nd ed., p. 639, pl. xiv, fig. 27, 1798 (*ex* Jacobs MS.). If it were admitted that *Retusa* could be differentiated from *Tornatina*, then *Retusa* would displace *Tornatina* in the British List, whilst *Tornatina* would more probably come into use, vice *Retusa* as used by Hedley, as quoted above.

#### PHACOIDES, Blainville.

This name was used by Hedley for Australian molluscs, and when I first noted it I had recognized no shells similar to Hedley's species. Working through the article "Mollusques" in the Dict. Sci. Nat. (Levrault), vol. xxxii, where Blainville reviewed the whole group, and which is the basis of the Manuel published the following year, I noticed the name. Before proceeding further it may be of interest to record the actual dates of publication of these two works. The 32nd volume of the Dict. Sci. Nat. was acknowledged in the Bibliographie de la France on November 13, 1824. In the same record for October 22, 1825, I find the Manuel "In 8<sup>vo</sup> de 41 feuilles plus 2 tableaux et 20 planches (formant la première livraison des planches). Ce volume contient la texte entier de l'ouvrage". On December 28, 1825, is added, "Deuxième livraison . . . Tout le text a été délivré avec la première livraison de planches." The date of publication of the Dict. Sci. Nat. is stated by Blainville in the preface to the Manuel as "commencement d'octobre de l'année dernière". I make this note as commonly the Manuel is quoted instead of the Dict. Sci. Nat., whereas the former is simply a reprint of the latter as regards the bulk of the work, the additions and corrections being separately added.

Deducing Dall's initiative as the basis of Hedley's usage, I referred to the monumental Tertiary Mollusca of Florida (Trans. Wagner Free Inst. Sci. Philad., vol. iii, 1903, p. 1359), where I found *Phacoides* used, the basis being given as Blainville, Manuel. That is, however, simply a reprint of the Dict. Sci. Nat., p. 334, where appears "*Lucine. Lucina*"; divided into five sections, each diagnosed and named thus:—

- "A. Diagnosis (Les L. Phacoides).
- B. " (G. Loripède, Poli).
- C. "
- D. " (G. Amphidesme, Lamck.)
- E. " (G. Fimbria, Megerle; Corbeille, Cuv.)."

It must be obvious that these names are vernaculars only, the Latin name *Fimbria* of Megerle appearing solely because Megerle gave no French equivalent. Such are continually repeated throughout, and similar to the first named may be quoted "Les V. Mactroïdes", a section of *Venus*, p. 339, and "Les V. Lucinoïdes", another section of *Venus*, p. 340. As of Blainville, then, either of the Dict. Sci. Nat. or of the Manuel, *Phacoides* cannot be utilized. I next find *Phacoides* under the following conditions: In the Proc. Zool. Soc. 1847, p. 195, Gray wrote—"Lucina, Brug., 1792. Lam., 1801. *Venus*, sp. Gmel. *Phacoides*, Blainv., 1825. *Ven. jamaicensis*." This takes us back to *Lucina*, its introduction and type.

The name first appears at the head of the plates in the Tabl. Encycl. Méthod. (Vers.), vol. ii. On pl. 284 it is first seen, and this appeared in 1797, as far as at present known, not 1792, as once thought, and accepted by Gray. No names are given to the species of shells figured. Lamarck in the Mém. Soc. Nat. Hist. Paris, 1799, p. 84, introduced *Lucina*, and gave as sole example *Venus edentula*, L. The recognition of the plate above noted, made thirty years afterward, gave the species as *Lucina pensylvanica*, *jamaicensis*, and *edentula* (L.).

Under such circumstances I conclude Lamarck's fixation of a type must be regarded as final. I do not, however, so regard Lamarck's citation of a species of a Linnean genus. In 1801 Lamarck utilized other species as examples, and in the case of *Lucina* changed his choice to *jamaicensis*. The 1801 book being commonly available and the 1799 article scarce, it was natural that Gray should consider the second choice typical. He was probably ignorant of the earlier selection.

Gray's action was unhesitatingly endorsed by H. & A. Adams (Gen. Rec. Moll., vol. ii, p. 466, April, 1857), who cited *Phacoides*, Blainville, as a synonym of *Lucine*, sensu lato, their example being also *L. jamaicensis*. As a sub-genus they proposed *Miltha*, p. 468, the only example being *childreni*, Gray.

Fischer in the Man. de Conch., pp. 1142-4, June, 1887, noted the confusion, and for *Lucina*, Lamarck, 1801, non 1799, proposed *Dentilucina*, with only *L. jamaicensis*, Lamarck, citing *L. edentula* as type of *Lucina*, Lamk., 1799. He does not mention *Phacoides*, probably considering it only a vernacular name, as it undoubtedly was. I have not traced the usage of *Phacoides* earlier than Dall, so that it would become an absolute synonym of *Dentilucina*, Fischer, since Dall's type is the same as Fischer's.

Dall associates under his genus *Phacoides* the sub-genus *Miltha* of H. & A. Adams. If this subordination were accepted, then the genus name to be used vice *Phacoides*, Dall, would be *Miltha*, H. & A. Adams, and the sub-genus to be recognized for the typical sub-genus of *Phacoides*, Dall, would be *Dentilucina*, Fischer.

Criticisms of these conclusions are desired, so as to fix the name for these Lucinoid molluscs, which is certainly not *Phacoides*, Blainville.

#### PLACENTA, Retzius.

A reference by Dall to the Portland Museum Catalogue caused the investigation of that work. I propose to give full details concerning



this Catalogue in a succeeding number of these Proceedings, but would here note its effect upon two generic names. I find the following entries :—

- “p. 16. Two fine species of *Placuna*, S., viz. *placenta* and *ephippium*.  
 56. *Placuna*, S. (*Anomia*, L.), *placenta* and *ephippium*.  
 136. *Placuna ephippium*, S. (*Anomia*, L.), and  
 140. *Placuna placenta*, S. (*Anomia*, L.).”

The ‘S’ stands for Solander, and it must be concluded that *Placuna* is here legitimately proposed as the genus name for the species *placenta* and *ephippium* which Linné had placed in *Anomia*. I designate the species *placenta* as type, and this will necessitate the reversion to the familiar *Placuna*, as this name dates from 1786, while *Placenta*, Retzius, only dates from 1788.

I note that Gray in the Proc. Zool. Soc., 1847, p. 195, wrote “*Placenta*, Retz. 1788. *Placuna*, Soland. *An. placenta*”, apparently unaware that Solander’s name has priority of publication.

Another interesting item may be here recorded. In Hutchins’ History of Dorsetshire, published in 1799, Pulteney wrote a Catalogue of the Shells, and often made reference to Solander’s manuscript. On p. 35 he stated: “Under the term *Ostrea*, Linnæus has comprehended the Oysters, the Scallops, and the shells called *Isogona* and Saddle-Oysters . . . If they were separated, they must form more than two genera: the *Ostrea*, the *Pecten*, and a third, which I believe Dr. Solander intended to call *Placuna*, including the Saddle-Oysters.”

#### MELINA, Retzius.

This name has been recently used to replace the more familiar *Perna*, but apparently another change must be made. In the Catalogue of the Portland Museum, under the same circumstances as in the preceding, I find—

- “p. 9. *Ostrea isognomon*, L., called *Isognoma lignea* by S(olander).  
 41. *Isognomon perna*, S. (*Ostrea*, L.).  
 52. *Ostrea perna*, L. (*Isognomon*, S.).  
 115. *Isognoma rigida*, S., for List. 227. 62.  
 137. *Isognoma perna*, S. (*Ostrea*, L.).”

From these quotations *Isognomon* must displace *Melina*, having again two years priority. The type of *Isognomon* would be by tautonymy, *Ostrea isognomon*, L.

*Isogonum*, Bolten, Mus. Bolt., 1798, p. 168, is exactly equal.

Fischer in the Man. de Conch., p. 956, 1886, used *Perna*, but quoted as sections: “*Perna*, s.s. *P. ephippium*, L., and *Isognomon*, Klein. *P. esognomum*, L.”

I see Gray in the Proc. Zool. Soc. 1847, p. 200, wrote: “*Melina*, Retz., 1788. *Isognomon*, Klein, 1753. *Pedalion* sp., Soland. *Ostrea ephippium*. *Pedalion*, Soland. MSS. *Ost. isognomon*.”

I have not yet noticed Solander’s usage of *Pedalion*, and it may be that Gray’s was the first introduction of it. It is obviously equivalent to Solander’s *Isognomon* as here discussed. Whether *Melina* can be retained in a subgeneric sense I cannot now decide.

Hedley, in his Catalogue of the Marine Mollusca of Queensland (Proc. Austral. Assoc. Adv. Sci. Brisbane, 1909, p. 344), has included, perhaps by inadvertence, *Perna* and *Melina*. The former was used for the *isognomum* group, to which it has no claim whatever. *Perna*, as so used, dated from Bruguière, 1789, but the writers who so utilized it overlooked that Retzius, in 1788, had previously appropriated the name in a different sense. In the same paper where *Placenta* and *Melina* were proposed Retzius introduced *Perna*. This introduction was for the species of *Mytilus*, Linné, we now consider typical *Mytilus*. It was due to such cases as the present that 'type by elimination' came to be discarded. I note this as in my succeeding note I have to consider a case where results were achieved by this usage, and which must be now discarded. In the present case Retzius was the first to split up the Linnean *Mytilus*, and he dissociated what we now consider *Mytilus* under the name *Perna* and left the Ostreiform shells to bear that name. Retzius was not followed by later writers, but by exact elimination much confusion would have to be faced. Retzius' *Perna* must therefore be considered on its merits and not simply as a substitute for *Mytilus*, Linné, as it is not, but a subdivision. Fortunately, the type is easily fixed, being the first species, *Perna magellanica*, Retzius, a new name for *Mya perna*, L. *Perna* then falls under *Mytilus*, Linné, but becomes the earliest name for the sub-genus for which Jukes-Browne, in his Review of the Genera of the Family Mytilidæ (these Proceedings, vol. vi, p. 218, 1905), used the name *Chloromya*, Mörch, with type *M. perna*, Linné. The exact reference to the paper in which Retzius proposes the names *Placenta*, *Chæna*, *Perna*, and *Melina*, is Diss. Hist. Nat. Nov. Test. Gen., 1788, the pages being respectively 15, 19, 20, and 22.

Retzius stated that *Chæna* was simply proposed as a substitute name for *Gastrochæna*, Spengler, as Spengler's name was not euphonious.

#### ANATINA, Lamarck.

When Dall wrote about the Boltenian generic names (Journ. Conch., vol. xi, 1906) on p. 296 he left as undetermined—

"*Laternula* (1 *Mya truncata*, Gmel.) = *Mya* (L.) + Lam., *Auriscalpium*, Megerle, 1811 + *Anatina*, Lam., 1812."

He had probably overlooked the fact that Gray in the Proc. Zool. Soc., 1847, p. 190, has designated as type of *Laternula*, *L. anatina*, and had used Bolten's genus name to displace *Anatina*. As the type-species was also called *lanterna* the coincidence is exact. It appears that *Anatina* cannot be preserved in any case, as most writers quote as equivalent Megerle's *Auriscalpium*, and that name has also priority over *Anatina*, the latter not being published until 1818, so that *Laternula* must at once be made use of.

I find, since the preceding was written, that Dall in the Trans. Wagn. Free Inst. Sci., vol. iii, p. 1530, October, 1903, that is, previous to his essay on the Boltenian names, actually made use of *Laternula* in place of *Anatina*. Peculiarly enough this alteration has escaped the notice

of recent workers such as Hedley and Smith, who have both recently utilized *Anatina*. I see Dall quoted "*Anatina*, Lamarck, Phil. Zool., p. 319, 1809", but this is a pure mistake, as only vernacular names occur in that work, and the earliest date *Anatina* was used as a Latin word appears to be in 1818; in 1812, also commonly quoted, a vernacular name only was used. The earliest introduction by Lamarck of *Anatina* is in the Anim. sans Vert., vol. v, 1818, p. 462, and consequently, in addition to its being preceded by *Laternula* and *Auriscalpium*, it is preoccupied by *Anatina*, Schumacher, Essai nouv. syst. Test., 1817, pp. 42 and 125, proposed for a different mollusc.

CYPRICIA, Gray.

Dealing with Australian Mactridæ, Mr. Edgar Smith (Proc. Malac. Soc., vol. xi, June 1914, p. 150) used *Cypricia*, pointing out that *Labiosa*, recently accepted in preference by Dall and Hedley, was introduced in a somewhat doubtful manner as a new name for *Anatina*, Schumacher, whereas *Cypricia* was legitimately proposed by Gray (Ann. Mag. Nat. Hist., vol. xi, p. 43, 1853), concluding, "It becomes a question whether the genus *Cypricia* should not be retained rather than *Labiosa*." My own rendering of the Laws led me to side with Dall and Hedley, but my results in connexion with the preceding remove all doubtful points. For

ANATINA, Schumacher

is the earliest and correct name for the genus, both *Labiosa* and *Cypricia* being provided as substitutes for that name under the mistaken idea that it was later in date than the same name of Lamarck.

MELEAGRINA, Lamarck.

This name has been quite commonly used right up to the present time, but I have failed to recognize exactly how many names have prior claim. I have noted *Margaritophora*, Megerle, 1811, *Margarita*, Leach, 1814, and *Perlamater*, Schumacher, 1817, as all anterior to Lamarck's name proposed in 1819 (Anim. s. Vert., vol. vi, 1819, p. 150). A better substitute than any of these seems to be

PINCTADA, Bolten.

In the paper just quoted Dall left it undetermined as

"*Pinctada* (1 *Myt. margaritiferus*, Gmel.) = *Avicula*, Brug., 1791, + *Malleus*, Lam., 1799 + *Margaritophora*, Megerle, 1811".

I would designate *P. margaritifera*, Bolten, the first species, as type, and thus make Bolten's name valid for this group, which is known to the French as "Pintadines". Referring to the Dict. Sci. Nat. (Lervault), vol. xli, 1826, p. 93, I also noted the following:—

"PINTADE (*Conch*). Les marchands de coquilles paroissent donner ce nom à la coquille qui fournit le plus ordinairement les perles, *mytilus margaritiferus*, Linn., *avicula margaritifera*, Brug.; *Pintadina margaritifera*, de M. de Lamarck, mais à un état particulier, qu'ils ont désigné par la dénomination de mèche-perle stérile (De B.).

PINTADINE, *Meleagrina* (*Conchyl.*) . . ."

This is the only usage of *Pintadina* I know of, and I see Scudder has recorded it: it is a word very easily missed, yet Scudder has it, and has not *Spiratella*, which is more prominently printed. I have before complained of Scudder's peculiarities, and this accurate recording of this name only serves to emphasize his untrustworthiness. Finding this unemphasized name carefully included one would anticipate carefulness otherwise and be sadly misled.

#### SOLECURTUS, Blainville.

This genus name was proposed by Blainville in the Dict. Sci. Nat. (Levrault), vol. xxxii, 1824, p. 351, who divided his genus into three sections—

- A. *Ex Solecurtus radiatus*, E. m., pl. 225, fig. 2.
- B. *Ex S. strigilatus*, E. m., pl. 224, fig. 3.
- C. *Ex S. Legumen*, E. m., pl. 223, fig. 3.

No type was designated, nor can one be determined by tautonymy. The only way is that of subsequent designation.

In the Manuel, 1825, the same matter is reproduced. In the 49th vol. of the Dict. Sci. Nat., 1827, the genus is again dealt with by Blainville himself. A rearrangement is there effected, the same three sections being recognized, but as equivalent to Section A is noted "*G. Silique*, Megerle", and *S. legumen* is here transferred. The section B is retained for *S. strigillatus*, and a new species, *S. albus*. Under Section C a series of shells is included, among which are *S. caribæus*, Lam., *S. antiquatus*, Mont., and *S. tagal*, ex Adanson. No type is mentioned, so that this reconsideration is merely of historical interest.

In the Actes Soc. Linn. Bordeaux, No. 26, vol. v, March 15, 1832, Desmoulins introduced the genus *Malletia*, and discussed its relationships. On p. 88 Desmoulins wrote, "Solécourte de M. de Blainv., en prenant pour type de ce dernier genre le *S. strigilatus* (a)." In the footnote (a) he gave his reasons for this selection, pointing out that the examples otherwise quoted by Blainville did not agree with the generic diagnosis. This action was perfectly legitimate, but further investigation showed that Deshayes had even anticipated him, for in the Dict. Class. d'Hist. Nat., vol. xv, p. 482, May, 1829, that worker wrote, "Ce sont ces motifs qui ont déterminé Blainville à proposer le démembrement du genre *Solen* de Lamarck et d'en extraire d'abord celui qu'il nomme Solécourte qui a pour type le *Solen strigillatus*."

There can be no argument that under the present rules the type of *Solecurtus*, Blainville, is *Solen strigilatus*. This note has been written, as Dall, using elimination, arrived at quite a different result, and fixing *S. legumen* as the type of *Solecurtus*, used *Psammosolen* for the *strigilatus* group. He has been followed by Hedley, but reversion to the conventional usage is necessary. I at first thought that *Solecurtoides*, Desmoulins, might have to displace *Pharus*, but I have concluded that it will not be necessary to discard that name, and that *Solecurtoides* was rightly considered by Dall as a synonym of *Silique*, Megerle.

## ON HUMPHREY'S CONCHOLOGY.

By TOM IREDALE.

*Read 9th April, 1915.*

IN the Portland Museum Catalogue reference is made to Humphrey's Conchology. Some little difficulty was found in its recognition, and quite a little interest was aroused as to its authorship. The following notes seem worthy of record, as I cannot see any absolute proof, and the fact that it is cited under two or more names needs emphasis.

Reference to Sherborn's *Index Animalium* (I have used up all the laudatory adjectives at my command in praise of this vade-mecum of the systematist) gave me in the Bibliography the following entries:—

p. xxx. "[Humphrey, G.] i-vi. Numbers of a Conchology. fo. Lond. 1770-71. 26 pp. 12 pls. [No sp.nn.; some say this was published by Da Costa.]"

p. xx. "Costa, E. M. da. Number 1 of a Conchology. fo. Lond. [1770]. [6 nos. were published, 26 pp. 12 pls. No sp.nn.; some say this was issued by Geo. Humphrey.]"

When Sherborn recorded the discovery of the long-lost "*Museum Humfredianum*" (*Ann. Mag. Nat. Hist.*, ser. vii, vol. xvi, pp. 262-4, August, 1905) he observed, p. 264: "The sale occupied . . . thirty-six days . . . the last day, taking books, of which Humphrey had a poor lot, the only rarities being seven copies of his own '*Conchologie*' . . . As this book is stated in the '*Mus. Humf.*' itself to be '*Humphrey's Conchologie*', it confirms the opinion expressed in my '*Index Animalium*', 1902, p. xxx, that Humphrey, and not E. M. Da Costa, was the author of the book."

The fact that in the Portland Museum Catalogue the common reference to Humphrey's Conchology also appears, would seem positive evidence in favour of Sherborn's conclusions. Reference to the book itself, however, appears to contradict that view, so I give here the extracts I have observed in connexion with this work. In the British Museum (Natural History) is preserved a copy, and a part with three original wrappers. The lettering of the wrappers read as follows:—

"Number I | of a | Conchology, | or | Natural History of Shells: | containing | The Figures of Shells correctly and finely engraved, | and accompanied with | their Descriptions in English and French. | The whole exhibited in a Systematical Manner. | By a Collector. |

"Conditions 1. This work will be printed in Imperial Quarto and on a good Type cast by Mr. Caslon. It is designed to be published in Monthly Numbers, each Number containing Two Copper Plates, and Four Pages of Letter-Press, with their Descriptions in English and French. The Price of each Number will be Three Shillings. Some Copies will be coloured after Nature, for the Curious who desire it, at the Price of Five Shillings. |

"London: Printed for the Author, by T. Jones, in Fetter-Lane, | And Sold by Mr. B. White, Bookseller, in Fleet-street; Mr. Elmsley,

Bookseller in the Strand, | and Mr. Humphrey, Dealer in Shells, and other Natural Curiosities, in | St. Martin's-Lane, near Charing-Cross."

On the wrapper of No. I is written, "Presented by the Editors Jan. 18, 1771," and on No. III, "Presented by the Editors, June 14, 1771."

As recorded by Sherborn there are 26 pages of letterpress, accompanied by 12 plates; the letterpress only gives the descriptions of the shells on the first four plates, the first figure of the fifth, and commencing on the second figure. This is a copy with coloured figures, and I see that three draughtsmen were employed in the preparation of these dozen plates: plates i, ii, iii, iv, and vi are signed "I. Wicksteed, Junr. del."; plates v and vii are signed by "W. Humphrey"; and plates viii-xii by "P. Brown". They were all engraved on copper by P. Mazell, who seems to have stood alone in this art about this time.

Now, from the wrapper alone the "Collector" and "Mr. Humphrey, Dealer in Shells", would seem to be different entities. Confirmation is apparent from a perusal of the Preface, which reads:—

"The Editor begs Leave to acquaint the Curious, that it is impossible to fix the Extent of his work, as it will depend on the Quantity of new Species that occur: but he assures them, that he shall neither spare Expense, or be wanting in an unwearied Application to render it complete, and hopes that on the Publication of the Numbers, they will judge of its Merits, and of its being more perfect than any other book of Conchology hitherto offered to the Learned . . .

"There now only remains to solicit of the Collectors an Access to their Cabinets, to acquire the proper Opportunities of perfecting his intended Plan; and should any Ladies or Gentlemen possess any non-descript Shells in their Collections, and chuse to have them engraved and described, if they will honour the Editor to send them either to the Booksellers Messrs. *White* and *Elmsley*, or to Mr. *Humphrey*, to be conveyed to him, he will return them safe, and gratefully acknowledge the Favour, by adding to the Description the Collector's Name (if permitted) to whom he is obliged."

From this extract the conclusion would be that "the Editor" and "Mr. Humphrey" were different personages. Judging the work alone, from a knowledge of Da Costa's known work and from Humphrey's own plea of ignorance, I should unhesitatingly ascribe it to the former, and not to the latter.

I would simply record the following facts: Chemnitz, in the *Neues Syst. Conch. Cab.*, vol. xi, published in 1795, quotes the book as (p. 181) "*Da Costa, Conchology or Natural History of Shells*"; (p. 184) "*Da Costa Conchol*"; (p. 185) "*Da Costa Conchology*"; and on pp. 186-8. I would note that recently, since Chemnitz's work, as above, has been rejected as non-binominal, the names from this eleventh volume have been accepted; but this volume is certainly as polynominal in its nomenclature as the others, the apparent regularity of binominals being superficial: thus, of twenty-three species of *Murex* listed, eleven only consist of two words; of nine species of *Mytilus* four are binominals, five are not. If *Tellina* or *Venus* were

simply looked at, a different conclusion might be gained, as here all the species happen to range themselves under a binominal system. If any student will carefully consider all the names in the volume no other course save that of rejection can be urged.

Bolten, in the Mus. Bolten, 1798, apparently ignorant of Chemnitz's quotations, as that volume of Chemnitz, viz. xi, is never quoted in Bolten's work, only knew Da Costa as the author of the work, as references to that name appear on pp. 1, 2, 3, 4, 5, 6, 7, where Latin names are given to the species figured in the "Conchology". Maton & Rackett, in their Historical Account of Testaceological Writers (Trans. Linn. Soc., vol. vii, 1804), wrote under the name Da Costa—"Still more acceptable to the public were two other works of this author; one of which, however, was on too extensive a scale to admit of being completed; we mean the '*Conchology* or *Natural History of Shells*', which was published, anonymously, in folio numbers, but never proceeded beyond twenty-six pages of letter-press and twelve plates."

Doubt as to the authorship of the work appears to have arisen later, as Dillwyn in his Descr. Cat. Recent Shells, vol. i, p. ix, 1817, gave a "Catalogue of the Books consulted", and on p. ix wrote: "*Humphrey's Conch.* Conchology, or Natural History of Shells. (Supposed to be the joint work of E. M. Da Costa and George Humphreys)." In the Index Hist. Conch., Lister published in 1823, Dillwyn simply wrote: "Humphreys and Da Costa. Conchology, or Natural History of Shells."

It may be of interest to note Da Costa's own account. In the Elements of Conchology, 1776, p. 51, he wrote: "A new anonymous Conchology began to be published in this Metropolis in 1770, in folio, illustrated with copper plates. It was to be published in monthly numbers, and each number to contain two plates of Shells, with their descriptions in English and French. It was also intended to be a General Natural History of Shells, and to include the figures of all the known species, common as well as rare, beautiful, or otherwise; and some copies were designed to be accurately coloured for the use of the curious. Six numbers of it were published, comprehending the families of the Limpets, Sea-Ears, and Worms; but not meeting with suitable encouragement, the authors have laid it aside, at least for the present." Later, when reproducing figures, Da Costa wrote, "taken from the anonymous new Conchology."

While strongly of the opinion that Da Costa was the author of the work, this note has been written for the purpose of emphasizing the fact that quotations to "Da Costa", "Da Costa Conch.", or "Humph. Conch." all refer to the same work. This work was published anonymously, the author being given as "A Collector", and under this heading the book may be met with in some library catalogues.





SMITHSONIAN INSTITUTION,  
UNITED STATES NATIONAL MUSEUM,  
WASHINGTON, D.C.

*Edgar A. Smith, Esq., I.S.O.,*

*Malacological Society of London, London, England.*

Dear Sir,—I have prepared, and the Smithsonian Institution has printed, an historical Introduction and complete Index to the Museum Boltenianum, edition of 1798, of a size to be bound with the reprint of that work by Sykes and Sherborn in 1906. It will be sent to the entire list of Malacological Correspondents of the Smithsonian, but there are doubtless others interested in the Nomenclature of Mollusca who might like to possess it, and to such applicants copies will be furnished by the Smithsonian as long as the edition lasts. Please bring this to the notice of the Society at its next meeting.

Yours very truly,

WM. H. DALL.

April 2, 1915.

# Malacological Society of London.

(Founded 27th February, 1893.)

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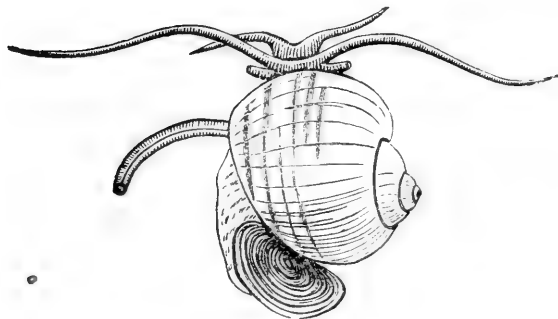
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MALACOLOGICAL SOCIETY  
OF LONDON.

EDITED BY

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

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See page iv of this wrapper.

## ORDINARY MEETING.

FRIDAY, 14TH MAY, 1915.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

The following communications were read :—

1. "On a Dibranchiate Cephalopod (*Plesioteuthis*) from the Lithographic Stone (Lower Kimmeridgian) of Eichstätt, Bavaria." By G. C. Crick, F.G.S., F.Z.S.

2. Description of a new species of *Peltatus* from British East Africa." By J. R. le B. Tomlin, M.A.

3. "Description of a new species of *Dyakia*." By G. K. Gude, F.Z.S.

Mr. A. Reynell exhibited a book containing a number of figures on quarto plates which were used for illustrating Maton's edition of *Pulteney's Dorsetshire Hills*. Mr. B. B. Woodward gave some interesting information on the subject, and Mr. Reynell was requested to gather all the data obtained into a note for publication.

## ORDINARY MEETING.

FRIDAY, 11TH JUNE, 1915.

The Rev. A. H. COOKE, M.A., Sc.D., F.Z.S., President, in the Chair.

The following communications were read :—

1. "A list of the known species of *Clausilia* from China." By E. A. Smith, I.S.O.

2. "Descriptions of new species of *Streptaxis*, *Planispira*, and *Chloritis*." By H. C. Fulton.

3. "Molluscan Notes, II." By H. C. Fulton.

4. "Note on the Duct of the Spermatheca of *Hyalinia excavata*." By A. E. Boycott.

5. "Notes on the Names of some British Marine Mollusca." By Tom Iredale.

6. "*Marginella shacklefordi*, nom. nov. for *M. eburnea*, Preston, non Lamarck." By H. B. Preston, F.Z.S.

## NOTE.

*MARGINELLA SHACKLEFORDI*, NOM. NOV. FOR *M. EBURNEA*, PRESTON,<sup>1</sup> 1906, NON LAMARCK. (*Read 11th June, 1915.*)—The Rev. Lewis J. Shackleford having very kindly pointed out to me that the name *eburnea* is preoccupied by Lamarck for a fossil species of the genus, I have much pleasure in taking the present opportunity of substituting the name *M. shacklefordi* in its place.

H. B. PRESTON.

---

<sup>1</sup> Proc. Malac. Soc., vol. vii, p. 35, 1906.

ON A DIBRANCHIATE CEPHALOPOD (*Plesioteuthis*) FROM  
THE LITHOGRAPHIC STONE (LOWER KIMMERIDGIAN) OF  
EICHSTÄDT, BAVARIA.

By G. C. CRICK, F.G.S., F.Z.S., of the British Museum (Natural  
History).

(Published by permission of the Trustees of the British Museum.)

*Read 14th May, 1915.*

PLATE IX.

ALTHOUGH the genus *Plesioteuthis*, instituted by Dr. A. Wagner (6, p. 785) in 1860, is perhaps the best-known dibranchiate Cephalopod (see Zittel, 7, p. 519) from the Lithographic Stone of Bavaria, particularly the species *P. prisca*, an example of this genus in the British Museum collection from Eichstädt, Bavaria, is so excellently preserved, and displays certain characters which have not been previously recorded in any described example of the genus, that it seems to merit description. It is the subject of the present note.

The fossil is displayed on the surface of a slab and exhibits a dorsal aspect of the specimen. It is almost symmetrically arranged and exhibits the body with its fins, the head, and the arms. A stellate mass of calcite in the head appears to represent the cavity of the buccal mass.

The *Body* is elongated, broadest at about two-fifths of its length from the anterior margin (*e*), which is indicated by a narrow shallow transverse groove, rather more than one-fourth of its length. At the anterior margin the body appears to have been about 65 mm. wide; thence it tapers very gradually to about 56 mm. at a distance of about 60 mm. from the anterior margin; it then expands rather rapidly, attaining its greatest width of 74 mm. at about 110 mm. from the anterior margin; from the point of its greatest width it tapers evenly towards the posterior end for about another 95 mm. After gradually expanding for about 20 mm. it again tapers evenly to the end of the body. Here there are four obscure, almost symmetrically disposed spinous processes which seem to have belonged to the animal. Two are at the extreme end of the animal, their bases 8 mm. apart, feebly inclined outwards, and roughly about 13 mm. long. The others are situated at the posterior end of the line of junction of each fin with the body, and are also of about the same length (13 mm.). The writer has not seen similar processes in any of the other examples of this genus in the British Museum Collection. Judging from the impression of a portion of the mantle displayed on each side of the body, the surface of the mantle appears to have been finely granular. So far as the present writer is aware, the presence of *fins* in this genus has not yet been recorded. The specimen under consideration exhibits them very clearly. They

are separate and quite at the posterior end of the body. As preserved in this specimen they are not of the same length. Each is wing-shaped and transversely elongate, and though fairly well-, is not sharply-defined. That on the right (*g*) is about 83 mm. long, and 25 mm. broad at its widest part; its line of attachment is about the same as the width of the fin, the distal end obtusely pointed and slightly recurved; the proximal half of the anterior border is feebly concave and the distal half slightly convex, whilst of the posterior border the middle portion is feebly convex, the proximal and distal thirds faintly concave; the fin on the left side (*h*) is rather larger than that on the right, its anterior and posterior margins are nearly parallel, it is about 120 mm. long and 30 mm. wide, and its distal end is obtusely pointed and recurved. The dorsal part of the *mantle-margin* (*e*), which alone can be seen, is on the whole feebly convex, with a faint concavity on each side of the median third. In this (the dorsal) aspect of the animal the *siphon* (being on the ventral side) is naturally not shown, and it may be fortunately for the rest of the fossil, there are no traces of the ink-bag and no discoloration due to the spilt ink.

The *Head* appears to have been narrower than the body, probably only about 40 mm. wide; a smooth oval-shaped area (*i*), 19 mm.  $\times$  11 mm., immediately beneath the base of the arms, on the left of the median line, with its major axis placed longitudinally and slightly inclined towards the median line, probably indicates the position of the left eye; whilst a similarly-situated lenticular impression (*j*), 18 mm.  $\times$  8 mm., on the right of the median line, apparently indicates the position of the right eye.

The *Arms*, eight in number, are disposed almost symmetrically with respect to the body. That there are four pairs is quite clear, but they are all so much flattened that their sequence is somewhat obscure. There does not seem to be much doubt that the irregular stellate mass, partially filled with calcite, indicates the position of the buccal mass (*k*), the somewhat irregular projections from it being the remains of the points of the buccal membrane. A thickened V-shaped mass, having its obtuse point directed backwards, and at about 30 mm. in front of the centre of the buccal mass, evidently represents two thick arms (*a<sup>l</sup>*, *a<sup>r</sup>*) with their bases attached. Each is about 11 mm. wide, and, tapering rather rapidly, appears to have been about 55 mm. long. A very indistinct forwardly-concave curve (*l*), at about 33 mm. from the extreme base of the united arms, may indicate the margin of a web joining the two arms. Compared with the other arms these appear to have been relatively short and stout. Since they appear to be overlaid by the other arms, and remembering that the dorsal surface of the animal is uppermost, it seems safe to assume that they were the ventral pair. Near the buccal mass is a smooth area from which arise two smooth areas, each approximately 15 mm. wide; these pass over the short, stout arms with their inner margins about 17 mm. apart; they slowly diverge at an angle of about  $18^{\circ}$  until at about 65 mm. from the buccal mass, from which point they gradually converge, when they meet and are superposed. Each can be traced for a length of about 150 mm. from the buccal



mass, but their distal ends are not definitely indicated. Each of these flattened areas bears two distinct bands of a reddish-brown colour, averaging about 1 mm. wide, their edges being usually more distinct than the rest of the band, the inner of the two bands being the larger on each side; that (the longer one) on the right can be traced for about 100 mm. from the centre of the buccal mass. It would seem, therefore, that each of these elongated flattened areas represents two arms, that ( $d^l$ ,  $d^r$ ) nearer the median line being the longer of the two, and extending from the buccal mass to the point of superposition with its fellow. Further, the longer arm ( $d^l$ ,  $d^r$ ) appears to rest upon the shorter ( $c^l$ ,  $c^r$ ), since, on the right side, the shorter band of colour ends abruptly at a very slightly elevated ridge formed by the outer edge of the longer arm, whilst on the other side the colour band of the corresponding arm disappears before the band on the larger arm. Outside these arms, on a level with the buccal mass and about 26 mm. apart, arise two arms ( $b^l$ ,  $b^r$ ), each about 4 mm. wide, diverging at about an angle of  $40^\circ$ , that extend in an almost straight line for about 30 mm., and then curve gently outwards, extending for about another 30 mm. These appear to have been more cylindrical than the arms marked  $b$  and  $c$ , and their surface appears to have been rougher. Further, connecting these and the arms marked  $c$ , there appears to have been a membrane, the outward margins of which seem to be indicated on each side of the animal by an obscure forwardly-concave curve at about 54 mm. in advance of the centre of the buccal mass. Anterior to this curved line the surface of the stone is somewhat rougher, indicating that the membrane (if such there was) was comparatively smooth. The order of these appendages seems to have been (commencing on the ventral side)  $a$ ,  $b$ ,  $c$ ,  $d$ , and if none of these represent the tentacles in living Cephalopods, then the order of the arms (counting from the ventral side) would be  $a$ ,  $b$ ,  $c$ ,  $d=1, 2, 3, 4$  respectively. There are no traces of hooklets on or about any of the arms, a fact which was mentioned by Zittel (7, p. 519); nor are there any structures which can be definitely recognized as suckers, though each probably did exist.

Within the two thickened arms there is on the right side a thickening ( $m$ ) about 7 mm. wide, which, passing under the stout arm on the right side, curves over to the right, and can be traced for a further distance of about 27 mm., when it abruptly ends. There is a similarly placed but more obscure thickening on the left side. Whether these represent the *tentacles* or whether, in fact, they had anything to do with the animal, is quite uncertain.

Diffused over the head, the anterior portion, and the posterior part of the body there is a reddish-brown hue, similar to the bands of colour on some of the arms, that, it is suggested, may have been derived from the colour of the animal. There is a similar colour, more intensified, however, on the matrix immediately adjacent to each side of the animal, that may have had the same derivation.

The form of the *gladius* (or pen) is well shown, chiefly as the impression of its ventral surface, only a few fragments of the actual

gladius being preserved at its anterior end, at about its mid-length, and at its posterior end respectively. As a whole the gladius is acutely-triangular, the apical angle being about  $11^\circ$ , and the base, which is anterior, about 53 mm. It is traversed by very fine somewhat irregularly-placed longitudinal striæ. There is a well-marked median area, which at the anterior end of the pen attains a width of about 14 mm., and a lateral area on each side. Each lateral portion bears a slightly-thickened area which extends longitudinally, and terminates anteriorly in a rounded process (*n*) about 9 mm. wide, and of a brownish colour. Between these two processes the anterior boundary of the gladius is obscure; it may have been projected forward for about 12 mm., so as to form a broad, fully-convex projection, about 21 mm. broad, since the surface of this projection seems to be continuous with that of the pen. Posteriorly, at about 55 mm. from the end of the lateral process, the pen expands rather suddenly, though slightly, but soon resumes its original direction, and at about its mid-length it again gradually expands through about a fourth of its length, then gradually contracting it attains, at about 55 mm. from the posterior end, a width of about 25 mm. The rest of the pen has a rhomboidal form, its greatest width, corresponding to the shorter axis of the rhomboid, being about 43 mm., the lateral angles of the rhomboid occupying the median line of each fin, for which undoubtedly this portion of the pen formed a support.

*Dimensions.*—Assuming that the stellate mass (*k*) of calcite in the head represents the cavity of the buccal mass, and that the posterior end of the body (excluding some spinous processes) is about 332 mm. from this point, the dimensions of the specimen, so far as ascertainable, are as follows:—

	mm.
From posterior end of body to mantle-margin . . . . .	290
From posterior end of body to anterior end of lateral process of pen . . . . .	278
Breadth of body (at anterior end) . . . . .	55
Breadth of body at widest part, which is at about 105 mm. from the anterior end . . . . .	75
Width of pen at anterior end of lateral process . . . . .	52
Width of pen at about 70 mm. posterior to the anterior end of lateral processes . . . . .	53
Width of head probably about . . . . .	40
From anterior end of pen to centre of buccal mass . . . . .	42
From the centre of the buccal mass the arms can be certainly traced for a length of . . . . .	58

The whole length of the animal with its arms must have been 490 mm. (about 1 ft.  $7\frac{1}{2}$  in.).

When Dr. A. Wagner (6, p. 784) founded the genus *Plesioleuthis*, he recognized two species, viz. *Plesioleuthis prisca* and *P. acuta*.

*Plesioleuthis prisca* was originally described by Rüppell (5, p. 8, pl. iii, fig. 1) as a *Loligo* in 1829, and quite a number of forms which were subsequently described by Münster and by D'Orbigny were

regarded by Wagner as referable to the same species.<sup>1</sup> The type came from the Deutingen Quarry, near Mohnheim.

The other species, *Plesiotеuthis acuta* (3, p. 64, pl. vii, figs. 4, 5) was originally described by Münster as an *Acanthoteuthis*.

In the original description, in 1829, of the species *P. prisca*, Rüppell (5, p. 9) referred to the presence on the dorsal side of a heart-shaped swimming membrane, about one-fifth of the length of the whole mantle, and, from his figure, it would seem that he was alluding to the expansion at the posterior end of the body, surrounding the lance-shaped posterior extremity of the gladius to which he also refers. It would appear that this expansion of the gladius was fairly flexible, because in several examples in the British Museum collection that exhibit a lateral aspect of the animal the posterior part of the pen is evidently folded upon itself along the median line.

The lance-shaped extremity of the gladius was figured by Münster (3) in several Teuthids from the Lithographic Stone of Bavaria (pl. iv, figs. 6, 7; pl. v, figs. 1-5; and pl. vi, fig. 3); but none of these were named. Of these the one most nearly resembling the present specimen is the original of pl. v, fig. 3. So far as the present writer is aware, the presence in this genus of terminal fins has not yet been recorded.

The genus *Acanthoteuthis* was instituted by R. Wagner (in Münster, 1, pp. 92-4) in 1839, and subsequently Münster (3, pp. 56-9) recognized three subdivisions of the genus, viz. (1) *Acanthoteuthis*, sens. str., (2) *Doryanthes*, and (3) *Acanthopus*. The figures above mentioned would all belong to his section *Doryanthes* (p. 58), but there seems to be no allusion to them in the text, and they are not named in the explanation of the plates. This is to be regretted, since one example (pl. v, fig. 3) exhibits, at the anterior end, structures to which one would like to have seen some reference. One of these—the posterior—is very similar to the structure of the anterior end of the median portion of the gladius in the present specimen. It is, however, to be noted that Münster's figure, judging from the presence of the ink-bag, represents the ventral surface of the gladius, from which structure it is quite distinct, although the anterior boundary of the gladius is not very clearly shown.

Although the present example exhibits features which have not hitherto been observed in the genus *Plesiotеuthis*, it is not proposed to establish a new genus for it, nor even to regard it as a new species, but to consider the specimen as an example of *Plesiotеuthis prisca* in a better state of preservation than any specimen previously described.

<sup>1</sup> The synonyms mentioned by Wagner (6, p. 816) were as follows:—

"*Acanthoteuthis angusta, brevis, intermedia, lata* (partim), *rhomboidalis, sagittata, semistriata, subconica, subovata, and tricarinata*, Münster.

*Loligo prisca*, Rüpp.; *L. subsagittata*, Münster.; *Enoplotеuthis subhastata*, d'Orb.

*Onmastrephes angustus, sagittatus, intermedius, and cochlearis*, d'Orb."

To these may be added the *Leptoteuthis gracilis* of Owen (4, p. 3), from the Lithographic Stone of Solenhofen, near Pappenheim, Germany, which the present writer had an opportunity of examining in 1887.

## LIST OF WORKS CITED.

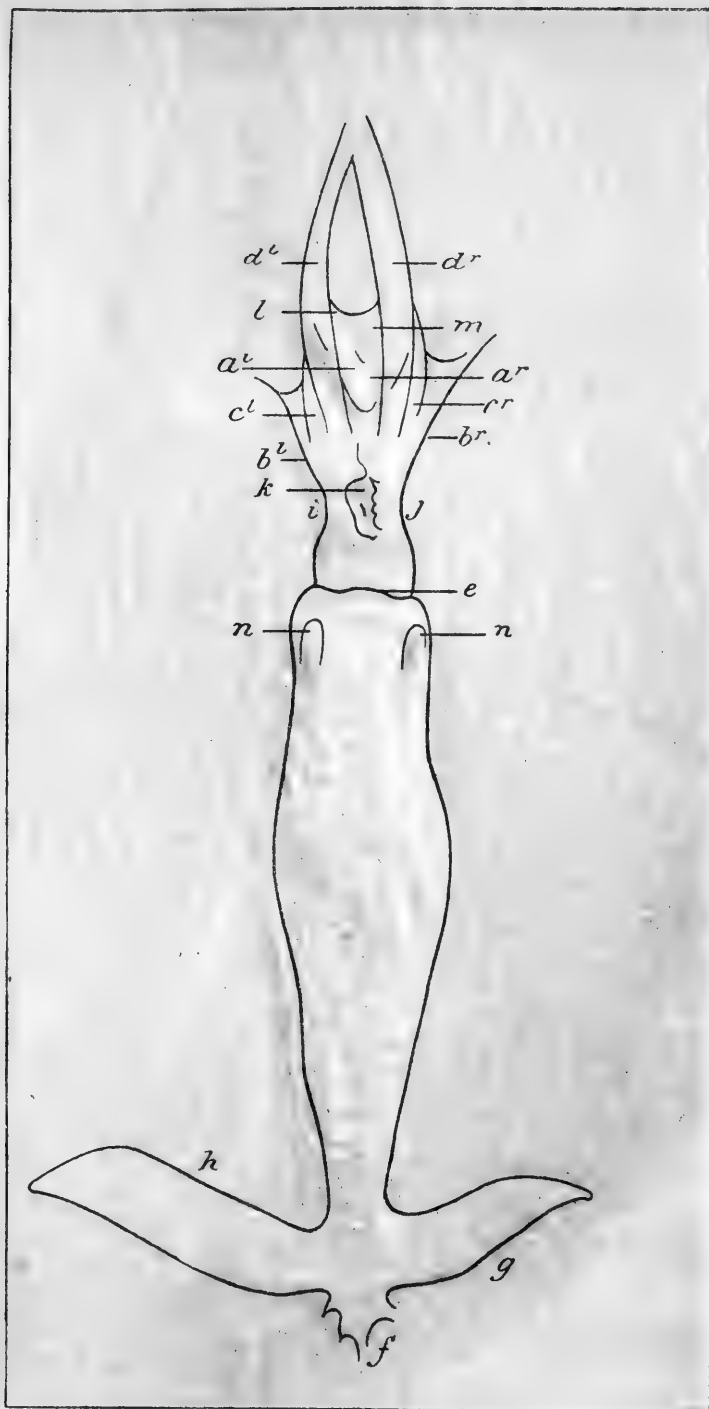
1. MÜNSTER, G. G. v. "*Acanthoteuthis*, ein neues Geschlecht der Cephalopoden, zu der Familie der Loligineen oder Teuthidæ (Owen) gehörend": Beiträge zur Petrefacten-Kunde, Heft i, pp. 91-7: 1839.
2. — "Ueber einige neue fossile schalenlose Cephalopoden und eine neue Gattung Ringelwürmer (Anneliden)": Beiträge zur Petrefacten-Kunde, Heft v, pp. 95-9, pl. i: 1842.
3. — "Ueber die schalenlosen Cephalopoden des oberen Juragebirgs, der lithographischen Kalkschiefer in Bayern": Beiträge zur Petrefacten-Kunde, Heft vii, pp. 51-65, pls. iv-ix: 1846.
4. OWEN, RICHARD. [Descriptions of the specimens of the Cephalopoda.] *Descriptive Catalogue of the Fossil Organic Remains of Invertebrata contained in the Museum of the Royal College of Surgeons of England*: 1856.
5. RÜPPELL, EDUARD. *Abbildung und Beschreibung einiger neuen oder wenig gekannten Versteinerungen aus der Kalkschieferformation von Solenhofen*. 1829.
6. WAGNER, A. "Die fossilen Ueberreste von nackten Dintenfischen aus dem lithographischen Schiefer und dem Lias des süddeutschen Juragebirges": Abh. Akad. Wissensch., München, math.-phys. Cl., Bd. viii, Abth. iii, pp. 749-821, 1 pl.: 1860.
7. ZITTEL, K. A. von. *Handbuch der Palaeontologie*, Bd. ii, Abth. i: 1884.

## EXPLANATION OF PLATE IX.

## PLESIOTEUTHIS PRISCA, Rüppell, sp.

- a<sup>r</sup>*, *b<sup>r</sup>*, *c<sup>r</sup>*, *d<sup>r</sup>*. 1st, 2nd, 3rd, and 4th arms of the right side.  
*a<sup>l</sup>*, *b<sup>l</sup>*, *c<sup>l</sup>*, *d<sup>l</sup>*. 1st, 2nd, 3rd, and 4th arms of the left side.  
*e*. mantle-margin.  
*f*. spinous processes at posterior end of body.  
*g*. right terminal fin.  
*h*. left terminal fin.  
*i*. position of left eye.  
*j*. position of right eye.  
*k*. cavity indicating position of buccal mass.  
*l*. probable margin of web connecting arms.  
*m*. obscure thickening of uncertain character.  
*n*, *n*. anterior terminations of lateral portions of gladius.

Lithographic Stone (Lower Kimmeridgian): Eichstädt, Bavaria. One-third of the natural size. Original in the Geological Department of the British Museum (Natural History), London. [Register number C. 15118.]



## LIST OF WORKS CITED.

- 1 MÜNSTER, G. G. v. "Anthothuria, ein neues Geschlecht der Cephalopoden, zu der Familie der Loligiden oder Tenthidæ (Owen) gehörend": Beiträge zur Naturgeschichte-Kunde, Heft i, pp. 91-7: 1839.
- 2 — "Ueber einige fossile schalenlose Cephalopoden und eine neue Gattung (Murex) der (Ammonoiten)": Beiträge zur Petrefacten-Kunde, Heft v, pp. 95-9, pls. 8, 1842.
- 3 — "Ueber die schalenlosen Cephalopoden des oberen Juragebirgs, der lithographischen Kalkschiefer in Bayern": Beiträge zur Petrefacten-Kunde, Heft vii, pls. 61-62, pls. iv-v: 1846.
- 4 OWEN, RICHARD. [Description of the specimens of the Cephalopoda.] *Descriptive Catalogue of the Fossil Organic Remains of Invertebrata and Fishes in the Museum of the Royal College of Surgeons of England*: 1845.
- 5 RUPPEL, ERNST. "Ueber die Beschreibung einiger neuen oder wenig bekannten Fossilien aus der Kalkschieferformation von Solenhofen." 1829.
- 6 WAGNER, A. "Die fossilen Terebranten und nackten Dintenfische aus dem lithographischen Schiefergebirge des süddeutschen Juragebirgs": Abh. Naturh. Mus. München, math.-phys. Cl., Bd. viii, Abth. iii, pp. 749-821, 1 pl.: 1860.
- 7 ZITTEL, E. A. von. *Handbuch der Paläontologie*, Bd. ii, Abth. i: 1884.

## EXPLANATION OF PLATE IX.

PLESIOTECTITES PRISCH, Rüppell, sp.

- a, b, c, d. 1st, 2nd, 3rd, and 4th arms of the right side.  
 a', b', c', d'. 1st, 2nd, 3rd, and 4th arms of the left side.  
 e. mantle-margin.  
 f. spinous processes at posterior end of body.  
 g. right terminal fin.  
 h. left terminal fin.  
 i. position of left eye.  
 j. position of right eye.  
 k. cavity indicating position of buccal mass.  
 l. probable margin of web connecting arms.  
 m. obscure thickening of uncertain character.  
 n, n. anterior terminations of lateral portions of gladius.

Lithographic Stone (Lower Kimmeridgian): Eichstädt, Bavaria.  
 One-third of the natural size. Original in the Geological Department of the British Museum (Natural History), London. [Register number C. 15118.]





PLESIOTEUTHIS PRISCA, Rüppell, sp.  
( $\frac{1}{3}$  nat. size)





DESCRIPTION OF A NEW SPECIES OF *PELTATUS* FROM BRITISH EAST AFRICA.

By J. R. LE B. TOMLIN, M.A.

*Read 14th May, 1915.**PELTATUS POLYSTEPHES*,<sup>1</sup> n.sp.

Shell narrowly umbilicate, depressedly turbate, thin, with suture slightly marked; whorls 5, rounded, increasing rapidly, the ultimate and penultimate being somewhat flattened above, while the first three whorls rise in a rather acute spire; apical whorl smooth and more or less shining, the other four being marked with fairly regular lines of growth—much finer and closer together on whorls two and three than they are on the two last; colour olivaceous, with an endlessly variable series of chalky-white bands; the bands vary greatly in width and in number, sometimes being reduced to mere threads of white, or they coalesce broadly as in forms of *Helix nemoralis*; rarely the shell is all but white with faint indications of olive bands; the outline of the aperture, if completed, would almost form a circle, but is slightly flattened in the plane of the spire; margin of aperture acute, regularly curved; columellar margin reflected over the umbilicus. Diam. maj. 12, min. 10 mm.; alt. 9 mm.



*Hab.*—Teita Hills, British East Africa, between 4,500 and 6,000 feet. (W. Feather.)

By Mr. Gude's advice I place it in the genus *Peltatus*, on account of its close resemblance to *P. cotyledonis* (Benson),<sup>2</sup> and he has also been kind enough to furnish me with the following particulars in which *P. polystephes* differs from *P. cotyledonis*; the whorls increase more rapidly, the last whorl being proportionately much wider; they are also more tumid and more strongly transversely striated by the lines of growth, in fact it might almost be stated that *P. polystephes* is finely irregularly ribbed. The aperture is more transversely dilated and the columellar margin is a little more oblique.

<sup>1</sup> πολυστεφής = decked with many wreaths.

<sup>2</sup> Cf. Godwin-Austen in Ann. Mag. Nat. Hist., ser. VIII, vol. ix, p. 134, 1912.

With an equal number of whorls *P. cotyledonis* measures 16 mm. in diameter, whereas *P. polystephes* is only 12 mm. The markings are also different.

A large number of this species was collected by Mr. Feather and forwarded alive, but they did not survive the journey. Whether any of the specimens are quite mature is questionable. Under a 1 inch objective there are distinct traces of microscopically fine spiral striae on the apical whorl.

I have placed the type in the collection of the British Museum.

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DESCRIPTION OF A NEW SPECIES OF *DYAKIA*.

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

*Read 14th May, 1915.**DYAKIA VENATOR*, n.sp.

Shell sinistral, narrowly umbilicated, conoid, finely and closely striated, the striæ cut into minute granules by close spirals, pale fuscous, lustreless; spire elevated, apex acute, suture linear. Whorls  $6\frac{1}{4}$ , flattened above, tumid below, excavated around the umbilicus, increasing slowly and regularly, the last whorl keeled at the periphery, sulcate below the keel, not descending in front, slightly dilated towards the aperture. Aperture oblique, semi-lunate, margins slightly convergent; peristome thin, reflexed, upper margin nearly straight, descending, outer and basal margins strongly curved, columellar margin ascending, slightly overhanging the narrow umbilicus. Diam. maj. 25, min. 21.5 mm.; alt. 12 mm.



*Hab.*—Borneo. Type in my collection.

This new species is based on two specimens from the Nevill Collection, purchased as far back as 1904, and a third specimen from the same source in Mr. Ponsonby's collection.

It approaches *Dyakia busanensis*, Godwin-Austen, var. *concolor*, Smith,<sup>1</sup> but the latter has the whorls more convex above and more rapidly increasing, the striæ and spirals are much finer and closer, the lower side is shining and strongly polished, and the umbilicus is narrower. Another allied species is *Dyakia subdebilis*, Smith,<sup>2</sup> but that shell is darker in colour, the whorls are still more flattened, are margined below the suture, and provided with a peripheral band; the striæ and spirals are also finer.

My second specimen possesses only 6 whorls and measures: diam. maj. 22.25, min. 20.25 mm.; alt. 11.75 mm. Mr. Ponsonby's shell has the same diameter as the type, but is a little more depressed, measuring alt. 23.5 mm.

<sup>1</sup> Proc. Zool. Soc., 1895, p. 103.

<sup>2</sup> Loc. cit., p. 104, pl. ii, fig. 11.

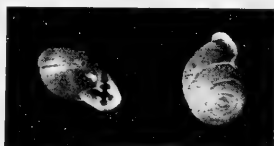
DESCRIPTIONS OF NEW SPECIES OF *STREPTAXIS*, *PLANISPIRA*,  
AND *CHLORITIS*.

By HUGH C. FULTON.

Read 11th June, 1915.

*STREPTAXIS* GUDEL, n.sp.

Shell glassy-white, moderately umbilicated, obliquely ovate; whorls  $5\frac{1}{2}$ , closely arcuately costulate above, the costæ being stronger at the suture and gradually weakening below, last whorl with short inconspicuous costæ or striae at the suture only; interior of aperture armed with six plicæ or tubercles, one prominent entering fold at centre of the parietal wall, with a smaller one above and parallel to it; two nodules are situated on the right inner margin of the peristome, the upper one being very small, the lower prominent; the remaining two are at centre of base and centre of the columella lip, the latter being the broader; peristome thickened and somewhat expanded; interior of umbilicus sharply obliquely striated. Maj. diam. (including peristome) 8, height 6 mm.



*Hab.*—Pac Kha, Tonkin (Col. Messenger).

Var. *minor*. Maj. diam. 6.5, height 5 mm.

*Hab.*—Lao Kay and Muong Kong, Tonkin (Col. Messenger).

The form *minor* is somewhat similar in size and in the arrangement of its armature to *St. heudei*, Schm. & Böttgr., and *St. paulus*, Gude (two scarcely separable forms), but both of those are distinguished by their smooth whorls.

Named in honour of G. K. Gude, Esq., F.Z.S., whose valuable list of the species of this genus (Proc. Malac. Soc., vol. v, pp. 201-44, 1902; pp. 322-7, 1903) is very helpful.

*PLANISPIRA* SUBATACTA, n.sp.

Shell narrowly umbilicated, moderately solid, ovately depressed, ground colour cream, with five reddish-brown spiral bands on the last whorl, one situated at the periphery, one encircling the umbilicus, and three narrower ones above which ascend towards the apex; whorls  $4\frac{1}{2}$ , convex, with conspicuous raised oblique striae, the last whorl constricted behind the aperture; aperture oval, outer bands showing through the interior; peristome slightly expanded, whitish. Max. dimensions—width 19, height 9 mm.

*Hab.*—West Celebes.

Similar in form, colour, and position of its spiral bands to *P. atacta*, Pfr., but readily separated by its smaller size and prominent oblique



striae. In *atacta* the striae are very inconspicuous and might be described as growth-lines, whereas in *subatacta* they might be termed very thin, closely set costae.

CHLORITIS VERRUCOSA, n.sp.

Shell depressed-globose, rather thin, dark brown; whorls 4, covered with irregularly disposed hair-scars, first whorl minutely and closely pitted, the next two with oblique, somewhat raised flexuous striae, the last whorl conspicuously corrugated; umbilicus moderately open and deeply excavated, broadening out above and



prominently keeled; aperture oval, dark within; peristome thin, light brown, slightly expanded, margins connected by a thin callus. Max. dimensions—width 13, height 7 mm.

*Hab.*—Sierah Island, Tenimber Group.

A very distinct form, easily distinguished by its corrugated surface. Although but few hairs remain, it is probable that in life the shell is covered with them, and that they fall off after death.

MOLLUSCAN NOTES. II.<sup>1</sup>

By HUGH C. FULTON.

Read 11th June, 1915.

## No. 7.—PLANISPIRA QUADRIFASCIATA, Guillou.

Owing to the variation in size of the shell, the denticle on basal portion of peristome, and width of colour-bands, this species has received several names. The synonymy is as follows :—

1842. *Helix quadrifasciata*, Guillou, Rev. Zool., p. 141.  
 1864. *H. instricta*, Marts., Monatsbericht. Berl. Akad., p. 268.  
 1867. *H. quadrifasciata*, var. *edentata*, Marts., Ost. Zool. Landschn., p. 300, pl. xvi, fig. 5.  
 1902. *Planispira kendigiana*, Rolle, Nachr. deutsch. Malak. Ges., p. 189.  
 1902. *P. rollei*, Mölldff., Nachr. deutsch. Malak. Ges., p. 189.  
 1903. *P. quadrifasciata*, var. *halmaherica*, Gude, Journ. Malac., vol. x, p. 48, pl. iii, fig. 2.

The *instricta*, Marts. (afterwards changed to *quadrifasciata*, var. *edentula*, Marts.), has only a slight swelling at the usual place of the denticle. *P. rollei*, Mölldff., is a small specimen, otherwise typical. *P. kendigiana*, Rolle, is simply a variety with wide bands. *P. quadrifasciata*, var. *halmaherica*, Gude, was described from a specimen with three colour-bands only, otherwise it appears to be quite typical.

## No. 8.—HELIX NODIFERA, Pfr.

This species is evidently the large form of *Papuina grata*, Mich., as recently collected by the brothers Meek at Muswar Island, Dutch New Guinea, and described by me as *P. grata*, var. *magna*. The absence of the usual colour-band in Pfeiffer's example is probably owing to loss of its periostracum, since specimens before me demonstrate that the colour is only in the periostracum, which is of a deciduous character. Although Michaud's figure does not show the characteristic columellar nodule or swelling, he notes in his description, "au bas de la columelle se trouve une petite dent."

1831. *Caracolla grata*, Mich., in Guérin's Mag. Zool., pl. ix, figs. 1-3.  
 1860. *Helix nodifera*, Pfr., Proc. Zool. Soc., p. 21, pl. ii, fig. 4; Novitates Conchologicæ, p. 166, pl. xlv, figs. 7-8.  
 1891. *Papuina grata*, Mich., Tryon's Man. Conch., vol. vii, p. 35, pl. xiii, figs. 50-1.  
 1910. *P. grata*, var. *magna*, Fulton, Ann. Mag. Nat. Hist., ser. VIII, vol. v, p. 370.

## No. 9.

In my note No. 6, in the Proc. Malac. Soc., vol. xi, p. 241, 1915, I stated that I had been unable to find a description of *Helicina*

<sup>1</sup> Continued from p. 241.

*suprafasciata*, Sow., Mr. Charles Hedley has been good enough to call my attention to its publication in Reeve's *Conchologia Iconica*. I had inadvertently overlooked this monograph, prepared by G. B. Sowerby (2nd) after Reeve's decease, but now have gone through it, and present herewith an additional list of species omitted from Dr. Anton Wagner's monograph.

*aurantioviridis*, Sow., Conch. Icon., 1873, pl. xi, sp. 97. Philippines.  
*benigna*, Crosse, Journ. de Conch., vol. xviii, pl. xi, fig. 97, 1870.

New Caledonia.

*braziliensis*, Gray, Zool. Journ., vol. i, p. 66, 1824. Brazil.

*brenchleyi*, Baird, Brenchley's Cruise of H.M.S. *Curaçoa*, 1873, p. 448, pl. xli, figs. 1-2. Upolu, Navigators Island.

*carinifera*, Sow., Thes. Conch., vol. iii, p. 295, fig. 431, 1866.  
Woodlark Island.

*chrysostoma*, Pfr., Monog. Pneumon. Viv., 1852, p. 330; Conch. Cab., 1853, p. 330, No. 3. Cuba.

*conoidea*, Pfr., P.Z.S., 1853, p. 53. Barbadoes.

*forbesiana*, Sow., Thes. Conch., vol. iii, sp. 192, fig. 344, 1866.

*fulgurata*, Baird, Brenchley's Cruise of H.M.S. *Curaçoa*, 1893, p. 448, pl. xli, figs. 3-4.

*gratiosa*, Pfr., P.Z.S., 1856, p. 385. Admiralty Islands.

*gratulata* (Blanf.), Sow., Conch. Icon., sp. 96, 1873. Pegu.

*inequalis*, Pfr. (*Lucidella*), P.Z.S., 1859, p. 28. Jamaica.

*julii*, Baird, Brenchley's Cruise of H.M.S. *Curaçoa*, 1873, p. 449, pl. xli, figs. 7-8.

*mittochila*, Crosse, Journ. de Conch., vol. xvii, p. 187, 1869; vol. xix, p. 65, pl. ii, fig. 5, 1871. Pacific Islands.

*multifasciata*, Baird, Cruise of H.M.S. *Curaçoa*, 1873, p. 449, pl. xli, figs. 5-6. South Sea Islands.

*norfolkensis*, Pfr., P.Z.S., 1856, p. 391. Norfolk Island.

*novæcaledoniæ*, Baird, Cruise of H.M.S. *Curaçoa*, 1873, p. 450. New Caledonia.

*pictella*, Pfr., P.Z.S., 1856, p. 392. Norfolk Island.

*polychroa*, Sow., Conch. Icon., sp. 153. Cuba.

*repanda*, Pfr., P.Z.S., 1855, p. 101. *Hab.* (?)

*retracta*, Poey, Mém., vol. i, p. 116, pl. xii, figs. 20-6.

*rhamphostyla*, Pfr., P.Z.S., 1856. *Hab.* (?)

*riparia*, Pfr., P.Z.S., 1853, p. 53. New Granada.

*rotelloidea*, Mighels, Proc. Boston Soc. Nat. Hist., 1845, p. 19. Oahu Island.

*rudis*, Pfr., P.Z.S., 1855, p. 102.

*rugulosa*, Pease, Amer. Journ. Conch., vol. iv, p. 157, 1868. Tahaa Island.

*semistriata*, Sow., Thes. Conch., vol. iii, p. 281, pl. 268, fig. 86, 1856.  
*Hab.* (?)

*shanghaiensis*, Pfr., P.Z.S., 1855, p. 102. Shanghai.

*strigata*, Baird, Brenchley's Cruise of H.M.S. *Curaçoa*, 1873, p. 450, pl. xli, figs. 9-10. Upolu.

*suavis*, Pfr., P.Z.S., 1856, p. 385. Admiralty Islands.

*subconica*, Sow., Thes. Conch., vol. iii, p. 287, pl. vi, fig. 226, 1866.

*Hab.* (?).

*subturrita*, Sow., Thes. Conch., vol. iii, p. 285, pl. v, fig. 185, 1866.

*Hab.* (?).

*suprafasciata*, Sow., Conch. Icon., sp. 300, 1874. Australia.

*tayloriana*, Sow., Conch. Icon., sp. 206, 1873.

*tecta*, Sow., Thes. Conch., vol. iii, p. 295, pl. 277, fig. 434, 1866.

*Hab.* (?).

*tricarinata*, Sow., Thes. Conch., vol. iii, p. 283, pl. iv, figs. 119-20, 1866. *Hab.* (?).

*turbinella*, Pfr., P.Z.S., 1855, p. 103. Sydney, Australia.

*unicarinata*, Sow., Thes. Conch., vol. iii, p. 285, pl. v, figs. 177-8, 1866. *Hab.* (?).

*virens*, Pfr., P.Z.S., 1856, p. 339. *Hab.* (?).

*yorkensis*, Pfr., P.Z.S., 1862, p. 277. Cape York, Australia.

The monograph in the *Conchologia Iconica* requires, among others, the following corrections:—

sp. 37. For *behaniana* read *behniana*.

sp. 43. For *scopularum* read *scopulorum*.

sp. 45. For *pyramidata* read *pyramidalis* (was first described in Thes. Conch., vol. i, 1842).

sp. 62. For *cumingii* read *cumingiana*.

sp. 79. For *keatii* read *heatei*.

sp. 87. For *platycheila* read *platychila*.

sp. 99. For *Cuba* read *Jamaica*.

sp. 109. For *Helicina nicholetti* read *Schasicheila nicoleti*.

sp. 182. For *cinctilla* read *cinctella*.

sp. 195. For *marchionessa* read *marchionissa*, and for *Homblich* read *Homb. et Jacq.*

sp. 204, 205. Correct authority as in sp. 195.

sp. 228. For *braziliana* read *braziliensis*, and for p. 64 read 66.

sp. 232. For *oxyrhinea* read *oxyrhyncha*.

sp. 241. For *Orb.*, Voy. Amér. Mérid. read *Sow.*, Thes. Conch., vol. iii, p. 295, fig. 431, 1866.

sp. 250. For *Morton* read *Morelet*.

sp. 254. For *forbesiana* read *verecunda*, Gld., Proc. Bost. Soc. Nat. Hist., 1859 (= *forbesiana*, Sow.), Conch. Icon., sp. 254, 1873.

sp. 255. Was described in P.Z.S., 1842, p. 7, and in Thes. Conch., vol. i, p. 13, 1842 (see list of errata).

sp. 275. For *mittocheila* read *mittochila*.

sp. 277. For *Gray* read *Pfr.*

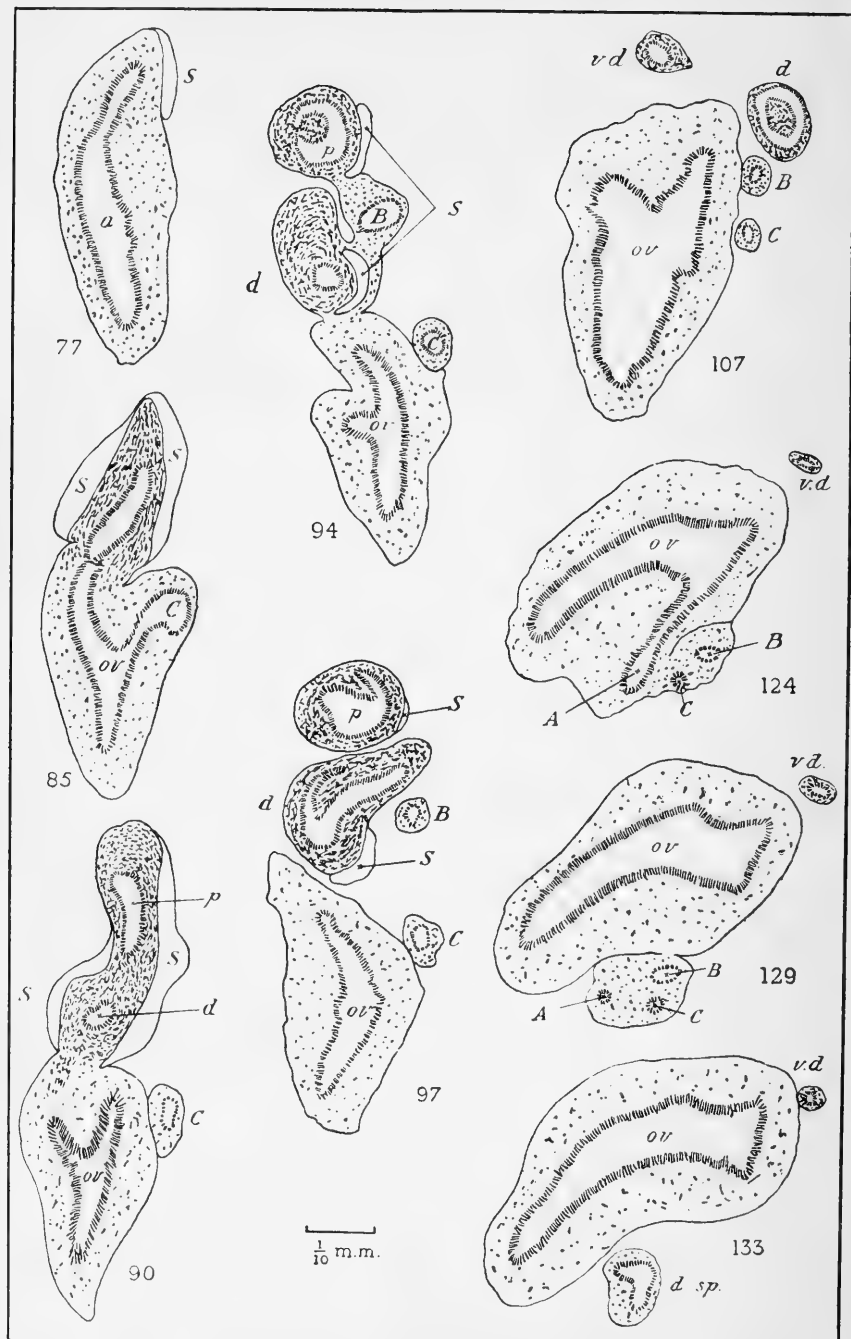
sp. 281. For *moriensis* read *mouensis*. *Hab.*—Mount Mou.

sp. 285. Insert after *Pease*.—Amer. Journ. Conch., vol. iv, p. 157, pl. xii, fig. 11, 1868.

sp. 309. For *Hidalgo* read *Crosse*.







SECTIONS OF THE GENITAL APPARATUS OF HYALINIA EXCAVATA.

NOTE ON THE DUCT OF THE SPERMATHECA OF *HYALINIA*  
*EXCAVATA*.

By A. E. BOYCOTT.

Read 11th June, 1915.

PLATE X.

THE curious anatomy of the duct of the spermatheca in *Hy. excavata* and *nitida* was noticed by C. Ashford, and first, I think, described by W. Moss.<sup>1</sup> They found that passing downwards from the spermatheca the duct bifurcated, one branch opening into the vagina in the usual way, while the other came into relation with the penis and possibly opened into it. P. Pelseneer<sup>2</sup> found that this second branch did not actually form a passage into the lumen of the penis, but ended in a blind sac surrounding the lower end of the penis and dart-sac.<sup>3</sup>

So anomalous an arrangement seemed worth reinvestigation, and I have examined in detail, by means of complete series of microscopical sections, five specimens out of a number collected at Portmadoc (Carnarvonshire) in August, 1913. As appears to be usual at that time of year, few of them had darts; of the specimens examined two possessed spicula, and in the other three the dart-sac was empty.

The accompanying sketches of nine sections, approximately transverse to the general axis of the genital apparatus, show the condition found. The sections were each 0.009 mm. thick, and the numbers attached to each show its position in relation to the section containing the external genital orifice, which would be numbered 0. Section 133 shows the oviduct with the vas deferens and spermatheca duct. In section 129 the latter has divided into three branches, one of which (duct A) almost immediately opens into the oviduct, the transition being shown in section 124. The other two (ducts B and C) run for a short distance in close connexion with the wall of the oviduct, but presently separate from it, and from one another, as seen in section 107, which shows also the passage of the vas deferens into the penis, and the upper end of the dart-sac. Section 97 shows penis, dart-sac, free oviduct, duct B close to the dart-sac, duct C in contact with the oviduct, and also the upper extremities of the sac (S) into which duct B opens. This opening is placed just below section 94. In section 90, penis, dart-sac and oviduct are confluent, duct B has disappeared into the sac which is about here at its largest, and duct C is still separate. The opening of duct C into the vagina concurrently with the junction of the penis and dart-sac is shown in section 85, while section 77 shows the common genital passage and the lower extremity of the sac.

<sup>1</sup> *Journal of Conchology*, vol. viii, pp. 421, 1897.

<sup>2</sup> *Mém. Acad. roy. Belgique*, vol. liv, p. 62 (of reprint), 1901.

<sup>3</sup> See the description and figures of J. W. Taylor, *Monograph*, vol. iii, pp. 135, 142.

Duct C, running from the spermatheca to the genital passage in the neighbourhood of the origin of the penis, is evidently the customary duct. Duct A, much smaller than the other two, affords an alternative route to the oviduct: it has not, I believe, been previously described and, while it was quite obvious in the three smaller specimens which I examined, it could not be found in the two larger ones which had darts. Possibly therefore it represents some arrangement which is falling into desuetude. Duct B, which for most of its course is the largest of the three branches, is the most curious, since it opens below into a thin-walled sac lying round the upper end of the common genital passage and the lower parts of the penis and dart-sac. I could find no opening out of this sac save into duct B; indeed, I am fairly confident that no other anatomical opening exists. The sac is lined with simple thin epithelium, as is also duct B in its lower two-thirds, and in none of the specimens did the sac show any visible contents. The appearances do not, therefore, suggest that the sac has any very active secretory function, but rather that it is a reservoir of liquid. In the face of our ignorance of the function of the spermatheca, speculation is hardly proper, but it may perhaps be suggested that when the penis is everted in copulation the sac would probably be compressed and any liquid in it forced along duct B: in this way duct C, and possibly the spermatheca itself, would be washed out into the vagina. Alternatively the sac might act as an aspiratory apparatus on the cessation of copulation, though the tenuity of its walls renders this unlikely. The examination of sexually active specimens might throw much light on the matter, but these I have not been fortunate enough to meet with.

The specimen from which the drawings were made had a shell 6.4 mm. in diameter: the body was straightened out and probably somewhat stretched before the sections were prepared.

A, duct A of spermatheca; B, duct B of spermatheca; C, duct C of spermatheca; *a.* common genital passage; *S.* sac into which duct B opens; *ov.* oviduct; *p.* penis; *d.* dart-sac; *v.d.* vas deferens; *d.sp.* undivided duct of spermatheca.

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## NOTES ON THE NAMES OF SOME BRITISH MARINE MOLLUSCA.

By TOM IREDALE.

*Read 11th June, 1915.*

My present theme will read somewhat strangely to those conversant with my writings, and an apology seems necessary. In my Antipodean researches I have had continually to refer to British literature and forms. The latest List of British Marine Mollusca appeared in the *Journ. Conch.*, vol. x, p. 9 et seq., January, 1901, and I found it to be unreliable as a guide to present-day conclusions. This List was prepared by a Committee of the Conchological Society of Great Britain and Ireland, and I therefore suggested to the Society, through my friend Mr. J. R. le B. Tomlin, that it was necessary to prepare a new List, and also that I would offer my services as regard nomenclatural details. As far as I can judge the Society was unwilling, but it was intimated that a new List might be unofficially published were full reasons for alterations given, and further that I might undertake it myself. I thereupon criticized the List, and noting that the majority of generic names would at some time or other come under examination in connexion with Antipodean material, I undertook the rectification of the List. Before I had performed much work, I discovered that the explanation for the reasons of the innumerable necessary changes would occupy much more space than the List itself. As many of the names are of much more than local interest, I take this opportunity of recording a number of alterations, with the reasons, and at the same time would remark that a similar criticism of the shells themselves would probably necessitate as many changes.

It would appear that in the quotation and proposal of varietal names no scientific value was considered; the most striking example is in *Paludestrina*, where, under the species *stagnalis*, Basterot, I note var. *octona*, Linné; as I consider this genus non-marine, I make no further remark. In the genus *Littorina* I note under the species *rudis*, Maton, the var. *saxatilis*, Johnston; but the name *saxatilis* is the oldest for this kind of shell, being given by Olivi. I observe that this nomination is of quite ordinary occurrence; nevertheless, it is incorrect, misleading, perplexing, and invalid. To accurately fix any of the names, a complete synonymy, with dates properly determined, is necessary, and this I am now engaged in compiling. As it will probably take years to gather together all the strands, I consider it necessary, as an aid, to publish imperfect conclusions, and solicit criticism from all interested.

## Genus NOVALUNA, nom. nov.

For a genus of Aplacophora, *Neomenia*, Tullberg, is in use. This name was proposed in the *Bihang. K. Svensk. Vet.-Ak. Handl. Stockh.*, vol. iii, No. 13, p. 3, October, 1875, for the new species *N. carinata* alone. Tullberg gave the derivation as from the Greek for 'new moon', but in 1828 Billberg, in the *Synopsis Faunæ*

Scand., vol. i, pt. ii, table A, had proposed *Neomenius*, with the same derivation. I therefore propose to replace Tullberg's name as above. The synonym *Solenopus*, Koren & Danielssen, Archiv Math. and Naturh. Kristiania, vol. ii, p. 127, 1877, is itself preoccupied by *Solenopus*, Schoenherr (Isis, 1825, col. 584).

#### TECTURA, Gray.

*Acmaea*, Eschscholtz, has been preferred to *Tectura*, and I note that this was long a source of discussion which was at last decided in favour of *Acmaea* on the score of priority. That there was a prior *Acmea* seems to have been ignored by all the disputants, but such is a fact, which was on record all the time. *Acmea* is a valid molluscan name, and I think it quite impossible to maintain as well, in practical usage, *Acmaea*. I think, moreover, that the type of *Acmaea* cannot be regarded as congeneric with the British shells so named. For them we can then revert to *Tectura*, first introduced in a Latin guise by Gray, Proc. Zool. Soc., 1847, p. 158, the type by original designation being *Patella parva*, which is regarded as a synonym of *P. virginea*, O. F. Müller (Zool. Dan. Prodr., p. 237, 1776, Danmark). 'Tecture' had only previously appeared as a French vernacular, as admitted by all writers.

When Dall reviewed the *Acmaeidæ* he proposed *Collisella* (Amer. Journ. Conch., vol. vi, p. 245, April 4, 1871) as a sub-genus of *Acmaea*, designating as type *A. pelta*, Eschscholtz. To that sub-genus he referred *Patella testudinalis*, O. F. Müller (Zool. Dan. Prodr., 1776, p. 237, Danmark). As a synonym of this name has been generally quoted *Patella tessellata*, O. F. Müller. That name first appeared on the same page as *testudinalis*, but placed before it, and has therefore place priority; it is there spelt *tessulata*. In the Zool. Dan. later, O. F. Müller gave long detailed descriptions of the new species diagnosed in two lines in the Prodomus above cited. In vol. i, p. 27, 1779, a full detailed account of *Patella tessellata* is given, but there is no further mention of *P. testudinalis*. This is, to me, suggestive, as there was a prior *P. testudinaria*, Linné, Syst. Nat., 10th ed., 1758, p. 783, and I would conclude that Müller's *tessulata* or *tessellata* has the best claim to usage.

#### ANSATES, Sowerby, 1839.

In the List *Patina*, Leach, is used. I hope such a quotation will surely never be given again by a worker who has to trace names, and my usage is the rejection of all Leachian names until it be proved that Leach published them. The earliest usage of *Patina* I have yet traced is that by Gray, when he published the Leachian names in the Ann. Mag. Nat. Hist., vol. xx, p. 271, October, 1847. His type was by monotypy *P. lævis*. However, in the Conchological Manual, 1st ed., 1839, by Sowerby, I came across the following entry: "p. 6, *Ansates*, Klein. Species of *Patella* with a produced recurved beak. *Helcion*, Montf. Ex. *Patella pellucida*, fig. 230." From this, the only conclusion possible is the recognition of *Ansates*, Sowerby

(ex Klein) in place of Gray's name *Patina*, over which it has eight years priority.

# DIODORA, Gray.

In the List *Fissurella græca* appears. The species *græca* cannot be referred to the genus *Fissurella*, so that error is here at once apparent. *Fissurella* was introduced by Bruguière in the Encycl. Méthod. Vers., vol. i, p. xiv, 1791, with a vague diagnosis, and no species cited. At this introduction it can only be considered a *nomen nudum*. In 1799 Lamarck in the Mém. Soc. Hist. Nat., p. 78, cited in conjunction the species *Patella nimbose*, Linné. The name then dates for actual usage from this place, and *nimbosa* is not congeneric with *græca*. In the Man. Conch., vol. xii, p. 205, 1890, Pilsbry recognized this, and allotted the species '*græca*' to *Glyphis*, Carpenter. This name was proposed in the Cat. Mazatlan Shells, p. 220, 1856, apparently for the *græca* group, but the name chosen was preoccupied by *Glyphis*, Agassiz (Poiss. foss., vol. iii, p. 241, 1843). Hedley, following Pilsbry and Johnson (Nautilus, vol. v, p. 104, January, 1882), in his Cat. Marine Moll. Queensl. (Proc. Austr. Assoc. Adv. Science, Brisbane, 1908, p. 352, 1909) therefore rejected *Glyphis*, and used for a large group *Fissuridea*. This name was proposed by Swainson (Treatise Malac., p. 356, 1840) with the diagnosis "Sub-conical, cap-shaped; the summit close to the posterior margin: the perforation narrow. *T. pileus*, Sw. Sp. nov." The species was recognized as '*galeata*, Helbling' by Pilsbry, and Swainson's name was used for this alone. With doubt I have followed Hedley in associating shells of '*græca*' affinity with those like '*galeata*, Helbling'. Recently my doubts have been confirmed, and I will later show that these two are certainly generically distinct. Consequently *Fissuridea* is not available for the former. Dall in the Proc. U.S. Nat. Mus., vol. xlviii, pp. 437-40, January 19, 1915, has discussed the names given to species of this family in the *Conchological Illustrations*. He has there put forward *Lucapina*, as of Sowerby, 1835, as applicable to the group. On his data I would prefer *Foraminella*, but we are saved from a further complication by the recognition of a name long anterior to *Lucapina* or *Fissuridea*. Gray in the London Medical Repository, vol. xv, p. 233, March 1, 1821, proposed *Diodora* for *Patella apertura*, Mont. It is acknowledged, without argument, that *Patella apertura* was based upon the immature stage of the British shell known as *Fissurella græca*. This name, then, is available, and must be used for the *græca* affinity. The laws governing zoological nomenclature are definite on this point, and the subject requires no discussion. It is obvious that this detail was simply overlooked by Pilsbry and Dall, as neither of these workers would consider any argument with regard to such a simple matter.

The correct specific name of the British shell may as well be here discussed. Though '*græca*' was used in the List, this was against the conclusions of most conchological writers. The majority have affirmed the distinction between the British shell and the Mediterranean one named '*græca*'. Owing to confusion the majority of workers on

Mediterranean shells reject '*græca*' altogether. The British shell was first named "*P(atella) larva, reticulata*" by Costa in the Brit. Conch., 1778, p. 14, pl. i, fig. 3. This is one of the very few trinomials present in Costa's work, and has been dismissed as indeterminate. If he meant to use '*P. reticulata*', as would appear from his Index, then his name is antedated by Linné's usage in the Syst. Nat., 10th ed., 1758, p. 784. The same remark applies to *Patella reticulata*, used by Donovan, Nat. Hist. Brit. Shells, vol. i, pl. xxi, fig. 3, circa 1800, which has been often utilized.

We then arrive at *Patella apertura*, Montagu (Test. Brit., vol. ii, p. 491, pl. xiii, fig. 10, 1803: Falmouth), which, founded on an immature shell, must come into use.<sup>1</sup> The Laws are very clear regarding this, and nobody requests any revision.

#### RISSEOELLA, Gray.

In the Proc. Zool. Soc., p. 159, November, 1847, Gray wrote, "*Rissoella*. Rissoa, sp. Brown. *Rissoa? glaber*, Alder." Forbes and Hanley (Hist. Brit. Moll., vol. iii, p. 151, June, 1850) introduced a genus *Jeffreysia* as of Alder MS. for the above species and another one. The description is based upon the first-named, which must be therefore regarded as the type, and *Jeffreysia*, being coequal with and later than *Rissoella*, must pass into synonymy. The usage of the former has been continued, as it was urged that no description of *Rissoella* was offered previous to Forbes & Hanley's correct proposal of *Jeffreysia*. This argument, of course, does not hold good at all, but its basis is shattered by the fact that Gray in the Fig. Moll. Anim., vol. ii, p. 86, had provided a correct diagnosis, and this had appeared in February-March, 1850, that is, three months prior to Forbes & Hanley's introduction.

#### ACMEA, Hartmann.

In the Neue Alpina, Bd. i, pp. 204-12, 1821, Hartmann proposed a genus *Acmea*, with full diagnosis, species described, and figures given. Such a proposal cannot be ignored, yet such seems to have been the fate of this name. I select as type of the genus the species *Acmea truncata*, and thereby fix the name for active use. This will mean that *Acmea* will replace *Truncatella*, Risso, 1826. The murmur against the dismissal of *Truncatella* may be lessened when it is explained that three pages prior to his proposal of his name Risso had introduced the genus *Fidelis*, and under all the laws this name would also succeed against *Truncatella*. I would accept *subcylindrica*, Linné (*Helix s.*, Syst. Nat., 12th ed., 1766, p. 1248) for the species name, as used by French malacologists, and, as explained by Hanley, this name is confirmed by the shell in the Linnean cabinet: *truncata*, Montagu, is also twice invalid, being preceded by *subtruncata* (Test. Brit., vol. i, p. 300, 1803).

<sup>1</sup> I see Dall (loc. cit.) writes "*apertura*, Montagu (not Born)", but this appears to be a slip, following Gray, 1847, who quotes *Patella apertura*, Born. I cannot find such a name in Born's works, nor does Sherborn record it in the *Index Animalium*.



# TRIVIA JONENSIS (Pennant).

In the List *Trivia europæa* (Montagu) is used. Recent writers have admitted *Trivia arctica* (Pulteney) to be more correct, on the score of priority. I would only cite one, Shaw (Proc. Malac. Soc., vol. iii, p. 309, July, 1909), who has discussed the matter during a review of the species of *Trivia* and *Cypræa*. Pulteney's name appeared in a Cat. Birds, Shells, etc., Dorset, published in 1799, on p. 39, ex Solander MS. This work has on the title-page, "Printed for the use of the Compiler and his friends," and otherwise purports to be a part of Hutchins' History of Dorsetshire, and is so quoted by Forbes & Hanley. It is well-known that with the second edition of Hutchins' Hist. Dorset, an amended edition of Pulteney's work, prepared by Rackett, was published. I now state that, according to my results, Pulteney's Catalogue was *not* published as a part of Hutchins' History of Dorset, but only appeared in the guise, above noted, as a separate List. Prior to Pulteney's proposal of *C. arctica*, Costa (Brit. Conch., 1778, p. 33, pl. ii, fig. 66) had figured and described the British shell, and, doubting its reference to the Linnean *Cypræa pediculus*, had designated it (*Cypræa*) *pediculus* seu *monacha*. As it turned out to be different from *pediculus* the alternative name proposed by Costa must be recognized.

However, previously to Costa, Pennant (Brit. Zool., 2nd 8vo ed., vol. iv, p. 117, pl. lxxi, fig. 8, 1777) had described *Voluta jonensis*, from I. of Jona. Laskey (Mem. Wern. Soc., vol. i, p. 395, 1811) has observed under the name *Cypræa europæa*, M., "Rather plentiful at Dunbar, and to be met with sparingly on most parts of the coast. With all the varieties we are happy to find Mr. Montagu is of the same opinion in respect to this shell and the fry as ourselves. By this means *Cypræa arctica*, *Cypræa bullata*, *Bulla diaphana*, and, in fact, *Voluta Jonensis* of Pennant should be all erased from the British catalogue as species, and *arctica* should alone stand, as the variety without spots of *Europæa*. N.B.—A specimen of *Voluta Jonensis* is now in my cabinet from the Portland Collection: and it is well known Pennant figured his shell from this collection." Such an account, being in accordance with the known facts, demands the recognition of Pennant's name.

# COMARMONDIA, Monterosato.

The value of the divisions in the family Turridæ are not yet fixed. In the List, *Bellardiella*, Fischer, is given generic rank, while Dall (Bull. Mus. Comp. Zool. Harv., vol. xliii, p. 242, 1908) regarded it as a sub-genus only. Whichever it is, the name is invalid, for previous to Fischer's publication (Man. de Conch., pp. 593-4, December 20, 1883) Tapparone-Canevari (Ann. Mus. Genova, vol. xix, p. 265, ante July 11, 1883) had appropriated the name.

*Comarmondia* was proposed simultaneously by Monterosato (Nomen gen. e spec. Conch. Medit., 1884, p. 135) for the same shell, the author being necessarily ignorant of Fischer's action.

## ERATO VOLUTA (Montagu).

This shell is more commonly known as *Erato laevis*, Donovan (Nat. Hist. Brit. Shells, vol. v, pl. clxv (*Voluta*), 1804: Weymouth). As far as I can yet ascertain, this volume did not appear until after the publication of Montagu's Test. Brit. It may be that Donovan's name has really priority of publication, but until this can be actually proved we must admit Montagu's name. Many names depend upon the facts, and at the present time all Donovan's names published in the fifth volume are ranked as later than Montagu's. In the present instance Montagu's name has been rejected, as it has been cited as *Bulla voluta*, and there is a prior *Bulla voluta*, Gmelin (Syst. Nat., p. 3433, 1791). It is thus quoted in Forbes & Hanley's Hist. Brit. Moll., vol. iii, p. 502.

Montagu, however, called it *Cypræa voluta* (Test. Brit., pt. i, p. 203, pl. vi, fig. 7.7, 1803: Salcomb Bay), and this name is valid and must be preserved.

## Family CERITHIIDÆ.

Under this name appear the genera *Cerithium*, *Bittium*, *Triforis*, *Newtoniella*, *Cerithiopsis*, and *Læocochlis*. I am unable to defend this association, and I think that not only is the family heterogeneous, but the genera are also polyphyletic. The shell classed under *Cerithium* is quite unlike the type of the genus, whether we accept Lamarck's selection or not. For the species described by Jeffreys as *Cerithium procerum* (Ann. Mag. Nat. Hist., ser. iv, vol. xix, p. 322, April 1, 1877: Valorous, Station 12) I propose the new genus name

## CHASTERIA, n.g.

## CHASTERIA DANIELSENI (Friele).

This will be the name for *Cerithium procerum*, Jeffreys, as thirty odd years before Kiener, Coq. Viv. *Cerithium*, p. 22, pl. xviii, figs. 1-1a, 1841-2, had selected that name for a different shell. In the Nyt. Mag. Naturvid. (Christ.), vol. xxiii, pl. iii, p. 3, 1876-7, Friele had described the same shell as *Cerithium danielсени*. I have not yet ascertained the exact dates, but I believe that Friele's name has also priority, an advantage which is not now necessary.

## EUMETA ARCTICA (Mörch).

This would appear to be the correct name for the shell listed as *Cerithiopsis costulata*, Möller. In the Index Moll. Grœnl., 1842, p. 10, Möller proposed *Turritella* (?) *costulata* from Greenland. In the Vidensk. Med. Nat. Forh. (Kjöben.), 1868, p. 208, Mörch introduced *Eumeta* as a sub-genus of *Cerithium* for this species, having previously changed the specific name as above. This alteration has recently been rejected, as it was argued the species was not a true *Cerithium*. I would point out, however, that Mighels & Adams proposed in January, 1842, a *Turritella costulata* (Bost. Journ. Nat. Hist., vol. iv, pl. i, p. 50), and this name invalidates Möller's selection. In Brit. Conch., vol. iv, p. 273, 1867, Jeffreys wrote: "Mörch changed the name given by the discoverer to *Cerithium arcticum*, because the latter had

described the shell as *Turritella? costulata*, it not being Lamarck's nor Risso's so-called species. But the present species is not a *Turritella* (as, indeed, Möller suspected): and the reason assigned by Mörch is, therefore, insufficient. I described the fossil shell as *Cerithiopsis nivea*, and S. P. Woodward proposed to name the recent one *Cerithium Naiadis*." This passage might be cited as a perfect example of how *not* to make conchological literature. There is not a single reference given, and the attempted recovery of such has entailed so much labour that I here record my results as an aid to future investigators. Mörch changed the name in Rink's Grønland, Band ii, Nat. Bidr., p. 82, 1857, because he transferred the species to *Cerithium*, according to some writers. I have been unable to find *Turritella costulata* in Lamarck's writings, nor does Risso give such a species as far as I can discover.\* No reason was assigned by Mörch, his words being "*Cerithium arcticum*, nob. *Turritella? costulata*, Moll. nec. Lam. nec. Risso". Such an entry suggests what Jeffreys wrote, but it was his duty to verify the facts before endorsing the statement. In the Ann. Mag. Nat. Hist., ser. III, vol. iii, p. 53, pl. iii, figs. 17a, b, January, 1859, Jeffreys described *C(erithiopsis) nivea* from the Turbot Bank, Belfast Bay, with no intimation that it might be fossil. In the same place he recorded *C(erithiopsis) naiadis* from Zetland as "Mr. Woodward has undertaken to describe it, with other Norwegian shells, in the 'Annals'". I have searched this and every other source I can think of, and have been compelled to conclude that the last-named has never been described and is still a *nomen nudum*. In the British Museum there is a shell, presented by R. McAndrew, labelled in his handwriting "*C. naiadis*, Woodward MSS. Finmark, R. Mc."

#### GRAPHIS, Jeffreys.

*Cioniscus*, Jeffreys, must be abandoned in favour of this name. *Graphis* was proposed (Brit. Conch., vol. iv, p. 102, 1867) for *unica*, Mont. = *albidus*, 'G. Adams.' In the next volume, p. 210, 1869, Jeffreys replaced *Graphis* by *Cioniscus*, as he had noted that *Graphis* was preoccupied in Botany. Botanical names do not now concern us, and I do not find that *Graphis* was anteriorly used in Zoology, so that we must revert to Jeffreys' first nomination.

#### RISSOID NAMES.

I am now engaged upon these, and I find that there is great confusion. So far I note the following cannot be maintained: *Rissoa albella*, Lovén, *Alvania reticulata* (Montagu), *Manzonina costata* (J. Adams), *Onoba striata* (J. Adams), *Barleeia rubra* (Montagu), and probably *Galeodina carinata* (Costa).

#### Family PYRAMIDELLIDÆ.

In the List twelve generic groups are admitted. Dall & Bartsch issued as U.S. Nat. Mus. Bulletin, No. 68, December 13, 1909, a Monograph of West American Pyramidellid Mollusks, and therein gave a Synopsis of the Genera, Sub-genera, and Sections. Following

\* *Turritella costulata* Mich. Gal. Douai, 1856 in  
*Ann. Mag. Nat. Hist.*, ser. III, vol. iii, p. 53, pl. iii, figs. 17a, b, January, 1859.

a policy I cannot endorse, they recognized three generic groups in place of the twelve mentioned above, but regarded as sub-genera practically all the above and some additional ones. It is quite impossible to criticize thoroughly the treatment, but I cannot, from my studies in Antipodean molluscs, agree with the groups provided in the above-named Monograph. It would be useful simply to correlate the Monograph ideas and the List associations, but it must be remembered this is only a superficial résumé. I hope to thoroughly study the group at a later date.

## LIST NAMES.

*Odostomia*.  
 sp. (*conoidea*).  
*Jordanula*.  
*Liostomia*.  
*Brachystomia*.  
 Subg. *Doliella*.  
*Ondina*.  
*Oda*.  
*Pyrgulina*.  
 sp. (*interstineta*).  
 sp. (*fenestrata*).  
*Spiralinella*.  
*Miralda*.  
*Pyrgostelis*.  
 sp. (*scalaris*).  
*Turbonilla*.  
*Eulimella*.

## D. &amp; B. MONOGRAPH.

*Odostomia*, s.s.  
 Subg. *Ondina*.  
 Subg. *Jordaniella*.  
 Subg. *Liostomia*.  
 Sect. of *Odostomia*, s.s.  
 Subg. *Doliella*.  
 Subg. *Evalea*.  
 Subg. *Oda*.  
 Subg. *Pyrgulina*.  
 Subg. *Parthenina*.  
*Turbonilla*, subg. *Tragula*.  
*Odostomia*, subg. *Spiralinella*.  
 " " *Miralda*.  
*Turbonilla*, subg. *Pyrgiscus*.  
 " " *Pyrgisculus*.  
*Turbonilla*, s.s.  
*Pyramidella*, subg. *Eulimella*.

Though the associations seen in the List may, and do, need readjustment, the method utilized of expressing the facts is preferable to that of the Monograph. I will only deal here with nomenclatural matters, and will later discuss the relationships.

## CREMULA, n.g.

I propose this name for *Turbonilla clavula*, Lovén (Ofvers. K. Vet. Akad. Forh., Stockholm, 1846 (January 14), p. 49, pl. i, fig. 7: Norway). In the Moll. Reg. Arct. Norveg., November, 1878, p. 205, G. O. Sars introduced *Liostomia* for two species—*eburnea*, Stimpson, and *clavula*, Lovén. In the Nomen. gen. e spec. Conch. Medit., 1884, p. 95, Monterosato selected the type as *T. clavula*, Lovén. In the Monograph, apparently not recognizing this, the type is cited as *eburnea*, Stimpson. As far as I know, Dall & Bartsch first made this selection in the Proc. Biol. Soc. Wash., vol. xvii, p. 13, February 5, 1904, but that was twenty years too late. In the Treat. Malac., 1840, p. 328, Swainson had employed Sars' selection under the spelling *Leiostoma*, so that I now make rectification as above.

## ZASTOMA, nom. nov.

I propose the above for *Brachystomia*, Monterosato, Nomen. gen. e spec. Conch. Medit., 1884, p. 94, introduced with *rissoides*, Hanley, as the typical species. In the List this is given generic rank, with six species, and *Doliella*, Monterosato, Bull. Soc. Malac. Ital., vol. vi,

p. 73, 1880, proposed for *O. nitens*, Jeffreys, is added as a sub-genus for its type species alone. *Doliella* has thus priority, but Dall and Bartsch separate these, making *Doliella* a sub-genus, and admitting *Brachystomia* as a section only of *Odostomia*, s.str. Whatever the ultimate status, the name must be changed on account of the prior *Brachystoma* of many authors and even in Molluscs of Gardner, Geol. Mag., ser. III, vol. III, p. 160, 1876.

In the List appear *Brachystomia rissoides* (Hanley) and *B. ambigua* (Maton & Rackett) = *pallida*. In the first case, as a varietal name, is cited *nitida*, Alder.

*Odostomia rissoides* was proposed by Hanley in the Proc. Zool. Soc., 1844, p. 18, which appeared in July, while *O. nitida* was introduced by Alder in the Ann. Mag. Nat. Hist., vol. XIII, p. 326, pl. VIII, fig. 5, on May 1, 1844, and the latter has therefore absolutely priority.

Maton & Rackett proposed *Voluta ambigua* (Trans. Linn. Soc., vol. VIII, p. 132, 1807) as a new name for *Turbo pallidus*, Montagu, Test. Brit., pt. II, p. 325, 1803, and when it is acknowledged that the latter is indeterminable, the former must also be so classed. In La Feuille des jeunes Nat., ser. V, No. 493, January 1, 1912, Martel discussed *T. pallidus*, Montagu, and concluded that, in view of the diverse attempts at identification and the facts cited, it must be regarded absolutely as indeterminable. As a substitute he advocated *eulimoides*, Hanley, which was proposed at the same time and place as *rissoides*. He discussed this latter, and relegated it to varietal rank only under *eulimoides*. He did not concern himself with *nitida*, Alder, so that his nomination must be reconsidered, even if his facts be accurate. However, Forbes & Hanley (Hist. Brit. Moll., vol. III, p. 284, 1853) cite *Odostomia scalaris*, Macgillivray (Hist. Moll., Aberdeen, p. 154, 1843) as a synonym of *O. rissoides*, Hanley. This name is even earlier than *nitida*, Alder, and its claim must be investigated. Jeffreys ignored it, as he lumped the majority of the Pyramidelloid shells under *Odostomia*, and consequently Philippi's *Melania scalaris* (Enum. Moll. Sicil., vol. I, p. 157, pl. IX, fig. 9, 1836) was earlier. The latter species, however, is the type of *Pyrgisculus*, which, if not admitted as a valid genus, is ranked under *Turbonilla*. Apparently *scalaris* would replace *rissoides*, and *eulimoides* come into use for *ambigua*.

#### BURKILLIA, n.g.

I introduce this name for *Odostomia fenestrata*, Jeffreys (Ann. Mag. Nat. Hist., ser. II, vol. II, p. 345, November, 1848 (ex Forbes MS.): Dartmouth). This species is included in the List under *Pyrgulina*, which is obviously an unhappy location. Dall & Bartsch place it under *Turbonilla*, giving it subgeneric rank under the name *Tragula*, which Monterosato (Nomen. gen. e spec. Conch. Medit., 1884, p. 86) provided for it alone. That name cannot, however, be maintained, as there is a prior *Tragulus*, Brisson, Reg. Anim., 1762, p. 65.

#### EVALEA, A. Adams.

Dall & Bartsch replace *Ondina*, Folin, by the above name, which was proposed as a sub-genus of *Odostomia* (Ann. Mag. Nat. Hist.,

ser. III, vol. vi, p. 22, July, 1860) for apparently the same group. I believe Dall & Bartsch in this case are right, but as another synonym (p. 192) they cite "*Ptychostomon*, Locard, Prod. les Moll. France, 1886, p. 228. Type *Turbo conoideus*, Brocchi". In this they are wrong as, though Locard proposed *Ptychostomon* without designating a type, he used it generally for the smooth *Odostomia*, which name is missing. Upon reference to p. 571, Locard explained that *Ptychostomon* was proposed as a new name for *Odostomia*, Fleming, 1819, on grounds of purism. The type of *Ptychostomon* is, then, *Turbo plicatus*, Montagu.

Kobelt has used Locard's emendation, disregarding all laws of nomenclature, the family name becoming Ptychostomidæ. Many years previously, however, a general substitute for *Odostomia* had been proposed by Clark (Jeffreys, Brit. Conch., vol. iv, p. 109, 1867), viz. *Monoptaxis*, and this would have been available, though possibly purists might make complaint against this even. It is also as well to record that Locard, in his choice of a name, had been long anticipated by *Ptychostomum*, Stein, Sitzung. Böhm. Ges. Wiss., vol. lxi, 1860.

#### PYRGISCULUS, Monterosato.

This name would replace *Pyrgostelis*, Monterosato (Nomen. gen. e spec. Conch. Medit., 1884, p. 89), which had as type *Mel. rufa*, Philippi, regarded in the List as a var. of *interrupta*, Totten, as it was proposed in the same place, on the previous page, for *scalaris*, Philippi, which is here classed with it. Dall & Bartsch, however, do not consider these two should be placed in the same sub-genus, but admit two different sub-genera for them, *Pyrgiscus* and *Pyrgisculus*, placing them under *Turbonilla*.

*Pyrgiscus* was introduced by Philippi in the Archiv für Nat. (Wieg.) 1841, p. 50, apparently as a substitute for *Turbonilla*, Risso, but Dall & Bartsch have used as type of this the species *rufa*, and consequently, if their action be correct, *Pyrgostelis*, Monterosato, is an absolute synonym of *Pyrgiscus*.

#### NOEMIAMEA.

*Oda* was proposed by Chaster (Journ. Conch., vol. x, p. 8, January, 1901), on Monterosato's suggestion, to replace *Noemia*, De Folin, "as this name is preoccupied in the coleoptera," citing *Odostomia dolioliformis*, Jeffreys, in this connexion. It is accepted as a sub-genus of *Odostomia* by Dall & Bartsch, while *Noemia* and *Noemiamea* are included in the synonymy of *Chrysallida*, Carpenter, the type being given of *Noemia* as *Noemia angusta*, De Folin.

I have already indicated errors in connexion with Dall & Bartsch's quotations ex *Les Fonds de la Mer*. Mr. Alex Reynell has lent me a number of parts of the first volume of *Les Fonds de la Mer*, and from them I find that this journal came out in livraisons in the order they appear according to pagination. Consequently the name *Noemia* depends upon its first introduction, which was in connexion with the species *Noemia valida* (Folin, *Fonds de la Mer*, vol. ii, p. 63, pl. ii,

fig. 6, 1872: Gigon). The type of *Noemia* then, by monotypy, is this species, which has been recognized as *dolioliformis*, Jeffreys. This was fixed by Monterosato (Nat. Sicil., vol. iv, p. 85, January, 1885) as type of *Noemia*, De Folin, 1870. In 1870 De Folin only gave a crude and indeterminate diagnosis of the genus *Noemia*, and the first species associated with it afterwards was *valida*. In 1886 *Noemiamea* was proposed (Zool. Record, 1885, p. 94, 1886) to replace *Noemia*, as that name was seen to be preoccupied. No type was named, and therefore the name must follow Monterosato's designation, as well as monotypy. Monterosato, when he advised Chaster to propose *Oda*, simply overlooked the fact that the alteration had been made.

The type, cited by Dall & Bartsch, at their quotation, is only a nude name, and cannot be utilized. Consequently *Noemiamea* must replace *Oda*, and *Noemia* be cited as a synonym.

#### EULIMELLA MACANDREWII (Forbes).

*Eulimella* was first introduced by Jeffreys (Ann. Mag. Nat. Hist., vol. xix, p. 311, May, 1847), ex Forbes MS., for *Eulina macandrewi*, Forbes (Ann. Mag. Nat. Hist., vol. xiv, p. 412, pl. x, fig. 2, December, 1844: Loch Fyne). I would accept the name given to the British shell, as it seems doubtful that it is *Melania scillæ*, Scacchi, 1836, which, moreover, according to Monterosato (Nat. Sicil., vol. iv, p. 203, May 1, 1885), is *Turritella pyramidata*, Deshayes, 1832; this name I have not yet been able to trace.

Dall & Bartsch make *Eulimella* a sub-genus of *Pyramidella*, writing, "Columellar folds two." The author (Forbes) wrote, "Columella not plicated, straight or nearly so," and this appears to have been the opinion of every writer, save Dall & Bartsch, that I have consulted.

#### DONOVANIA BRUNNEA (Donovan).

It has been quite commonly recognized that *Buccinum minimum*, Montagu (Test. Brit., pt. i, p. 247, pl. viii, fig. 2, 1803: South Devon) was preoccupied by *Buccinum minimum*, Turton (Gen. Syst. Nat., vol. iv, p. 387, 1802), but the necessary alteration has never been made as above. *Buccinum brunneum* was described and figured by Donovan, Nat. Hist. Brit. Shells, vol. v, pl. clxxix, fig. 2, 1804, from Cornwall.

#### COLUS, Bolten.

In the Mus. Bolten, 1798, p. 117, Bolten introduced a genus *Colus*. Dall, in the Journ. Conch., vol. xi, p. 294, April, 1906, designated as type of this genus *Murex islandicus*, Gmelin, and consequently this name must come into use in place of *Tritonofusus*, Beck, as used in the List. As recently as 1911 (Proc. Malac. Soc., vol. ix, p. 339) Sykes used *Sipho* subgenerically for his group. This name cannot be defended by anyone, nor can the reference to Chemnitz, vol. iv, for the specific name.

#### TROSCHELIA, Mörch.

This name was introduced by Mörch in the Journ. de Conch., vol. xxiv, p. 376, 1876, for *Fusus berniciensis*, King, and should

come into use for that species, vice *Buccinofusus*, Conrad. Dall (U.S. Geol. Survey, Prof. Paper, No. 59, 1909, pp. 36-9) has stated, from a study of Conrad's species, that they are not congeneric with the British shell.

#### CYLICHNINA STRIGELLA (Lovén).

In the List *Tornatina umbilicata*, Montagu, is included. I have already shown that *Tornatina* cannot be maintained, and I now record that *Bulla umbilicata*, Montagu (Test. Brit., vol. i, p. 222, pl. vii, fig. 4, 1803: Falmouth) is antedated by *Bulla umbilicata*, Bolten (Mus. Bolten, 1798, p. 15). As a variety is classed *Cylichna strigella*, Lovén (Ofvers. K. Vet. Ak. Forh. (Stockh.), May, 1846, vol. iii, p. 142: Boh.), and this will now become the species name.

#### MUSCULUS NIGER (Gray).

This name will replace *Modiolaria discrepans* (Leach). Leach simply made use of this specific name as of Montagu, and when it is admitted the usage was different Leach's name becomes invalid. Gray in the Voy. N.W. Pass. by Parry, App. p. ccxiv, 1821, provided *Modiola nigra* as a new name for "*discrepans*, Mont., pl. xxvi, fig. 4".

#### IDASOLA, nom. nov.

This name is provided for *Idas*, Jeffreys, Ann. Mag. Nat. Hist., ser. iv, vol. xviii, p. 428, November 1, 1876, which was anticipated by *Idas*, Mulsant, Ann. Soc. Linn. (Lyon), n.s., vol. xxii, p. 223, 1875.

#### BROCKTONIA, n.g.

I propose this name for *Cryptaxis crebripunctatus*, Jeffreys, Proc. Zool. Soc., 1883, p. 398, pl. xlv, figs. 11a-c: between Hebrides and Faeroes. This shell does not really fall into *Cryptaxis*, Jeffreys, 1883, which is moreover invalid, and for which Cossmann (Essais Paléoconch. comp., i, p. 90, February, 1895) has provided the substitute *Clistaxis*.

#### RHOMBOIDELLA PRIDEAUX (Leach).

In the List appears *Crenella rhombea* (Berkeley), based on *Modiola rhombea*, Berkeley, Zool. Journ., vol. iii, p. 229, suppl. pl. xviii, fig. 1, September, 1827: Weymouth. It is acknowledged that this is the same shell as *Modiola prideaux*, Leach (Zool. Misc., vol. ii, p. 35, 1815: Milton, Devon), but this name was rejected as unfigured. This is no valid reason, but I might point out that Brown (Illus. Conch. Gt. Brit., pl. xxix, fig. 9) figured Leach's species the same year (1827) as Berkeley described his shell. If *Crenella*, Brown (Illus. Conch. Gt. Brit., 1827, pl. xxxi), provided for *C. elliptica*, figs. 12-14 (= *Mytilus decussatus*, Montagu, Test. Brit. Suppl., p. 69, 1808: Scottish coast), be regarded as a distinct genus from *Musculus*, then the present species should also be recognized under the name *Rhomboidella*, provided by Monterosato (Nomen. gen. e spec. Conch. Medit., 1884, p. 13) for this shell alone. In its sculpture it would fall into *Crenella*, but from its shape it would be regarded as a *Musculus*.



AZOR CHAMA-SOLEN (Costa).

This would appear to be the correct name for the shell known as *Solecurtus antiquatus* (Pulteney). Pulteney used it as of Solander, and I find that in the Mus. Portl. Solander's name was published (p. 101, 1786), but prior to this date Costa had named the same shell (Brit. Conch., 1778, p. 238: Weymouth), (*Solen*) *chama-solen*. This specific name must be preserved, and it is not inappropriate when it is remembered that *Chama*, Costa, was not *Chama*, Linné. Costa used it for the Gapers, and if his claim that the ancients so used it be correct, it does seem inaccurately to have been bestowed by Linné on a genus of shells noted for their tightly closed habit.

The earliest introduction of *Azor* seems to be by Brown (Illus. Conch. Gt. Brit., 2nd ed., 1844, p. 113) for this species alone. This relieves the difficulty noted by me in this journal (vol. x, 1913, p. 303). Anatomical examination has proved this species to differ sufficiently for generic recognition from *Solecurtus*.

PANOMYA ARCTICA (Lamarck).

This name will replace *Panopea norvegica*, Spengler, of the List. *Panomya* was proposed by Gray (Fig. Moll. Anim., vol. v, p. 29, 1857) for the species *Mya norvegica*, Spengler (Skriv. naturh. Selsk. Copen., vol. iii, pt. i, p. 46, pl. ii, fig. 18, 1793: Norway). There is, however, a prior *Mya norvegica*, Gmelin, Syst. Nat., p. 3222, 1791, which appears in the List as *Lyonsia norvegica*, Chemnitz. Gmelin's name depends upon Chemnitz's account given in the Conch. Cab., vol. x, p. 345, pl. 170, figs. 1647-8, and is used as Chemnitz was a non-binomial writer. The next name given to the *Panomya* appears to be *Glycymeris arctica*, Lamarck (Anim. s. Vert., vol. v, p. 458, 1819: White Sea). Dall (Trans. Wagn. Free Inst. Sci. Philad., vol. iii, p. 832, 1898) has shown the necessity of using *Panomya* generically, but he overlooked the invalidity of the specific name, calling the shell *Panomya norvegica* (Spengler).

OTINA AURICULA (Turton).

When Turton (Conch. Dict. Brit. Isles, 1819, p. 70) described this species under the name *Helix otis*, from Devonshire, he added, "We have been informed that it was known to the late Mr. Montagu, who had intended to denominate it *H. Auricula*; but as this name approaches too near to *auricularia*, we have called it *Otis*."

In making this alteration Turton selected a name used over thirty years previously by Solander (Mus. Portl., 1786, p. 38) for a different shell. We can then fall back upon the alternative name published in the paragraph above noted. I have observed that Locard (Prod. Malac. France, 1886, p. 88) introduced *Otina turtoni* as a new name for *Otina otis* (Turton), "Nom à changer par suite de pléonasme." But in addition to the above, Brown had called the species *Galericulum ovatum* (Illus. Conch. Gt. Brit., 1827, pl. xxxviii, figs. 27, 28), and there is a varietal name *candida*, Jeffreys.

*THRACIA VILLOSIUSCULA* (Macgillivray).

In the List appears *Thracia fragilis*, Pennant, but reference to Pennant shows that he only included *Tellina fragilis* (Brit. Zool., 2nd 8vo ed., vol. iv, p. 86, 1777) as of Linné. But he misidentified Linné's *Tellina fragilis* (Syst. Nat., 10th ed., p. 674, 1758), which is included in the British List as *Gastrana fragilis*. Consequently Pennant's specific name has no validity, and we must fall back upon *Anatina villosiuscula*, Macgillivray (Edin. New Phil. Journ., vol. ii, p. 370, pl. i, figs. 10, 11, March, 1827: I. of Harris).

*LUTRARIA MAGNA* (Costa).

Costa proposed a *Chama magna* (British Conch., 1778, p. 230, pl. xvii, fig. 4), and his name has been commonly rejected in favour of the later *Mya oblonga*, Gmelin, Syst. Nat., p. 3221, 1791 (based solely on Chemnitz, Conch. Cab., vol. vi, pl. ii, fig. 12, the latter writer being non-binomial), though the identity of the two has never been questioned.

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A LIST OF THE KNOWN SPECIES OF *CLAUSILIA* FROM CHINA.

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

Read 11th June, 1915.

THE British Museum received from Mr. W. L. Distant in October, 1913, a large *Clausilia*, 50 mm. in length, which he was informed came from Central China. Further inquiry was made, and the Rev. A. Arthur Elwin stated that he collected it among trees 400 feet above the lake at Hangchow, about 150 miles south-west of Shanghai.

In the endeavour to name the specimen it became necessary to study the whole literature dealing with the *Clausiliæ* of China, with the result that it appeared to be new to the fauna.

However, on comparing it with the specimens of the Japanese *Cl. martensi*, Herklots, I could find no distinguishing characters, and therefore I was compelled to come to the conclusion that a mistake had occurred with regard to the locality, or, what is very improbable, it might have been accidentally imported from Japan.

Again I applied to the collector of the specimen, and he then wrote: "I believe I found the big *Clausilia* near the city of Hangchow in China, more than 25 years ago, but, as I made no special note of it at the time, I do not think it would be well to publish any definite account of it. I have never received any shells from Japan, and did not collect any during the three summers I spent in that land."

Under these circumstances it may, I think, be concluded that the shell does not occur in China. However, since I have got together a list of the *Clausiliæ* of that country, its publication may, I hope, be useful to anyone engaged upon that part of the Chinese fauna. As many as 161 species appear to have been recorded. Père Heude heads the list of describers, having 66 species to his credit. Gredler follows with 32 species, Schmacker and Böttger conjointly are responsible for 19, Möllendorff for 17, Böttger for 7, Sykes for 4, Pfeiffer 3, Küster, Ancey, Benson, and Deshayes 2 each, and Menke, Martens, Philippi, H. Adams, and Preston a single species each.

In giving the following alphabetical list of the species I wish it to be understood that no attempt has been made to offer a synonymic catalogue. Doubtless some of the so-called species would fall as synonyms, but to ascertain this would entail a very long and careful study of all the numerous forms and the examination of authentic examples of a considerable proportion of them. The collection in the British Museum is very incomplete, and it may be mentioned that, of the sixty-six species described by Heude, only five are represented.

The numbers after the names in the list refer to the subjoined bibliography.

<i>acanthula</i> , Hde., 24.	<i>adaucta</i> , Gredler, 20.
<i>aculus</i> , Benson, 5.	<i>albopapillata</i> , Schm. & Bttgr., 42.
" var. <i>labio</i> , Gredler, 22a.	syn. <i>papillina</i> , Gredler, 21.
" var. <i>papillana</i> , Gredler, 22a.	<i>anceyi</i> , Bttgr., 9.

- antelopina*, Hde., 24.  
*aplostoma*, Hde., 24.  
*aprivora*, Hde., 24, 25.  
*ardouiniana*, Hde., 24.  
*artifina*, Hde., 24.  
*basilissa*, Schm. & Bttgr., 43.  
*baziniana*, Hde., 24, 26.  
*belemnites*, Schm. & Bttgr., 43.  
*bensoni*, H. Ad., 1.  
*binaria*, Hde., 24, 25.  
*bisdelineata*, Hde., 24.  
*bocki*, Sykes, 45.  
*breviplica*, Mlldff., 34.  
*broderseni*, Schm. & Bttgr., 43.  
*buccinella*, Hde., 24, 25.  
*bulimina*, Gredler, 23a.  
*cavicola*, Gredler, 17.  
*cecillei*, Philippi, 40.  
*celsa*, Gredler, 23a.  
*cetivora*, Hde., 24.  
*chinensis*, Pfr., 37 (1849).  
 „ Mlldff., 29a (1874).  
*cholerigena*, Hde., 24, 26.  
*circinnata*, Hde., 24.  
*clarocincta*, Bttgr., 8.  
*clavulus*, Hde., 24, 25.  
*coccygea*, Gredler, 17.  
 „ var. *ecaudata*, 22a.  
*cælicola*, Gredler, 18a, 21, 22a.  
*columbeliana*, Hde., 24.  
*comminuta*, Hde., 24, 26.  
*constellata*, Hde., 24, 25.  
*cookei*, Preston, 41.  
*crobylodes*, Schm. & Bttgr., 42.  
*cylindrella*, Hde., 24, 25.  
*decurtata*, Hde., and vars., 24.  
*delavayana*, Hde., 24.  
*diaconalis*, Hde., 24, 26.  
*distorta*, Küster, 27.  
*eastlakeana*, Mlldff., 31.  
*elamellata*, Schm. & Bttgr., 43.  
*elator*, Ancey, 2.  
*elizabethæ*, Mlldff., 30.  
*faberi*, Schm. & Bttgr., 43.  
*fargesiana*, Hde., 24.  
*fargesianella*, Hde., 24.  
*flippina*, Hde., 24.  
 „ var. *socia*, Gredler, 22a.  
*fitzgeraldæ*, Bttgr., 7.  
*flavescens*, Hde., 1884, 25a.  
 = *straminea*, Hde., preoc.  
*fortunei*, Pfr., 38.  
*franciscana*, Mlldff., 36.  
*frankei*, Schm. & Bttgr., 43.  
*frater minor*, Gredler, 23a.  
*frigida*, Hde., 1884, 25a.  
 = *septemplicata*, Hde., preoc.  
*friniana*, Hde., 24.  
*fuchsi*, Gredler, and var., 15, 18a.  
*fuchsi*, var. *kaspari*, 22a.  
*fuchsiana*, Hde., 24.  
*fulvella*, Hde., 24.  
*gastroptychia*, Mlldff., 33.  
*gemina*, Gredler, 13.  
*gerlachi*, Mlldff., 30.  
*gigas*, Mlldff., 36.  
*hainanensis*, Mlldff., 33, 35.  
*hensaniensis*, Gredler, 22.  
*heidiana*, Mlldff., 1882, 32.  
 = *pachystoma*, Hde., preoc.  
*hunana* (Gredler), Hde., 24, 1882.  
*hupeana*, Gredler, 23, 23a.  
*hupecola*, Gredler, 17.  
*imperatrix*, Schm. & Bttgr., 43.  
*indurata*, Hde., 24, 25.  
*infantilis*, Gredler, 21.  
*infecta*, Hde., 24, 25.  
*insularis*, Hde., 24.  
*inversa*, Hde., 24, 25.  
*janseniana*, Hde., 24.  
*julii*, Gredler, 17.  
*kiangshiensis*, Gredler, 23a.  
*labrosa*, Hde., 25.  
*labyrinthoides*, Sykes, 46.  
*largillierti*, Philippi, 40.  
*latilunellaris*, Schm. & Bttgr., 43.  
*laurentiana*, Mlldff., 36.  
*lea*, Gredler, 23a.  
*lepidospira*, Hde., and var., 24, 26.  
*leucospira*, Hde., 24.  
*loczyi*, Bttgr., 10.  
*loloensis*, Hde., 24.  
*longispina*, Hde., 24.  
*longurio*, Schm. & Bttgr., 43.  
*lorraini*, Menke, 29.  
*lunatica*, Hde., 24.  
*lyra*, Gredler, 19.  
*magnaciana*, Hde., 24.  
*magnacianella*, Hde., 24.  
*margaritacea*, Hde., 25.  
*meroniana*, Hde., 24.  
*microstoma*, Küster, 27; Gredler, 17a;  
 Mlldff., 32.  
*microthyra*, Schm. & Bttgr., 44.  
*missionis*, Ancey, 1883, 4.  
 = *straminea*, Hde., preoc.  
*müllendorffi*, Martens, 28.  
 = *chinensis*, Mlldff., non Pfr.  
*müllendorffiana*, Hde., 24.  
*moschina*, Gredler, 17.  
 „ var. *chamelodonta*, 22a.  
*mucronata*, Mlldff., 31.  
*nankingensis*, Hde., 24.  
*orphanuli*, Hde., 24.  
*oscariana*, Gredler, 23a.  
*pachyodon*, Hde., 1884, 25a.  
 = *pachystoma*, Hde., preoc.  
*pachystoma*, Hde., preoc., 24.

- pacifica*, Gredler, 18.  
 „ var. *siantanensis*, 22a.  
*pagnucciana*, Hde., 24.  
*pallidocincta*, Mldff., 34.  
*papillina*, Gredler, 18a, 21.  
*paradoxa*, Gredler, 15.  
*parietaria*, Schm. & Bttgr., 42.  
*phyllostoma*, Hde., 24.  
*planostriata*, Hde., 24.  
*pluviatilis*, Benson, 5.  
*ponsonbyi*, Bttgr., 8.  
*porphyria*, Mldff., 31.  
*præcelsa*, Gredler, 16.  
 „ var. *minor*, 22a.  
*presbyteralis*, Gredler, 23a.  
*principalis*, Gredler, 13.  
 „ var. *cristina*, 22a.  
*protrita*, Gredler, 19.  
*provisoria*, Gredler, 17.  
*pseudobensoni*, Schm. & Bttgr., 43.  
*psilodonta*, Hde., 24, 26.  
*ptychochila*, Bttgr., 6.  
*ptychodon*, Ancey, 3.  
*purpurascens*, Mldff., 36.  
*rathousiana*, Hde., 24.  
*recedens*, Schm. & Bttgr., 43.  
*recens*, Gredler, 23.  
*retorta*, Hde., 24.  
*ridicula*, Gredler, 14.  
*ringens*, Schm. & Bttgr., 42.  
*ruptiva*, Hde., 26.  
*rustica*, Hde., 24, 26.  
*rutilans*, Mldff., Gredler, 17a.  
*sarcochila*, Ancey, 1883, 4.  
 = *pachystoma*, Hde., preoc.  
*scholastica*, Hde., 26.  
*schombergi*, Schm. & Bttgr., 42.  
*seguiniana*, Hde., 24.  
*semprynii*, Gredler, 18.  
 „ var. *minor*, 22a.  
*septemlamellata*, Ancey, 1883, 4.  
 = *semplicata*, Hde., preoc.  
*semplicata*, Hde., preoc., 24.  
*serrata*, Deshayes, 12.  
*shanghaiensis*, Pfr., 39.  
*siderea*, Hde., 24, 25.  
*simiola*, Gredler, 15.  
*spinula*, Hde., 24.  
*straminea*, Hde., preoc., 24.  
*strictilabris*, Schm. & Bttgr., 42.  
*succinea*, Hde., 24, 25.  
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At some of the foregoing references, not only are new species described but others are critically discussed. For instance. Möllendorff's paper, No. 32, although containing no descriptions of new species, is very important, since it treats very fully upon a large proportion of the known forms from China. Gredler's paper (No. 22a) is useful also, since it contains a list of all the species and varieties described by him, with references to the publications in which the descriptions have appeared.

#### ERRATA.

June Number :

p. 276, last line, for 9-16 read 9-12.

p. 279, l. 16, for *Pterocera amantia* read *Pterocera aurantia*.

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A † is prefixed to the names of fossil species.

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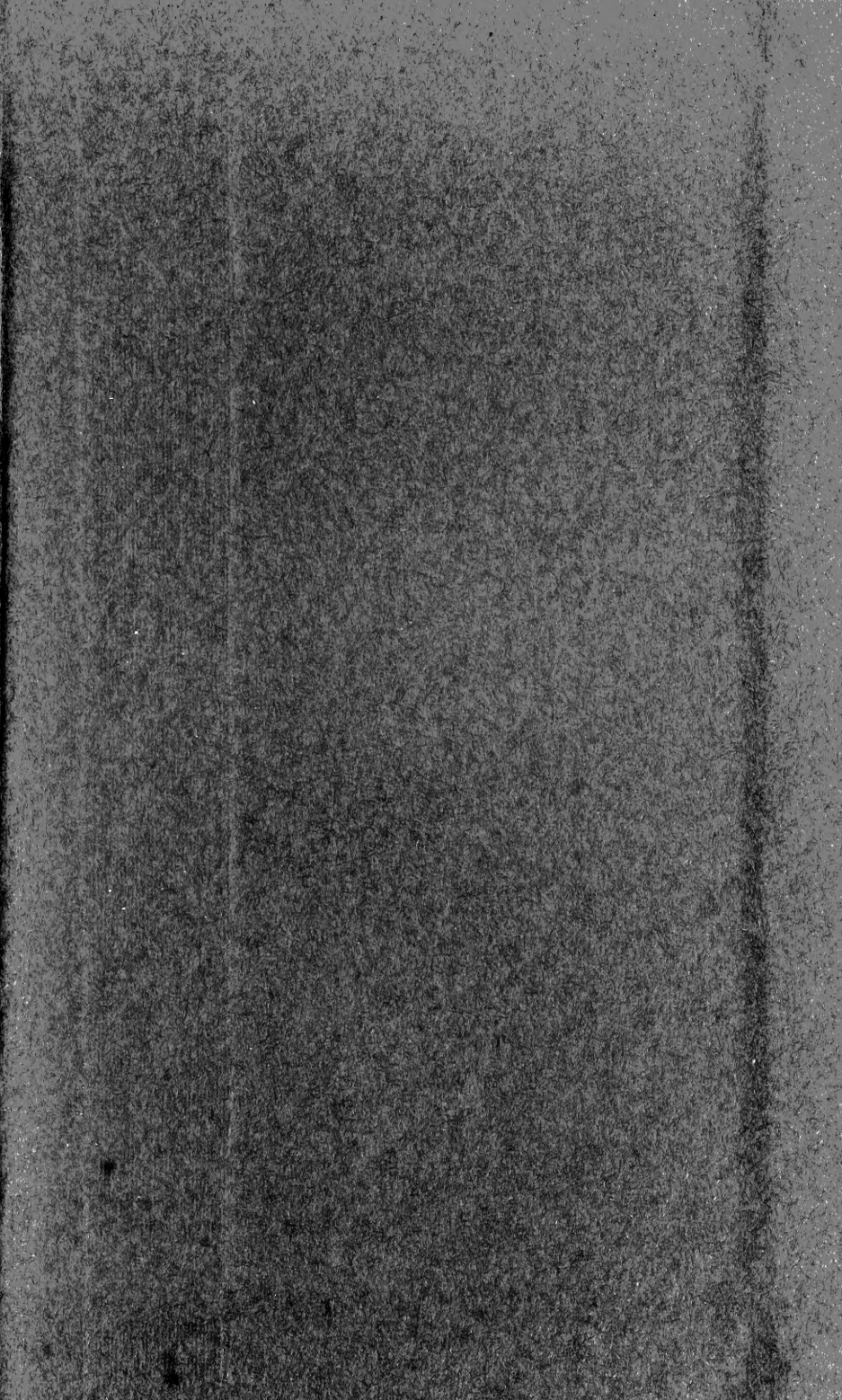












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