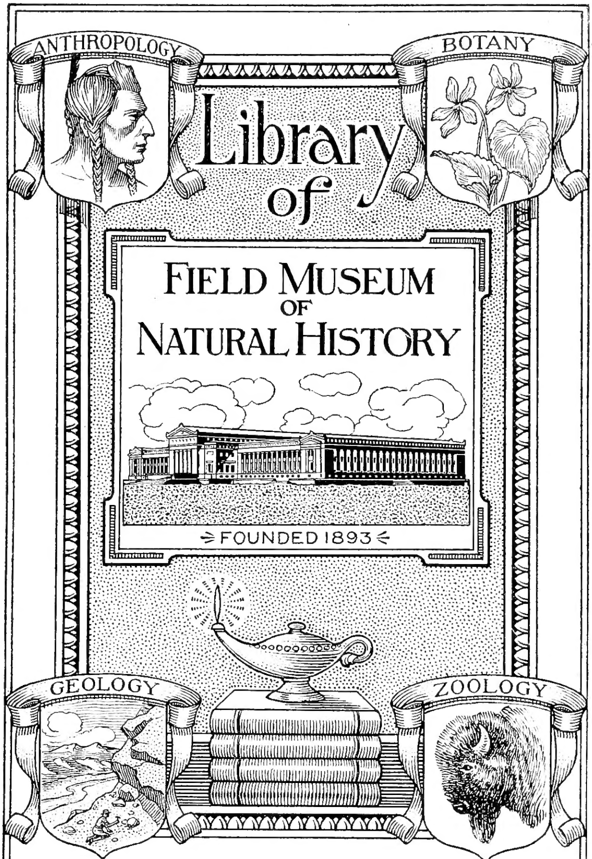
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PROCEEDINGS

OF THE

MALACOLOGICAL SOCIETY OF LONDON.

VOL. VIII.

1908—1909.

PROCEEDINGS

OF THE

MALACOLOGICAL SOCIETY

OF LONDON.

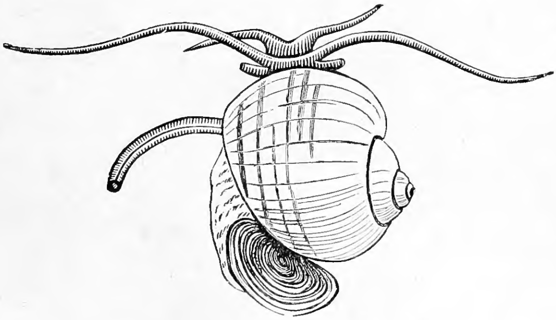
EDITED BY

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

Under the direction of the Publication Committee.

VOLUME VIII.

1908—1909.



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PROCEEDINGS

OF THE

MALACOLOGICAL SOCIETY OF LONDON.

ORDINARY MEETING.

FRIDAY, 8TH NOVEMBER, 1907.

B. B. WOODWARD, F.L.S., President, in the Chair.

The following communications were read:—

1. "Description of a new species of *Clathurella*, probably from Ceylon." By H. B. Preston, F.Z.S.

2. "On the Mollusca of Birket el Qurun, Egypt." By E. A. Smith, I.S.O.

3. "Descriptions of eight new species of marine Mollusca." By G. B. Sowerby, F.L.S.

4. "On the original drawings for the illustrations in the 'Historia Naturalis Testaceorum Britanniæ' of E. M. Da Costa, 1778." By A. Reynell.

5. "Descriptions of *Labyrinthus euclausus* and *Neocyclotus Belli* from Colombia." By Col. R. H. Beddome, F.L.S.

Mr. G. B. Sowerby exhibited a series of specimens and varieties of *Pecten rubromaculatus*, Sowerby, including *Pecten lemniscatus*, Reeve.

Mr. A. S. Kennard exhibited a series of specimens of *Petricola pholadiformis* from various localities on the east coast of England and also some very large valves of *Unio margaritifer*, Linn., dredged from Thames gravel, far out in the river at Mortlake. The species is now extinct south of Yorkshire as far as Eastern England is concerned. He also exhibited, on behalf of Mr. Polkinghorne, specimens of *Spirula Peronii* and *Nerita tessellata*, found at Sennen Cove, Cornwall.

Mr. E. A. Smith exhibited the type of *Pyrula Bengalina*, Grat., and a reversed specimen of *Achatina fulica*.

The President exhibited some original letters from Bean & Gilbertson.

ORDINARY MEETING.

FRIDAY, 13TH DECEMBER, 1907.

B. B. WOODWARD, F.L.S., President, in the Chair.

Miss M. F. Hickey, the Rev. E. W. Bowell, and Herman Lynge were elected members of the Society.

The following communications were read:—

1. "Additions to the marine molluscan fauna of New Zealand, with descriptions of new species." By Henry Suter.

2. "Descriptions of new species of fresh-water shells from Central Africa." By E. A. Smith, I.S.O.

3. "Descriptions of new species of land, fresh-water, and marine shells from West Africa." By H. B. Preston, F.Z.S.

Mr. E. A. Smith exhibited two living specimens of *Achatina marginata* from Ibadam, Western Province, Southern Nigeria, 100 miles from the coast.

Mr. H. B. Preston exhibited two living specimens of *Odontostomus Spixi*, var. *Paraguayana*, from Bolivia, and a series of *Streptaxis Funcki* from Venezuela.

ORDINARY MEETING.

Friday, 10th January, 1908.

R. H. Burne, B.A., Vice-President, in the Chair.

Dr. Henry Woodward and Mr. R. Bullen Newton were appointed Auditors of the accounts of the previous year.

The following communications were read:—

1. "*Mitra recurvirostris*; name substituted for *M. recurva*, Sowerby." By G. B. Sowerby, F.L.S.

2. "A list of species of shells described by Dr. Grateloup, with critical notes." By H. C. Fulton.

3. "Notes on *Planorbis vorticulus*, Troschel, and *Pl. lævis*, Alder; also on some proposed subdivisions of the genus." By A. S. Kennard, F.G.S.

4. "On *Vitrea Scharffi*, n.sp." By A. S. Kennard, F.G.S.

5. "On the Anatomy of *Vitrea Scharffi*." By Rev. E. W. Bowell, M.A.

6. "On the Radulæ of *Vitrea helvetica*, Blum., and the allied species." By Rev. E. W. Bowell, M.A.

Mr. H. B. Preston exhibited a white variety of *Metorthalicus Powisianus* from the Rio Wagua.

Mr. H. C. Fulton, on behalf of Mr. G. B. Sowerby, exhibited a series of *Pecten pallium* showing variation.

Mr. A. Reynell exhibited a specimen of *Astarte mutabilis*, S. Wood, from the Coralline Crag, Suffolk, with reversed hinge-dentition.

NOTES.

On *Pyrula Bengalina* of Grateloup. (*Read 8th November*, 1907.)—Jean Pierre Silvestre de Grateloup wrote but a single descriptive paper upon recent shells. He was the author of a list of the land and fresh-water Mollusca of Dax in the South of France and of a classification of the Bullidæ, but the rest of his writings upon Mollusca had reference to fossil forms. They were mostly published in the Bulletin or Actes de la Société Linnéenne de Bordeaux. The shell which forms the subject of this note was described under the name of *Pyrula Bengalina* in vol. xi, p. 447, of the Actes, and figured on pl. iv, fig. 5, and as far as I can discover has only been referred to since by Kiener, Paetel,[1] and Tryon,[2] the last-mentioned author having given a reduced reproduction of the original figure and a very brief description founded upon Grateloup's diagnosis. He was at the time in doubt where to place it, and did not know to what genus it really belonged, but introduced it in his classification after *Hemifusus*, observing that it was evidently a monstrosity. In this, however, he was mistaken. It is not a monstrosity, but only the young state of the common *Pterocera bryonia*, as he[3] subsequently discovered, probably from Kiener's[4] statement and figure, or from the figures and observations given by Chemnitz (Conch. Cab., vol. x, pl. clix, figs. 1513–15). Figure 1513 represents a specimen about the same size as the shell described by Grateloup. Chemnitz was not deceived by the different aspect of this early stage of the shell from that of the adult, but rightly described it as the young of *bryonia*. The figs. 1513, 1514, 1515 in vol. x, and figs. 904, 905 in vol. iii depict three early growths of the species. Fig. 1512 represents a still later stage, just before the claws would commence to form. I have been induced to call attention to this subject as the British Museum has just acquired through Messrs. Sowerby & Fulton the actual types described and figured by Grateloup in the paper referred to above, and among them the *Pyrula Bengalina*. The only other new marine shell described in this paper is *Scalaria clementina* from Singapore and Manila, of which *S. trifasciata*, De Haan, and *latifasciata*, Sow. (Con. Icon., fig. 117*a*), are synonyms. E. A. Smith.

On the Distribution of *Petricola pholadiformis*, Lam. (*Read 8th November*, 1907.)—Mr. W. Crouch was the first to notice this species in England in July, 1890, at Burnham-on-Crouch. In April, 1896, Mr. J. E. Cooper found several valves at Shellness, near Sandwich, Kent, whilst at the same time I found it living abundantly at Herne Bay, Kent. Examples of this species from the three localities were exhibited before this Society in May, 1896.[5] This year, whilst on a visit to Suffolk, I obtained several examples from peat thrown up on the shore at

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1 Cat. Conch.-Samml., 1887, vol. i, p. 37, as a *Thatcheria*.
2 Man. Conch., vol. iii, p. 113, pl. xliv, fig. 242.
3 Op. cit., vol. vii, p. 124.
4 Icon. Coq. viv. Pterocera, p. 4, pl. x, fig. 3.
5 Proc. Malac. Soc., vol. ii (1896), pp. 134–5.

Dunwich. They were, of course, dead, but were still in their crypts. Almost at the same time I received a letter from Mr. A. Mayfield, of Mendlesham, stating that he had found odd valves of this species at Lowestoft and Felixstowe. Thinking that perhaps it might occur on the Lincolnshire coast, where the conditions are suitable, I wrote to Mr. C. S. Carter, of Louth, who most kindly sent me examples of the shell collected at Mablethorpe in 1900, and a specimen found in August, 1896, between Minster and Warden Point, Sheppey. He stated that the shell had been known on the Lincolnshire coast for twenty years, but that it had become more abundant during the last few years. In the Journ. Roy. Micro. Soc., 1907, part 4, p. 416, quoting from Zool. Anz., vol. xxxi, No. 7, pp. 268–70, it is stated that C. Boettger had found this species near Sylt and between the North Frisian Islands and the mainland, and that E. Wolf had also found it near the East Frisian Islands. It has also been recorded by MM. Dupuis & Putzeys from the coast of Belgium. It will thus be seen that this species has a far wider distribution than was formerly supposed, and that it must have been a member of our fauna for some little time.

A. S. KENNARD.

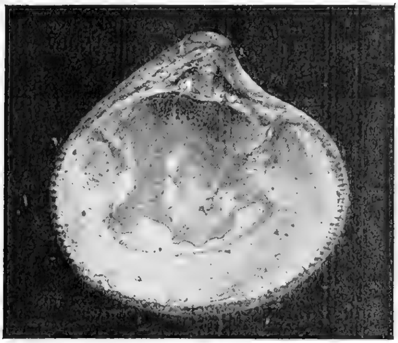
ON THE ORIGINAL DRAWINGS FOR THE ILLUSTRATIONS IN THE "HISTORIA NATURALIS TESTACEORUM BRITANNIÆ" OF E. M. DA COSTA, 1778. (*Read 8th November*, 1907.)—These were drawn and painted on seventeen sheets of vellum. Moses Harris was responsible for the sheet for pl. iii, which has his signature and the date November 24th, 1776, at the bottom left-hand corner. The sheets for the other sixteen plates bear the signature of Peter Brown, but no date. The former was and is fairly well known as an entomologist, and his "Aurelian or Natural History of English Insects" is still referred to. He was also the author of other works. The latter, as far as I know, was only responsible for one work, the "New Illustrations of Zoology," and this is not often seen. I do not think the engraver of these plates has been identified, and probably more engravers than one were employed, as plates viii, ix, x, xi, xv, and xvii were not reversed, as they should have been, and consequently the figures have come out sinistral. These plates with additions and deletions were afterwards re-engraved and used to illustrate Pulteney's "Dorsetshire Shells" in Hutchin's "History of Dorset," 1799. One figure appears on Da Costa's plates which was not on the originals, viz. fig. 7 of pl. vi, *Monodonta crassa* (Montfort) (*T. lineatus*, Da Costa), its place being taken by a figure of *Limnæa*, which appears on pl. v as fig. 17, the reversed view of this species originally drawn being deleted.

A. REYNELL.

MITRA RECURVIROSTRIS; NAME SUBSTITUTED FOR *M. RECURVA*, SOWERBY. (*Read 10th January*, 1908.)—By a curious oversight in the Journal of the Linnean Society, 1889 (vol. xx, p. 396, pl. xxv, fig. 7), I gave the name '*recurva*' to a striking form of *Mitra* received from the late V. de Robillard, of Mauritius, although the name had been used by Reeve for a very different species (Proc. Zool. Soc., 1845, p. 56) described and figured in the *Conchologia Iconica*, vol. ii, pl. xxxvi, fig. 297. I now propose to alter the name of the species to *M. recurvirostris*.

G. B. SOWERBY.

ON *ASTARTE MUTABILIS*, WITH REVERSED HINGE-DENTITION. (*Read 10th January*, 1908.)—The left valve of *Astarte mutabilis*, Searles Wood, from the Pliocene (Coralline Crag) of Suffolk, exhibited by me on January 10th, is very remarkable on account of having the hinge-dentition of the right valve. In other respects it is quite normal. As instances of similar variation are so extremely rare, I have thought it desirable to give a figure which at once shows the large central cardinal tooth of the



right valve instead of the two diverging ones with a pit between, which are characteristic of the normal left valve. A. REYNELL.

DESCRIPTION OF A NEW SPECIES OF *CLATHURELLA*, PROBABLY FROM CEYLON.

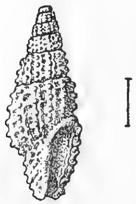
By H. B. Preston, F.Z.S.

Read 8th November, 1907.

The shells which form the subject of the present paper were recently found by me among a number of others from the collection of the late Hugh Nevill, and are in all probability from Ceylon. I have been unable to identify them with any known form, and as there are several specimens all showing the same characters I now venture to describe the species.

Clathurella Birtsi, n.sp.

Shell elongate, fusiform, white, painted with rows of reddish-brown spots; remaining whorls spirally sculptured with coarse ribs, increasing from three on the upper whorls to six on the body-whorl, which are intersected by transverse grooves, giving the shell a beaded



appearance; suture impressed; aperture narrow; columella descending obliquely; peristome bent inwards and serrated by the termination of the spiral ribs.

Length 6, diam. maj. 2·25 mm.; aperture, length 1·75, diam. ·25 mm.

Hab.—Ceylon?

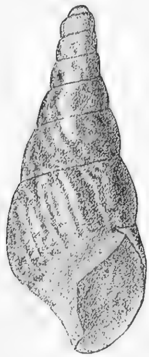
DESCRIPTIONS OF NEW SPECIES OF LAND, FRESH-WATER, AND MARINE SHELLS FROM WEST AFRICA.

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

Read 13th December, 1907.

Pseudoglessula efulenensis, n.sp.

Shell conic-turreted, carinate at the periphery, closely, but irregularly, streaked, blotched and spotted with rich chestnut; whorls $7\frac{1}{2}$, the first three tumid and sculptured with spiral rows of fine pit-marks, the fourth smaller and smooth, the remainder gradually



increasing in size and also smooth; sutures impressed; aperture ovate; peristome acute; columella descending very obliquely, excavated above; surface of parietal wall pearly; aperture subquadrate.

Alt. 22, diam. maj. 8 mm.; aperture, alt. 7, diam. 3 mm.

Hab.—Efulen, Cameroons.

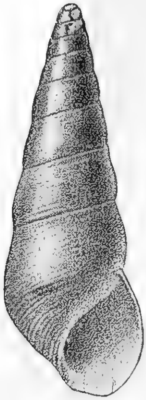
Melania funerea, n.sp.

Shell subulately turreted, dark blackish-brown; remaining whorls 9, flat, upper whorls smooth, lower granulosely, spirally, striate, and transversely marked with wavy lines of growth; sutures scarcely impressed; peristome acute, flexuous; columella arched, extending into a thin callus, which reaches the lip above; aperture ovate; interior of shell bluish slate-colour.

Hab.—Gold Coast.

Alt. 34·5, diam. maj. 12 mm.; aperture, alt. 10, diam. 6 mm.

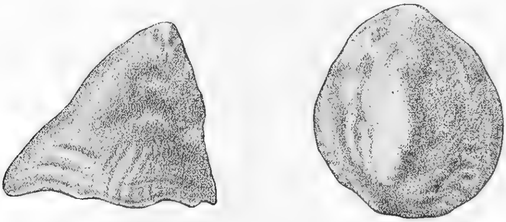
Distinguished from *M. Mörchi*, Brot, also from West Africa, by its much more subulate form and the flatness of its whorls; it is also



more coarsely spirally striate, and the sutures are much less well defined than is the case with that species.

HIPPONYX SALEBROSUS, n.sp.

Shell irregularly conical, white, calcareous, bearing traces round the margin of irregular radiate ribs; interior of shell pale greenish-white; apex solid and massive; margin acute.



Alt. 10, diam. maj. 12 mm.

Hab.—Gold Coast.

The generally rugged appearance of this species, together with its conical form and thickened apex, easily separate it from any other hitherto described species of *Hipponyx*.

The dimensions given above refer only to the type-specimen; in the large number of individuals examined the measurements vary enormously owing to their irregular shape.

ON THE MOLLUSCA OF BIRKET EL QURUN, EGYPT.

By Edgar A. Smith, I.S.O.

Read 8th November, 1907.

The Mollusca quoted in the following list were collected by Dr. W. A. Cunnington and Mr. C. Boulenger in the Birket el Qurun, an expanse of water some twenty-five miles in length west of the Nile below Cairo. It is slightly saline, especially in places most remote from the canals and streams which drain into the lake. A list of the species obtained by M. Blanckenhorn[1] includes the following:—

Melania tuberculata.	*Neritina Nilotica.*
Cleopatra bulimoides.	*Planorbis Ehrenbergi.*
Hydrobia stagnalis.	*P. marginatus,* var. *subangulata.*
Valvata Nilotica.	*Corbicula fluminalis.*

To this list I now add a species of *Lanistes*, a *Corbicula*, and an *Isidora*. Whether the *Paludestrina* obtained by Messrs. Cunnington & Boulenger is the same shell as that quoted by Blanckenhorn as *Hydrobia stagnalis*, L., var. *cornea*, Risso, is somewhat uncertain, as it is quite impossible to know what his idea of that form may have been.

The *Helix stagnalis* of Linnæus, founded on the *Turbo stagnalis* of Baster, according to Hanley is a doubtful species, but may be the *Helix* [*Turbo*] *ventrosa* of Montagu. On the contrary, Jeffreys regarded Baster's species the same as the well-known *Paludestrina ulvæ.*

All of the eleven species now enumerated may be regarded as Nilotic forms, some ranging into Upper Egypt or even to the great lakes of Central Africa.

The localities quoted are situated as follows, and were the places where the collectors encamped for a time:—

(1) East End Camp. At the extreme eastern end of the lake.

(2) Taban Bay, (3) the Sand-spit, Taban Bay, and (4) Promontory Camp. On the north shore, east of the middle of the lake.

(5) Kahk Camp, (6) Wady Camp, (7) mouth of Wady, west of road. All south of the lake, near the middle.

1. Vivipara unicolor (Olivier).

Hab.—From beach near Kahk Camp, dead shells only; one living example from Taban Bay.

2. Cleopatra bulimoides (Olivier).

Hab.—Dead shells from beach near Kahk Camp; and live specimens in swamp, East End Camp.

3. Lanistes carinatus (Olivier).

Hab.—Swampy ground, East End Camp.

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[1] Zeitsch. deutsch. geol. Gesell., vol. liii, p. 463 (1901).

4. Paludestrina Peraudieri (Bourguignat)?

Hydrobia Peraudieri, Bgt.: Spicil. Malac., p. 108 (1862); Malac. Algérie, vol. ii, p. 227, pl. xiv, figs. 5–8.

Hab.—On rushes growing in three feet of water, shallow bay of lake, east of road, Wady Camp; also on stones in shallow water, Promontory Camp; and dead from beach of Sand-spit, Taban Bay.

I do not feel certain that all the specimens from the various localities belong to one and the same species, as they exhibit some variation in form, the convexity of the whorls, etc. They appear, however, to agree closely with examples of this Algerian species. but I cannot affirm that they are absolutely the same. In a genus where the distinguishing characters are so few and not striking, the identification of the species becomes extremely difficult, and it really is necessary for one to study the genus as a whole before one can understand at all clearly the distinctions between the various species. Indeed, it is almost impossible from a study of the shells only, and a knowledge of the animals is really necessary before one is in a position to uphold or deny the validity of many so-called species which have been described from the shells only. The *Hydrobia stagnalis*, Linn., var. *cornea*, Risso, quoted by Jickeli,[1] may be the same species.

5. Valvata nilotica, Jickeli.

Valvata nilotica, Jickeli: Nova Acta Acad. Cæsar. Leopold. Nat. Curio., vol. xxxvii, p. 233, pl. vii, figs. 29*a–c* (1874).

Hab.—Beach of Sand-spit, Taban Bay, dead shells only.

6. Melania tuberculata (Müller).

Hab.—Dredged on mud in about one fathom, off mouth of bay east of the Wady and off East End Camp; also dead shells from beach of Taban Bay.

7. Neritina nilotica, Reeve.

Neritina nilotica, Reeve: Conch. Icon., vol. ix, figs. 157*a*, *b*.

Hab.—Beach near Kahk Camp, dead shells only.

Martens is probably right in his supposition that *N. arctilineata*, Sowerby, is the same as this species.

8. Isidora contorta (Michaud).

Hab.—On reeds growing in swamp near mouth of Wady, west of road.

9. Planorbis cornu, Ehrenberg.

Hab.—On reeds growing in swamp near mouth of Wady, west of road, and beach of Sand-spit, Taban Bay.

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[1] Fauna Land- und Sussw. Moll. Nord-ost-Afrika, p. 247.

10. Corbicula fluminalis (Müller).

Hab.—Dead shells from beach of Taban Bay.

These specimens vary so much in shape that the extreme forms might well be regarded as distinct species.

11. Corbicula radiata (Philippi).

Hab.—In swamp near mouth of Wady, west of road.

A single specimen only.

DESCRIPTIONS OF NEW SPECIES OF FRESH-WATER SHELLS FROM CENTRAL AFRICA.

By Edgar A. Smith, I.S.O.

Read 13th December, 1907.

The shells described in this paper were collected by Mr. R. L. Harger in Lake Tanganyika and Lake Mweru, and have very kindly been presented to the British Museum. In addition to the species now referred to, the collection includes a nice series of the remarkable *Unio* (*Metaptera*) *Johnstoni*, Smith,[1] from Lake Mweru, the *Vivipara Mweruensis*, *Cleopatra Johnstoni*, *Melania Mweruensis*, *imitatrix*, and *Crawshayi*, and a few species of *Unio*, *Burtonia*, *Ampullaria*, and *Limnæa* from Lake Tanganyika, and some of the usual thalassoid forms. As far as I can ascertain, the only species recorded from Lake Mweru are those quoted by me in the volume of the P.Z.S. already referred to. Among those now described especially interesting is the *Mutela*, on account of its peculiar form. With this species and the new *Cleopatra* I have much pleasure in associating the name of the donor and collector.

Giraudia minima, n.sp.

Testa minima, ovato-conica, imperforata, lævis, albida, rufo-zonata; anfractus 6 parum convexi, infra suturam rufo-nigro zonati, ultimus quadrifasciatus; apertura subpiriformis, intus fasciata; labrum vix incrassatum; columella crassa, obliqua, reflexa, callo tenui labro juncta, in medio rufo-nigro tincta. Long. 3, diam. 1·5 mm.; apertura 1·4 longa, 1 lata.

Hab.—Lake Tanganyika, under stones.

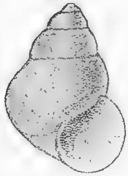
A very small species, having the upper whorls with two zones and the body-whorl with four, one, darker than the rest, just below the suture, one above and one below the periphery, and the fourth at the base. The labrum is dark brown at the termination of the zones.

Vivipara Kalingwisiensis, n.sp.

Testa ovato-conica, imperforata, olivacea, haud zonata, tenuiter spiraliter striata, incrementi lineis tenuibus sculpta, haud nitida;

[1] Proc. Zool. Soc., 1893, p. 640, pl. lix, figs. 18–20.

spira turrita, ad apicem erosa; anfractus reliqui quatuor convexiusculi, infra suturam leviter angulati, ultimus circa medium uni- vel biangulatus; apertura inverse late auriformis longitudinis totius ½ vix æquans, intus cærulescens; peristomium nigrescens, margine columellari leviter incrassato et reflexo. Long. 22, diam. 15 mm.; apertura 11 mm. longa, 8·5 lata.

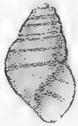


Hab.—Kalingwisi River, Lake Mweru.

Rather like *V. capillata*, Frauenfeld, from Lake Nyassa, but darker-coloured, not umbilicated, with the whorls more distinctly keeled or angled, and with more distinct spiral striæ. The angulation a little below the suture gives the spire a turreted appearance. Of the two keels upon the middle of the body-whorl the lower one is peripheral and the upper one falls above the suture on the penultimate whorl.

Cleopatra Hargeri, n.sp.

Testa ovato-conica, ad apicem plerumque abrupta, imperforata, olivacea, rufo-nigro fasciata, lævis, lineis incrementi tenuissimis striata; anfractus reliqui 3–4 convexiusculi, ultimus ad peripheriam subcarinatus, fasciis 4–6 cinctus; apertura subovalis, antice leviter effusa, intus fasciata; labrum tenue, arcuatum; columella curvata, albida. Long. 14, diam. 8·5 mm.; apertura 7 mm. longa, 5 lata.



Hab.—Kalingwisi River, Lake Mweru.

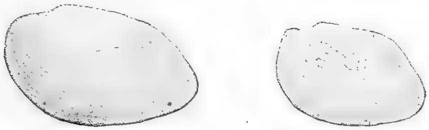
It is one of the blackish lines around the periphery that usually forms a slight carination. The species is larger than *C. Morelli* of Preston, is imperforate, and has a larger aperture. Some examples exhibit more or less spiral striation.

Unio Mweruensis, n.sp.

Testa parva, inæquilateralis, mediocriter tenuis, utrinque anguste hians, antice curvata, postice angustior, producta, periostraco fusco-olivaceo induta, interdum lineis viridibus radiantibus postice picta, lævis, sed striis incrementi sculpta et versus umbones plus minus corrugata; umbones erosi, longe ante medium siti; pagina interna albida, margaritacea, iridescens; dentes anteriores rugosi, posteriores tenues, elongati; cicatrix antica mediocriter profunda, postica levis, vix impressa. Long. 26, alt. 15, diam. 10·5 mm.

Hab.—Lake Mweru.

This species varies considerably in form and sculpture. Some specimens are much longer than others, and the amount of corrugation towards the umbones varies considerably. Some examples are almost entirely smooth, whereas occasionally the wrinkling may extend over two-thirds of the surface. The valves are white beneath an

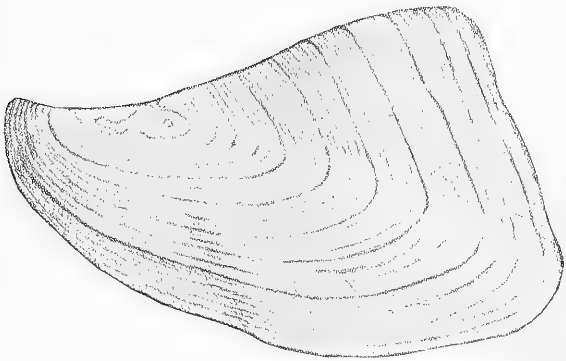


olive-brown periostracum, which almost invariably exhibits one or more green rays down the hinder slope. There is in most specimens a kind of lunule in front of the umbones, which varies much in shape, being quite broad and diamond-shaped in some shells and quite narrow and linear in others.

An elongate example is 29 mm. in length and 14 in height. A shorter specimen is 20·5 mm. long and 12·75 high.

Mutela Hargeri, n.sp.

Testa irregulariter triangularis, alata, valde compressa et inæquilateralis, albida, periostraco olivaceo induta, lineis incrementi striata, lineis tenuissimis radiantibus confertis subviridibus undique picta;



latus anticum breve, oblique curvatum, posticum latissimum, supra oblique truncatum; margo ventralis late curvatus; valvæ tenues, in medio ab umbone ad latus posticum paulo elatæ vel porcatæ; pagina interna albida, margaritacea, iridescens; linea cardinis simplex;

ligamentum tenue, elongatum, marginem totum occupans; cicatrix antica haud profunda, irregulariter rotundata, postica obscura, superficialis. Long. 104, alt. 68, diam. 16 mm.

Hab.—Lake Mweru.

Only a single left valve of this species was obtained. The diameter above given is supposed to be that of a complete specimen. The radiating lines are hair-like and scarcely noticeable unless specially looked for. *Spatha alata*, Lea, from Lake Nyassa, is an allied species, but less winged.

DESCRIPTIONS OF EIGHT NEW SPECIES OF MARINE MOLLUSCA.

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

Read 8th November, 1907.

PLATE I.

Turbo granoliratus, n.sp. Pl. I, Fig. 4.

Testa globoso-turbinata, crassiuscula, angustissime umbilicata, pallide straminea, fusco late et oblique radiata, undique spiraliter densissime grano-lirata, sulcis pernumerosis parum obliquis longitudinaliter sculpta; spira acuta, mediocriter elata; anfractus 6 convexi, sutura anguste canaliculata divisi; ultimus supra angulatus, ad angulum rotunde carinatus, supra angulum concavus, infra convexus, basin versus obscure biangulatus, undique liris granulosis circiter 45 ad basin latioribus sculptus. Apertura circularis, aperta, intus lævis, margaritacea; columella callosa, antice effusa; peristoma simplex, ad marginem luteo tinctum. Long. 48, diam. maj. 43 mm.

Hab.—New Guinea (Boucard).

The shell is similar in form to *T. crassus*, Wood, from which it is distinguished by its close-set, narrow, conspicuously granular liræ; the granules are formed by the intersection of numerous rather oblique longitudinal grooves. The liræ become broad and rather flattened near the umbilicus, so that a rough plication is seen in place of the granular appearance already described.

I have only seen three specimens of this interesting species; they were found in the collection of the late Mr. A. Boucard, labelled "New Guinea."

Liotia Walkeri, n.sp. Pl. I, Fig. 2.

Testa subdiscoidea, late et profunde umbilicata, alba; spira depresse conoidea; anfractus 3½, primi leviter convexi, penultimus depressiusculus, radiatim leviter plicatus et subtilissime striatus, ad angulum nodoso-carinatus; sutura canaliculata, utrinque crenulata; anfractus ultimus bicarinatus, carinis acute nodulosis; basis leviter planulata, radiatim minutissime striata; margo umbilicalis acute plicatus; apertura circularis; peristoma crassum, duplicatum. Diam. 3·5, alt. 3 mm.

Hab.—N.W. Australia (J. J. Walker).

The nearest ally I can find to this species is *L. discoidea*, Reeve, than which it is much smaller, much less depressed, and instead of having one duplicate keel at the periphery it has two separate acutely nodulous keels, which become smooth and rounded towards the aperture.

A few specimens of this and of the following species were found in shell-sand dredged by Mr. J. J. Walker off North-West Australia some years ago.

Urosalpinx Walkeri, n.sp. Pl. I, Fig. 1.

Testa fusiformis, pallide straminea; spira acuminata, turrita, acutiuscula; anfractus 7½, primi 2 læves, rotundati, sequentes convexi, biangulati, spiraliter tenuiter lirati, costis longitudinalibus latiusculis parum elevatis instructi; sutura leviter callosa; anfractus ultimus spiram paulo superans, undique liris angustis numerosis inæqualibus leviter scabrosis munitus, obtuse angulatus, supra angulum declivis, vix concavus, infra contractus, ad basim breviter rostratus; apertura oblongo-ovata, intus denticulata, antice sub-late canaliculata; columella rectiuscula, ad basim leviter recurva; labrum arcuatum, sinu postico rotunde excavato, vix profundo. Long. 11, diam. 5 mm.

Hab.—N.W. Australia (Walker).

A small, narrow, closely ridged shell, with somewhat widely separated longitudinal ribs or plicæ, and characterised by a distinct sinus at the posterior end of the peristome.

Sistrum chrysalis, n.sp. Pl. I, Fig. 5.

Testa oblongo-ovata, nigra, umbilicata; spira conica, mediocriter elata; anfractus 5, planato-declives; penultimus biseriatim tuberculatus, ultimus oblongus, ¾ longitudinis testæ fere æquans, liris obtusis irregulariter squamoso-tuberculatis alternatim latis et angustis instructus, ad basim acutus; umbilicus latiusculus; apertura oblonga, intus cyaneo-albida, quadri-tuberculata; peristoma continuum, ad marginem acutum, plicatum, nigrum. Long. 27, diam. 15 mm.

Hab.—New Caledonia (Bouge).

The peculiar chrysalid form of this shell distinguishes it from *S. tuberculatum*, Blainv., and its tubercles are much less prominent, being very irregular and for the most part not at all clearly defined. The anterior end of the shell is rather peculiarly pointed. Several specimens, presenting but little variation, were brought from New Caledonia by Monsieur Bouge.

Natica Bougei, n.sp. Pl. I, Fig. 3.

Testa ovato-pyriformis, imperforata, lævis, nitens, alba, zona lata interrupta fusco variegata picta; spira breviter conica; anfractus 3, convexi; ultimus oblique ovalis; apertura semicircularis, intus lævis, fusco picturata; columella callosa, albo-nitens, effusa; labrum tenue. Operculum testaceum, albo-nitens, ad marginem bisulcatum. Long. 8, lat. 7·5 mm.

Hab.—New Caledonia (Bouge).

Excepting for the pretty variegated markings arranged on the broad median zone, this shell closely resembles in miniature the large common *Polinices mamilla*. It does not, however, belong to that genus or section, as shown by the operculum, which is testaceous as in typical *Naticæ*.

Amalthea Coxi, n.sp. Pl. I, Figs. 9–11.

Testa elato-conica vel corniformis, irregulariter contorta, tenuis, luteo-albida, transversim confertissime anguste lirata, radiatim extus intusque sex costata; costis utrinque duobus approximatis, et una distincta; apertura irregulariter subcircularis. Alt. 18, diam. maj. 13 mm.

Hab.—Port Stephens, Australia (Dr. Cox).

This very curious species, of which the generic position is doubtful, is so irregular and diversiform that anything like an exact diagnosis of it is scarcely practicable. The chief distinguishing character will be found in the disposition of the ribs, of which both on the convex and on the concave side there are three, two near together and one apart; these ribs or keels are also pretty prominent in the interior of the shell and extend slightly beyond the margin. Taking the twisted horn-shaped specimen for the type, I figure two others much less elevated, and more obtuse. In one of these, it appears from the disposition of the ribs that the apex is twisted over the reverse way, and in the other laterally. The disposition of the ribs on the convex side of the type shell reminds one of *Amathina tricostata*, Gmelin, to which genus or subgenus it may possibly belong. The specimens came in the collection of Dr. Cox, of Sydney, labelled "Port Stephens."

Chlamys Smithi, n.sp. Pl. I, Figs. 6, 7.

Testa subcircularis, æquilateralis, depressiuscula, lutea, rufo alboque variegata. Valva dextra planato-convexa, costis radiantibus circiter 21, angustiusculis, plerumque trisulcatis, minutissime transversim squamoso liratis, interstitiis profundiusculis conspicue transversim acute lamellatis. Valva sinistra paulo convexior, costis æqualiter numerosis, magis scabrosis, interstitiis lævioribus, auriculis inæqualibus, squamoso-liratis. Alt. 17, lat. 17, crass. 6·75 mm.

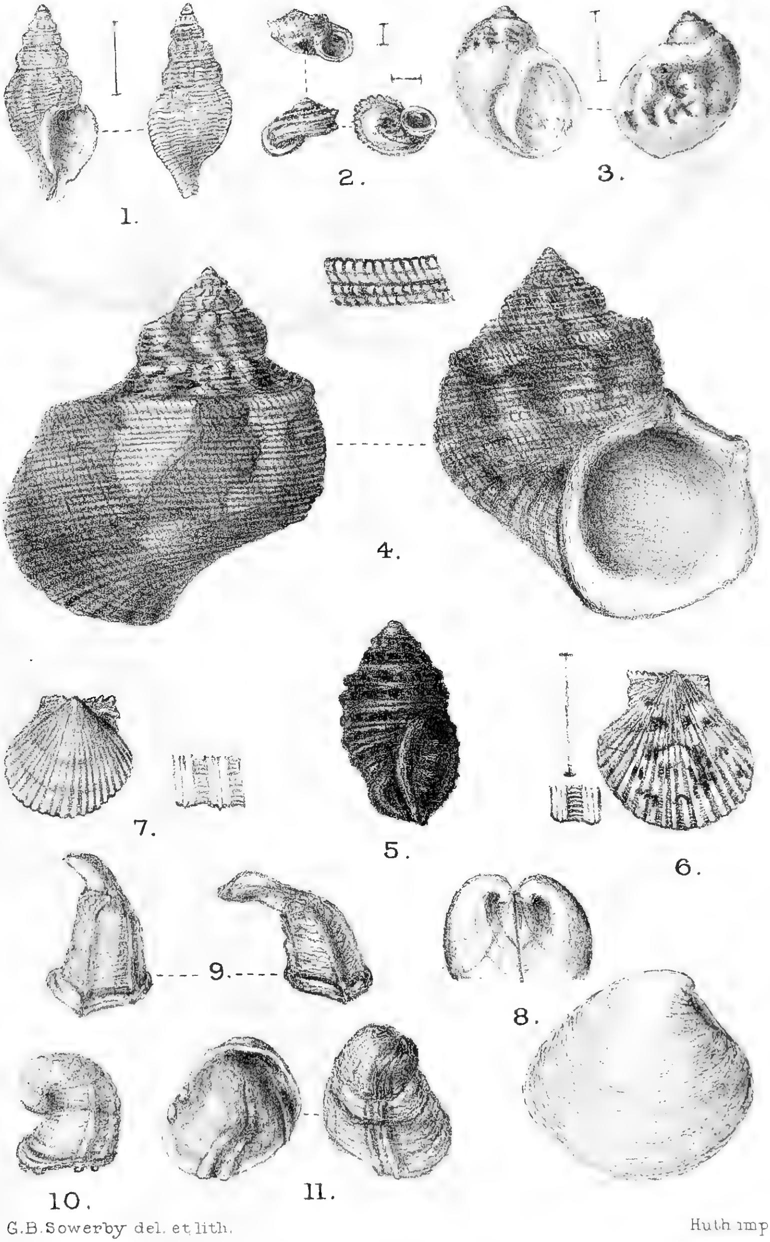
Hab.—Mauritius.

This pretty species, sent many years ago by the late Mr. V. de Robillard from Mauritius, has long been wanting a name. It has been confounded with *Chlamys nux* (Reeve) and *C. corruscans* (Hinds), but it certainly does not belong to either. *C. nux* has a different form and general aspect; it is much more ventricose and tumid, with the sides more straightly sloping from the umbones, and the depression behind the left auricle is more pronounced. I may add (although colour does not count for much in determining species of this genus) that the prevailing colour of *C. nux* is white, more or less variegated with red or brown markings. *Chlamys corruscans* (Hinds) differs somewhat in form from *C. Smithi*, and is longitudinally lirate between the ribs, and without concentric sculpture.

Pitaria elata, n.sp. Pl. I, Fig. 8.

Testa subtrigono cordata, tumida, crassiuscula, inæquilateralis, alba, concentrice irregulariter rugose striata; latus anticum breve, superne concavum, inferne rotundatum; latus posticum arcuatum; margo ventralis rotundatus, postice leviter sinuatus; lunula leviter depressa, cordiformis; umbones acuti, approximati, antrorsum incurvati. Ligamentum longum, tenue, immersum. Cardo normalis. Alt. 28, lat. 31 mm.

Hab.—Off Sierra Leone (Keppel).



G.B. Sowerby del. et lith. Huth imp

NEW SPECIES OF MOLLUSCA.

This species is allied to *P. tumens*, Gmel. (the type of the genus), which is also West African. It is distinguished by its obliquely trigonal form, being much higher in proportion from the umbones to the ventral margin.

EXPLANATION OF PLATE I.

Fig.	1.	*Urosalpinx Walkeri*, n.sp.
,,	2.	*Liotia Walkeri*, n.sp.
,,	3.	*Natica Bougei*, n.sp.
,,	4.	*Turbo granoliratus*, n.sp.
,,	5.	*Sistrum chrysalis*, n.sp.
,,	6.	*Chlamys Smithi*, n.sp. (right valve).
,,	7.	,, ,, (left valve).
,,	8.	*Pitaria elata*, n.sp.
,,	9.	*Amalthea Coxi*, n.sp. (type).
,,	10.	,, ,, var.
,,	11.	,, ,, var.

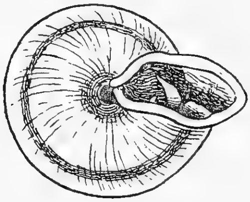
DESCRIPTIONS OF *LABYRINTHUS EUCLAUSUS* AND *NEOCYCLOTUS BELLI*, N.SPP., FROM COLOMBIA.

By Colonel R. H. Beddome, F.L.S.

Read 8*th November*, 1907.

Labyrinthus euclausus, n.sp.

Umbilicate, depressed lens-shaped, acutely carinate, pearl-coloured with two narrow spiral chestnut bands continued along the whorls above and one similar band below near the periphery; surface minutely granulate and with irregular oblique striation; whorls $4\frac{1}{2}$, flat, slowly widening, the last acutely carinate, abruptly deflexed anteriorly, concave and contracted behind the peristome near the umbilicus; aperture much longer than broad; peristome reflexed, white, continued across the parietal wall, where it is rather deeply sutured; parietal lamina large, elevated, running well into the shell;



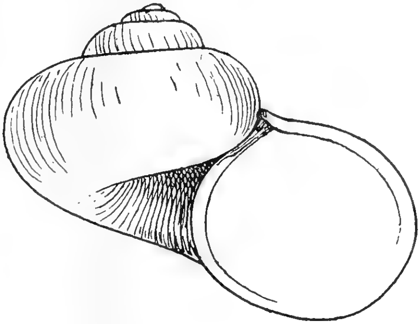
basal margin of the peristome with a large elevated receding arched lamina which all but touches the parietal lamina and almost shuts up the orifice, behind this are two teeth which are entering angular folds. Greatest diameter 31 mm.

Singularly like *L. uncigera* in shape and colouring, but with quite different laminæ or teeth in the aperture.

Hab.—Colombia, near Zaragoza, 800 feet elevation, in dense forests. Lately discovered by Mr. Ernest Bell (mining engineer).

Neocyclotus Belli, n.sp.

Shell openly but rather narrowly umbilicate, turbinately depressed with conical spire, solid, of a rich chestnut-brown, somewhat paler underneath and at the sutures; whorls five, convex, the first four gradually increasing, the last very large, the two apical ones smooth and shining, the others with prominent close oblique transverse striation; aperture obliquely subcircular; peristome simple, thick, sinuate at the suture; operculum shelly, nearly flat, six-whorled. Diameter 51, height 32 mm.; aperture 25 mm.



Hab.—Colombia, in dense forests near Zaragoza, at 800 feet elevation. Lately discovered by Mr. Ernest Bell.

ADDITIONS TO THE MARINE MOLLUSCAN FAUNA OF NEW ZEALAND, WITH DESCRIPTIONS OF NEW SPECIES.

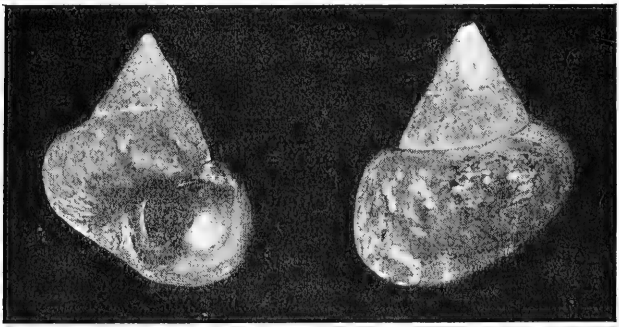
By Henry Suter.

Read 13*th December*, 1907.

PLATES II and III.

1. Cantharidus opalus, Martyn, n.var. biangulatus.

Differs from the typical form in the disproportional expansion of the last whorl, beginning after the first quarter of the volution; it rapidly protuberates, getting broadly shouldered above, flat at the periphery, and having a biangulate outline. The suture on this part of the shell is canaliculate; the aperture subpentagonal; the base flatly convex. There are about eight whorls. Diam. maj. 27, min. 23 mm.; height 37 mm.



Hab.—Cook Strait.

Two specimens, both alike, were found by Capt. J. Bollons. Had there been only one I certainly would have taken it for a monstrosity, but as two were found I am inclined to consider them as a well-established variety. Anyhow, it is certainly worth while to put this curious form on record. The whole shell is covered with Nulliporites. Type in my collection.

2. Monilea (Minolia) semireticulata, n.sp. Pl. II, Fig. 1.

Shell small, depressed turbinate, thin and fragile, spirally lirate. Sculpture consisting of numerous, slightly elevated, and rounded liræ, six on the penultimate, about sixteen on the body-whorl; those on the upper surface with a fine spiral thread in the interstices, which are of about the same width as the riblets; the liræ on the outer side of the base are finer and closer together, on the inner side three broad, slightly crenulated ribs surround the umbilicus, which is also prominently spirally ribbed. The two liræ below the suture are crossed and beaded by strong and sharp equidistant radiate riblets, dividing the interstices into regular squares; remainder of the whorls with fine growth-lines. Colour whitish, light horny. Spire low, with convex outlines, very little higher than the aperture; apex rather blunt. Protoconch small, globular, of one smooth convex whorl. Whorls 4, rather rapidly increasing, somewhat flattened below the suture, then convex; base convex. Suture subcanaliculate. Aperture circular, slightly iridescent within. Peristome sharp, the ends converging and nearly meeting, united by a white parietal callosity. Columella vertical, arcuate, slightly expanded. Umbilicus about one-third of the diameter, deep and scalar. Diam. max. 5, min. 4 mm.; height 3·2 mm.

Hab.—Near the Snares Islands, in 50 fathoms, empty shells only (Capt. J. Bollons).

It is nearly allied to *M. plicatula*, Murdoch & Suter, but the liræ are much more numerous, the umbilicus narrower and distinctly spirally lirate, etc. Type in my collection.

3. Liotia solitaria, n.sp. Pl. II, Figs. 2, 3.

Shell small, discoidal, solid, umbilicated. Sculpture; the flat surface having a peripheral stellate carina, the processes triangular and directed forward; the base bordered by a smooth and sharply elevated carina; a few radiate folds outside the suture and round the umbilicus. Colour yellowish-pink. Spire perfectly flat. Protoconch minute, flat, indistinct. Whorls $3\frac{1}{2}$, rapidly increasing, flat, the last very little convex above, slightly concave between the two keels; base convex inside the carina. Suture superficial, slightly margined. Aperture circular. Peristome continuous, slightly thickened, ornamented with two processes produced by the keels. Columella arcuate, thick. Umbilicus moderately wide, showing the apical whorls. Operculum not seen. Diam. 2·75, height 1 mm.

Hab.—Near Little Barrier Island, in 20 fathoms (R. H. Shakespear).

The only specimen in my possession is not an adult shell. The species is allied to *L. stellaris*, Ad. & Rve. Type in my collection.

4. Liotia serrata, n.sp. Pl. II, Figs. 4, 5.

Shell small, discoidal, rather solid, umbilicated. Sculpture consisting of fine and slightly wavy radiate riblets; periphery of the flat whorls adorned with distant sharp denticles; base on the outside with a carina with low and rounded tubercles; margin of umbilicus more or less crenulate. Colour white. Spire flat. Protoconch very small, of one flat whorl only. Whorls $3\frac{1}{2}$, rapidly increasing, flat above, with a pronounced angle at the periphery and a rounded carina below, space between them convex; base flat. Suture impressed, the serrate processes extending over it. Aperture circular, slightly oblique. Peristome continuous, with a callous varix. Columella arcuate, with an outer tubercle at its base. Umbilicus rather large and deep. Diam. 2·5, height 1 mm.

Hab.—Near Little Barrier Island, in 20 fathoms (R. H. Shakespear).

This species is nearly allied to the foregoing, but distinct from it in several characters. Type in my collection.

5. Liotia rotula, n.sp. Pl. II, Fig. 6.

Shell small, discoidal, umbilicate, rather solid, translucent, radiately prominently ribbed. Sculpture consisting of distant, elevated, and rounded radiate riblets, much closer together on approaching the aperture. Interstices distinctly microscopically spirally striate. Colour white. Spire flat, the apex only slightly raised. Protoconch of two narrow, smooth, convex whorls. Whorls 4, convex, the last large, rounded at the periphery; base convex. Suture impressed. Aperture circular. Peristome continuous, thickened by the last radiate rib. Columella arcuate, not reflexed. Umbilicus wide, perspective, showing all the whorls. Diam. 1·7, height 1 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. J. Bollons).

Allied to *L. annulata*, Ten.-Woods, from Tasmania, which, however, has the radiate riblets more distant and lacks spiral striation. *L. corona*, Hedley, is also nearly related, but it is much smaller and the radiate riblets are less elevated. Type in my collection.

6. Cyclostrema micra, Ten.-Woods, 1877.

Cyclostrema micra, T.-Woods: Proc. Roy. Soc. Tasm., 1876 (1877), p. 147.

C. (*Tubiola*) *micra*, T.-Woods: Man. Conch. (1), vol. x, p. 95, pl. xxxiii, fig. 13.

C. micron, T.-Woods: Tate, Proc. Roy. Soc. S. Austr., vol. xxiii, p. 221.

C. micra, T.-Woods: Pritchard & Gatliff, Proc. Roy. Soc. Vict., vol. xiv (n.s.), p. 101.

Shell small, elevated turbinate, white, polished, umbilicated. Sculpture consisting of exceedingly fine microscopical spiral striæ, more distinct on the umbilicus. Colour white. Spire conical, outlines convex, a little higher than the aperture. Protoconch minute, spherical, of one smooth translucent whorl. Whorls 5, regularly increasing, convex, the last rounded at the periphery; base convex. Suture deep. Aperture circular, slightly angled above. Peristome continuous, sharp, not thickened. Columella arcuate, thin. Umbilicus narrow, deep. Operculum horny, multispiral. Diam. 1·5, height 2 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. J. Bollons). The type is from Tasmania, and the species is also recorded from South Australia and Victoria.

7. Cyclostrema corulum (Hutton).

Scalaria corulum, Hutton: Trans. N. Zeal. Inst., vol. xvii, 1884 (1885), p. 322, pl. xviii, fig. 22; Plioc. Moll., p. 67, pl. viii, fig. 72; Suter, Trans. N. Zeal. Inst., vol. xxxix.

Shell minute, elevated turbinate, perforate, translucent, white, shining. Sculpture consisting of fine, equidistant radiate riblets, about twenty-eight on the last whorl, the interstices finely microscopically spirally striate. Colour white. Spire conical, higher than the aperture, outlines convex. Protoconch small, globose, of one smooth whorl. Whorls 5, rather rapidly increasing, convex, the last with the periphery and base rounded. Suture deep. Aperture roundly ovate, angled above. Peristome continuous, sometimes thickened by a radiate riblet. Columella arcuate, very little expanded. Perforation narrow, partly hidden by the columella. Diam. 1, height 1·5 mm.

Hab.—Titahi Bay, Cook Strait, in sand (Miss M. Mestayer). *C. Angeli*, T.-W., *conica*, Wats., and *crebresculptum*, Tate, are nearly allied species. Type, from the Pliocene, in the Canterbury Museum, Christchurch.

8. Cyclostrema eumorpha, n.sp. Pl. II, Figs. 7–9.

Shell very small, turbinate, umbilicate, translucent white, spirally distantly ribbed, and radiately striate. Sculpture consisting of five prominent spiral riblets, the first just above the periphery, a low and indistinct spiral riblet on the last whorl outside the suture, and sometimes a fine riblet bordering the funnel-shaped umbilicus; radiate sculpture formed by distinct threads, which are equidistant, slightly directed backward, the interstices wider than the threads. Colour white. Spire depressed conoidal, lower than the height of aperture. Protoconch minute, spherical, of one whorl only. Whorls 3, regularly increasing, convex, the last flattened between the suture and the first spiral riblet, periphery rounded; base convex. Suture impressed. Aperture oblique, circular. Peristome continuous, smooth inside, ornamented on the outside by spiral sculpture. Columella arcuate, strong, not reflexed. Umbilicus rather narrow, deep. Diam. maj. 1·7, min. 1·4 mm.; height 1·3 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. J. Bollons).

This species is allied to the South Australian *C. delectabile*, Tate, in which, however, the spiral riblets are more numerous and less prominent, the umbilicus much wider, perspective. Type in my collection.

9. Cyclostrema lissum, n.sp. Pl. II, Figs. 10, 11.

Shell minute, discoidal, thin, smooth, umbilicated. Sculpture: to the naked eye the shell appears to be quite smooth, but a powerful lens reveals subequidistant, strongly undulating radiate threads; there is no spiral sculpture visible. Colour yellowish-white. Spire flat, the nucleus only being slightly raised. Protoconch of one smooth whorl, which is convex and the first half very often slightly elevated. Whorls 2, the last flatly convex above, periphery and base rounded. Suture impressed. Aperture subcircular, a little angled above. Peristome continuous, sharp, outer lip advancing and producing a distinct notch at the suture. Columella arcuate, slightly thickened. Umbilicus moderate, open. Diam. 1, height 0·6 mm.

Hab.—Lyttelton Harbour, on seaweeds (H. S.); Titahi Bay, Cook Strait (Miss M. Mestayer).

This species is well characterized by its minuteness, the few whorls, and the microscopic radiate sculpture. Type in my collection.

10. Cyclostremella Neozelanica, n.sp. Pl. II, Fig. 12.

Shell small, planorboid, radiately ribbed, broadly umbilicate. Sculpture consisting of close, sharp, radiate riblets, the smooth interstices of about the same width as the riblets; they are finer and closer together near the aperture. Colour white. Spire sunken. Protoconch very minute, of about one whorl. Whorls 3, regularly increasing, leaving the apex considerably lower than any of the succeeding volutions, the last being the most elevated, and having a rounded periphery; base convex, very broadly and openly umbilicated. Suture strongly impressed. Aperture circular. Peristome discontinuous, thin. Columella short, arcuate, not thickened; the converging margins of the peristome connected by a thin parietal callosity. Umbilicus of the same aspect as the sunken spire. Diam. maj. 2, min. 1·6 mm.; height, 0·7 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). A single specimen. Type in my collection.

11. CIRSONELLA DENSILIRATA, n.sp. Pl. II, Fig. 13.

Shell small, turbinate, subdiaphanous, slightly shining, perforated. Sculpture consisting of numerous fine microscopic spiral liræ. Colour white. Spire depressed conoidal, outlines convex, lower than the aperture. Protoconch of two convex, smooth whorls, yellowish-white. Whorls 3½, rapidly increasing, convex, periphery of last whorl rounded; base convex, with an impressed umbilical area. Suture not much impressed. Aperture circular, oblique, inside microscopically lirate. Peristome continuous, thick. Columella arcuate, slightly expanded towards the narrow perforation, sometimes partly concealing it. Operculum horny, multispiral, nucleus central. Diam. 2·25, height 1·75 mm.

Hab.—Near the Snares and Bounty Islands, in 50 fathoms (Capt. Bollons).

This species is very closely related to the Tasmanian *C. Weldii*, Ten.-Woods, which, however, is smooth, having a few spiral liræ around the umbilicus only. Type in my collection.

12. PSEUDOLIOTIA IMPERFORATA, n.sp. Pl. II, Fig. 14.

Shell small, globose, imperforate when adult, thick, spirally costate. Sculpture consisting of prominent nodulous ribs, the nodules rather low; there are two ribs on the penultimate and six on the last whorl; on the latter a small nodulous rib appears on the last half of the volution close to the suture, followed by four equally strong, equidistant spiral ribs, the interspaces much broader than the ribs; the whole crossed by fine, close, oblique incremental striæ; a sixth broad rib, more nodulous than the others, forms a semicircle around the strongly impressed umbilical area, which is ornamented with distant axial folds. Colour yellowish-white, the spiral ribs maculated with brown. Spire depressed, lower than the aperture. Protoconch white, of two spirally costate flat whorls. Whorls 4, the last large, flattened below the suture, then convex; base rounded. Suture not impressed. Aperture oblique, nearly circular, white and porcellanous inside. Peristome thick, very little contracted, crenulated on the outside by spiral ribs, regularly convex. Columella arcuate, shining, white, thick; inner lip spreading over the umbilicus, completely sealing it up, or sometimes leaving a minute chink; a white callus unites the converging margins of the peristome. In young specimens the umbilicus is open, but very narrow. Operculum not seen. Diam. 3·5, height 3·5 mm.

Hab.—Stewart Island.

The species is distinguished from the type, *P. micans*, A. Adams, by the absence of radiate riblets, the discontinuous peristome, and the closed umbilicus. Type in my collection.

13. Leptothyra fluctuata, Hutton, n.var. immaculata.

Distinguished from the typical form of the species in being larger, having more numerous cingula, and no colour-markings at all. My specimens (dead shells) are white. Diam. 4, height 2·5 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

14. Cocculina craticulata, n.sp. Pl. II, Figs. 15, 16.

Shell small, thin, oval, the sides subparallel, elevated. Sculpture consisting of subequal, close, distinct concentric grooves, reticulated by radiate grooves which are slightly slanting to the left on the anterior slope, the surface being cut up into series of squarish granules; the summit having only concentric sculpture. Colour yellowish-green. Nucleus spiral, smooth, small, evidently deciduous, very little within the posterior margin. Posterior slope short, steep, concave; anterior slope long, regularly rounded. Inside light-green, shining. Length 2·8, breadth 1·8, height 1·2 mm.

Hab.—Dusky Sound, in 30 fathoms (R. Henry); a single specimen.

The subparallel sides and prominent reticulate sculpture distinguish this species from *C. Tasmanica*, Pilsbry. Type in my collection.

15. Cocculina compressa, n.sp. Pl. II, Figs. 17, 18.

Shell small, thin, laterally much compressed, the sides parallel, anterior and posterior end raised, navicular, the summit anterior and considerably elevated. Sculpture consisting of fine, rather distant and indistinct radiate striæ, crossed by concentric growth-lines. Colour white. Nucleus minute, resting on the narrowly elevated summit, situate at the anterior two-fifths of length. Anterior and posterior slope straight, side-slopes lightly convex. Margin sharp, smooth; interior white. Length 5, breadth 2, height 2·8 mm.

Hab.—Flat Point, East Cape; one specimen. Type in the collection of Miss M. K. Mestayer, Wellington.

16. Cocculina clypidellæformis, n.sp. Pl. II, Figs. 19, 20.

Shell minute, having the shape of a *Clypidella*, i.e. saddle-shaped, the sides descending, and the anterior and posterior margin slightly elevated; thin, translucent, smooth, apex slightly posterior. Sculpture consisting of concentric growth-lines only; they are fine and microscopic on the upper half, more conspicuous and irregular towards the base. Colour white. In the young shell the nucleus is minute, globose, and polished; adult shells have usually lost it. The summit is very little behind the middle in the adult, roundish shell, but nearly at the posterior third in the young, more oval shell; it is slightly raised; the anterior, posterior, and lateral slopes are uneven, moderately convex. Interior greenish-white; muscular impression very distinct, forming a semicircle. Length 2·8, breadth 2·5, height 2·2 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

17. Rissoa rufoapicata, n.sp. Pl. II, Fig. 21.

Shell small, elongately oval, rimate, solid, costate, shining. Sculpture: the embryonic whorls smooth, the succeeding ones closely ribbed, the riblets at first faint and inconspicuous, then getting much stronger as growth proceeds; they are flat, close together, with smooth and slightly narrower interstices, flexuous, nearly vertical on the upper whorls, but obliquely directed backward on the last whorl, and extending over the base. Colour: the first two or three whorls are rufous or purple, the following two dark grey, and the last whitish. Spire elevated conical, two and a half times the height of the aperture; outlines slightly convex. Protoconch papillate, of two flatly convex whorls. Whorls 6, regularly increasing, flattish; base convex. Suture deep, slightly uneven. Aperture oblique, ovate, white. Peristome continuous, much thickened and expanded. Columella very short, arcuate. A distinct umbilical chink is formed by the reflection of the inner lip. Operculum unknown. Diam. 1·9, height 4 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons).

In general appearance this species recalls *R. subfusca*, Hutt., which, however, is quite smooth. Type in my collection.

18. Rissoa (Alvania) exserta, n.sp. Pl. II, Fig. 22.

Shell small, elongately oval, imperforate, thin, semitransparent, but faintly shining, strongly axially costate and spirally striate. Sculpture consisting of distant, stout axial riblets with a rather sharp edge, ten to eleven on the upper whorls, twelve to fourteen on the body-whorl, on which they vanish below the periphery; the interstices and riblets are crossed by distant spiral threads, about fourteen on the last whorl; they are closer together upon the base. Colour white; in fresh examples the apex pinkish-brown. Spire elevated conical, about twice the height of the aperture; outlines slightly convex. Protoconch small, globular, of one and a half microscopically densely spirally striate whorls. Whorls 4, the last large in proportion, flattened below the suture, thence strongly convex; base rounded. Suture deep. Aperture subvertical, oval. Peristome continuous, thickened inside, sharp; outer lip with a varix formed by the last axial riblet; basal lip slightly effuse. Columella oblique, short, slightly arcuate. Operculum unknown. Diam. 1·3 to 1·6, height 2·2 to 2·8 mm.

Hab.—Near the Snares and the Bounty Islands, in 50 fathoms (Capt. Bollons).

Allied to the Australian *R. devecta*, Tate (= *gracilis*, Ang.), which, however, has more numerous axial riblets. Type in my collection.

19. Rissoa (Onoba) foliata, n.sp. Pl. II, Fig. 23.

Shell minute, turriculate, solid, opaque, white, spirally ribbed. Sculpture: the first one and a half whorls are microscopically distantly spirally striate; the succeeding whorls have on the upper third a strong spiral cord, and below it two smaller ones, the lower of which margins the suture; on the last whorl the whole of this sculpture is more prominent, and on the base is a fourth cord, parallel to the columella; the entire surface is ornamented with dense axial foliations, crenulating the spiral riblets. Colour white. Spire graduate, much higher than the aperture; outlines very little convex. Protoconch conspicuous, globular, of one and a half whorls. Whorls 4½, regularly increasing, concave from the suture to the first cord, turned inward in a straight line to the suture below; base convex. Suture not much impressed. Aperture subvertical, ovate, slightly angled above. Peristome continuous, thick, and blunt. Basal lip slightly expanded. Columella very short, vertical, nearly straight. Operculum unknown. Diam. ·8, height 2 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons).

Nearly allied to *R. Suteri*, Hedley, which, however, is much broader, has the protoconch smooth, two spiral cords on the third whorl, and lacks the foliated axial sculpture. Type in my collection.

20. Rissoina (Setia) lubrica, Suter. Pl. II, Fig. 24.

Rissoa lubrica, Suter: Proc. Malac. Soc., vol. iii, p. 5, Fig. 3 in text (1898).

A figure is here given of a specimen dredged in 50 fathoms near the Bounty Islands by Capt. Bollons. Diam. ·8, height 1·7 mm.

21. Rissoa (Cingula) lampra, n.sp. Pl. II, Fig. 25.

Shell minute, ovate, imperforate, translucent, polished. Sculpture: sometimes a few microscopic distant spiral lines are present on the upper whorls, but more often the shell is perfectly smooth. Colour white. Spire conic, higher than the aperture, outlines slightly convex. Protoconch small, globose, and smooth. Whorls 5, slightly convex, the last rounded, but somewhat flattened below the suture; base convex. Suture not much impressed, margined below. Aperture oval, vertical, angled above. Peristome continuous, slightly thickened and expanded. Columella short, arcuate. Operculum unknown. Diam. ·8, height 1·5 mm.

Hab.—Titahi Bay, Cook Strait, in sand (Miss M. Mestayer). Type in my collection.

22. Rissoa (Cingula) roseocincta, n.sp. Pl. II, Fig. 26.

Shell minute, ovate, rimate, polished, thin, translucent, with pink and white spiral bands. There is no sculpture, except for fine microscopic oblique growth-lines. Colour: the first three whorls are pink, the last whitish with a narrow pink band below the suture, a second just below the periphery, and a third upon the base; sometimes the last whorl is also pinkish, and the lighter bands are only faintly visible. Spire conical, higher than the aperture; outlines a little convex. Protoconch small, broadly rounded, smooth. Whorls 4, flatly rounded, the last rather large and somewhat inflated; base convex. Suture not deep. Aperture vertical, roundly oval, slightly angled above. Peristome continuous in adult specimens, thin on the parietal wall, slightly thickened, sharp. Columella short, subvertical; the inner lip slightly expanded and giving rise to a narrow chink. Operculum unknown. Diam. ·9, height 1·6 mm.; diam. 1, height 1·5 mm.

Hab.—Titahi Bay, Cook Strait; found in sand (Miss M. Mestayer).

The nearly allied *R. rosea*, Hutton, is larger, more solid, and opaque, uniformly pink; the outlines of the spire are straight, and the whorls flat. Type in my collection.

23. Rissoa (Setia) atomus, n.sp. Pl. II, Fig. 27.

Shell minute, globular, rimate, smooth, translucent, polished. The only sculpture consists of microscopic growth-lines. Colour light yellow. Spire short, with a blunt apex, very little higher than the aperture; outlines convex. Protoconch small, depressed, flatly convex. Whorls 3, convex, rapidly increasing, the last volution occupying about four-fifths of the whole height; base rounded. Suture deep, sometimes deeply channelled on approaching the mouth. Aperture roundly ovate, angled above. Peristome continuous, very little callus, edge rather blunt. Columella subvertical, slightly arcuate; inner lip a little reflexed, and producing an umbilical chink. Operculum unknown. Diam. 1, height 1·25 mm.

Hab.—Near the Bounty Islands, in 50 fathoms (Capt. Bollons).

Nearly allied to *R. micans*, Webster, which, however, has 3½ to 4 whorls and is much less globose, specimens from Hauraki Gulf measuring 1·1 by 1·5 mm. Type in my collection.

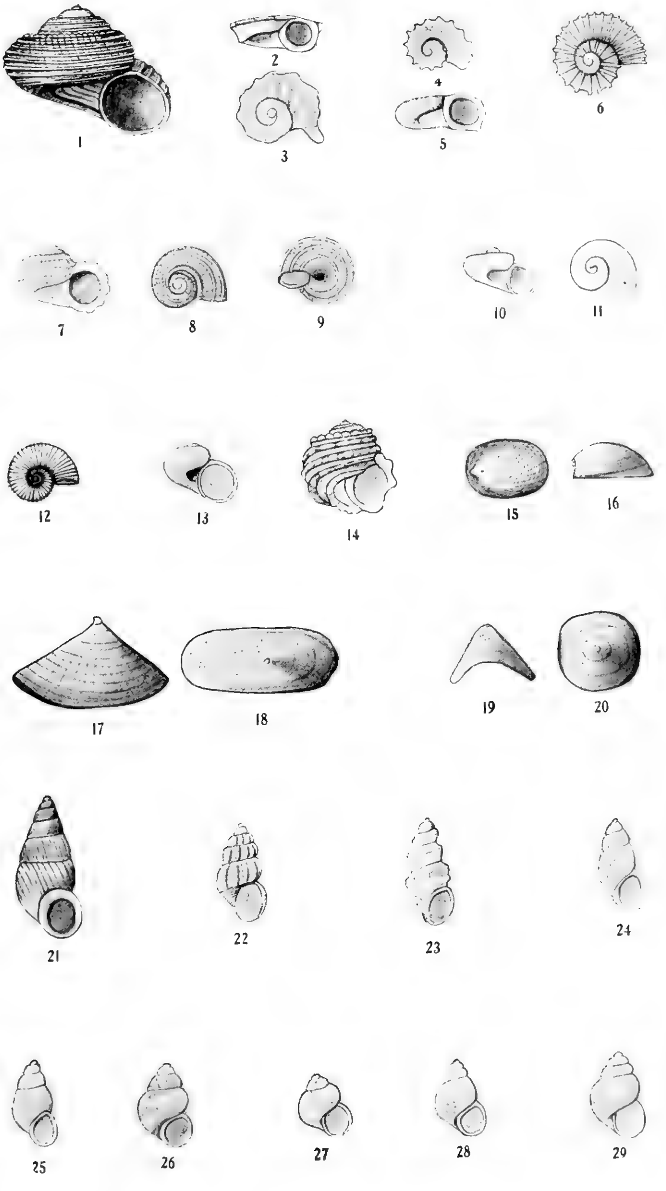
24. Rissoa (Setia) verecunda, n.sp. Pl. II, Fig. 28.

Shell minute, ovate, rimate, solid, slightly shining, smooth. There is no sculpture except fine growth-lines. Colour very light horny; dead shells are cretaceous. Spire conical, very little higher than the aperture; outlines slightly convex. Protoconch small, papillate, of one and half smooth and convex whorls. Whorls 4, the last high, lightly rounded; base convex. Suture impressed. Aperture oblique, oval, angled above. Peristome continuous, thickened, with a blunt edge. Columella short, arcuate; inner lip slightly reflexed, forming a narrow umbilical chink. Diam. 1·25, height 2 mm.

Hab.—Near the Snares Islands, in 50 fathoms, type, and Queen Charlotte Sound, in 16 fathoms (Captain Bollons). Type in my collection.

25. Rissoa (Setia) porcellana, n.sp. Pl. II, Fig. 29.

Shell minute, ovate, rimate, smooth, translucent white, whorls faintly shouldered. Sculpture consisting of fine growth-lines, crossed by a few microscopic spiral striæ upon the base. Colour white. Spire conical, faintly gradate, one and a half times the height of the aperture; outlines but little convex. Protoconch small, globose. Whorls 4½, convex, slightly shouldered, the last large; base rounded. Suture not deep. Aperture ovately rotund, angled above. Peristome discontinuous, rather sharp. Columella vertical, arcuate; inner lip not expanded,



H. Suter del.

MOLLUSCA FROM NEW ZEALAND.

spreading as a thin callosity over the parietal wall. There is a distinct umbilical chink. Diam. 1·3, height 1·8 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). Dusky Sound, in 30 fathoms (R. Henry). Dredged off Otago Heads (A. Hamilton). Type in my collection.

26. Rissoa (Setia) Stewartiana, n.sp. Pl. III, Fig. 30.

Shell minute, ovate, rimate, smooth, and faintly shining. Sculpture consisting of fine oblique growth-striæ, crossed on the last whorl by microscopic faint and distant spiral lines. Colour light horny; dead shells are whitish. Spire conical, a little higher than the aperture; outlines convex. Protoconch small, globose, of one and a half smooth white and shining whorls. Whorls 4½, convex, the last large; base rounded. Suture much impressed. Aperture oblique, oval, subangled above. Peristome continuous, slightly thickened inside, sharp. Columella short, vertical, a little arcuate. A distinct umbilical chink is present. Diam. 1·25, height 1·9 mm.

Hab.—Port Pegasus, Stewart Island, in 18 fathoms (Capt. Bollons). Type in my collection.

27. Rissoa (Setia) infecta, n.sp. Pl. III, Fig. 31.

Shell minute, oval, rimate, translucent, thin, polished. Sculpture: a few faint spiral lines are sometimes present below the periphery on the last whorl; growth-lines very fine, oblique or nearly straight. Colour light horny. Spire conical, a little higher than the aperture; outlines slightly convex. Protoconch small, globose, smooth. Whorls 4, convex, the last large in proportion; base rounded. Suture impressed, narrowly margined below. Aperture slightly oblique, oval, angled above. Peristome not continuous, not thickened, thin and sharp. Columella vertical, nearly straight; inner lip slightly expanded and forming a thin layer on the parietal wall. The umbilical chink is distinct. Diam. 1·1, height 1·6 mm.

Hab.—Lyall Bay, Cook Strait (Miss M. Mestayer). Near Taumaki Island, west coast of the South Island, in 10 fathoms (Capt. Bollons). Type in my collection.

28. Scrobs Hedleyi, n.sp. Pl. III, Fig. 32.

Shell minute, oval, usually spirally sculptured, pinkish or white, imperforate. Sculpture consisting of fine spiral lines, distant or close together, with a keeled shoulder, and sometimes a cincture margining the suture below; the shoulder may be ornamented by a few spirals only or by numerous fine spiral threads; very often the sculpture is becoming obsolete or may be absent altogether, the shoulder only slightly angled. Colour uniformly pink, mostly yellowish-white near the mouth, but sometimes with a light-coloured band below the suture and the base whitish; white specimens are also met with, on which the spiral sculpture may be pink-coloured. Spire conic, with blunt and rounded apex, a little higher than the aperture; outlines convex. Protoconch rather large, of one flatly convex, smooth whorl, the nucleus large. Whorls 3, convex, the last shouldered; base convex.

Suture canaliculate. Aperture oblique, ovato-semilunar, extended beyond the body-whorl by a broad, white, flat, and slightly sunken callosity. Peristome very thick and rounded; columella very short. Diam. ·7, height 1·2 mm.

Hab.—Maloney's Reef, Hauraki Gulf, type (H. S.); Lyall Bay, Cook Strait (H. S.); Titahi Bay, Cook Strait (Miss M. Mestayer).

Named in honour of my friend Mr. Charles Hedley, of the Australian Museum, Sydney, who informed me that he had discovered the same species in Australian waters. With regard to sculpture this is one of the most variable shells known to me; all intermediate grades between quite smooth and distinctly spirally ridged forms occur, but the peculiarities of the aperture remain constant. Type in my collection.

29. Anabathron gradatum, n.sp. Pl. III, Fig. 33.

Shell very small, oval, gradate, rimate, solid, not shining. Sculpture consisting of irregular fine axial plications, crossed by fine microscopic spiral striæ. Colour white. Spire conical, a little higher than the aperture; outlines convex. Protoconch small, papillate, of one and a half convex and microscopically finely spirally lirate whorls. Whorls 4, the last very large, shouldered above, angle not carinated, slightly convex below; base convex. Suture impressed. Aperture oblique, oval. Peristome continuous, slightly thickened and expanded, sharp, thin on the parietal wall. Columella short and arcuate. Umbilical chink well marked. Diam. 1·6, height 2·25 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

30. Rissoina Hanleyi, Schwartz.

Rissoina Hanleyi, Schwartz: Die Familie der Rissoiden, 1860, p. 64, pl. iv, fig. 28.

R. fasciata, A. Adams: Suter, Proc. Mal. Soc., vol. iii, p. 7, not of Adams.

Hab.—Bay of Islands, Hauraki Gulf (H. S.).

Two specimens in the Canterbury Museum, collected by Mr. C. Spencer, near Auckland, and determined by the late Capt. F. W. Hutton as *R. fasciata*, A. Ad., are undoubtedly *R. Hanleyi*, Schw. The New Zealand specimens taken for *R. fasciata* by Angas and Sowerby were no doubt varieties of *R. rugulosa*, Hutton, which is nearly allied to the former. I am not aware that *R. fasciata* has ever been found in New Zealand waters.

31. Rissoina fuscozona, n.sp. Pl. III, Fig. 34.

Shell small, elongately oval, imperforate, thin, smooth, shining, semitransparent. Fine oblique growth-lines form the only sculpture. Colour fulvous, a dark-brown band below the suture; peristome fuscous. Spire elevated conic, twice the height of the aperture; outlines slightly convex. Protoconch small, flatly convex, smooth. Whorls 5, convex, regularly increasing, the last high, rather ventricose and slightly contracted below; base convex. Aperture oblique, oval, angled above. Peristome continuous, not thickened, basal lip slightly expanded. Columella oblique, a little arcuate, subtruncate, inner lip but little reflexed. Diam. 1·7, height 2·8 mm.

Hab.—Hohoura Bay, North Island (Roger Buddle). Type in my collection.

32. Rissoina olivacea, Hutton, n.var. lutea.

Distinguished from the typical form of the species by its light horn-colour, and in being a little more slender. Diam. 1·4 to 1·5, height 2·5 to 2·7 mm.

Hab.—Maloney's Reef, Hauraki Gulf (H. S.); Titahi Bay, Cook Strait (Miss M. Mestayer); Lyttelton Harbour (H. S.). Type in my collection.

33. Rissoina rufolactea, n.sp. Pl. III, Fig. 35.

Shell small, elongate, imperforate, solid, opaque, costate, not shining. Sculpture: the first two whorls are smooth, the succeeding ones axially costate, the riblets thick and rounded, interstices of the same width as the costæ, about fifteen on the last whorl, and obsolete below the periphery, leaving the base quite smooth; there is no trace of spiral sculpture. Colour: the first three whorls are rufous, with a narrow darker band below the suture, the rest yellowish-white; sometimes the whole shell is rufous, or with a milk-white peripheral band, the base white. Spire elevated, a little more than twice the height of the aperture; outlines straight. Protoconch small, dome-shaped. Whorls 5, flatly convex, the last volution high; base convex. Suture not deep. Aperture oblique, oval, angled above. Peristome continuous, slightly thickened, the edge rather blunt, thin on the parietal wall; basal lip slightly expanded. Columella oblique, almost straight, very thin. Diam. 1·5, height 3·3 mm.

Hab.—Hauraki Gulf (H. S.).

A species allied to *R. rugulosa*, Hutt., but much smaller and lacking spiral sculpture. Type in my collection.

34. Omalogyra fusca, n.sp. Pl. III, Fig. 36.

Shell minute, planorbiform, thin and fragile, slightly shining. Sculpture consisting of very fine microscopic spiral striæ, faintly reticulated by growth-lines. Colour fuscous, with a few white radiate streaks and irregularly scattered spots. Spire depressed. Protoconch of one whorl, distinctly marked off from the next volution, spirally striate. Whorls $2\frac{3}{4}$, rather rapidly increasing, convex; base concave. Suture deep. Aperture circular; peristome sharp, straight, slightly discontinuous through the intervening parietal wall. Diam. 1, height ·3 mm.

Hab.—Lyttelton Harbour, on seaweeds (H. S.). Type in my collection.

35. Omalogyra bicarinata, n.sp. Pl. III, Figs. 37–37*a*.

Shell minute, discoidal, thin, not shining. The sculpture consists of two spiral keels, one above and one below the periphery. Colour white. Spire depressed. Protoconch of one smooth whorl, marked off from the next. Whorls $2\frac{1}{4}$, rather rapidly increasing, flattened above and below, convex at the periphery, bicarinate; base slightly concave. Suture canaliculate. Aperture subquadrate; peristome continuous, thin, and straight. Diam. 1·5, height ·5 mm.

Hab.—Near the Snares Islands, in 50 fathoms, one specimen (Capt. Bollons). Type in my collection.

36. Bittium retiferum, n.sp. Pl. III, Fig. 38.

Shell very small, subulate, thin, and fragile. Sculpture consisting of three cingula on the upper whorls, four on the body-whorl, the uppermost close to the suture and slightly lower; crossed by straight equidistant axial riblets, about twenty on the last whorl, interstices with microscopic fine growth-lines; points of intersection ornamented with round gemmules. Colour yellowish-white. Spire high conical, much higher than the aperture; outlines almost straight. Protoconch papillate, of two convex smooth whorls, a little deviated from the vertical axis. Whorls about 7, regularly increasing, flatly convex; base smooth and slightly concave. Suture impressed, channelled by the cingula. Aperture vertical, ovate, angled above, produced below into a short, widely open, and basally emarginate canal. Outer lip sinuated by the spiral sculpture; basal lip produced beyond the canal. Columella short, rounded, gently curved off toward the short margin of the canal; parietal wall concave. Diam. 1, height 3·2 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

37. Bittium vitreum, n.sp. Pl. III, Fig. 39.

Shell small, elongate, thin and fragile, translucent, finely reticulated. Sculpture: the first two whorls smooth, the following four with three subequidistant fine spiral threads, and the body-whorl with five, the two lowest a little stronger than the others; they are reticulated by subequidistant, slightly oblique, and flexuous axial threads, slightly nearer together than the spiral lines, and extending over the base; interstices with fine microscopical growth-striæ. Colour yellowish-white. Spire high, turriculated, outlines lightly convex. Protoconch of two convex, smooth, and polished whorls. Whorls 7, regularly increasing, convex, flattened towards the suture; base slightly convex. Suture impressed. Aperture subquadrangular, produced below into a short and open canal. Outer lip rounded, thin, and sharp; basal lip bent almost straight over towards the canal. Columella vertical, straight, curving off at the base to form the inner margin of the canal. Diam. 1·8, height 4·2 mm. (shell of 7 whorls).

Hab.—Foveaux Strait, in about 15 fathoms. Type in my collection.

38. Bittium granarium, Kiener.

Cerithium granarium, Kiener: Icon. Coq. viv., vol. v (1842), p. 72, pl. xix, fig. 3.

A specimen was found in the Hauraki Gulf by Mr. E. A. Annett, from Crawley, Sussex, England, which agrees very well with specimens from Tasmania and Australia.

39. CERITHIOPSIS CESSICUS, Hedley.

Bittium minimum, Ten.-Woods: P. Roy. S. Tasm., 1877 (1878), p. 123; 1878 (1879), p. 37; Hedley, Proc. Linn. Soc. N.S. Wales, 1901, p. 722, fig. 20.

Cerithiopsis minima, Ten.-Woods: Tate & May, Proc. Linn. Soc. N.S. Wales, 1901, p. 385, not of Brusina, 1864.

C. cessicus, Hedley: l.c., 1906, p. 529.

This species I found amongst the shells dredged by Capt. Bollons near the Snares Islands, in 50 fathoms.

40. CERITHIOPSIS ACIES, n.sp. Pl. III, Fig. 40.

Shell very small, acicular, rather solid. Sculpture consisting of three equidistant cingula, the uppermost very thin and close to the suture, which is margined above by a fine thread; the last whorl with a fourth spiral ridge emerging from the suture; the spiral sculpture crossed by slightly oblique axial riblets, also equidistant and of the same width as the interstices, about fifteen on the last whorl; the points of intersection raised into round gemmules; the axial sculpture is more prominent than the spiral. Colour white. Spire high and narrowly conical, much higher than the aperture; outlines almost straight. Protoconch polygyrate, cylindro-conical, of four slowly increasing, strongly convex and smooth whorls. Whorls about 10, convex; base slightly concave. Suture deeply impressed. Aperture subquadrangular, vertical, with a short and widely open canal. Outer lip sinuated by spiral sculpture. Columella vertical, slightly sinuate, pointed at the base. Diam. 1·1, height 3·5 mm.

Hab.—Port Pegasus, Stewart Island, in 18 fathoms (Capt. Bollons). Type in my collection.

41. CERITHIOPSIS SUBANTARCTICA, n.sp. Pl. III, Fig. 41.

Shell very small, subulate, rather solid. Sculpture consisting of three cingula, equidistant, with a fourth keel on the last whorl; crossed by oblique axial riblets, eighteen to twenty on the last whorl; the points of intersection raised into prominent gemmules. Colour light brown. Spire elevated conical, much higher than the aperture; outlines straight or faintly concave. Protoconch polygyrate, of four smooth and convex whorls. Whorls about 11, first very slowly increasing, slightly convex; base concave. Suture impressed, not margined. Aperture vertical, quadrangular, produced below into a short, open canal. Outer lip sharp, denticulated on the outside by the gemmules. Columella vertical, sinuate, rounded, terminating in a point below. Diam. 1·5, height 4·8 mm.

Hab.—Near the Snares, type, and Bounty Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

42. CERITHIOPSIS CANALICULATA, n.sp. Pl. III, Fig. 42.

Shell small, subulate, solid, with channelled suture. Sculpture consisting of three spiral keels, equidistant, the uppermost weaker and close to the suture, the last whorl with an additional keel arising from the suture; crossed by oblique straight axial riblets, about twenty on the body-whorl, their interstices narrower than those between the cingula, crossing points raised into roundish gemmules. Colour light brown, the uppermost cincture of a darker colour. Spire high, conic, much higher than the aperture; outlines straight. Protoconch of the only specimen broken off, one smooth and convex whorl only left. Whorls about 7, regularly increasing, flatly convex; base smooth and moderately concave. Suture deep, canaliculated by the cingula. Aperture vertical, subquadrangular, produced below into a very short and open canal. Outer lip denticulated on the outside by the spiral sculpture. Columella subvertical, rounded, slightly sinuate, terminating in a blunt point below. Diam. 1·6, height 5 mm.

Hab.—Near the Bounty Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

43. Cerithiopsis styliformis, n.sp. Pl. III, Fig. 43.

Shell small, acicular, almost cylindrical, rather thin. Sculpture consisting of three cingula, the uppermost close to the suture and less elevated, a fourth smooth keel on the last whorl, continued from the suture; crossed by straight axial riblets, about fifteen on the last whorl; the points of intersection raised to conspicuous rounded gemmules on the second and third keel, the first, however, remaining nearly smooth. Colour yellowish brown, the first three whorls slightly darker. Spire high, subcylindrical, but tapering towards the apex, very much higher than the aperture; outlines straight. Protoconch papillate, of one and a half smooth, convex, and shining whorls. Whorls 8 to 9, regularly increasing, convex; base slightly concave and smooth. Suture impressed. Aperture vertical, subquadrangular, produced below into a very short, open, and emarginate canal. Outer lip sharp, sinuated on the outside by the spiral keels. Columella vertical, straight above, bending over in a curve to the canal below. Diam. 1·1, height 3·7 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

44. Cerithiopsis marginata, n.sp. Pl. III, Fig. 44.

Shell very small, subulate, solid. Sculpture consisting of two broadly rounded cingula, the last two whorls with a narrow thread margining the suture, and two additional narrow and smooth keels on the body-whorl, bounding the smooth base; axial sculpture formed by straight, equidistant, and rather broad riblets, about twenty on the last whorl; crossing points produced into rounded gemmules. Colour white. Spire elevated conic, much higher than the aperture; outlines faintly convex. Protoconch papillate, the nucleus globular, of one and a half smooth, convex, and polished whorls. Whorls about 8, regularly increasing, the upper ones somewhat convex, the others flattish; base slightly concave. Suture impressed, margined on the last whorls. Aperture subquadrangular, produced into a short and open canal, not notched at its base. Outer lips nodulous on the outside, basal lips sinuate. Columella subvertical, straight, truncated below by the oblique upper margin of the canal. Diam. 1, height 2·7 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

45. Seila Chathamensis, n.sp. Pl. III, Fig. 45.

Shell small, elevated conic, solid. Sculpture: first whorl smooth, the succeeding two with two cingula, the upper of which is inconspicuous, but the lower one is thick and prominent; the following five whorls have three rounded cingula, then there are four on the next volutions, and six on the last whorl, the lowest being upon the base; the uppermost cingulum on the last whorl is usually grooved or divided into two narrow cingula, increasing their number to seven. The interspaces are densely and finely longitudinally striated by growth-lines. Colour fulvous. Spire high conical, much higher than the aperture; outlines slightly concave below the first two whorls, nearly straight further down. Protoconch small, depressed, of one smooth whorl only. Whorls about 13, regularly increasing, the second and third convex, the others flattish; base flat, concave round the canal. Suture not much impressed. Aperture vertical, subquadrangular, produced below into a very short and open canal, which is slightly turned to the left. Outer lip denticulated on the outside by spiral sculpture, smooth inside; basal lip nearly straight. Columella arcuate, bent over at a blunt angle toward the canal. Diam. 3·2, height 10 mm.

Hab.—Foveaux Strait, in 15 fathoms, type; Chatham Islands; Hauraki Gulf (H. S.). Type in my collection.

46. Seila bulbosa, n.sp. Pl. III, Fig. 46.

Shell small, elongate, many-whorled, with a bulbose apex, rather solid. Sculpture: the first one and a half whorls smooth, the following volutions with three narrow and rather sharp spiral keels, the upper two closer together, last whorl with five keels, the lowest of which is upon the base; interstices having fine, dense, straight growth-lines, sometimes oblique near the suture. Spire much higher than the aperture; outlines straight. Protoconch globular, of one and a half smooth whorls, the first bulbose, of greater diameter than the next few whorls. Whorls about 14, slowly and regularly increasing, flat; base slightly concave. Suture very little impressed. Aperture subquadrangular, produced below into a short and open canal. Outer lip sinuated on the outside; lower lip horizontal, slightly ascending towards the canal. Columella short, nearly straight, bent over and ending in a point below; parietal wall lightly excavated. Diam. 3, height about 13 mm. (no perfect specimen available).

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

47. Seila dissimilis, n.sp. Pl. III, Fig. 47.

Shell minute, subcylindrical, rather thin. Sculpture: the first two whorls are smooth, the succeeding ones having three prominent, unequal, equidistant, and flat cingula, the uppermost narrower, lower, close to the suture; the last whorl has a fourth cingulum towards the base, but quite close to the upper one; indistinct axial riblets and fine growth-striæ are visible in the interstices; the cingula on the third to fifth whorl are faintly nodulous, but those on the later whorls remain smooth. Colour light yellowish-white. Spire high, subcylindrical, much higher than the aperture; outlines straight. Protoconch pauci-spiral, globose, of two smooth and convex whorls. Whorls about 6, regularly increasing, very little convex; base smooth, slightly concave. Suture not deep. Aperture subquadrangular, with a short and open canal below. Outer lip sinuated by the spiral sculpture; basal lip almost straight. Columella subvertical, nearly straight, narrowing to a point below. Diam. ·8, height 2·5 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

48. Triphora Huttoni, n.nov. Pl. III, Fig. 48.

Cerithium (*Ino*) *minimus*, Hutton: Cat. Mar. Moll. N. Zeal., 1873, p. 27.
Triforis Angasi, Crosse: Martens, Errata and Addenda to Cat. Mar. Moll. N. Zeal., 1874, p. 2; Hutton, Journ. de Conch., 1878, p. 26.
Triphoris Angasi, Crosse: Hutton, Man. N. Zeal. Moll., 1880, p. 75; Proc. Linn. Soc. N.S. Wales, vol. ix, p. 936.
Triforis Angasi, Crosse: Index Faunæ Novæ-Zeal., p. 76; not of Crosse.

Shell small, acicular, slightly polished, rather fragile. Sculpture: the first whorl smooth, the next one or two with two keels, succeeding whorls with three, the last with four keels and one upon the base; sometimes the last two to four whorls bear four keels, the lowest of which, however, may be reduced to a suprasutural thread; the axial sculpture is very variable: fine growth-lines in the interstices between the keels, or distinct threads passing over the keels, very often rendering them moderately nodulous. Colour light brown. Spire high, subcylindrical; outlines straight. Protoconch of one broadly convex whorl. Whorls about 11, regularly increasing, almost flat. Suture not much impressed. Aperture broadly oval, vertical, angled above, produced below into a short, slightly recurved, and narrowly open canal, its base not emarginate. Outer lip sharp, sinuated by the spiral sculpture. Columella short, perpendicular, bent off and drawn out to a point upon the inner margin of the canal. Diam. 1·5, height 5·25 mm., one of the types with 11 whorls.

Hab.—Stewart Island, in 30 fathoms, type; Whangaroa Harbour (C. Traill); near the Bounty and Snares Islands, in 50 fathoms (Capt. Bollons).

The specific name *minima* being preoccupied in *Triphora* by Pease, 1870, I change it to *T. Huttoni*. The nearly allied Australian *T. Angasi*, Crosse, has a much more prominent axial sculpture, the cingula are gemmate, and the base has two keels. *T. Kesteveni*, Hedley, from Sydney Harbour, is another nearly related form. Type in the Colonial Museum, Wellington.

49. Triphora fascelina, n.sp. Pl. III, Fig. 49.

Shell small, slender, and narrow. Sculpture: the polygyrate protoconch has the first whorl smooth, the second microscopically finely spirally striate, and the remaining three whorls axially plicated and slightly angled at the periphery; the next seven whorls have two equal keels, but the later whorls have a fine spiral thread intercalated between them; all these keels are crossed by about fifteen axial riblets, the points of intersection raised into rounded gemmules; a fourth suprasutural keel below the periphery of the last whorl, and two upon the base. Colour of protoconch light brown, the other whorls white with a central fulvous spiral band on the lower whorls; base fulvous. Spire high, conical; outlines slightly convex. Protoconch high, of five convex, subangled whorls, the nucleus globose. Whorls about 15, regularly increasing, flattish; base flat. Suture impressed, sometimes lightly margined by the suprasutural keel. Aperture vertical, subquadrate, with a short, straight, and narrowly open canal below, its base slightly emarginate. Outer lip thin, sharp, sinuated by the spiral sculpture. Columella vertical, slightly arcuate, ending in a point upon the inner margin of the canal. Diam. 1·6, height 4·8 mm., shell of 15 whorls.

Hab.—Near the Snares (type) and Bounty Islands, in 50 fathoms (Capt. Bollons).

This species is nearly allied to *T. innotabilis*, Hedley, from Sydney Harbour, which, however, is brown, the gemmules white and more numerous, and the spur of the basal lip crosses the pillar. Type in my collection.

50. Triphora lutea, n.sp. Pl. III, Fig. 50.

Shell small, lightly polished, fragile, slender. Sculpture: the protoconch is smooth, with two keels, the lower of which is much more prominent; the adult whorls have three keels, the uppermost a little narrower, these are crossed by about sixteen axial riblets, with deep and slightly narrower interstices between them; the crossing-points produced into rounded, not very prominent nodules; on the last whorl there is a fourth smooth suprasutural keel and two upon the base. Colour light orange, white towards the apex, old dead shells are dull white. Spire subulate; outlines straight. Protoconch consisting of three whorls, the nucleus pointed and slightly oblique. Whorls about 10, regularly increasing, lightly convex; base moderately convex. Suture deep, sometimes margined by the suprasutural thread. Aperture vertical, ovate, angled above, produced below into a straight, short, and open canal, but faintly emarginate at the base. Outer lip sharp, slightly sinuate. Columella perpendicular, narrowed below to a point. Diam. 1·8, height 5·5 mm., shell of 10 whorls.

Hab.—Near the Snares, type, and Bounty Islands, in 50 fathoms (Capt. Bollons). Type in my collection.

51. Turritella chordata, n.sp. Pl. III, Fig. 51.

Shell small, subulate, moderately solid, spirally lirate, white. Sculpture: the first one and a half whorls are smooth, the next has three, the following four, the fourth five, and all the succeeding whorls six subequidistant, prominent, flatly rounded cords, the suprasutural cord being less distinct; on the last whorl each of the furrows between the cords is provided with a fine thread, and the carina bounding the base bears the suprasutural cord; base with six fine cingula. Colour dirty white (dead shell). Spire high, narrowly conical; outlines lightly convex. Protoconch globose, smooth, and polished. Whorls 8, regularly increasing, convex; base nearly flat. Suture impressed. Aperture vertical, oval, higher than broad. Outer lip sharp, with a broadly rounded, not very deep sinus. Basal lip effuse. Columella vertical, almost straight; inner lip slightly reflexed, spreading over the parietal wall as a thin, white, and shining callus. Diam. 3·7, height 10·8 mm., specimen of 8 whorls.

Hab.—Dredged off Otago Heads (A. Hamilton).

The only specimen I possess has the outer lip damaged; the shell is no doubt not quite full-grown. There is a very nearly allied form, still undescribed, from the Pliocene of Waikopiro in my collection. Type in my collection.

52. Turritella difficilis, n.sp. Pl. III, Fig. 52.

Shell small, elevated conical, rather thin, lower whorls with three cingula, the lowest suprasutural. Sculpture: the first two whorls smooth, the third with a spiral at the periphery and one below it, the next four whorls with four spirals, interspaces subequal, the lowest spiral close to the suture; on the remaining whorls the second, median, spiral is becoming much finer, and at the same time another fine spiral thread appears; very soon they increase to the number of six to eight, filling the interspace between the original first and third prominent spiral; a few spiral threads develop between the suture and the first spiral, and four to five between the suprasutural and the spiral above. The suprasutural spiral forms a sharp keel bounding the base, which is finely spirally striated; growth-lines indistinct, sinuated. Colour yellowish-white (dead shells). Spire high, conical, with straight outlines. Protoconch of two smooth, strongly convex whorls. The number of whorls may be 15 or more; the third and fourth gradate, the following two or three convex, and the rest flat, the interspaces between the spirals concave; base excavated. Suture impressed. Aperture subquadrate. Outer lip sharp, with a moderately deep, median, rounded sinus. Columella vertical, arcuate. Diam. 6, height 16 mm., immature specimen of 10 whorls only. Angle of spire 20°.

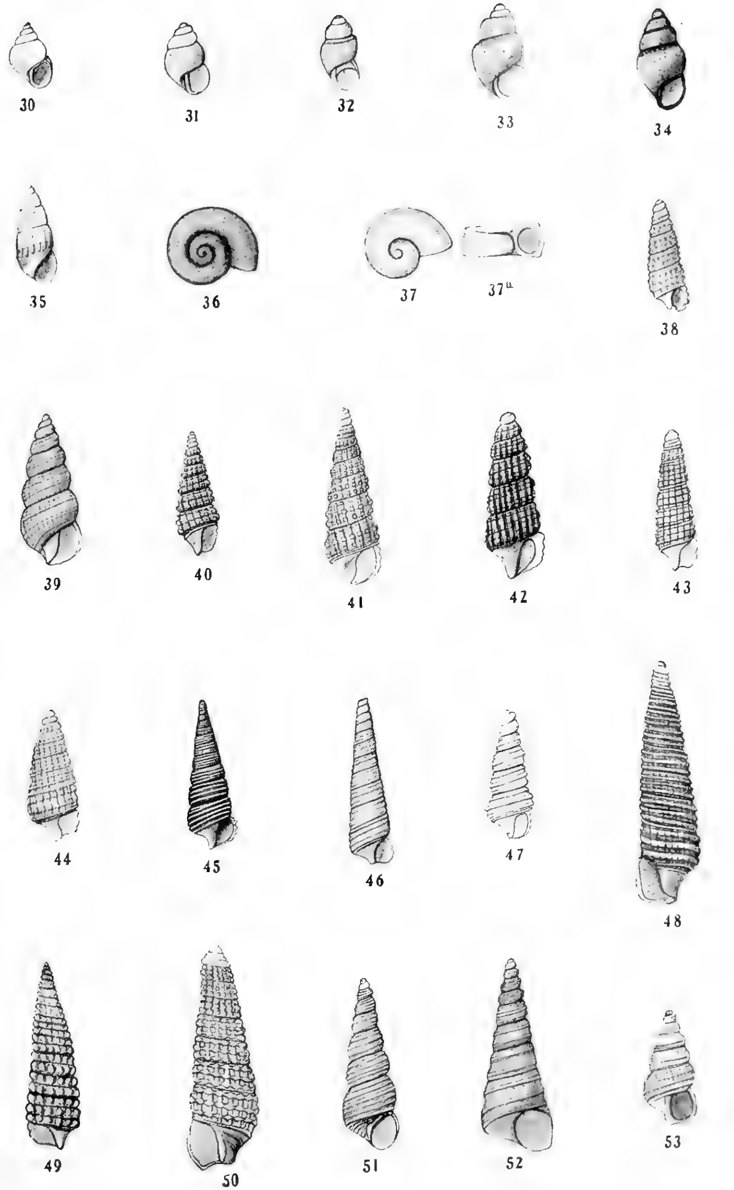
Hab.—Near the Snares Islands, in 50 fathoms (Capt. Bollons).

No perfect specimens.

Miss J. Donald mentions (these Proceedings, vol. iv, p. 50) that in the British Museum, Cuming Collection, there are six specimens of *T. sinuata*, Reeve, and two from New Zealand. I have seen a good many *Turritellæ* from all parts of New Zealand, but I never came across the Australian *T. sinuata*, nor the Tasmanian *T. quadrata*, Donald, either recent or fossil. If the specimens in the British Museum mentioned by Miss Donald are really *T. sinuata*, then the locality stated is most likely wrong. Type in my collection.

53. Mathilda Neozelanica, n.sp. Pl. III, Fig. 53.

Shell minute, turriculate, spirally ridged and radially finely striate, imperforate. Sculpture: the first, embryonic, whorl with four sharp



H. Suter del.

MOLLUSCA FROM NEW ZEALAND.

spirals, the second with a median spiral and one below it, the third with an additional fine spiral thread upon the shoulder, increasing to two on the following whorls; the last whorl with a double keel bounding the base, which is finely spirally striate; the spiral sculpture reticulated by radiate, subequidistant, straight threads, which do not extend upon the base; interstices microscopically reticulated. Colour white. Spire elevated conic, much higher than the aperture, apex blunt, outlines straight. Protoconch with the smooth nucleus almost completely immersed in the spire. Whorls $5\frac{1}{2}$, regularly increasing, the upper whorls distinctly shouldered, the last more convex; base flat. Suture impressed. Aperture rotund, vertical, effuse at the base towards the columella. Outer lips simple, dentate by the sculpture. Columella vertical, slightly arcuate, rounded, very little expanded. Diam. 1·2, height 2·5 mm.

Hab.—Hauraki Gulf (H. S.).

The Australian *M. decorata*, Hedley (Mem. Austr. Mus., vol. iv, part 6, p. 352, fig. 75), is an allied species, though larger and having a different protoconch. Type in my collection.

EXPLANATION OF PLATES II AND III.

Plate II.

Fig. 1. *Monilea semireticulata*, n.sp. 5 × 3·2 mm.
Figs. 2, 3. *Liotia solitaria*, n.sp. 2·75 × 1 mm.
,, 4, 5. *L. serrata*, n.sp. 2·5 × 1 mm. (Fig. 4 young, Fig. 5 adult shell.)
Fig. 6. *L. rotula*, n.sp. 1·7 × 1 mm.
Figs. 7–9. *Cyclostrema eumorpha*, n.sp. 1·7 × 1·3 mm.
,, 10, 11. *C. lissum*, n.sp. 1 × ·6 mm.
Fig. 12. *Cyclostremella Neozelanica*, n.sp. 2 × ·7 mm.
,, 13. *Cirsonella densilirata*, n.sp. 2·25 × 1·75 mm.
,, 14. *Pseudoliotia imperforata*, n.sp. 3·5 × 3·5 mm.
Figs. 15, 16. *Cocculina craticulata*, n.sp. 2·8 × 1·8 × 1·2 mm.
,, 17, 18. *C. compressa*, n.sp. 5 × 2 × 2·8 mm.
,, 19, 20. *C. clypidellæformis*, n.sp. 2·8 × 2·5 × 2·2 mm.
Fig. 21. *Rissoa rufoapicata*, n.sp. 1·9 × 4 mm.
,, 22. *R. exserta*, n.sp. 1·3 × 2·2 mm.
,, 23. *R. foliata*, n.sp. ·8 × 2 mm.
,, 24. *Rissoina lubrica*, Suter. ·8 × 1·7 mm.
,, 25. *Rissoa lampra*, n.sp. ·8 × 1·5 mm.
,, 26. *R. roseocincta*, n.sp. ·9 × 1·6 mm.
,, 27. *R. atomus*, n.sp. 1 × 1·25 mm.
,, 28. *R. verecunda*, n.sp. 1·25 × 2 mm.
,, 29. *R. porcellana*, n.sp. 1·3 × 1·8 mm.

Plate III.

Fig. 30. *R. Stewartiana*, n.sp. 1·25 × 1·9 mm.
,, 31. *R. infecta*, n.sp. 1·1 × 1·6 mm.
,, 32. *Scrobs Hedleyi*, n.sp. ·7 × 1·2 mm.
,, 33. *Anabathron gradatum*, n.sp. 1·6 × 2·25 mm.
,, 34. *Rissoina fuscozona*, n.sp. 1·7 × 2·8 mm.
,, 35. *R. rufolactea*, n.sp. 1·5 × 3·3 mm.
,, 36. *Omalogyra fusca*, n.sp. 1 × ·3 mm.
Figs. 37, 37*a*. *O. bicarinata*, n.sp. 1·5 × ·5 mm.
Fig. 38. *Bittium retiferum*, n.sp. 1 × 3·2 mm.
,, 39. *B. vitreum*, n.sp. 1·8 × 4·2 mm.

FIG. 40. *Cerithiopsis acies*, n.sp. 1·1 × 3·5 mm.
,, 41. *C. subantarctica*, n.sp. 1·5 × 4·8 mm.
,, 42. *C. canaliculata*, n sp. 1·6 × 5 mm.
,, 43. *C. styliformis*, n.sp. 1·1 × 3·7 mm.
,, 44. *C. marginata*, n.sp. 1 × 2·7 mm.
,, 45. *Seila Chathamensis*, n.sp. 3·2 × 10 mm.
,, 46. *S. bulbosa*, n.sp. 3 × 13 mm.
,, 47. *S. dissimilis*, n.sp. ·8 × 2·5 mm.
,, 48. *Triphora Huttoni*, n.nov. 1·5 × 5·25 mm.
,, 49. *T. fascelina*, n.sp. 1·6 × 4·8 mm.
,, 50. *T. lutea*, n.sp. 1·8 × 5·5 mm.
,, 51. *Turritella chordata*, n.sp. 3·7 × 10·8 mm.
,, 52. *T. difficilis*, n.sp. 6 × 16 mm.
,, 53. *Mathilda Neozelanica*, n.sp. 1·2 × 2·5 mm.

A LIST OF SPECIES OF SHELLS DESCRIBED BY DR. GRATELOUP, WITH CRITICAL NOTES.

By Hugh C. Fulton.

Read 10*th January*, 1907.

The species here listed formed part of the collection of the late Dr. J. P. S. de Grateloup, of Bordeaux. It has recently been broken up, and the types of the species enumerated are now in the British Museum. They were described by Dr. Grateloup in the Actes de la Soc. Linn. de Bordeaux, vol. xi (1839), pp. 389–455, but unfortunately about a dozen of the species there described could not be found.

The plates illustrating Dr. Grateloup's paper are badly drawn, some of the figures being more or less misleading; the localities given in the text are not all correct, and some are known to be quite erroneous.

The type-specimens were in card trays with labels giving the localities and references to the plates and figures.

I am indebted to Mr. Edgar Smith for friendly co-operation in making comparisons with some of these types.

Pyrula Bengalina. Mr. E. A. Smith has already read a note upon this shell (see p. 3).

Scalaria clementina.

Melania Madagascariensis.

M. Riquetii.

Helix Bombayana. (*Xestina.*)

H. alauda, var. *bizonalis.* (*Cepolis.*)

H. chlorozona. (*Ampelita.*)

H. depicta. I take this to be a young specimen of *Cepolis* (*Coryda*) *alauda*, var. *hebe*, Dohrn.

H. fuscolutea. A *Xesta*, like a miniature *X. Crespignyi*, Higg., but quite distinct from that species.

H. monodonta. *Cepolis* (*Plagioptycha*).

H. oviformis. A dead and worn specimen of *Helicophanta Goudotiana*, Fér., quite distinct from *Helicophanta oomorpha*, Mabille (= *oviformis*, var. *phenax*, Pils.), with which it has often been confounded.

H. polychroa, var. *picturata.* (*Cochlostyla.*)

H. porcellana. A worn and damaged specimen with peristomal callosities similar to *Cepolis*, but with the general form and smoothness of *Planispira.* In Martens, Preuss. Exped. Ost-Asien, Zool., vol. ii, p. 302, it is said to have been found at Lombok Island; if so, it should be placed in the section *Vulnus* of *Planispira* proposed by E. R. Sykes, Journ. of Malac., vol. xi (1904), p. 88.

H. pseudoparilis. As suggested by Pfeiffer, a young and edentate *Pleurodonta* (*Caprinus*) *parilis*, Fér.

H. rufescens. *Hemiplecta Grateloupi*, Pfr. (= *rufescens*, Grat., *non* Penn.). This species is allied to *ambrachys* and *eos* of Dohrn from Madagascar, and not to *Xesta* (*Eurypus*) *Pfeifferi*, Phil., as suggested by Pfeiffer.

H. trizonalis. This is the shell figured and described by Dr. Pilsbry in Tryon's "Manual of Conchology," vol. v, p. 94, pl. xlix, figs. 65–67, as *Cepolis trizonalis*, var. *trizonella*; although closely allied, it is quite distinct from the *trizonalis* of various authors, which species I propose to name *Cepolis definita.* Grateloup's figure makes the shell appear globose, instead of depressed-globose.

Caracolla smaragdina. Is a young specimen of *Corasia reginæ*, Brod.

C. Terveriana. A rather small specimen of *Ampelita lancula*, Fér.

Partula Bataviæ. Professor von Martens suggested (Preuss. Exped. Ost-Asien, Zool., vol. ii, p. 398) that this was perhaps *Amphidromus sinistralis*; after careful examination I believe it to be a small specimen of *Amphidromus Adamsi*, var. *rubiginosa*, Fult. The locality given by Grateloup, viz. Java, is probably incorrect.

Bulimus magnificus. Strophocheilus (*Thaumastus*) *magnificus.*

Achatina kercadonis. (*Perideris.*)

A. Leaiana. Is *Pseudachatina Downesi*, Gray.

Clausilia Laterradii. Grateloup's figure of this shell is not good; the peristome should be more in line with the spire, as in Pilsbry's figure of *Brachypodella* (*Strophina*) *Laterradii*, var. *strophina*, Pils. (Tryon's Manual of Conch., vol. xvi, p. 56, pl. viii, figs. 59, 60), which is a seven-whorled specimen of *Laterradii.* In the British Museum there are three specimens from the Cuming Collection, having 7, 8, and 9 whorls respectively; they are from Beate Island, San Domingo (Capt. Suensen). The type-specimen has nearly 10 whorls, with coarse, rather widely spaced oblique ribs; its form is somewhat cylindrical, narrowing slightly from the fourth to the last whorl.

Cyclostoma Abeillei.

C. Arthurii. Is *C. pulchrum*, Gray.

C. Arthurii, var. *albida.* A dead and bleached *C. pulchrum*, Gray.

C. Duisabonis. = *C. unicarinatum*, Lamk., var.

C. hæmastoma.

C. helicoides. (*Leptopoma.*)

C. ligatula.

C. Michaudii.

C. Moulinsii. The type is a young specimen, which accounts for "labro acutissimo" in the original description.

C. multifasciata.

C. philippi. Is *C. hæmastoma.*

C. punctata. (*Cyclophorus.*)

C. spurca. This is, in my opinion, a bleached specimen of *Neocyclotus translucidus*, Sow. Grateloup's locality, Bombay, is certainly wrong.

C. Terveriana. Is *C. articulatum*, Gray.

C. zebra. Judging by a specimen in the Grateloup Collection labelled *C. zebra* (not the type), it is *Cyclophorus tigrinus*, Sow.

Helicina citrina.

Moulinsia Nunezii. Is *M. grandis*, Gray.

PROPOSED NEW NAME FOR *CEPOLIS TRIZONALIS*, AUCT., NON GRAT.

By Hugh C. Fulton.

Read 10*th January*, 1908.

Cepolis definita, n.n.

Helix trizonalis, Pfr., *non* Grateloup: Conchyl. Cab., *Helix*, Theil ii, p. 474, pl. clviii, figs. 12–15.
H. trizonalis, Rve, *non* Grat.: Conch. Icon., vol. vii, figs. 592*a*, *b*.
H. (*Cepolis*) *trizonalis*, Pils.: Man. of Conch., vol. v, p. 93, pl. xlix, figs. 68–70.

This well-known shell, which has been described and figured several times as *H. trizonalis*, Grat., and occurs in most collections under that name, bears in coloration and general form a close likeness to that species, but can easily be distinguished from it by its larger size and much finer sculpture. The oblique striæ are scarcely seen without a lens, whereas in *trizonalis* they are coarse and conspicuous. The terminations of the peristome of *definita* are connected by a very thin callus, whilst in *trizonalis* it is thick and prominent.

I take as the type of *definita* the shell in the British Museum (Cuming Coll.) figured in Reeve's "Conchologia Iconica."

NOTES ON *PLANORBIS VORTICULUS*, TROSCHEL, AND *PL. LÆVIS*, ALDER; ALSO ON SOME PROPOSED SUBDIVISIONS OF THE GENUS.

By A. S. Kennard, F.G.S.

Read 10th January, 1908.

1. Planorbis vorticulus, Troschel.

The occurrence of this species in the Pleistocene of England was first noted in 1905,[1] when it was recorded from Grays, Swanscomb, and West Wittering. I am now able to record it from the Cromerian (Forest Bed) of West Runton, Norfolk, the Holocene of Knettishall, Suffolk, and in a recent state from Pevensey, Sussex. From the Cromerian it is represented by a single example in the collection of Mr. B. B. Woodward, and the specimens from the Holocene of Knettishall, Suffolk, were obtained from material sent by Mr. A. Mayfield, whilst the recent examples were collected a few years ago by the late P. Rufford. It may be worthy of record that when this species was first noted in the Pleistocene of Swanscomb Dr. A. C. Johansen told me that he quite expected this species to be found living in England, since on the Continent it was a rare form and was easily overlooked, and I think that this explanation is the correct one. In a fossil state it is perhaps not so likely to be passed over, but living examples might easily be mistaken for immature *P. vortex*. Now that attention has been called to the form there is very little doubt that it will be found in several of the eastern and south-eastern counties of England.

2. Planorbis lævis, Alder.

There has always been a divergence of opinion as to the correct name of the shell which has been known in succession as *Planorbis lævis*, Alder, *P. glaber*, Jeff., and *P. parvus*, Say. It was first noticed in this country in 1832, and was described by Alder in 1838 as *P. lævis*,[2] and this name continued in use until the publication of Jeffreys' "British Conchology," when it was identified with the previously described *P. glaber*, Jeff. Since Jeffreys' work was accepted as the standard authority, *glaber* displaced *lævis* until the last few years, when the form has been identified with the North American species *P. parvus*, Say. The last use of *lævis* in this country that I can trace was in 1899 by Lieut.-Colonel H. H. Godwin-Austen.[3] *P. glaber* was described by Jeffreys in 1833.[4]

He states: "Found with the last [*P. albus*], though much less common. It is a much more depressed shell than the *P. albus*, of

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[1] A. S. Kennard & B. B. Woodward, Proc. Malac. Soc., vol. vi (1905), pp. 356–7.
[2] Trans. Nat. Hist. Soc. Northumb., 1838, p. 337.
[3] Proc. Malac. Soc., vol. iii (1899), p. 260.
[4] Trans. Linn. Soc., vol. xvi, pp. 387–8.

a white colour, more polished and transparent, and is destitute of any markings. The upper side is uniformly more even, and the under exceedingly concave." It will at once be noticed that this description does not quite agree with *P. lævis*, for that species is never found with *P. albus*, and it is not white.

Moreover, examples of *P. glaber* sent by Jeffreys to Alder are stated by the latter to be only a variety of *P. albus*,[1] and it was considered as such by J. E. Gray and Forbes & Hanley. That *P. glaber*, Jeff., of "British Conchology" is *P. lævis*, Alder, there can be no doubt, but it appears to me that the *P. glaber*, Jeff., of the Linn. Trans. is only a variety of *P. albus*.

Under these circumstances and in justice to the memory of one of our most competent malacologists, it is advisable to relegate *glaber*, Jeff., to the synonymy of *albus*, Müll., and to revive the use of *lævis*, Alder.

The question, however, whether we should use *parvus*, Say, is another matter.

There are in the Holarctic region several described species which conchologically have considerable resemblance to each other. These include *lævis*, Alder, *parvus*, Say, *arcticus*, Beck, *Sibiricus*, Dunker, *Rondeli*, Bourg., *vermicularis*, Gould, and *Rossmaesslerii*, Auers. Practically nothing is known of the anatomy of these forms, and it is quite impossible to state whether these are geographical races of one species, or whether we are dealing with genuine species with a superficial likeness. In any case, it is better to retain the specific name *lævis*, for though similar to the American *parvus* it is not identical.

It is, I think, worthy of note that both the Palæarctic and Nearctic regions possess a group of three species in the *Gyraulus* group. In North America we have *P. hirsutus*, Gould, *P. deflectus*, Say, and *P. parvus*, Say, and in Europe there are *P. albus*, Müll., *P. Stroemii*, West., and *P. lævis*, Alder, and there is great similarity between the species in the order given. This may be a mere coincidence, but it is possible that it may be a phenomenon in the evolution of species.

3. On some proposed Subdivisions of the Genus.

Dr. W. H. Dall has recently elaborated a new scheme of classification for *Planorbis* with some new subdivisions,[2] and there are two proposed new sections which, in my opinion, are open to criticism. Dr. Dall's divisions are as follows[3]:—

Section *Diplodiscus*, Westerlund (restricted).

Shell small, with numerous slowly enlarging whorls, keeled or angulate from the beginning. Type, *P. vortex*, Linn.

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[1] Mag. Zool. Bot., vol. ii (1837), pp. 113–14.
[2] Dr. W. H. Dall, Land and Freshwater Mollusca of Alaska; New York, 1905.
[3] Op. cit., pp. 85–6.

Section *Paraspira*, Dall, nov. sect.

Shell resembling *Diplodiscus*, but with the whorls rounded throughout and the aperture simple, hardly expanded. Type, *P. rotundatus*, Poiret.

It may be noted that in order to use *Diplodiscus*, Westerlund, Dr. Dall has a wholesome disregard for the rules of nomenclature, which is indeed noteworthy after the priority purist view that he has taken with regard to *Euconulus fulvus*, Müll. Dr. Dall is unfortunate in his choice of a type species for his proposed section *Paraspira*, for it is now quite impossible to say what Poiret's species was.

It is sometimes applied to *P. leucostoma*, Millet, a form which is so closely allied to *P. spirorbis*, Müll., that it is considered by some authorities to be only a variety of that species, but this form sometimes possesses, if not a keel, certainly an angulation. Taking, however, the description of the section, the species which answers best to the description is *P. spirorbis*, Müll., but in any case the only character that separates the two sections is that *Diplodiscus* possesses a keel and *Paraspira* does not.

But this is not even a specific distinction in *Planorbis*, for it is an inconstant character in *P. albus*, and cannot be considered sectional even if we have a classification of only one species to each section. A classification which, purely on conchological grounds, places *P. spirorbis*, Müll., in one section, and *P. vortex*, Linn., in another, appears to me to be over-elaborate.

With regard to another proposed section, *Torquis*, and the subgenus *Gyraulus*, Agassiz, there is a little confusion. Dr. Dall defines them as follows:—

Subgenus *Gyraulus*, Agassiz.

Shell small, flattish, with few, rapidly increasing whorls, fully exposed above and below with a nearly median periphery, spirally striate and hispid; aperture simple, sharp-edged, oblique. Type, *Planorbis albus*, Müll.

Section *Torquis*, Dall, nov. sect.

Like *Gyraulus*, s.s., but with more rounded, less rapidly increasing whorls, not hispid or spirally striate, the aperture expanded and slightly thickened in the adult. Type, *P. parvus*, Say.

The differences between the subgenus *Gyraulus* and the section *Torquis* are so slight that they cannot be considered sectional. The only real criterion is the presence or absence of spiral striæ, and since as a rule these can only be detected by the aid of a lens, I venture to think that here again an unnecessary section has been created, and the synonymy has been added to. Even Dr. Dall himself is not clear as to the limits of this new section, for in the account of "*Planorbis* (*Torquis*) *Nathorsti*, Westerlund," he states that it has spiral striation, whilst in his definition of the section *Torquis* he expressly states that it is not spirally striate. Moreover, he is of opinion that this species is intermediate between *parvus* and *arcticus*, though how a species which is spirally striate can be intermediate between two others neither of which possesses this character is more than I can understand. Dr. Dall also throws doubt on the specific name of *Planorbis albus*, Müller. He says with reference to *Planorbis hirsutus*, Gould,[1] "The identity of our American species with the so-called *P. albus*, Müll., of Europe, I do not doubt, but whether the name *albus* is the proper one to use for the latter is open to question, and on the present occasion I prefer to use a name about whose application no doubt can exist."

With regard to the above statement, Dr. A. C. Johansen informed me that Müller's types are undoubtedly the species which is always called by the name *albus*.

It is possible, however, that Dr. Dall refers to the claim that has been put forward that *P. spirorbis*, Linn., should be used instead of *P. albus*, Müll., but any attempt to transfer a well-established name such as *spirorbis* from the species to which it has been applied for over one hundred years to another common species should, I think, be resisted by all students, for endless confusion would result. Whether *P. albus*, Müll., and *P. hirsutus*, Gould, should be considered one species is an old and vexed question. Personally I am convinced they are distinct, and this opinion is, I believe, shared by many competent malacologists.

I must tender my best thanks to Dr. A. C. Johansen, Messrs. Bryant Walker and A. Mayfield, and Dr. E. Wüst for kind assistance.

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[1] Op. cit., p. 94.

ON *VITREA SCHARFFI*, n.sp.

By A. S. Kennard, F.G.S.

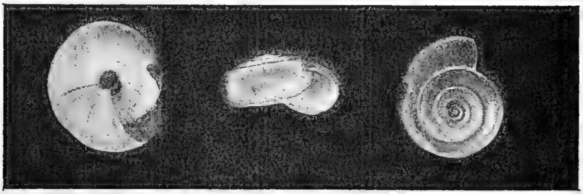
Read 10*th January*, 1908.

Last year Mr. A. W. Stelfox kindly sent me a large series of *Vitreas*, which he had collected in the south-west of Ireland. Besides a number of *V. hibernica*, Kennard, there were a few examples which he had noted as being unknown to him. After a careful comparison I failed to identify them with any recorded British species, and attention was called to them in the report on the Cork Conference of the Irish Field Clubs.[1] In those genera such as *Vitrea*, *Vitrina*, and *Succinea*, where the shell is in a more or less degenerate condition, it is, I think, advisable that new species should be founded if possible on anatomical evidence, and for this reason I refrained from adding another species to the British list, preferring to wait till an opportunity occurred of examining the animal. It was therefore a matter of congratulation when Mr. R. A. Phillips forwarded me several living specimens of this form which he had collected at Kilrush, co. Clare.

These examples were at once sent to the Rev. E. W. Bowell, and after a careful examination of their anatomy he concurred in pronouncing them as distinct from any known British form. I therefore propose to dedicate it to Dr. R. F. Scharff, who has done so much to promote the study of Natural Science in Ireland.

Vitrea Scharffi, n.sp.

Shell convex above and beneath, very glossy, light fulvous horn-colour above, opaque white beneath, with irregular curved striæ parallel with the mouth. Whorls $5\frac{1}{2}$, body-whorl about half the size of the shell; suture shallow; umbilicus narrow and deep. Alt. 6, diam. 12 mm.



The type from Cloughjordan, co. Tipperary, N. Ireland, is in my own collection. An account of the anatomy of this form will be given by the Rev. E. W. Bowell. It is of course possible that it may be identical with one of the numerous species of *Vitrea* which have been described

[1] Irish Naturalist, vol. xvi (1907), pp. 278 and 288.

from France and Spain, but I have been unable to identify it. It has been suggested that it is *V. subglabra*, Bourg., but judging from the original description and figure this is a synonym for *V. lucida*, Drap., an opinion which has already been expressed by Mr. J. W. Taylor.[1] Up to the present I have noted this species from Grange, Lancaster, and Seathwaite, Broughton-in-Furness, Lancashire; near Stromness, Orkney, Scotland; and in Ireland from Cloughjordan, Borrisokane, and Nenagh, co. Tipperary, N.; Kilrush, co. Clare; Morru, co. Down; Bantry, co. Cork; Birr, Kings Co.; near Ross, co. Galway, W.; Loughrea, co. Galway, E.; Salthill, co. Galway, W.; Knocknarea Glen, co. Sligo; Ballinspittal, co. Cork, W.; Youghal, co. Cork, E.; Carrigrohane, co. Cork, Mid; Donegal Priory Lough Gill, co. Sligo; and Youghal, co. Waterford.

There is but little difficulty in distinguishing *V. Scharffi*, for its colour is very striking and quite sufficient to separate it from either *V. lucida*, *V. cellaria*, or *V. hibernica*. Compared with *V. cellaria* it is larger, more robust, and with a much smaller umbilicus, whilst it may readily be distinguished from *V. lucida* by the last whorl being not so expanded, and from *V. hibernica* by the smaller umbilicus and its far more polished surface.

It is interesting to note the various names which have been applied to this species. The Grange examples have always been known as *cellaria*, whilst in all probability all the Irish records of *V. helvetica*, Blum., and *V. glabra*, Studer, really refer to this species.

In the *Irish Naturalist*, vol. iii (1894), pp. 45–6, it is stated that "specimens of a *Vitrea* [*Hyalinia*] found at Whitegate, co. Cork, and Bantry, were submitted to Dr. O. Boettger of Frankfort, and Dr. Westerlund, both of whom agree, as also does the original describer, in pronouncing it to be *V. helvetica*, Blum." I have seen some of the shells referred to, and they include both *V. hibernica* and *V. Scharffi*.

It cannot be too strongly emphasized that many of the records of *Vitreas* are inaccurate and misleading. Until a few years ago a large *Vitrea* was always called *cellaria*, Müll., by English and American students, and there is no doubt that many of the records of *cellaria* refer to *V. lucida*, *V. hibernica*, or *V. Scharffi*. Judging from its known distribution, *V. Scharffi* is a Western species, and may possibly occur in Western Europe.

In conclusion, I must tender my best thanks to those gentlemen who have so kindly assisted me, and without whose help this paper could not have been written. Mr. A. W. Stelfox, Mr. R. Welch, Mr. R. B. Lucas, and Dr. R. F. Scharff forwarded series of Irish shells, Mr. R. A. Phillips sent a large number of living examples from Ireland, Mr. J. Davy Dean a number of shells from Lancashire, and Mr. J. Wilfrid Jackson a fine series from Grange, with a number of the animals preserved in spirit.

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[1] J. W. Taylor, Monograph of the L. & F.W. Moll. of the British Isles, part xiv, p. 19.

ON THE ANATOMY OF *VITREA SCHARFFI.*

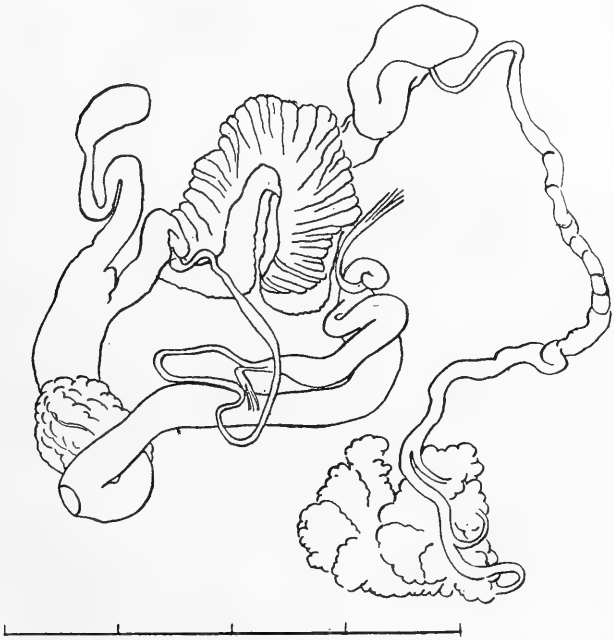
By Rev. E. W. Bowell, M.A.

Read 10*th January*, 1908.

Some ten or eleven years ago Dr. Boycott drew my attention to the existence, at Hereford, of a form of *Vitrea* having a radula like that of *V. cellaria*, but a shell answering to the description of *V. nitidula*, var. *nitens* (in particular). The preparations were kept, and they undoubtedly belong to the species Mr. Kennard has just described. I have also found examples in my Hereford material collected before that time; and it has also occurred in the material taken by me in the Ross-on-Wye district this last summer. The shell certainly bears a strong superficial resemblance to that of *nitidula*, though the resemblance no doubt seemed greater in the days when one took it for granted that all common *Vitreæ* must be either *cellaria* or *nitidula*. It is not such a resemblance as would deceive the practised eye of Mr. Kennard, but it may account for some of the mistakes which are often made when large numbers of *Vitreæ* have to be sorted. The nicely cleaned cabinet specimen exhibits it less markedly than the living animal, because the combination of colours of skin and shell assists the 'make-up.' The prevailing tint of the animal of *Scharffi* is, however, a dull brown; it is generally more or less flecked with black, but in small patches not forming a pattern or lines.

Mr. Kennard has sent me a number of specimens from the localities he has mentioned, and I have many others yet to be examined. I have, however, gone carefully through the original consignment, and taken samples of the rest. The drawings here given are all from the same specimen—one of the original ones; but the description is equally based on 17 other careful dissections and 22 conducted more hastily. It is now my practice to examine with a 26 mm. objective the texture of all shells that may be called "doubtful *nitidula*": if they present the regular series of parallel concentric striæ which characterises that species, I find it is pretty safe to assume that they are *nitidula*; if not, they are put on one side for further examination, and generally turn out to be *Scharffi*.

Reproductive System (Fig. 1). The ovotestis, in several specimens in which it was minutely examined, had five ducts; in one four only could be found. The acini form a voluminous mass in the specimen figured; further (histological) details will be embodied in a special paper. The hermaphrodite duct is exceptionally long and wide, and but little convoluted, but appears to be provided at several points of its course with valves, originating from a kind of intussusception. The albumen gland is slug-shaped, and the duct joins it in a deep trifid groove at a point above the middle. The epididymis has two and a half complete turns between the albumen gland and the entry of the vas deferens. In specimens which have the oviducal portion distended the epididymis forms a compact suboval organ, but the number of turns does not seem to be increased. The vagina is long, and divides into two branches above, one being bent upon itself and going to join the oviduct, while the other forms an S-shaped duct for the spermatheca. Judging by the tissue composition of these branches they should be regarded as parts of the vagina proper. There is a small eminence between their roots which may be the vestige of a diverticulum. The spermatheca is spoon-shaped, but the flattened side, which normally is attached to the middle of the epididymis, is thinner and softer than the convex outer surface; and this flattened side is occasionally found distended, causing the spermatheca to



Scale of millimetres.

FIG. 1.

assume a more globular form. The vagina is joined to the atrium by a semicircular duct, provided with an oval glandular jacket. The atrium or common duct itself is very short. The lower parts of both male and female organs are in addition enclosed in a loose reticulum of connective tissue, which in some specimens assumes the appearance of a bag, similar to that which is found in the same place in *Vitrina*, though not so well marked. The penis is remarkably long and has two flexures; the part between the flexures is the penis proper. The vas deferens joins the male organ not far from the upper end; a stout muscle is attached to this upper end, which is coiled and has a termination suggestive of a rudimentary flagellum. The superior dilatation of the vas deferens is unusually large, and presents a sigmoid flexure; a large muscle rises from its lower end.

There is variation in the degree of slenderness or tumidity of the different parts of this apparatus, but the remarkable flexures of the spermathecal duct, vas deferens, and lowest part of the vagina appear to be always present. I think that care should be taken to study these organs in fixed specimens, unless the object is only to make a rapid diagnosis. The use of acid alcohol facilitates the proper separation of the parts.

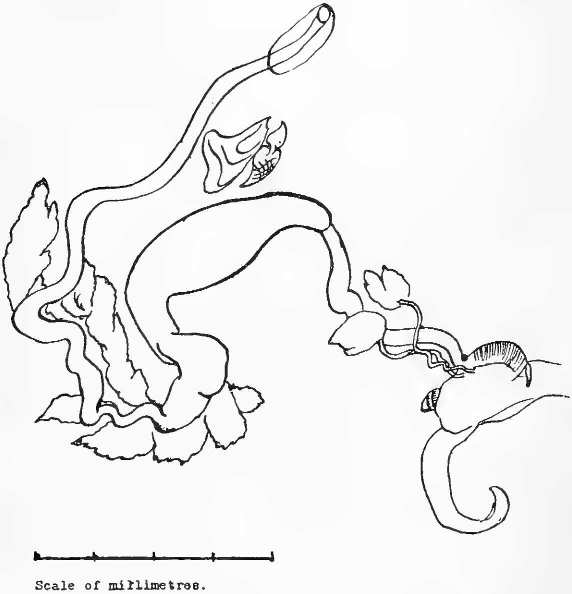


Fig. 2.

The general arrangement of the digestive tract is shown in Fig. 2. The buccal mass resembles that of *V. hibernica*, but is usually more oblongate. The ducts of the salivary glands are long and twisted. The large muscle terminating in the maxilla has a sheath marked with regular transverse striations. Its mode of attachment to the maxilla is somewhat complicated; this organ is shown in Fig. 3. It consists of one-half of a sphincter oris muscle chitinised in two layers. Round this lies a thin margin of chitin which is morphologically continuous with the preoral folds of the epidermis, in which incipient chitinisation may sometimes be seen, though not so clearly as in some species (e.g. in *Agriolimax agrestis*). The actual 'beak' of the mandible is not very prominent; it appears to originate by chitinisation of the fibrous ends of the muscle. The short elasma is connected with the sheath of this same muscle. In Fig. 3, A represents the maxilla seen from the back; the W-shaped portion shaded darker, which projects considerably, is the attachment of the muscle. B shows the appearance of the organ as viewed from below; the semicircular foundation is seen through the transparent 'beak.' C shows the maxilla in the aspect in which it is usually figured. It is right to point out that few drawings give any idea of the complexity of this remarkable organ. In the present species it consists of four distinct elements, and in the large Helices there are five. It is possible to separate these by carefully treating with sodium hypochlorite. It can then be seen that the odontognath mandible conceals a leiognath or oxygnath one. Calcareous granules are usually to be noticed (unfortunately for microtome knives) in the tissues round the chitin-forming parts, and seem to be in some way concerned with the process, which may be of a degenerative character. I shall be very glad to hear from anyone who is making a study of the chemistry of chitin and the histological processes involved in its deposition.

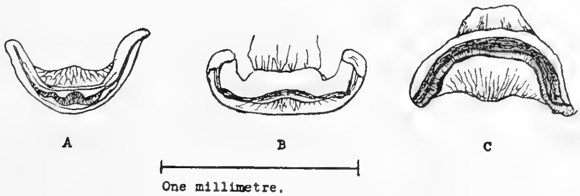


Fig. 3.

Though the glands which discharge into the buccal cavity are called salivary glands, the nature of their secretion does not appear to be accurately known. The large organ in the centre of Fig. 2 (the 'crop') is also provided with glands (not shown). Only a part of the pyloric glandular apparatus is shown in the figure. The nephridium is subtriangular; it has the curious property of staining with borax carmine much more readily than the other tissues. This and the heart are shown here merely to indicate their general position.

Fig. 4 shows the radula, which is probably sufficient for identifying the species. The noticeable points about it are: (*a*) the small number of marginals; 7 or 8 as against the 10 or 12 usually found in the species of this group. Juvenile specimens of *cellaria* might have only 7 or 8, but their centrals and laterals are of an easily recognisable type. (*b*) The shortness of the cusps, in consequence of which the rows hardly overlap at all. (*c*) The transitional or third lateral is only distinguished from the marginals by a very slight bicuspidation. The central teeth resemble those of *V. hibernica*, and the general configuration of the basal plates is also similar. The radular variation, that I have seen took the form of accessory endocones to central tooth; central and first lateral fused; second lateral with bifid endocones. In two specimens the marginals were much shorter than those figured, and lay huddled together much after the fashion of those of the genuine *nitidula.*

In conclusion, I believe that the great variation in genitalia and radulæ which has been observed within the limits of certain species is due largely to the fact that the species hitherto recognised have been composite. But, if I may borrow a phrase now consecrated by

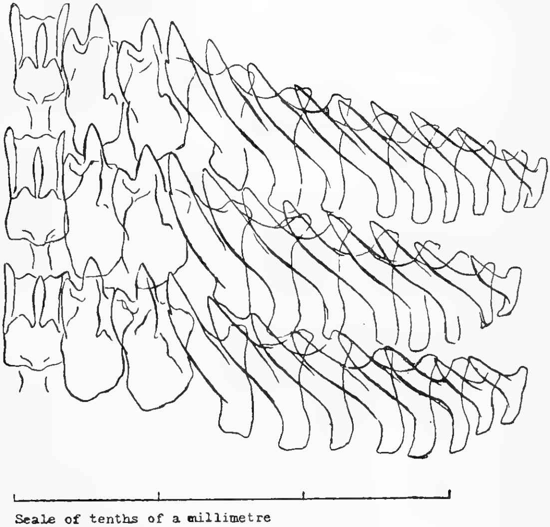


Fig. 4.

official usage, there is such a thing as non-significant variation. Some instances of it have been noted above: but it is only by obtaining a more complete knowledge of the physiology of the snail that we can hope to settle definitely what variations come under this head. One other thing: the *Vitrea* radula has larger teeth than that of any other group except *Testacella*; but to see even *Vitrea* properly a really high power is needed.

ON THE RADULÆ OF *VITREA HELVETICA*, BLUM., AND THE ALLIED SPECIES.

By Rev. E. W. Bowell, M.A.

Read 10*th January*, 1908.

The radula of *V. helvetica*, Blum. (Fig. 2), is a very characteristic organ, and by it the species may be distinguished from other *Vitreæ*, so far as my own investigations have gone. The central tooth is small, and its basal plate remarkably quadrate; central cusp long, with sides

Fig 1

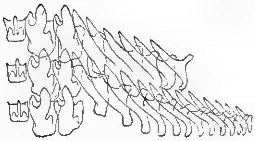


Fig 2

Fig 3

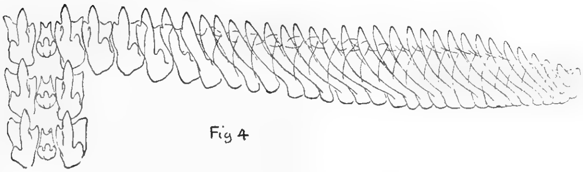


Fig 4

Each division of the scale represents ten micra.

nearly parallel. There are but two well-developed laterals (admedians), and these are also remarkable for the squared character of their basal plates. Their mesocone and endocone together are of a compactly rounded shape, somewhat suggestive of the appearance of a half-closed fist; the ectocone is closer than usual to the mesocone, on account of the abbreviated shape of the whole tooth. The tooth which follows may be regarded as transitional or first marginal with equal propriety; it is furnished with a very slight prominence marking the place of an endocone. There are 13 to 16 marginals, closely set, with very curved basal plates; their cusps are of average length, and do not overlap the next row to any great extent.

The specimen here figured was extracted by me from one of the original specimens from Solothurn, now in Mr. Kennard's collection. My warmest thanks are due to him for permitting the somewhat risky operation of extraction to be performed on so valuable a specimen. The proximal parts of the genitalia, showing an extremely short vas deferens, commencing two-thirds of the way down the sheath of the male organ, and a shoe-shaped spermatheca with a short, stout, and twisted duct, are shown at Fig. 5 of the accompanying illustrations.

Mr. B. B. Woodward, with his invariable kindness, has permitted me to make a careful examination of the specimen (radula) of *V. helvetica* which he described in 1903, when he showed that the English specimens referred to *helvetica* could not well be that species, and therefore gave them the name of *Rogersi*, in honour of the original British discoverer. It has been remarked by several students of the group that the specimen figured by Woodward seemed to be abnormal, in respect of possessing a first admedian without separated endocone. That was the conclusion I myself had formed from an examination of the figure. When Mr. Woodward first showed me the specimen, some months ago, I had to admit that the peculiarity occurred with such regularity, on both sides of the radula, that it might be a normal feature. On that occasion it was examined with a Zeiss D objective. After that came the preparation of the companion radula, from the shell in Mr. Kennard's collection; and this is very markedly normal; i.e., it has the type of admedian to which we are accustomed in this group of *Vitreæ*. I then made a number of preparations of *Vitreæ*, fixing the radula together with its natural investments, taking particular care not to remove the cells which coat the upper surface of the unused part, but to fix them with as little shrinkage as possible. These preparations show that the rounded cavity between the endocone and mesocone is normally filled up by a group of cells which seem to act as a plug to prevent the advance of chitinisation in that cavity, while the other surfaces of the cusps continue to become thickened till the middle of the organ is reached. On closely examining Mr. Woodward's *helvetica* radula with apochromatic objectives of unexceptionable definition, I soon came to the conclusion that the only material difference between it and Mr. Kennard's specimen was that this group of cells had itself become impacted and chitinised in the cavity. I have since found several other instances of the same kind of thing; it may be described as a very slight pathological abnormality. Abnormalities arising from fusion of basal plates are not rare in this group, but they rarely occur on both sides of the radula symmetrically. A group of teeth from Mr. Woodward's specimen is here figured (Fig. 3); the emphasising of the endocone of the transitional tooth figured is not a constant character throughout.

In order to study *V. Rogersi*, which is well known to be a very variable form, it is desirable to have frequent access to a locality where it abounds; Mr. Kennard kindly indicated to me such a locality near Westerham. There is in the Westerham specimens a considerable amount of variation in the length of the mesocone of the central tooth; the central tooth is also frequently asymmetrical, and bears an additional ectocone on one side. The exact shape of the admedians is also very variable, as shown in the example figured (Fig. 1). When, as in the top row in that figure, there is a shortening of the teeth, a kind of ridge is formed at the base of the tooth, clearly marking the process as abnormal; and this kind of abnormality has no tendency to be repeated in series. One never finds the neat and distinct quadration of the basal plate which is so strongly marked in *helvetica*. The basal plates of centrals and admedians are much longer; the cusps of the centrals are rounded or ovate; mesocone of admedians more slender, ectocones having a tendency to disappear, or to be reduced so as to suggest a serration. It ought to be mentioned that with a microscope of poor defining power the appearance of serration is often given where there is merely a slight irregularity of contour, the eye not being able to distinguish between true contours and interference effects; the pectinations on the teeth of *Physa fontinalis*, which are in reality thin, equal, and parallel, though wedge-shaped in section, form a most excellent test for the objective to be used for examining radulæ. The marginal teeth of *V. Rogersi* are comparatively short and not closely set, totally unlike those of either *glabra* or *helvetica*. In general, the variation of *Rogersi* is non-significant, being due mainly to looseness of build.

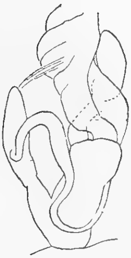


Fig 5

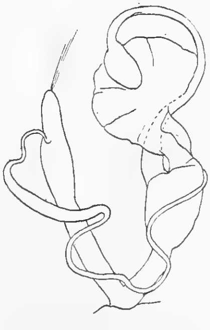


Fig 6

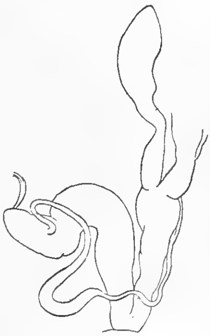


Fig 7

Fig. 6 represents the proximal part of the genitalia of a Westerham *Rogersi*, for comparison with Fig. 5 (*helvetica*). The duct of the spermatheca, which is soft and flexible, containing less muscular fibre than do the other canals, has been dissected out and is here shown laid over the first half-turn of the female epididymis. The vas deferens has merely been turned over from its more central normal position; the flexures shown are found pretty uniformly.

Mr. W. Moss has most kindly lent me, and allowed me to figure, a radula from his collection inscribed "*Hy. glabra*, Studer. Per Prof. Simroth. Leipsic. 28/9/98. 470." The dentition of this is shown in Fig. 4. There is no need of detailed description to prove that this is not an ordinary British *Vitrea*. The genitalia of the same specimen have also been lent me by Mr. Moss, and are figured here (Fig. 7). (The flexures of the male side and of the duct of the spermatheca are partially accidental.) I have no doubt that Mr. Moss was right in the opinion which he expressed to me in 1897, to the effect that the Anglesey '*glabra*' (which I have also studied in their native land) are near to, but not identical with, this form.

It appears to me that according to the anatomical characters the *Vitreæ* of this group may be arranged in a series of couples, somewhat after this manner:—

lucida vera, ? affinities with *olivetorum* group.
Draparnaldi and *glabra* (Fig. 4).
hibernica and *Scharffi*.
cellaria and *Rogersi*.
helvetica and *alliaria*.

This may of course be purely artificial, but it is based on a general consideration of the variable points. It is worth noting that the species above enumerated may be distinguished by comparison of their basal plates. In order to see these clearly and with certainty they should be stained, and the preparation mounted in Canada balsam. The stain of carbol thionin (which is very convenient for quick work) will keep in glycerine, for a temporary mount, for a few weeks only.

I am very willing to examine any British specimens that may be supposed to be true *V. helvetica*, Blum. They are best sent in a fresh condition. This paper ought not to close without a small word of thanks to our President for observing and maintaining the distinctness of *V. helvetica* and *V. Rogersi*.

REFERENCE TO ILLUSTRATIONS.

Fig. 1. Radula of *Vitrea Rogersi*, Woodward. (Westerham.)
,, 2. Radula of *Vitrea helvetica*, Blum. (Solothurn co-type; Mr. Kennard's specimen.)
,, 3. Part of radula of *Vitrea helvetica*, Blum. (Solothurn co-type; British Museum specimen.)
,, 4. Radula of *Vitrea glabra*, Studer. (From Professor Simroth, Leipsic; lent by Mr. W. Moss.)
,, 5. Genitalia of No. 2.
,, 6. Genitalia of No. 1.
,, 7. Genitalia of No. 4.

☞ The magnification of Nos. 1, 2, and 4 may be ascertained from the scale; that of No. 3 is slightly greater, it having been necessary to employ a different objective.

MALACOLOGICAL SOCIETY OF LONDON.

INCOME AND EXPENDITURE FOR THE YEAR ENDED 31st DECEMBER, 1907.

Dr.	£	s.	d.	£	s.	d.
To Balance from last year				24	11	6
,, Annual Subscriptions—						
Ordinary Members	£36	15	0			
Corresponding Members	21	9	6			
				58	4	6
,, Annual Subscriptions in arrear—						
Ordinary Members	£1	11	6			
Corresponding Members	1	17	6			
				3	9	0
,, Annual Subscriptions in advance—						
Ordinary Members	£1	1	0			
Corresponding Members	5	8	6			
				6	9	6
,, Entrance Fees				1	11	6
,, Sale of "Proceedings"				20	14	2
,, Dividends on £50 Metropolitan $2\frac{1}{2}$ % Stock				1	5	0
,, Donations for Illustrations				20	6	6
,, Advertisement Receipts				0	15	0
				£137	6	8

Cr.	£	s.	d.	£	s.	d.
By Cost of "Proceedings"—						
Printing and Postage	£72	14	10			
Illustrations	33	19	0			
				106	13	10
,, Printing Circulars, etc.				2	0	6
,, Treasurer's Postage				0	11	6
,, Linnean Society—						
For the use of Rooms	£3	3	0			
Gratuities to Attendants	2	10	0			
				5	13	0
,, Secretary's Postage				2	10	0
,, Balance in hand				19	17	10
				£137	6	8

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.

p.p., John H. Ponsonby, Hon. Treasurer.
R. H. Burne.
January 23rd, 1908.

HENRY WOODWARD
R. BULLEN NEWTON } Auditors.

ANNUAL GENERAL MEETING.

FRIDAY, 14TH FEBRUARY, 1908.

B. B. WOODWARD, F.L.S., President, in the Chair.

The Rev. C. W. Bowell and Mr. A. S. Kennard were appointed scrutineers.

The following report was read :—

"Your Council, in presenting their fifteenth Annual Report, are again able to record a year of satisfactory progress.

During the past twelve months five new members have been elected. By death we have lost two members, Mr. S. I. Da Costa, whose presence as well as his useful and interesting papers will be sincerely missed, and Miss Caroline Birley.

The membership of the Society on December 31st, 1907, stood as follows :—

Ordinary members	82
Corresponding members	85
Total	167

At the end of the year 1906 the total membership was 164, and of 1905, 161.

The financial condition of the Society is quite satisfactory; all the liabilities of the year have been discharged, and there is a balance in the banking account of £19 17*s.* 10*d.*, while the sum of £50 still remains invested in Metropolitan 2½ per cent. Stock.

Since the last Annual Meeting three parts of the 'Proceedings,' forming the last half of the seventh volume, have been issued. They consist of 170 pages of text, 11 plates, a portrait frontispiece, and 22 text-figures.

The Society is indebted to the following gentlemen who have generously contributed towards the cost of the plates and other illustrations, or have furnished drawings for reproduction:—H. H. Bloomer, G. C. Crick, the late S. I. Da Costa, Sir C. N. E. Eliot, H. C. Fulton, J. C. Melvill, R. B. Newton, J. H. Ponsonby, H. B. Preston, E. A. Smith, G. B. Sowerby, and H. Suter. Without such generous assistance the 'Proceedings' could not possibly be so fully illustrated.

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

On the motion of Colonel Godwin-Austen, seconded by Mr. E. R. Sykes, the above was adopted as the Annual Report of the Society.

The following were elected as Officers and Council for the year 1908 :

President.—B. B. Woodward, F.L.S.
Vice-Presidents.—Colonel R. H. Beddome, F.L.S.; R. H. Burne, B.A.; W. G. Ridewood, D.Sc., F.L.S.; E. R. Sykes, B.A., F.L.S.
Treasurer.—J. H. Ponsonby, F.Z.S., 15, Chesham Place, London, S.W.
Secretary.—Alexander Reynell, Carleon, Whyteleafe Road, Caterham, Surrey.
Editor.—E. A. Smith, I.S.O., F.Z.S., Natural History Museum, Cromwell Road, London, S.W.
Other Members of Council.—H. H. Bloomer, F.L.S.; Rev. R. Ashington Bullen, B.A., F.L.S.; G. C. Crick, F.G.S.; G. K. Gude, F.Z.S.; H. B. Preston, F.Z.S.; Henry Woodward, LL.D., F.R.S.

On the motion of Dr. Ridewood, seconded by Mr. H. B. Preston, a vote of thanks was accorded to the Retiring Officers and Members of Council, and to the Auditors and Scrutineers.

The President delivered his annual address, entitled "Malacology *versus* Palæoconchology."

ORDINARY MEETING.

Friday, 13th March, 1908.

B. B. Woodward, F.L.S., President, in the Chair.

Mr. M. Connolly was elected to membership of the Society.

The following communications were read:—

1. "Descriptions of two new species of *Synapterpes*." By H. C. Fulton.
2. "Description of a new species of *Strophocheilus*." By H. C. Fulton.
3. "On the identity of *Plectopylis leiophis* and *P. pseudophis*." By G. K. Gude, F.Z.S.
4. "On the Mollusca of some Holocene deposits of the Thames River System." By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S.
5. "Note on the Radula of *Pomatias elegans* (Müll.)." By Rev. E. W. Bowell, M.A.
6. "The Application of Poli's Generic Names." By A. J. Jukes-Browne, F.G.S.

Mr. A. J. Jukes-Browne exhibited a postcard received from Mr. Hirase showing enlarged photographs of the markings on shells.

ORDINARY MEETING.

Friday, 10th April, 1908.

B. B. Woodward, F.L.S., President, in the Chair.

The President drew the attention of the members to a communication which had been received from Copenhagen, signed by a number of conchologists of that city, who request that it might be published in the "Proceedings" of the Society. This communication was practically an English translation of an article entitled "Ein malakologischen Schwindel," which had already appeared in the "Nachrichtsblatt der Deutschen Malacozoologischen Gesellschaft" (1907, Heft iii, pp. 169–172) and in the "Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien" (1907, pp. 275–277).

This article refers to the alleged malpractices of a certain youth, Hans Schlesch, of Copenhagen. The members of the Society were therefore advised to acquaint themselves with the contents of the article in question before having any dealings with the person referred to.

The following communications were read:—

1. "On the known recent species of the genus *Vanikoro*." By E. A. Smith, I.S.O.

2. "Note on *Lanistes magnus*, Furtado." By E. A. Smith, I.S.O.

3. "Note on the Clausilium of a Chinese species of *Clausilia*." By Professor H. A. Pilsbry.

4. "Description of a new species of *Rhagada* from Western Australia." By H. B. Preston, F.Z.S.

Mr. A. S. Kennard exhibited original coloured drawings of British land Mollusca by J. D. Dean.

The Rev. R. Ashington Bullen exhibited examples of *Tapes pullastra*, *T. decussatus*, and *Donax semistriatus*, from the coast of Catalonia, Spain.

Mr. H. B. Preston exhibited a species of *Pisidium* from an elevation of 14,500 feet in Thibet.

Mr. A. Reynell, specimens of *Calliostoma cleopatra*, *C. obesula*, and *Scala Richardi*, dredged in the north part of the Bay of Biscay.

OBITUARY NOTICES.

It is with much regret that we chronicle the death of Mr. S. I. Da Costa, one of the original members of the Society. He was born on June 1st, 1827, and died on the 28th of the same month last year, just over 80 years of age. Mr. Da Costa was for many years an enthusiastic collector of land, fresh-water, and marine shells from all parts of the world, but some years ago he parted with most of the marine forms and restricted his acquisitions chiefly to terrestrial species, especially those from the South American Continent, the beauty and extent of his series from that region being the admiration of conchologists, whom he was always pleased to welcome to his house.

From the first ordinary meeting of the Society on May 12th, 1893, Mr. Da Costa was a constant exhibitor of new or interesting species, and he took a close interest in the progress and management of the Society, and between the years 1895 and 1907 was six times elected to serve on the Council. He was not a prolific writer, having written only ten short papers of a purely descriptive character, all, with one exception, published in the Society's "Proceedings." These were invariably fully illustrated with plates or text-figures, to the cost of which he was always pleased to make a handsome contribution.

Mr. Da Costa had a very striking personality, and displayed a most genial manner towards his many conchological friends. In his early career he was engaged in engineering, but subsequently he became a member of Lloyds, and twice had the honour of being elected chairman of that body.

In concluding this brief notice it is most gratifying to state that, in accordance with the wish he many times expressed to his family, all the types in his collection have been placed in the British Museum by his son, at whose request the donation is to be regarded "as a gift in the name of my father."

The rest of Mr. Da Costa's collection was dispersed by public auction last October, and many were the beautiful and interesting shells which found new possessors.

E. A. S.

Miss Caroline Birley, whose death occurred last year in her 56th year, became a member of this Society in 1894, and frequently attended its meetings. She was perhaps more attached to the science of geology than to the study of recent Mollusca, and was a very enthusiastic collector of fossils, in the course of years accumulating quite a large collection for a private individual. Some of her discoveries have been described by Dr. Henry Woodward and Mr. R. Bullen Newton in the *Geological Magazine* for 1900, 1901, and 1905; and in dec. v, vol. iv of that journal (1907) a fuller memoir of this lady is given by Dr. Woodward, to whom she was personally known for many years.

ANNUAL ADDRESS BY THE PRESIDENT,

B. B. Woodward, F.L.S., F.G.S., etc.

(*Delivered 14th February*, 1908.)

MALACOLOGY *versus* PALÆOCONCHOLOGY.

Ladies and Gentlemen,—

By long custom an annual address usually assumes the form of a summary of some sort, and most frequently that of a review of the status of the object for the advancement of which the Society addressed exists, or of some particular branch thereof.

In this wise I ventured last year to put before you some ideas concerning what evidences there might be of evolutionary processes among the Mollusca, and to-night would invite your attention to what may be called the case of Malacology *versus* Palæoconchology.

This title rather emphasizes a condition of affairs that certainly ought not to exist, but which, unhappily, does exist even yet, namely, that the gulf between the students of the recent and of the fossil forms of Mollusca is still far wider than of right it should be. Each goes too much his own way without taking account of the work of his fellow, at the same time complaining, and often with justice, that the other pays no heed to his discoveries or conclusions.

Surely it is not asking too much of the morphologist that, though apparently endowed with a plethora of recent material to work on, he should nevertheless check the results of his investigations as to the phylogenetic relationships of the groups with which he may be dealing by the corresponding work of his palæontological brethren so far as they will serve him.

On the other hand, no condemnation is too strong for the palæontologist who wilfully ignores the teaching of the morphologist and persists in classing together convergence forms, well-known at the present day (e.g. *Dreissensia* and *Septifer*), that have no natural relationship. Such only do harm to the Science by retarding its progress, and it must be regretfully added that in this they are only too frequently assisted by some students of recent forms, who occupy themselves exclusively in compiling faunal lists on antiquated lines.

Despite these dissonances among its devotees it is satisfactory to realize that some very substantial progress has been made in the study of Malacology as a whole, that becomes apparent when to the morphologist's conclusions as to the phylogeny of the phylum the touchstone of the geological record is applied.

For this purpose let us take the most recent classification of the main groups of the Mollusca from the morphological point of view, that of Dr. Paul Pelseneer in the fifth volume of the "Treatise on Zoology, edited by Sir E. Ray Lankester" (*41*). If from this, which seems to be the system most widely recognized at the present day, we reconstruct a phylogenetic tree, taking as our basis the one by the same author in Blanchard's "Traité de Zoologie," fasc. xvi (*38*, p. 176), but correcting it to his later views and inserting, for reasons hereafter to be explained, the additional group-names "Prostreptoneura" and "Conularida," the following diagrammatic scheme results:—

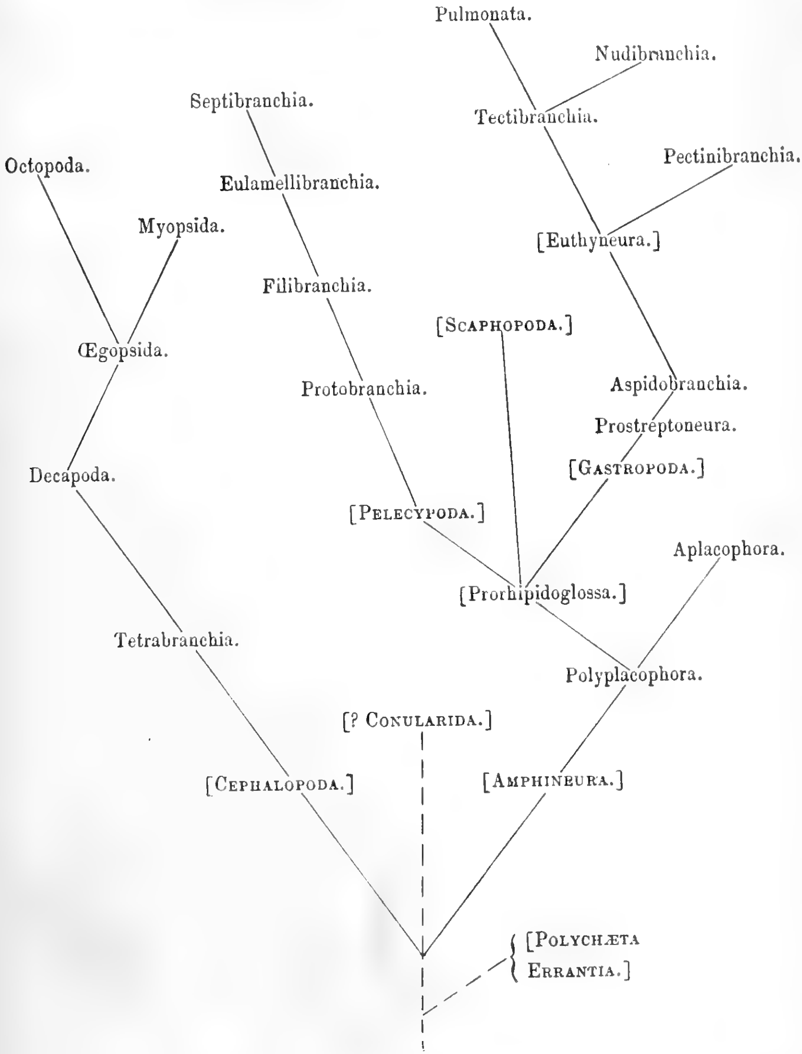


TABLE I.

It is true that phylogenetic trees, those "intellectual weeds" as Professor Sollas once wittily dubbed them, are rather out of fashion. Still, they serve a very useful purpose, bringing before the mind by the agency of the eye, more rapidly than whole pages of text can do, the opinion of the moment on the interrelationships of the members of the groups they deal with.

Next let us take the scheme thus set forth and apply it to the geological record after the manner shown in the succeeding diagram and examine the result. In this diagram the spaces allotted to the several geological formations approximate their relative thicknesses, and consequently to some extent, also, show their relative periods of duration.

Beginning with the highest molluscan group—the Cephalopoda—we find that the most archaic forms, the Tetrabranchia, of which *Nautilus* is alone the living representative, are met with as early as the Upper Cambrian, testified by seven species belonging to the genera *Orthoceras*, *Endoceras*, *Biloceras*, *Actinoceras* (?), and *Cyrtoceras* (*17*, pt. i). Continuing up into the Ordovician, the lower beds yield a transitional form, *Bactrites* (*17*, pt. iii), which, passing up to the Carboniferous, connects on through the Devonian Goniatites (*Clymenia*, etc.) with the Ammonites that flourished in the Jurassic and died out in the Cretaceous.

A long interval elapsed between the appearance of the Tetrabranchs and the arrival of the Dibranchs. From the Lower Muschelkalk (Middle Trias) near Sondershausen, Picard (*43*, p. 308) describes a form, *Campylosepia triassica*, which he considers to be an important transitional link between the Belemnites and the Sepias. Mr. Crick, however, with characteristic caution, is not prepared, owing to the obscure condition of the fossil, to endorse this opinion. At any rate, we have here a forerunner of the Decapods, of which the more primitive branch, the Œgopsida, are definitely represented in the Upper Trias by *Atractites* and *Aulacoceras*, and the higher, Myopsida, in the succeeding Jurassic by *Geoteuthis*, *Beloteuthis*, and *Teuthopsis*. The highest cephalopod group of all, the Octopoda, made their appearance in the Upper Cretaceous, with the oldest and only known fossil example, *Palæoctopus Newboldi*, H. Woodward (*58*).

So far, then, as the Cephalopoda are concerned the order of their appearance in geological time corresponds almost exactly with the phylogenetic scheme.

An interesting fossil group, the Conularida, may be taken next if only because a cephalopod affinity has been claimed for it. At one time they were relegated to the Pteropoda, and Barrande (*1*, p. 134), Matthew (*30*, p. 104), and others even identified certain lower Palæozoic forms with the existing genera *Styliola* and *Creseis*. The discovery of the morphologists, however, that the Pteropoda were in reality highly developed and specialized Opisthobranchs has in this instance been taken to heart by their palæontological confrères, and it is now generally recognized that Pteropods are not met with in earlier rocks than those of the Tertiary period.

The latest monographer of the Conularida, Miss Ida L. Slater (*47*), considers, for reasons which in themselves are not very convincing, that *Conularia* is a mollusc appearing to resemble the primitive Cephalopoda more than any other forms, but she prefers "to regard *Conularia* as a member of an extinct group equivalent to the Cephalopods, and derived with them from the same simple shelled ancestor." As such, then, we leave them in our tables.

The Pelecypoda were yet earlier in their advent than the Cephalopoda. Two forms have been recorded from the Cambrian. The one, however, *Fordilla* of Barrande, is suspect and may be the remains of a Pod-Shrimp. The other, *Modioloides priscus*, Walcott, founded on an oval, internal cast 2 mm. long, exhibiting an anterior adductor scar and apparently a simple pallial line, is considered to be an early Protobranch.

From British Upper Cambrian (Tremadoc beds) come some obscure casts, which have been referred to several primitive genera—one doubtfully to *Orthonota*, which is also a Protobranch, others to *Palæarca* and *Glyptarca*, genera now sunk in *Cyrtodonta*. The exact position of this latter genus is uncertain; though usually placed with the Arcacea, its members, with their mixture of hinge-characters, may rather be regarded as linking the Protobranchs with the Filibranchs. Associated with these are some mytiloid shells and two pterinoid examples from an unknown horizon (*26*, p. 200; Brit. Mus. Registered No. 48762 and No. I. 2612), that may belong to *Ambonychia* or *Byssonychia*, in which case they would form some of the earliest representatives of the Pectinacea, as defined by Pelseneer, and usher in the Filibranchs, of which suborder more unmistakable examples are met with in the succeeding Ordovician period. Obviously these ancient bivalves require to be carefully re-studied in the light of the researches of the late Félix Bernard (*2*), whose premature demise was a most serious loss to Malacology.

Of the next order, the Eulamellibranchia, no representatives appear earlier than the Silurian, where a form doubtfully referred to *Lucina* (Submytilacea) has been detected, as well as one of the more highly specialized Anatinacea, *Rhytimya*. The Ostracea, represented by *Palæopinna*, only came in with the Devonian, in which, too, the first fresh-water shell, *Archanodon*, is found, its record for the Lower Devonian falling to the credit of our member, Mr. R. Bullen Newton (*32*). An early example of the Myacea, *Palæosolen*, likewise is found in beds of this age.

Of the most specialized order of the Pelecypoda, the Septibranchia, no example is met with at least till Jurassic times, if *Corburella* be admitted to this group, or with certainty till the Cretaceous, where *Liopistha* makes it appearance, followed by *Poromya* in the Tertiary.

On the whole, therefore, due allowance being made for the poverty of the early materials, the Pelecypoda fairly conform in their geological history to the conclusions based on the study of their morphology.

The Scaphopoda, having been derived, according to Pelseneer, from the same stock as the Pelecypoda and Gastropoda, might have been expected to share an equally early advent. It is true that one fossil has been referred to this class from as far back as the Upper Cambrian, viz. *Spirodentalium osceola*, Walcott, but Pilsbry and Sharp consider this spurious and "radically unlike any form known to belong to the Scaphopoda" (*46*, p. 247). The Silurian records equally fall under suspicion, the tubes of the serpulid *Ditrupa* having frequently been mistaken for *Dentalium*. It is not, therefore, till the Devonian is reached that an undoubted member of the group is met with.

Turning next to the big class Gastropoda, we find them foreshadowed near the beginning of the Cambrian period by *Scenella* (a patelliform shell referred by common consent to the Docoglossa), by *Rhaphistoma* (one of the Pleurotomariidæ), and by two capuloid forms, *Stenotheca* and *Platyceras*, generally placed in the Capulidæ. These are reinforced in the Upper Cambrian by further representatives of the Rhipidoglossa, viz., *Murchisonia* (Pleurotomariidæ), *Cyrtolites* and *Owenella* (Bellerophontidæ), *Straparollina* (Euomphalidæ), and *Trochonema* (the type of its family), and by the curious *Subulites*, which is generally referred to the Tænioglossa.

A certain amount of complexity attends the relationships of these early Gastropods, as might be expected. Some of them are generalized types: thus the Trochonematidæ are considered by Ulrich (*52*, p. 1043) to be connected through *Trochonema* with the Pleurotomariidæ and through *Cyclonema* with the Turbinidæ.

The most difficult ones to deal with, however, are those that have been considered to belong to the Tænioglossa. To begin with, such very diverse forms have been placed together under one generic name, especially by the earlier palæontologists. As Ulrich remarks (*52*, p. 1068) of *Platyceras*, it "includes a host of wonderfully diverse shells"; and of *Holopea*, which appears in the Ordovician, he says it "embraces much that does not belong . . . [and] most diverse affinities are indicated by different sets of species, some evidently being true Littorinidæ, others related to *Cyclonema*, another set to *Platystoma*" (*52*, p. 1064).

Platyceras, as originally defined by its founder, Conrad (7, p. 205), contained both capuloid shells and those of a naticoid type; and though about two years later Conrad established *Platystoma* to receive these last, the name was for a long time ignored, and any shell or cast of a capuloid or naticoid character, with small spire, coming from these old beds, was forthwith put down as *Platyceras*. The name consequently carries no weight with it. Moreover, it has been rather overlooked in the past that, as pointed out in my last address (*56*, p. 248), conical shells may occur in widely different groups as a response to environmental conditions: they are none of them primitive forms of shell, but all the result of specialization to a common end—the resistance of destructive forces.

Reflecting on this and the fact that all these forms, including the Limpets, began life with a coiled, nautiloid shell, it occurred to me that the loosely-coiled forms of *Platyceras* might really represent survivors of the ancestors of the Docoglossa, and of such Rhipidoglossa as the Stomatiidæ and Delphinulidæ.

Possibly this idea may have been more or less a case of unconscious cerebration, for, wishful to enquire further into the evolution of the Docoglossa, I re-consulted the interesting paper by Dr. Fleure (*16*),[1] and found, what had escaped my memory, the germ of the idea there.

Dr. Fleure hypothecates a prostreptoneure ancestor for the Prosobranchia, and reconstructs and figures such an animal. This prostreptoneure was in his opinion probably far more symmetrical externally than many of its descendants, with a symmetrical pair of shell-muscles, and nearly, but not quite, symmetrical shell possessing a moderately developed spiral, coiling in or near the sagittal plane, while in its anterior edge there was a sinus or slit. It had also a moderately developed operculum. Among other points in support of his contention, Dr. Fleure directs attention to the fact that "among the earliest Gastropod fossils we find many feebly spiral shells which are almost or quite symmetrical" (*16*, p. 270).

Personally I would accept Dr. Fleure's Prostreptoneura, and have, therefore, included the name in the tables, but I would define the animal and shell as perfectly symmetrical, coiling in the sagittal plane, with a complete operculum, and regard the loosely-coiled, capuloid shells found in early strata and usually referred to *Platyceras* as their modified descendants. Nor do I think the presence of the slit necessary, for, as Ulrich points out (*52*, p. 948), there is an almost total absence of a long, parallel-edged slit in the lower Silurian Pleurotomariidæ, while according to Hall, who also is not speaking of the oldest forms (*20*, p. 16), there is in many species of *Platyceras* a sinuosity of the striæ indicating a notch in the margin of the aperture during the first stages of growth, which does not always persist in the adult stage. In those in which this notch becomes closed another begins at some other point, while in others the peristome becomes plicated with several sinuosities in the mature condition. Seeing that in life most of the genus attached themselves to foreign bodies, these various sinuosities were probably due to irregularities on the surface of the object of attachment, and do not reflect any important anatomical structure in the animal.

Unfortunately the casts of these fossils do not so far appear to have yielded traces of the muscular attachment, and it is therefore not possible to say whether two distinct scars exist, or the single horseshoe-shaped scar of the Capulidæ. Koken describes and figures (*24*, p. 464, pl. xi, fig. 9) a cast under the name of *Platyceras Protei*, Œhl., from the Lower Devonian, showing the capuloid muscle-mark, but this cast obviously appertained to a shell without any spire and came from a far higher horizon than those of which we are speaking. Moreover, once the spire disappears, the strengthening of the muscle follows as a matter of course, just as in the Limpets, which equally have a horseshoe-shaped muscle attachment, but are not on that account

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[1] The author desires me to mention in citing this paper that the impression accidentally conveyed here and there in it that he included certain of the Rhipidoglossa among the Docoglossa is due to an unfortunate oversight when passing the proofs, as the context of the whole paper shows.

considered allies of the Capulidæ. The horseshoe-shaped form of scar is a secondary character and not a criterion of affinity, as paired scars would be.

Pilsbry remarks of *Platyceras* that "the fusion of this genus with *Capulus* . . . is hardly justifiable" (*61*, p. 461).

Under these circumstances I would advocate the removal of these early forms from the Capulidæ and their relegation to the Prostreptoneura, the primitive stock whence both the Docoglossa and the Rhipidoglossa were derived.

Still more difficult is the case of *Subulites*. No palæontologist seems quite to know what to do with this genus. Zittel (*59* and *60*) puts them with a somewhat miscellaneous assemblage in the Pyramidellidæ and next before the Melaniidæ in his Ctenobranchia. Lindström (*28*, p. 192) created the family Subulitidæ for *Subulites* and *Euchrysalis*, to which also he considered *Bulimorpha* and *Fusispira* probably belonged. Fischer (*14*, p. 770) forms them into a family (with *Fusispira* and *Euchrysalis*) near the end of the Tænioglossa, but adds that they ought to be placed after the Strombidæ, which with him come early in the same section. Tryon (*51*, p. 246) includes them in Eulimidæ. Pilsbry (in Zittel, *61*, p. 457) retains them in Pyramidellidæ, putting that family as Fischer does in the Gymnoglossa, but at the same time admits that they "probably form a separate family." Ulrich (*52*, p. 1069) keeps them in a separate family; he retains *Subulites* for the long, slender, terebelliform species, and wisely creates a new genus, *Cyrtospira* (p. 1073), for the short, curved forms; he further associates with these *Fusispira* (p. 1075) for the more tumid forms. Finally, Pelseneer (*41*, p. 154) makes the Subulitidæ the 25th of his 55 families of Tænioglossa (in which the Gymnoglossa are included), placing them between the Melaniidæ and Nerineidæ, the Pyramidellidæ being his 53rd family.

Lindström's summing up of this question of the Subulitidæ is probably the one that will most appeal to all. He says (*28*, pp. 192, 193): "What characterizes them all, besides the elongate and smooth shells and the narrow aperture with incomplete peristome, is the important feature of a distinct apertural canal, situated exactly as in all Siphonostomata and quite as much developed as in several of them . . . We see consequently in this family the most ancient representatives of the great section of the siphonostomous shells. The systematic place of the species of this family is by far not as easily cleared up as their nature of siphonostomous shells, and I think that this question must for the present be left undecided."

Nevertheless, the consensus of opinion appears to be that the Subulitidæ belong to a higher order of Gastropoda than the Aspidobranchs, in which case it would seem that three out of the four principal divisions of the Streptoneura are first met with almost simultaneously in the oldest known fossiliferous rocks.

The fifth division, the Stenoglossa, comprising the more highly differentiated genera from *Turbinella* to *Conus*, made its appearance geologically much later, a form ascribed to *Fusus* being the first to be met with, in beds of Cretaceous age. The Jurassic *Purpuroidea*, although included by Fischer in his Muricidæ, is more appropriately placed in the Tænioglossa.

Of the Euthyneura the Tectibranchs are the senior branch, and according to Pelseneer (*39*, p. 77) the most archaic families of the group are the Bullidæ and Acteonidæ, which are nearest in their affinities to the rhipidoglossate Trochids. Hence one would expect to meet with them early in the geological series. As a matter of fact the earliest representative that so far has been discovered appears to be a species of *Cylindrobullina* (*Scalites carbonarius*, De Kon.) in the Carboniferous.[1] This, as presently to be seen, is antedated by the Pulmonates in the Upper Devonian.

The Nudibranchs, by some lucky chance, like that which revealed *Palæoctopus*, may yet furnish a genuine glimpse of their past history. At present we fear that category will not include the exhibition before the Geological Society of Glasgow by a Mr. John Smith of "specimens of a curious set of small bodies found in a fossiliferous shale exposed on the railway from Giffen to Kilburnie in Ayrshire. These bodies are still undetermined, but belonged, he believed, to one of the Carboniferous Nudibranchs, and for which he therefore proposed the provisional name of *Archæodoris carbonarius*" (*48*).

The records of the Pulmonata in the remoter past are few but highly interesting, and since, by a strange oversight, they have not been done justice to in any single geological or other textbook, perhaps it may be well to deal with them, and some associated air-breathing Prosobranchs, a little at length.

The first discovery of Palæozoic Land Snails was made in 1852, when Sir C. Lyell, in company with Dr. (afterwards Sir) J. W. Dawson, visited the Upper Carboniferous beds at South Joggins, Nova Scotia. From the interior of an erect stump of a *Sigillaria*, they extracted some pupiform shells associated with the remains of some reptiles. These shells were alluded to and figured, but not described or named, in a joint paper in 1853 (*29*, p. 60, pl. iv, figs. 1–5). In 1858 Owen's article on "Mollusca" appeared in the "Encyclopædia Britannica" (*33*), and unaware of, or having forgotten the discovery, he states (p. 403) that "terrestrial species have not been found in strata older than the Tertiary." His attention must have been speedily called to the oversight, for in his later article on "Palæontology," which appeared in 1859 (*34*), he alludes to their occurrence (p. 111), and gives the name *Dendropupa* to them, in brackets. In 1860, when this article was reprinted as a separate work under the same title (*35*), the name is repeated (p. 79), but this time occurs in the midst of a quotation, the source of which has not yet been traced. That same year Dawson for the first time described and named the mollusc *Pupa vetusta* (*8*), but, strange to say, in his frequent succeeding references to the subject never again once alluded to this paper.

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[1] By an oversight in last year's address (*56*, p. 252), *Bullinella* from the Permian was credited with being the earliest example.

The next discovery took place in the same locality in 1866, when a small helicoid was found. This was described by P. P. Carpenter (in Dawson, *10*, p. 331: figs.) under the name of *Zonites* (*Conulus*) *priscus*. The species was subsequently referred to *Archæozonites* (Zittel, *60*, p. 365), but Pilsbry now places it in *Pyramidula* (?) (*45*, p. xxxix).

In 1869 Mr. F. H. Bradley obtained two new forms of Land Shells from the concretionary limestone accompanying the underclay of coal at Pelly's Fort, Vermilion River, Illinois (*3*, p. 254). These were described by him in 1872 (*4*, pp. 87–88) as *Pupa Vermilionensis* and *Anomphalus Meeki*. He subsequently recognized that the latter was not, as he had supposed, a marine shell, and removing it from Meek's genus, defined it as a helicoid and created the genus *Dawsonella* for its reception (*5*, p. 151).

In 1880 Sir J. W. Dawson published a "Revision of the Land Snails of the Palæozoic era" (*11*), adding to the list *Pupa Bigsbii*, from the South Joggins Coal-measures, and *Strophites grandæva*, from the still older Erian (Devonian) Plant-beds of St. John, New Brunswick.

The following year Mr. R. P. Whitfield (*55*) described and figured from the higher beds of the Coal-measures, near Marietta, Ohio, a strongly striate, toothed pupoid shell, under the name of *Anthracopupa Ohioensis*. At the same time he alluded to Bradley's *Dawsonella*, which on the evidence obtained from better material he referred to the Helicinidæ.

C. D. Walcott next, in 1883 (*53*, p. 808; and *54*, pp. 261–263), described and figured from the lower portion of the Carboniferous group, on the western slopes of New York and Richmond Mountains, Eurika district, Nevada, a remarkable elongate and obviously terrestrial form under the name of *Zaptychius carbonarius*. With it were found two fresh-water forms described as *Physa prisca* and *Ampullaria* (?) *Powelli*.

The Middle Permian beds of Chambois, Saône-et-Loire, were the next to yield a terrestrial mollusc described by Dr. P. Fischer (*15*, p. 100: fig.) as *Dendropupa Walchiarum*.

Sir J. W. Dawson, in his "Synopsis of the Air-breathing Animals of the Palæozoic in Canada up to 1894" (*12*, pp. 83–84), includes "*Pupa pervetus*, Matthew," which proves to be an intended reference to a species described in a succeeding paper by G. F. Matthew (*31*, p. 98, pl. i, figs. 10*a* and *b*) as *Pupa primæva*. Either Dawson took a wrong note when Matthew's paper was read or the name was changed on going to press. This species came from the same Upper Devonian bed that yielded the *Strophites grandæva*.

Finally Dr. Smith Woodward has just obligingly drawn my attention to some specimens sent to the Natural History Museum by Dr. I. C. White, State Geologist, of West Virginia, U.S.A., for determination. These include, besides a millipede and some ostracod remains, examples of small terrestrial Gastropods very like *Dendropupa*, and a possible helicoid. They come from the Peruvian limestones near Valley Grove, Ohio County, West Virginia.

In this little group of Palæozoic air-breathers we have the earliest terrestrial Rhipidoglossate, if we accept, as I think we may do, Whitfield's determination of *Dawsonella* as such, the oldest known *Ampullaria*, for Walcott's "?" seems unnecessary, and the first of the Pulmonates.

Both divisions of the last-named order are represented, the Basommatophora by *Physa* and *Zaptychius*. The determination of the *Physa* is probably correct, for one would hardly look for so highly differentiated a form as a sinistral *Limnæa* at so early a period in the world's history; moreover, *Physa* is the more primitive of its congeners, its radula being less specialized than those of *Limnæa* or *Planorbis*, both of which are met with far later in the record of the rocks.

Zaptychius, however, connotes an older family, since, according to Walcott—and our Editor, Mr. E. A. Smith, agrees in that opinion—it "appears to have its nearest ally in *Auricula*." Pelseneer holds (*37*, p. 114; *40*, p. 66) that the Auriculidæ are nearest akin to the Opisthobranchs and are consequently the most archaic of the Pulmonates, and present the greatest number of characters common to both Basommatophora and Stylommatophora. By right, therefore, they should make their appearance earlier in the geological sequence than the more specialized Stylommatophora. This they just fail to do, for Dawson's *Strophites*, although fragmentary, certainly seems to belong to the Pupidæ, although not identical, as he subsequently appears to have thought, with *Strophia*—*Cerion* as we now know it.

The remaining Pupidæ—for such they probably are, unless, like *Sphyradium*, the *Dendropupa* group belongs really to the Endodontidæ—fall into two divisions, those with and those without teeth, neither of which can it be pretended is identical with *Pupa* itself.[1] It seems, therefore, most reasonable for the present, till further material shall be forthcoming, to provisionally range the edentulous species under *Dendropupa*, and the dentigerous under *Anthracopupa*.

It may facilitate purposes of reference if the information here gathered concerning these Palæozoic Pulmonates be summarized as follows:—

HELICINIDÆ.

Dawsonella Meeki, Bradley. Upper Carboniferous.

[Mentioned, but not named] Bradley: Rept. Geol. Surv. Illinois, vol. iv (1870), p. 254.

Anomphalus Meeki, Bradley: Amer. Journ. Sci., ser. III, vol. iv (1872), p. 88, fig.

Dawsonella Meeki, Bradley: as a helicoid, op. cit., vol. vii (1874), p. 151: belongs to Helicinidæ, Whitfield, op. cit., vol. xxi (1881), p. 127, figs.

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[1] Dawson's comparisons with recent forms do not seem altogether happy ones.

AMPULLARIIDÆ.

AMPULLARIA POWELLI, Walcott. Lower Carboniferous.

Ampullaria (?) *Powelli*, Walcott: Science, vol. ii (1883), p. 808, figs.; U.S. Geol. Surv., Monog. viii (1884), p. 261, figs.

AURICULIIDÆ.

ZAPTYCHIUS CARBONARIA, Walcott. Lower Carboniferous.

Zaptychius carbonaria, Walcott: Science, vol. ii (1883), p. 808, fig.; U.S. Geol. Surv., Monog. viii (1884), p. 263, fig.

PHYSIDÆ.

PHYSA PRISCA, Walcott. Lower Carboniferous.

Physa prisca, Walcott: Science, vol. ii (1883), p. 808, fig.; U.S. Geol. Surv., Monog. viii (1884), p. 262, fig.

ENDODONTIDÆ.

PYRAMIDULA (?) PRISCA (Carpenter). Upper Carboniferous.

Zonites (*Conulus*) *priscus*, Carpenter: in Dawson, Quart. Journ. Geol. Soc., vol. xxiii (1867), p. 331, figs.; Dawson, Amer. Journ. Sci., ser. III, vol. xx (1880), p. 411, figs.

Archæozonites [*priscus*, Carp.], Zittel: Grundzüge der Paläontologie (Paläozoologie), Abth. i, Invertebrata, 1895, p. 365; 2nd ed. (1903), p. 393.

Pyramidula (?) [*prisca*, Carp.], Pilsbry: Man. Conch., ser. II, vol. ix (1894), p. xxxix.

PUPIDÆ.

STROPHITES GRANDÆVA, Dawson. Upper Devonian.

Strophites grandæva, Dawson: Amer. Journ. Sci., ser. III, vol. xx (1880), p. 413, fig.

Strophia (*Strophella*) *grandæva*, Dawson: Trans. Roy. Soc. Canada, vol. xii (1895), sect. iv, p. 84.

DENDROPUPA VETUSTA (Dawson). Upper Carboniferous.

Pupa [sp.], Lyell & Dawson: Quart. Journ. Geol. Soc., vol. ix (1853), p. 60, pl. iv, figs. 1–5.

Dendropupa [sp.], Owen: article "Palæontology," Encyc. Brit., 8th ed. (1859), p. 111; "Palæontology," 1860, p. 79.

Pupa vetusta, Dawson: Quart. Journ. Geol. Soc., vol. xvi (1859), p. 270, figs.; vol. xviii (1862), p. 7 (mentions in footnote Owen's name of *Dendropupa*); "Air-breathers," 1863, p. 67, pl. iv, figs. 49–53.

Pupa (*Dendropupa*) *vetusta*, Dawson: Trans. Roy. Soc. Canada, vol. xii (1895), sect. iv, p. 83.

DENDROPUPA BIGSBII (Dawson). Upper Carboniferous.

Pupa Bigsbii, Dawson: Amer. Journ. Sci., ser. III, vol. xx (1880), p. 410, figs.; Trans. Roy. Soc. Canada, vol. xii (1895), sect. iv, p. 84.

DENDROPUPA WALCHIARUM, Fischer. Middle Permian.

Dendropupa Walchiarum, Fischer: Journ. de Conchyl., tom. xxxiii (1885), p. 100, fig.

DENDROPUPA PRIMÆVA (Matthew). Upper Devonian.

Pupa pervetus, Matthew; n.n. Dawson: Trans. Roy. Soc. Canada, vol. xii (1895), sect. iv, p. 84.

Pupa primæva, Matthew: loc. cit., p. 98, pl. i, figs. 10*a* and *b*.

ANTHRACOPUPA OHIOENSIS, Whitfield. Upper Carboniferous.

Anthracopupa Ohioensis, Whitfield: Amer. Journ. Sci., ser. III, vol. xxi (1881), p. 126, figs.

ANTHRACOPUPA VERMILIONENSIS (Bradley). Upper Carboniferous.

[Mentioned, but not by name] Bradley: Rept. Geol. Surv. Illinois, vol. iv (1870), p. 254.

Pupa Vermilionensis, id.: Amer. Journ. Sci., ser. III, vol. iv (1872), p. 87, fig.; Dawson, op. cit., vol. xx (1880), p. 410, figs.

The fact that a European example of a Palæozoic Land Snail has been found, albeit of a later age than the described American ones, should encourage research in this country, where doubtless, when looked for in likely situations, examples will also be found.

Another early form of Gastropod calls for mention here, and that is *Hercynella*, because by some authorities it has been placed with the Siphonariidæ on account of the curious fold running from the apex to the margin of the patelliform shell. Now Pelseneer has pointed out (*40*, p. 67) that *Siphonaria* is a Basommatophore that has secondarily become adapted to a marine life. With such an origin an example is hardly likely to be found so early in the geological sequence as the Devonian; even *Anisomyon*, from the American Cretaceous, seems doubtful, and unquestioned examples only come in with the Tertiary period. Moreover, a careful scrutiny of the most recent figures (Perner, *42*, tom. i, pls. xliv–l; tom. ii, pls. cv, cxviii–cxxiii) does not give at all the impression that *Hercynella* belongs to the Siphonariidæ; indeed, the characteristic fold partakes far more of the channel observable in *Subemarginula*, near which it has been placed by some palæontologists. Fischer (*14*, p. 861) inclines to ally it with *Capulus*, and consequently *Platyceras*. Probably it would be most correctly placed as an aberrant form of the then decadent Prostreptoneura, but further evidence is required.

The past history of the Gastropod branch of the Molluscan phylum is on the whole, therefore, less consonant with their morphological genealogy than is seen to be the case in the Cephalopoda and Pelecypoda.

There remains now the class Amphineura to consider.

These molluscs are generally held to be a very primitive group, and Pelseneer shows them to be the most archaic of recent Mollusca, and derives from them all the other classes save the Cephalopoda (*39*, pp. 1–41 and 82). Hence, to accord with their morphological position they should have been the oldest mollusc geologically. This, however, is not the case, and they are not met with in any strata older than the Ordovician, when the genus *Priscochiton* makes its appearance, followed by *Helminthochiton*, *Chelodes*, etc., in the Silurian, *Probolæum* in the Devonian, *Gryphochiton* in the Carboniferous, and so on. For these Palæozoic Chitons Pilsbry (in Zittel, *61*, p. 434) has established the family Gryphochitonidæ, characterized by the absence of insertion plates. The modern Lepidopleuridæ, which date from Tertiary times, are closely allied to them, and, though the higher genera of this family possess insertion plates, these are still unslit. This antique type has only been able to exist to the present time by taking to deeper water, where competition in the life-struggle is less severe (Pilsbry, *44*, p. x).

That older representatives of the Polyplacophora will yet be found, I feel sure, and would suggest search for them among fossils referred to the plates of Pod-Shrimps, seeing that one at least has thence been brought to light (H. Woodward, *57*, pp. 356–358).

The more highly specialized Aplacophora have not been recorded fossil as yet, but some day an energetic microscopist, if any such be left, may when hunting over fossil sponge-spicules come on examples of those of these interesting molluscs.

Measured, then, against the record of the rocks as at present revealed to us, the story of molluscan development according to the latest morphological investigations, based on the study of living forms, is not in complete harmony therewith, although much more so than one would at first be led to suspect. The Amphineura, Scaphopoda, and Opisthobranchia all make a relatively more tardy appearance in the strata than they theoretically should do, while the early Gastropods have distinctly not sorted themselves out phylogenetically. This circumstance is due largely no doubt to the imperfections in the geological record, largely also to the fact that the true relationships of those fossil forms that are known to us, especially the older ones, are not yet satisfactorily determined. Chiefly is this the case with the Gastropoda, in which class, as Eastman remarks (*61*, p. 502, note), "the difficulty of adapting a strictly zoological classification, based upon the anatomy of the soft parts, to the practical needs of the palæontologist is strikingly illustrated."

Although this difficulty may never be entirely overcome, many of the gaps in our knowledge may be successfully bridged by steady patient work of the kind already attempted by Hyatt, Buckman, Waagen, and others, for the Ammonites; by Cossmann, Grabau, and others, for the Gastropods; and by Jackson for the Pelecypods; the method adopted being to trace out the relationship and succession of the various allied species in a given group, or, better still, to trace the morphology of a given form both laterally along a definite horizon, and vertically into successively newer and newer beds. It had been my intention to allude more fully to this method of working, and the class of results it yields, but the subject is one that will well bear treatment at greater length on some future occasion when more time can be devoted to it.

The lacunæ in our knowledge of the interrelationships of the members of the various families and orders of Mollusca are slight, however, compared with the blank caused by the total absence from palæontological history of any hint of passage forms between the classes themselves, or between the Mollusca and their nearest allies. Nor is this hiatus confined to the Molluscan phylum; it is the same for all branches of the animal kingdom. There is circumstantial evidence that transitional forms must have existed, but of actual proof none whatever. All the classes of Mollusca appear fully fledged, as it were. No form has as yet been discovered of which it could be said that it in any way approached the hypothecated prorhipidoglossate mollusc, still less one linking all the classes.[1]

Howbeit, behind the period yielding the earliest fossils known to us must have lain an age equally vast as that separating us from it, and we can only hope that in some yet geologically unexplored region of the earth's surface, examples of older rocks may be found that have escaped the metamorphic agencies which have rendered ours azoic. At present we can only dimly infer from such available material as we have what the connecting links between these forms of life may have been in the past.

Perhaps, by way of conclusion, a word or two as to the possible ancestry of the Molluscan phylum may not be out of place.

The subject has had a good deal of fascination for the morphologists, but dealing with recent material and mostly being unfamiliar with the palæontological aspect and its requirements, the conclusions they have arrived at have been rather various.

The two principal theories are (1) that the Mollusca were derived from the Flat-Worms of the Class Turbellaria, and (2) that they come from the Segmented Worms (Annulata), while recently R. T. Günther (*19*) has sought to show that the Chætognatha are the primitive Mollusca. This last hypothesis has been met by Thiele (*50*) with arguments which though brief seem effective, quite apart from the fact that it does not seem practicable to compare so highly specialized a being as a Chætognath with such equally highly differentiated Molluscan forms as the Dibranchiate Cephalopods and the Pteropoda.

The Turbellarian ancestry of the phylum has been advocated by Lang (*27*), Thiele (*49*, pp. 507–508), and others, Thiele more particularly indicating the Polycladia Cotylea (*49*, p. 529) as the stem. Korschelt and Heider admit that the theory has much to be said for it, but consider "this origin has the disadvantage of starting from very highly differentiated animals, and . . . affords no explanation of the striking resemblance existing between the larvæ of the Mollusca and those of the Annelida" (*25*, pp. 320–321). Pelseneer, however (*36*, p. 368), and Garstang (*18*, pp. 39–44) had already, as it seems to me, sufficiently disposed of the arguments urged in favour of a Polyclad ancestry, the latter postulating a common stem whence the Polyclads branched off on one side and the Annelida

[1] W. K. Brooks (*5a*) has developed a somewhat fantastic idea to the effect that the earliest animals were pelagic, that the principal groups evolved them, and that they subsequently discovered and colonized the sea-floor when they became fossilized. This leaves out of account the fact that pelagic animals drop to the bottom and become fossilized also.

and Mollusca on the other. Conklin (*6*, pp. 192 et seqq.) dwells on the remarkable similarity between the early pretrochophore stages of development in the Annelida and Mollusca. Korschelt and Heider (*25*, pp. 321–2 and 327) incline to the Annelid affinities of the Mollusca; they point to the trochophore stage (trochosphere of Lankester) in both as indicating a common ancestry, and proceed to construct a primitive mollusc therefrom. This is always a dangerous proceeding, and, as they seem to have expected themselves, subsequent discoveries have demolished much of their structure. Other points of agreement that they indicate as existing between the two phyla are—"the conditions of the cœlom," which "agree in such a striking manner . . . that it is difficult to believe that two structures so remarkably alike arose in different ways" (*25*, p. 326), the occurrence of the nephridia and their connection with the cœlom, and the great resemblance of the circulatory system of the Mollusca to that of the Annelida (p. 327).

Pelseneer is yet more explicit, and as early as 1892 (*36*, pp. 371–372) concluded that the Mollusca came nearest to the Polychæta Errantia, and more especially to *Eunice*. The resemblances on which he relies are set forth more fully in his "Mollusques Archaïques" (*39*, pp. 85–87); they include the similarity in the early development in the two classes that has already been alluded to, the structure of the eyes and organs of taste, of the spicules and the generative organs, while in addition the Eunicidæ possess a muscular pharynx, with a cæcal invagination under the œsophagus enclosing chitinous denticles, all which points are paralleled in the buccal mass, radula sac, and radula of the Mollusca. In *Staurocephalus*[1] the similarity of the chitinous denticles to radula teeth is striking. Moreover, the anterior portion of the nervous system in *Eunice* and the Mollusca is, as Pelseneer shows, wonderfully similar. He also would, therefore, derive the Annelida and the Mollusca from a common stock.

It may further be noted that, although the modern morphologist is, as a rule, as chary of mentioning it as the shell-collector is of alluding to the 'nasty animal,' not a few molluscs do possess shells, and that while the morphologist is apt to treat its occurrence as a matter of no moment and a phenomenon that might readily arise at any time, Nature does not seem to acquiesce in this opinion. For except in the case of some of the most highly specialized, shell-less, forms of all, in which by acceleration of development the stage has been suppressed, all molluscs alike start in the egg with an exogastric nautiloid shell. The shell, therefore, being an embryonic character, would point to an ancestry that possessed this feature, and it is suggestive that of all the Worms the Polychæta alone furnish examples provided with calcareous tests (*Spirorbis*, *Serpula*), although in their case there is no organic connection between the animal and its shelly tube.

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[1] What the valid name of this Worm may be is at present uncertain. *Staurocephalus* is preoccupied for Trilobita, and the synonyms, *Anisoceras* and *Prionognathus*, quoted by Carus, are equally forestalled for other branches of the Animal Kingdom.

Another apparent parallelism may be adduced, namely, the spiny girdle of some Polyplacophora and the fringe of iridescent spicules borne by the Sea-Mouse (*Aphrodite*).

The remains of Polychæta, moreover, like those of the Mollusca, date back to early Palæozoic times. The tubes of *Spirorbis* (or kindred genera) are found abundantly in the strata from the Ordovician onwards, and *Serpula* from the Silurian. More important still was the discovery by Dr. Hinde of detached jaws and toothed plates of forms of Polychæta Errantia (*Eunicites*, *Arabellites*, *Œnonites*, etc.) in Palæozoic rocks, from the Ordovician to the Carboniferous, of Canada, Great Britain, and Sweden (*21*, *22*, *23*), while they have also been found by Mr. R. Etheridge, jun., in the Upper Silurian of New South Wales (*13*).

Such, then, so far as I am able to sum it up, is the case of Malacology *versus* Palæoconchology, and I here leave it to your judgement, pausing only to cordially acknowledge the kind help I have received on certain desired points from my colleagues, Dr. A. Smith Woodward, Mr. E. A. Smith, I.S.O., Mr. Crick, Mr. Bullen Newton, and Dr. Calman, as well as from my friend Mr. Pace and others.

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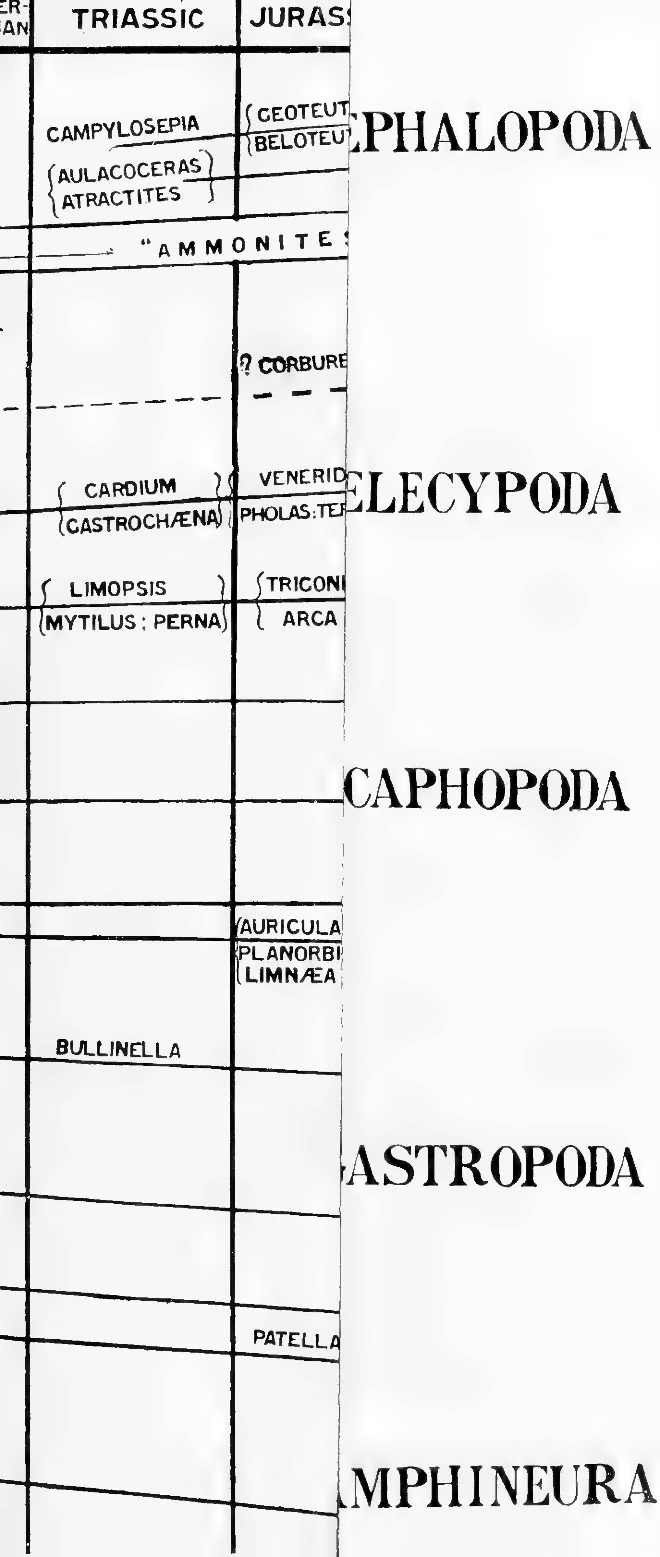

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? CORBURE
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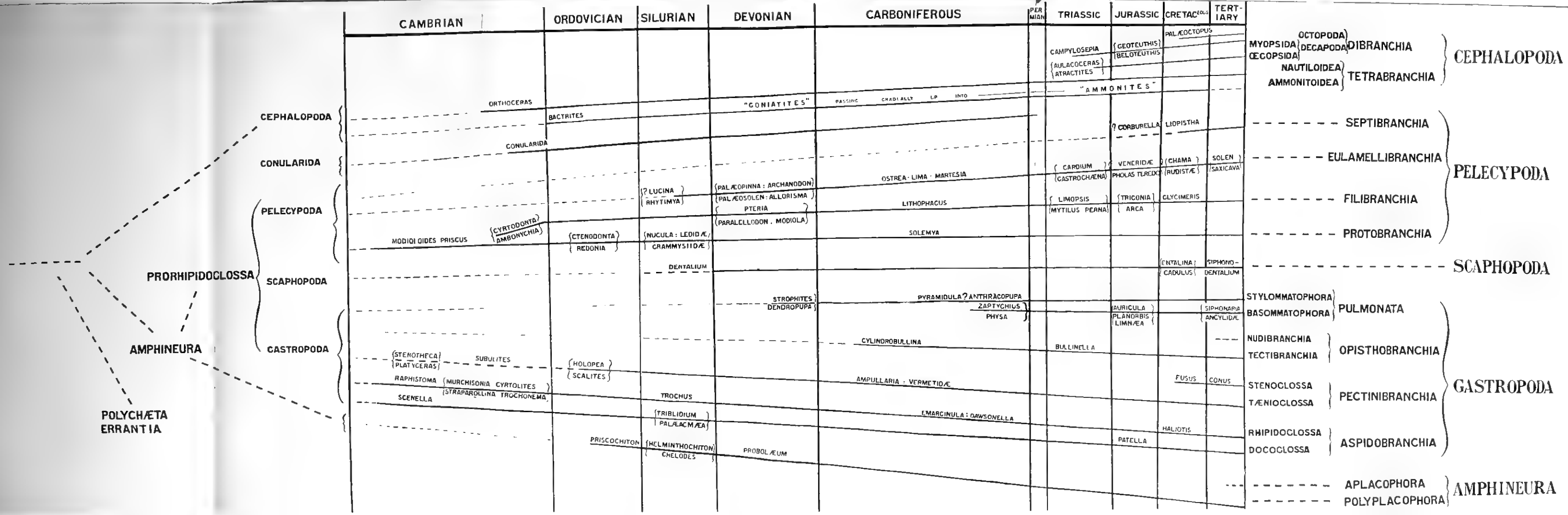
PLANORBI
LIMNÆA
BULLINELLA
ASTROPODA
PATELLA
MPHINEURA



CAMBRIAN
ORDOVICIAN
SILURIAN
DEVONIAN
CARBONIFEROUS
PERMIAN
TRIASSIC
JURASSIC
CRETACEOUS
TERTIARY
CEPHALOPODA
CONULARIDA
PELECYPODA
SCAPHOPODA
GASTROPODA
PRORHIPIDOGLOSSA
AMPHINEURA
POLYCHÆTA ERRANTIA
ORTHOCERAS
BACTRITES
"GONIATITES" PASSING GRADUALLY UP INTO
"AMMONITES"
CONULARIDA
MODIOLOIDES PRISCUS
CYRTODONTA
AMBONYCHIA
CTENODONTA
REDONIA
? LUCINA
RHYTIMYA
NUCULA : LEDIDÆ
GRAMMYSIIDÆ
PALÆOPINNA : ARCHANODON
PALÆOSOLEN : ALLORISMA
PTERIA
PARALLELODON . MODIOLA
OSTREA · LIMA · MARTESIA
LITHOPHAGUS
SOLEMYA
DENTALIUM
STROPHITES
DENDROPUPA
PYRAMIDULA ? ANTHRACOPUPA
ZAPTYCHIUS
PHYSA
CYLINDROBULLINA
STENOTHECA
PLATYCERAS
SUBULITES
HOLOPEA
SCALITES
RAPHISTOMA
MURCHISONIA CYRTOLITES
STRAPAROLLINA TROCHONEMA
SCENELLA
TROCHUS
TRIBLIDIUM
PALÆACMÆA
AMPULLARIA · VERMETIDÆ
EMARGINULA : DAWSONELLA
PRISCOCHITON
HELMINTHOCHITON
CHELODES
PROBOLÆUM
CAMPYLOSEPIA
AULACOCERAS
ATRACTITES
GEOTEUTHIS
BELOTEUTHIS
PALÆOCTOPUS
? CORBURELLA
LIOPISTHA
CARDIUM
GASTROCHÆNA
VENERIDÆ
PHOLAS TEREDO
CHAMA
RUDISTÆ
SOLEN
SAXICAVA
LIMOPSIS
MYTILUS PERNA
TRIGONIA
ARCA
GLYCIMERIS
ENTALINA
CADULUS
SIPHONODENTALIUM
AURICULA
PLANORBIS
LIMNÆA
SIPHONARIA
ANCYLIDÆ
BULLINELLA
FUSUS
CONUS
HALIOTIS
PATELLA
OCTOPODA
DECAPODA
MYOPSIDA
ŒCOPSIDA
DIBRANCHIA
NAUTILOIDEA
AMMONITOIDEA
TETRABRANCHIA
CEPHALOPODA
SEPTIBRANCHIA
EULAMELLIBRANCHIA
FILIBRANCHIA
PROTOBRANCHIA
PELECYPODA
SCAPHOPODA
STYLOMMATOPHORA
BASOMMATOPHORA
PULMONATA
NUDIBRANCHIA
TECTIBRANCHIA
OPISTHOBRANCHIA
STENOGLOSSA
TÆNIOGLOSSA
PECTINIBRANCHIA
RHIPIDOGLOSSA
DOCOGLOSSA
ASPIDOBRANCHIA
GASTROPODA
APLACOPHORA
POLYPLACOPHORA
AMPHINEURA

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DESCRIPTIONS OF TWO NEW SPECIES OF *SYNAPTERPES*.

By Hugh C. Fulton.

Read 13th March, 1908.

Synapterpes (Zoniferella) bicingulatus, n.sp. Fig. 3.

Shell imperforate, subfusiform, glossy, thin, dark green, with two whitish spiral bands on body-whorl, the upper one ascending the spire just above the suture; apex smooth, obtuse, yellowish-white; whorls $6\frac{1}{2}$, slightly convex, slowly increasing, last about half the length of the whole shell, lightly striatulate, somewhat puckered at the suture; aperture subovate, outer bands showing through; peristome quite thin; columella subtruncate, white, slightly expanded in the middle, entering deeply. Alt. 20, maj. diam. 8 mm.

Hab.—Ecuador.

Judging from the figure and description (I have not seen a specimen), this species is near *S. albobalteatus*, Dkr., but readily distinguished by its different form and banding.

The dark-green in the type-specimen is replaced in another by a yellowish-brown colour.

Synapterpes (Zoniferella ?) Pilsbryi, n.sp. Figs. 1, 2.

Shell narrowly umbilicate, rather thin, glossy, arcuately striated; lower whorls covered with narrow spiral bands of various shades of green alternating with several conspicuous narrow whitish bands; apex smooth, whitish, obtuse; whorls nearly 8, moderately convex;

1. 2. 3.

aperture subovate, outer bands visible within; peristome thin; columella almost straight, whitish, moderately thickened, and very slightly expanding up to the point of insertion. Alt. 26, maj. diam. 11 mm.

Hab.—El Congo, Quilachao, Cauca, Colombia. (Messrs. Paine & Brinkley.)

This striking new species is closely allied to the *Zoniferella* group of species placed under the genus *Synapterpes*, Pils. (= *Oxycheilus*, Albers, and *Orphnus*, auct.), in Tryon's Man. of Conch., vol. xviii (1906), p. 227.

The specimen I have taken as the type is an average example, but two or three older specimens show a curious variation in peristomal callosities (Fig. 2)—for instance, one specimen has a very small aperture with the peristome thickened and continuous, with two prominent, shortly entering plaits situated on the outer margin, close to the suture; another specimen has also the two plaits, but one is on the parietal wall and the other on the peristome, both close to the suture; another specimen has the plait on the parietal wall only; a fourth has a thin lip with a single long entering plait just beneath the suture.

Named in honour of Dr. H. A. Pilsbry, of Philadelphia, the eminent and indefatigable American malacologist.

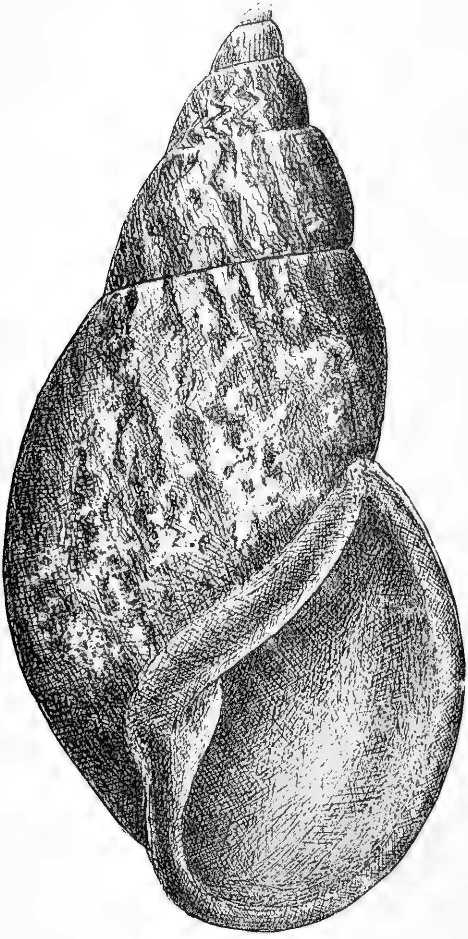
DESCRIPTION OF A NEW SPECIES OF *STROPHOCHEILUS*.

By Hugh C. Fulton.

Read 13th March, 1908.

Strophocheilus (Dryptus) jubens, n.sp.

Shell oblong-ovate, very narrowly perforate, solid, yellowish-brown; middle whorls with irregular dark-brown stripes, last whorl with less



distinct stripes and with a number of more or less distinct spots; nucleus consisting of about three whorls, with rather close and somewhat granular obliquely waved striæ; whorls 6, moderately convex, finely granulated; last whorl somewhat malleated, and with more or less distinct irregular spiral cords near the periphery; lines of growth somewhat decussated; aperture a little more than half the length of the shell, ovate, livid bluish within; peristome moderately thickened and expanded, polished, chocolate brown, fading to yellow on its inner edge; columella yellow, entering fold not very conspicuous, and only moderately strong.

Type (in British Museum): alt. 111, maj. diam. 57 mm.; alt. of aperture (including peristome), 63 mm. Another specimen in British Museum: alt. 140, diam. 73 mm.

Hab.—Capas, Venezuela.

In its general form this species is somewhat near large specimens of *S. Moritzianus*, Pfr., but its spire is more acuminate, its striping bolder; also its distinct granular sculpture and less malleated surface distinguish it from that species.

From *S. pardalis*, Fér., *marmoratus*, Dkr., and *Venezuelensis*, Nyst, it can readily be separated by its less cylindrical form and its proportionately larger aperture. It will be seen by the dimensions given that this species, of which I have seen four specimens, attains a very large size.

ON THE IDENTITY OF *PLECTOPYLIS LEIOPHIS* AND *P. PSEUDOPHIS*.

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

Read 13*th March*, 1908.

Mr. R. Cairns recently sent me three specimens of *Plectopylis* which he was unable to identify. Of their origin he knew nothing beyond the fact that they had been purchased by him at Stevens' Sale Rooms. At first the shells puzzled me somewhat, and I thought they belonged to an undescribed form intermediate between *Plectopylis leiophis* and *P. pseudophis*, for, while having a more depressed spire than the latter, besides being smaller, the parietal vertical lamina was found to be toothed in outline, a feature supposed to be characteristic of *P. pseudophis*. This led me again to examine carefully all the specimens labelled *P. leiophis* in my collection, which had considerably increased in number since first I discussed these structures.[1]

Lieut.-Col. Godwin-Austen in figuring and describing *P. pseudophis*[2] compares it with *P. perarcta*, with which he states it forms a close link, and while figuring side by side *P. leiophis* he overlooked the latter's true affinity with his supposed new species, for while *P. perarcta* is not only invariably smaller and more flattened, and has more convex whorls and a deeper suture, its parietal armature is quite distinct, the vertical parietal lamina not being united below to the second short fold, and its upper horizontal fold descending at first, then ascending, and finally descending again towards the aperture, while in *P. pseudophis* this fold runs parallel with the suture. On the other hand, the only characters which appeared to separate *P. pseudophis* from *P. leiophis* were the toothed outline of the vertical lamina, the more elevated spire, and the absence of the short fold between the first (upper) long fold and the second shorter one. On examining my other specimens I found, however, that none of these characters is constant, for while some specimens have the elevated spire and the toothed outline of the vertical lamina of *P. pseudophis*, and possess the short fold between the two other folds, stated to characterise *P. leiophis*, others, again, have a depressed spire, although the vertical lamina is toothed in a varying degree, being entire in some. I have already mentioned when discussing *P. leiophis*[3] that in a specimen in the collection of the late Dr. W. T. Blanford, and now in the British Museum, the short intermediate fold was absent, and that in an immature specimen in my collection this fold appeared as two short coalesced folds, while the figured[4] specimen of *P. pseudophis* possesses this fold also. In another specimen,

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[1] *Science Gossip*, n.s., vol. iii (1896), p. 154 et seq.
[2] Proc. Zool. Soc., 1874, p. 610, pl. lxxiv, figs. 3 and 3*a*.
[3] Op. cit., v (1898), p. 16.
[4] Loc. cit., p. 17, fig. 77.

which I received some time ago from Mr. Cairns, this same fold appears again as two coalesced folds, the posterior portion being below the anterior, and it possesses in addition an elongated denticle between the latter and the upper long fold, sharing this feature with an immature shell I received from Miss Linter.

In some specimens the free horizontal fold close to the lower suture and below the vertical lamina soon becomes attenuated, and runs parallel with the suture joining the parietal ridge at the aperture, but in other shells this fold terminates a little in front of the vertical fold. The palatal armature is identical in all the specimens. It appears, therefore, that no constant character differentiates *P. leiophis* and *P. pseudophis*, and the two must therefore be united under one name. The former having been published by Benson in 1860,[1] while the latter was described 14 years later, *P. pseudophis* becomes a synonym, and the shell will therefore have to be known as *P. leiophis*.

I would take this opportunity of pointing out that two names have likewise been applied to another species, i.e., *P. jugatoria*, Ancey, and *P. laminifera*, Möllendorff. M. Geret, of Paris, who purchased the collection of the late M. Ancey, was obliging enough to allow me to inspect the type of *P. jugatoria*, and upon careful comparison I found that this shell was identical with Möllendorff's *P. laminifera*. The latter name having been published in the Nachrichtsblatt der Deutsch. Malak. Ges. for November and December, 1885, while Ancey's species was described in Bull. Soc. Malac. France, vol. ii, No. 1, p. 127, dated July, 1885, the former name becomes a synonym, and the species will have to be known as *P. jugatoria*. To put the question of priority beyond doubt, I endeavoured to find out the actual date of publication of the French journal, and owing to Mr. Smith's usual kindness, I was able to see that the copy of it at the British Museum had been received there on October 20th, 1885.

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[1] Ann. Mag. Nat. Hist., ser. III, vol. v (1860), p. 246.

ON THE MOLLUSCA OF SOME HOLOCENE DEPOSITS OF THE THAMES RIVER SYSTEM.

By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S.

Read 13th March, 1908.

I. Uxbridge, Middlesex.

The Holocene deposits of the River Colne, though extensive, are practically unknown, and the only description of them was that given by J. Allen Howe in 1903.[1] The valley of the Colne undoubtedly resembles those of the Lea and the main stream of the Thames itself in that it furnishes evidence of the presence of an old and now buried channel. Unfortunately we have no details as to the depth or exact situation of this channel, but, judging from the main stream, the depth would probably be about 35 feet at Uxbridge. The sections examined are, as so often the case, very different in character. The first one is close to the present bed of the river, where extensive excavations have been made for gravel. The section is—

1. Peaty earth	... ...	2–6 feet.
2. Gravel	... ...	10–20 ,,

The peaty earth contains in places a little shell-marl, and the upper part yielded sixteenth century pottery, bones of ox, horse, sheep, pig, dog, and part of a single shed antler of fallow-deer.

According to information supplied by the workmen, this bed is thickest near the river and gradually thins out towards the eastern side of the valley. The gravel is of Pleistocene age, and probably belongs to the fourth terrace, i.e. a stage later than Crayford. The water-level is about a foot below the top of the gravel, and the gravel is excavated mechanically under water until the London Clay is reached. On the top of the gravel and beneath the alluvium an enormous number of worked flints, probably of late Pleistocene age, was found.

The other sections were first noted by our friend Mr. A. Loydell, who most kindly informed us of them, and placed the extensive collection of Mollusca which he had made at our disposal. These sections are situate at the foot of the eastern side of the valley just north of the main road, and were made during the construction of a railway siding. The deposit here is a sandy clay with molluscan remains scattered throughout, and but little peaty matter or gravel is seen. These beds yielded no evidence in the shape of human relics as to their age.

From these deposits we are now able to record fifty-nine species of Mollusca, viz.—

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[1] Proc. Geol. Assoc., vol. xviii (1903), pp. 188–190.

Vitrina pellucida (Müll.), 1 example.
Vitrea crystallina (Müll.), 2 examples.
V. cellaria (Müll.), 7 examples.
V. radiatula (Ald.), common.
Zonitoides nitidus (Müll.), common.
Euconulus fulvus (Müll.), common.
Arion ater (Linn.), 5 granules.
Punctum pygmæum (Drap.), 20 examples.
Pyramidula rotundata (Müll.), 7 examples.
Sphyradium edentulum (Drap.), 1 example.
Acanthinula aculeata (Müll.), 1 example.
Helicella Itala (Linn.), 3 examples.
Hygromia hispida (Linn.), common.
H. sericea (Drap.), common.
H. rufescens (Penn.), 1 example.
Vallonia pulchella (Müll.), common.
Helix aspersa, Müll., 2 examples.
H. nemoralis, Linn., common.
Helicigona arbustorum (Linn.), common.
Cochlicopa lubrica (Müll.), common.
Jaminia muscorum (Linn.), common.
Vertigo antivertigo (Drap.), 10 examples.
V. pygmæa (Drap.), common.
Clausilia laminata (Mont.), 3 examples.
C. bidentata (Ström), 2 examples.
Succinea putris (Linn.), 10 examples.
S. elegans, Risso, common.
Carychium minimum, Müll., common.
Ancylus fluviatilis, Müll., 4 examples.
Acroloxus lacustris (Linn.), 3 examples.
Limnæa auricularia (Linn.), 3 examples.
L. pereger (Müll.), common.
L. palustris (Müll.), common.
L. truncatula (Müll.), common.
L. stagnalis (Linn.), common.
Planorbis corneus (Linn.), 7 examples.
P. albus, Müll., common.
P. Strœmii, West., 1 example.
P. crista (Linn.), 1 example.
P. carinatus, Müll., 8 examples.
P. umbilicatus, Müll., common.
P. vortex (Linn.), 2 examples.
P. leucostoma, Millet, common.
P. contortus (Linn.), common.
Physa fontinalis (Linn.), 3 examples.
Aplecta hypnorum (Linn.), 1 example.
Paludestrina ventrosa (Mont.), 1 example.
Bithynia tentaculata (Linn.), common.
B. Leachii (Shepp.), 6 examples.
Valvata piscinalis (Müll.), common.
V. cristata, Müll., common.
Neritina fluviatilis (Linn.), 5 examples.
Sphærium corneum (Linn.), 4 valves.
Pisidium amnicum (Müll.), 10 valves.
P. Henslowianum (Shepp.), 14 valves.
P. pulchellum, Jenyns, 1 pair and 1 valve.
P. Casertanum (Poli) [= *cinereum*, Alder], 6 valves.
P. Gassiesianum, Dupuy, 12 valves.
P. pusillum (Gmel.), common.

One young valve of *Pisidium Henslowianum* possesses the appendicula, the remainder, although some of the examples are fine specimens, being devoid of it.

Vitrina pellucida, though a very common and widely distributed shell in these Islands, is extremely rare in a fossil state, and here it is only represented by a single young example.

Hygromia hispida is the commonest helicoid, and as usual is extremely variable, but the larger number are typical *hispida* (= *concinna*, Jeff.). We have on previous occasions mentioned the probability of the existence in England of another species of *Hygromia*, and we are now able to definitely introduce the name of *Hygromia sericea*, Drap. This is the *H. sericea*, Drap., of Continental authors, not of Jeffreys, which latter form is the *H. granulata*, Alder.[1]

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[1] Draparnaud was under the impression, as his synonymy shows, that his shell was identical with the *H. sericea* of Müller, but, as first pointed out by Beck in 1837 ("Index Moll.," p. 20), and frequently since by other authors, Müller's shell was a young and hispid form of his *H. incarnata*. This has been further established by co-types kindly sent us by Dr. A. C. Johansen. Strictly, then, Draparnaud's name cannot stand, but no other name seems available. Studer's *H. albula* is too imperfectly defined, while the *H. piligera*, Ziegler, is a *nomen nudum*, and *H. globularis*, Jeff., is a synonym for *H. granulata*. Under the circumstances we prefer to employ the name in use on the Continent, and to leave it for some future monographer to deal with the question.

We are greatly indebted to Dr. O. Boettger and Dr. Ewald Wüst for kind assistance in determining this species. In a living state we are able to record it from Harrogate, Yorkshire; Knettishall, Mendlesham, Suffolk; whilst in a fossil state it is represented in our collections from the Holocene of Knettishall, Suffolk; Clifton Hampden, Oxfordshire; Staines, Middlesex; Walthamstow, Chignal, Ilford, Essex; Greenhithe, Kent; Westbury, Gloucestershire; and from the Pleistocene of Barnwell, Cambridgeshire; Copford, Essex; and Swanscomb, Kent. There can be no doubt that it is a widely distributed form in England, especially in the eastern counties, but we have not as yet seen specimens from Wales, Ireland, or Scotland.

The band formulæ of the specimens of *Helix nemoralis* are—

1 2 3 (4 5)	8 examples.
(1 2) 3 (4 5)	5 ,,
1 2 3 4 5	8 ,,
1 0 3 (4 5)	2 ,,
0 0 3 0 0	2 ,,
1 0 3 4 5	2 ,,
0 (2 3 4 5)	1 ,,
(1 2 3 4 5)	1 ,,

In their general facies the examples of this species from Uxbridge are very similar to those from the Lea alluvium at Walthamstow.

Helicigona arbustorum, as usual, varies very much in size, the largest measuring 20 × 22·5 mm., and the smallest 13 × 17 mm. A mature sinistral example of this species, found and kindly given us by Mr. Loydell, measures 15 × 17 mm., and is the only fossil reversed specimen that we can trace, though one or two living examples have been found in this country.

Planorbis Strœmii is only represented by a single example, and that may well be a derived specimen.

We have ventured to apply the name of *Planorbis leucostoma*, Millet,[1] to the shell which is generally called in these Islands *P. spirorbis*, Linn., because it is not the latter form, though possibly only an extreme variety thereof.

Paludestrina ventrosa is represented by a single example, and is an extremely interesting record. At the present time this species is with us a brackish-water form, and in the Thames it is not found far above Erith, but in Pleistocene times it was present in fresh water, whilst on the Continent at the present day it frequents both brackish and fresh waters.

Speaking broadly, the shells from Uxbridge are a typical Thames Holocene group, and are in all probability of Roman or post-Roman age.

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[1] The name *P. rotundatus*, Poiret, 1801, antedates this, and is by some authorities considered to represent a synonym of Millet's species, but there is considerable doubt as to what Poiret's species really was, and hence we have not adopted the name.

II. Wallingford, Berks.

We are indebted to Mr. H. J. Osborne White for the material and the details of this section. It is exposed in a boat slip about 100 yards north of Wallingford Bridge on the Oxfordshire side, but is within the Berkshire boundary, which here crosses the river. The section shows—(*a*) Shelly loam, about 4 feet thick at the highest part of the bank, near the stream, resting on (*b*) fine sandy gravel with shells just showing above the water-level.

This bed also yielded remains of ox, horse, and probably sheep. Molluscan remains are abundant in the bed *a*, and of these we are able to compile a list of twenty-six species, viz.—

Agriolimax agrestis (Linn.), 2 examples.
Vitrea crystallina (Müll.), 1 example.
V. nitidula (Drap.), 1 example.
Arion ater (Linn.), common.
Hygromia hispida (Linn.), 6 examples.
Vallonia pulchella (Müll.), 3 examples.
Helicigona arbustorum (Linn.), 1 example.
Cæcilioides acicula (Müll.), 1 example.
Ancylus fluviatilis, Müll., 1 example.
Limnæa auricularia (Linn.), 1 example.
L. pereger (Müll.), 1 example.
Planorbis albus, Müll., 3 examples.
P. Strœmii, West., 8 examples.
P. crista (Linn.), 2 examples.
P. vortex (Linn.), 1 example.
Bithynia tentaculata (Linn.), common.
B. Leachii (Shepp.), 4 examples.
Valvata piscinalis (Müll.), common.
V. cristata, Müll., 2 examples.
Neritina fluviatilis (Linn.), common.
Unio tumidus, Retz., 1 valve.
Sphærium corneum (Linn.), 10 valves.
Pisidium amnicum (Linn.), 4 valves.
P. supinum, A. Schm., 16 valves.
P. Henslowianum (Shepp.), 3 valves.
P. Casertanum (Poli) [=*cinereum*, Alder]? 3 valves.

Bed *a*, judging from its constituent material and the contained mollusca, has been gradually accumulated during repeated floods, and is in all probability being continually added to. The mollusca form a typical Thames Holocene group, all the characteristic species being present. We would again draw attention to the presence of *Planorbis Strœmii* as showing the formerly widespread distribution in the Thames basin of this form, now quite extinct in England.

Of bed *b*, owing to its position, we have not been able to procure so much material as from bed *a*, hence our list of the included mollusca is smaller, comprising only sixteen species, viz.—

Hygromia hispida (Linn.), 1 example.
Succinea elegans, Risso, 1 example.
Acroloxus lacustris (Müll.), 1 example.
Limnæa pereger (Müll.), 2 examples.
Planorbis Strœmii, West., 1 example.
P. carinatus, Müll., 1 example.
Bithynia tentaculata (Linn.), common.
B. Leachii (Shepp.), 4 examples.
Vivipara vivipara (Linn.), 4 examples.
Valvata piscinalis (Müll.), common.
Neritina fluviatilis (Linn.), common.
Anodonta cygnæa (Linn.), 2 fragments.
Sphærium corneum (Linn.), 1 valve.
Pisidium amnicum (Linn.), 1 valve.
P. Henslowianum (Shepp.), 1 valve.
P. Casertanum (Poli) [=*cinereum*, Alder], 1 valve.

This bed is undoubtedly a true stream deposit, and has been laid down in the channel of the river. None of the species calls for any extended notice.

III. Caversham, Oxfordshire.

We are indebted to Mr. L. Treacher for our knowledge of this deposit, which is situated about 200 yards below Caversham Lock on the Berkshire bank of the Thames. The section shows—

1. Alluvium, with very few shells ... ... 3 feet.
2. Shelly loam ... ... 1 foot.
3. Gravel, passing under the river.

Mr. Treacher kindly sent us a sample of the shelly loam, and on washing this we obtained a large number of molluscan remains, representing twelve species, viz.—

Arion ater (Linn.), abundant.
Vallonia pulchella (Müll.), common.
Zonitoides nitidus (Müll.), 1 example.
Hygromia hispida (Linn.), abundant.
Helicella Itala (Linn.), 4 examples.
Helix nemoralis, Linn., 2 examples.
Cochlicopa lubrica (Müll.), 1 example.
Jaminia muscorum (Linn.), 9 examples.
Succinea elegans (Risso), 3 examples.
Limnæa pereger (Müll.), 3 examples.
L. palustris (Müll.), 6 examples.
L. truncatula (Müll.), 5 examples.

We also obtained two small flint flakes. It will be noted at once that no less than eight species are land mollusca, three are aquatic, and one semi-aquatic, whilst numerically the land mollusca predominate. There can be little doubt that we are here dealing with an old land surface, and one that, judging from the abundance of slug granules, was subject to flooding. A change in the level of the river has accelerated the deposition of alluvium, and it now lies buried under 3 feet of that material. In all probability it is of some antiquity, and from the occurrence of the flint flakes may well be of Neolithic age. The band formulæ of the two individuals of *Helix nemoralis* are— 1 2 3 4 5 and (1 2 3 4 5). The occurrence of *Helicella Itala* is noteworthy, since it is a species that rarely occurs in a Holocene alluvial bed.

IV. Ilford, Essex.

In 1904 Dr. Frank Corner sent us a quantity of material which had been obtained from a depth of 6 feet during the rebuilding of the bridge over the Roding. From this, by careful washing, a large number of mollusca was obtained. The deposit is undoubtedly newer than the upper peat, and therefore post-Roman, but nothing was obtained that can in any way enable us to accurately fix its age, although it may well be pre-Norman. Twenty-three species were determined, viz.—

Arion ater (Linn.), 1 granule.
Hygromia hispida (Linn.), 1 example.
Succinea elegans, Risso, 3 examples.
Ancylus fluviatilis, Müll., 1 example.
Acroloxus lacustris (Müll.), 2 examples.
Limnæa pereger (Müll.), 6 examples.
L. palustris (Müll.), 4 examples.
L. truncatula (Müll.), 1 example.
Planorbis carinatus, Müll., 2 examples.
P. vortex (Linn.), 1 example.
Bithynia tentaculata (Linn.), common.
B. Leachii (Shepp.), 6 examples.
Vivipara vivipara (Linn.), 2 examples.
Valvata piscinalis (Müll.), common.
Assemania Grayana, Leach, 1 example.
Neritina fluviatilis (Linn.), 5 examples.
Anodonta cygnea (Linn.), 1 example.
Sphærium corneum (Linn.), common.
Pisidium amnicum (Linn.), 1 example.
P. Henslowianum (Shepp.), 2 valves.
P. subtruncatum, Malm, 4 valves.
P. pulchellum, Jenyns, 1 valve.
P. Casertanum (Poli) [= *cinereum*, Alder]? 7 valves.

Of these the most important is *Assemania Grayana*, which has not hitherto been detected fossil. It is an extremely interesting species, being only known in a living state in England from the estuarine portion of the Thames and Medway, from the River Colne, the Blackwater, the Kentish Stour, the Orwell, the Alde and the Blyth in Suffolk. On the Continent it is known from Ribe, in Denmark, has been recorded from rejectamenta of the sea on the Belgian coast near the French frontier,[1] and has been taken on the German coast[2] on the banks of the dykes of the Dollart in the estuary of the Ems, and at Dangast on the Jade Busen. It will be noted that it only occurs in the area of the old Thames-Rhine river system, and its present discontinuous distribution is to be explained by the inroads of the North Sea, submerging the old estuary.

V. Dagenham, Essex.

In August, 1905, Dr. Frank Corner sent us a large quantity of material which had been obtained at a depth of 20 feet at Dagenham. The soil is a peaty silt containing many twigs and yielding a fair number of molluscan shells, as well as a few caddis-worm cases and insect remains. It is obviously a river deposit, whilst the depth at which it occurs shows that we are dealing with the older Holocene beds, deposits which are but rarely exposed in the Thames Valley, and in fact molluscan remains have only been noted from four localities—Crossness, Charlton, Tilbury, and the London Docks. We are able to record thirty-two species, viz.—

Zonitoides nitidus (Müll.), 5 examples.
Pyramidula rotundata (Müll.), common.
Helix nemoralis, Linn., 1 example.
Helicigona arbustorum (Linn.), 2 examples.
Ancylus fluviatilis, Müll., 2 examples.
Acroloxus lacustris (Müll.), common.
Succinea elegans, Risso, common.
Limnæa pereger (Müll.), common.
L. palustris (Müll.), common.
L. stagnalis (Linn.), 1 example.
L. truncatula (Müll.), 4 examples.
Planorbis corneus (Linn.), common.
P. umbilicatus, Müll., common.
P. carinatus, Müll., 6 examples.
P. contortus (Linn.), 10 examples.
P. albus, Müll., 12 examples.
P. leucostoma, Millet, 5 examples.
P. vortex (Linn.), 6 examples.
P. crista (Linn.), 2 examples.
P. fontanus (Lightf.), 3 examples.
Bithynia tentaculata (Linn.), common.
B. Leachii (Shepp.), common.
Valvata piscinalis (Müll.), common.
V. cristata, Müll., 8 examples.
Neritina fluviatilis (Linn.), 2 examples.
Unio tumidus, Retz., 8 valves.
Sphærium corneum (Linn.), 4 valves.
Pisidium amnicum (Linn.), 12 valves.
P. Henslowianum (Shepp.), common.
P. Casertanum (Poli) [= *cinereum*, Alder], common.
P. Gassiesianum, Dupuy, 2 valves.
P. pusillum (Gmel.), common.

All the examples of *Pisidium Casertanum* belong to the thick hinged mutation.

This collection forms an important addition to our knowledge of the mollusca of the early Holocene, for there are several species which were not noticed at either Crossness or Tilbury. These are *Planorbis corneus*, *P. albus*, *P. carinatus*, *P. vortex*, and *Pisidium amnicum*. Of particular interest are the examples of *Bithynia Leachii*, which resemble the recent Thames form and differ markedly from the var. *inflata*, which was the prevalent type during the deposition of the Pleistocene brick-earths of Crayford and Ilford.

It is noteworthy that *Planorbis Strœmii* is absent as at Crossness and Tilbury. In the main stream it has not yet been found lower

[1] Malzine (F. de), Mém. Soc. Sci. Hainault, i (1867), p. 317.
[2] Borcherding (F.), Abhandl. Naturw. Ver. Bremen, 1883, p. 330.

down than Bermondsey, whilst, in the Lea Valley, Canning Town is its limit.

Practically all the shells show only too plainly the corrosive action of the decaying vegetable remains in which they were buried This is particularly noticeable in *Unio tumidus* and *Neritina fluviatilis*. The examples of the former were so decayed that it was impossible to preserve them, although the species could be easily determined, whilst the two specimens of the latter are nearly destroyed, only the thicker part of the shell remaining.

The deposit is without doubt a shallow-water one out of the main current, and the presence of silt demonstrates that running-water did occasionally reach the spot. There is a total absence of all brackish-water forms, and this, in conjunction with the depth, clearly shows that the deposit was laid down in early Holocene times, when England stretched far out into what is now the North Sea, and the tidal waters were probably miles away.

NOTE ON THE RADULA OF *POMATIAS ELEGANS* (MÜLL.).

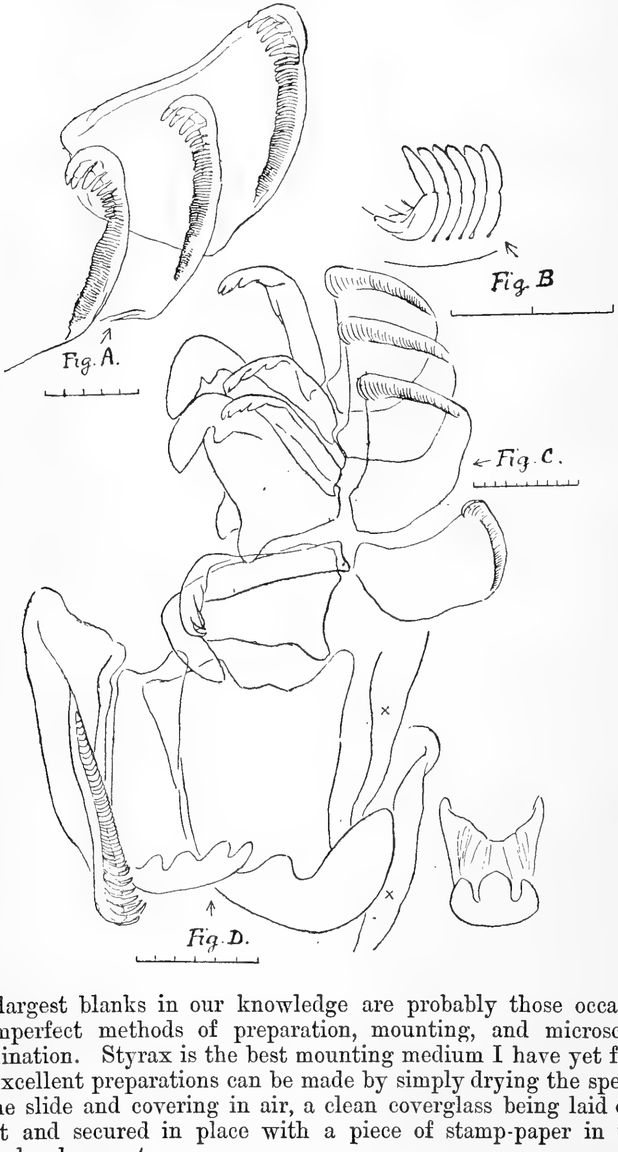
By Rev. E. W. Bowell, M.A.

Read 13th March, 1908.

The radula of this well-known species presents a trifid central tooth of a type somewhat similar to that found in many Pulmonates (*Carychium*, *Succinea*, *Punctum*). Both back and front of the basal plate are furnished with muscular fibres, and these appear to be in connection with the two large chitinous lamellæ which are usually (but I believe erroneously) described as 'jaws.' The fibres are of the semi-striated variety. Two other muscular chains connect the bases of the remaining teeth with the lamellæ, one chain on each side. The anatomical appearances leave no doubt that the individual rows of teeth are moved while the radula is in action. The bases of all the teeth, except the centrals, are approximated, as shown in Fig. C. The tooth which appears to be the first lateral is really tricuspid, though the inner cusp is usually hidden by the unfolding of the central one. I believe this tooth is homologous with the capituliform tooth of *Neritina*. Between it and the central there is a fold (marked × in Fig. D) which probably represents the true first lateral. It is easy to confuse this with the basal plate of the apparent first lateral, but by careful selective staining they may be distinguished. The outside tooth—apparent third lateral—is compound, and bears five large and about forty-five small uncini. In their structure and mode of attachment they are like the marginal uncini of *Neritina*, which are also attached in rows to folds of membrane. These uncini (*Pomatias*) are represented in Figs. A and B; it will be observed that each is composed of two separate elements, differing in refractive qualities, like all other radular teeth. The normal position of these hooklets would seem to be that shown in Fig. D; it is only when the radula is forcibly flattened that they are splayed out as in Fig. C, which is included to illustrate the relations of the bases to which muscular fibres are attached. (The divisions of the scale drawn with each figure represent each a distance of ten micra.)

In many specimens the points of the first five marginal uncini (teeth on the compound third lateral) will be found broken off, and the basal portion which remains presents the appearance of a square tooth. The squared cusps which have been noted on the centrals and laterals of *Vivipara* have the same origin; in all perfect specimens the sharp triangular point is present, though it is readily broken off, and may disappear in the lifetime of the snail. Thus the radulæ of *Valvata* and *Vivipara* are essentially of the same type. All the cusps in *Pomatias* are sharp in young individuals. In *Neritina* the uncini forming the 'fan' are pectinated according to the system found in the marginals of *Limnæa* and other Pulmonates, with which they are doubtless homologous.

So far as the radula goes, *Pomatias* is much nearer to the rhipidoglossate *Neritina* than to the tænioglossate *Littorina*. The actual length of the 'ribbon' is not at all extraordinary; it bears about the same ratio to the size of the animal as in *Neritina*, and it needs no microscope to demonstrate how different is the case with *Littorina*, a form which is readily obtainable for comparison. It should, however, be added that in young specimens of *Littorina* there are traces of the 'fans' which characterise the other two forms mentioned. In other cases they may be present where they have not been figured.



The largest blanks in our knowledge are probably those occasioned by imperfect methods of preparation, mounting, and microscopical examination. Styrax is the best mounting medium I have yet found; but excellent preparations can be made by simply drying the specimen on the slide and covering in air, a clean coverglass being laid on the object and secured in place with a piece of stamp-paper in which a hole has been cut.

THE APPLICATION OF POLI'S GENERIC NAMES.

By A. J. Jukes-Browne, F.G.S.

Read 13*th March*, 1908.

It is well known that much difference of opinion exists with regard to the generic names proposed by Poli in his "Testacea utriusque Siciliæ" (1791–5); some authors considering that there is nothing to hinder their adoption when they have priority to other names, while others are of opinion that they ought not to be employed in our modern system of conchological nomenclature. As a matter of fact neither view appears to be wholly correct, and I think it will be useful to publish some account of his method of nomenclature, so that, having the facts before him, every student of conchology may be able to form his own opinion of the matter.

Poli's work is in two folio volumes, and deals principally with the Lamellibranch Mollusca of the Mediterranean Sea. In the first volume (1791) he describes the animals of a certain number of species, indicating the genera and species by the current Linnean names. His anatomical descriptions and figures are excellent as far as they go, and he notices the points of agreement or difference which exist between the animals inhabiting the different kinds of shells.

Those animals which have certain characters in common he groups together under one generic name, and he perceives that the resemblances between the animals of different Linnean genera are often much greater than those between their respective shells, so that he regards the animals as congeneric in spite of the differences of the shells. Thus the animals of certain species of *Donax* and *Tellina* are grouped under the generic name of *Peronæa*, while those of the chief Mediterranean species of the Linnean genera *Mactra* and *Venus* are found to be so much alike, that all of them, except one, can be placed in the single malacological genus to which he gives the name of *Callista*. The exception is the animal of *Venus exoleta*, Linn., for which he proposes the name *Arthemis*.

Poli thus establishes a number of genera on the characters exhibited by the animal alone, and these genera are evidently intended to be quite independent of the Linnean genera which were based on the shells alone. Indeed, Poli seems to have regarded the shells as covers or constructions inhabited by the animal rather than as integral parts of the organism.

In the second volume (1795) he goes into specific differences, mentioning and describing the various species of shells, but always using the Linnean names both of genera and species: at the same time he indicates to which of his genera the inhabitant of each species belongs. To take an example, on p. 84 he gives a definition of the Linnean genus *Venus*, mentioning several species as examples. He comments on the wonderful variety of form, size, and sculpture displayed in the shells of this genus, but observes that the animals of all the species known to him exhibit great similarity, with the exception of *V. exoleta*, to the animal of which he had already given a special name (*Arthemis*).

On p. 95 he describes *Venus chione*, Linn., and on the next page he describes the enclosed animal in detail, giving it the name of *Callista coccinea*, and referring to a figure of which he says—"fig. 1, Tab. xx inspicientibus *Venus chione* adparebit Callistam coccineam tegens," thus making it quite clear that his main object was to introduce an independent binomial nomenclature for the animals, and that he had no intention of subdividing the Linnean genus *Venus* or of altering the names of the shells which Linnæus had placed in it. To him the name *Venus chione* represented the shell only, and *Callista coccinea* represented the animal which had constructed this shell. Also he might call *V. chione* a Callistoderm, but he would not and does not anywhere write of it as *Callistoderma chione*.

Moreover, in his opinion, different species of *Venus* shells might be formed by the same species of *Callista*. Thus, on p. 91 we have a description of *V. verrucosa*, Linn., and the mollusc itself is named *Callista gemella*, the specific name being given "ob insignem ejus similitudinem cum Callistâ quam Venerem floridam inhabitare demonstrabimus." Accordingly on p. 98 he says (in Latin), "the mollusc which *Venus florida* encloses is *Callista gemella*, and we have shown that *V. verrucosa* is (also) a cover (tegumento) of this," referring back to p. 91.[1]

I think it will now be admitted that Poli's intention was to introduce two separate and independent systems of nomenclature, one for the molluscs and the other for the shells, each system having its own series of generic and specific names. Consequently his list of the Sicilian species of *Venus* and their 'inhabitants' reads as follows:—

Shell.	Animal.
Venus chione, Linn.	*Callista coccinea.*
V. verrucosa, Linn.	*Callista gemella.*
V. gallina, Linn.	*Callista candida.*
V. rudis, Poli.	? (animal not known).
V. florida, Linn.	*Callista gemella.*
V. læta, Linn.	*Callista multicirrata.*
V. exoleta, Linn.	*Arthemis pudica.*
V. litterata, Linn.	? (animal not known).

It will be noticed that in the "Shell" column there occurs the name *Venus rudis*, Poli, because he had described a new species under this name. This specific name is rightly accredited to Poli, because he was the first to distinguish it from the other species of the Linnean genus *Venus*, and because it is clear that he intended the name to apply to the shell and not to the animal, which it seems he had not been able to examine.

Moreover, he seems to have imagined that it would be convenient to have distinctive generic names for the shells regarded merely as the covers or integuments of his Molluscan genera. Such names he

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[1] For these particulars and quotations from Poli I am indebted to the kindness of Mr. J. H. Ponsonby.

provides by compounding the Greek word *derma* with the name of each genus. Thus, from the *Callista*-group of animals we have the generic name *Callistoderma* for the shells, which form the coverings of the various species of *Callista*.

In thus attempting to develop a nomenclature for the animals as well as for the shells he was really only following in the footsteps of Linnæus, who also used a separate terminology for the animals of different kinds of Mollusca, but apparently he saw so little difference in them that he was content to give a single name, such as *Tethys*, *Limax*, or *Ascidia*, to a whole order or division of Molluscous animals. Poli, on the other hand, saw that the animals of each order did present differences which might be regarded as generic, though the genera so distinguished might not always correspond or coincide with the genera established on the shells.

In this connection it is worthy of note that Poli's idea was thoroughly understood by a writer who may have been his contemporary, and who published an essay on the classification of shells only sixteen years after the date of Poli's second volume. This was J. K. Megerle (von Mühlfeld), whose "Outline of a new System of Conchology" was published in 1811.[1] He defines his genera by the characters of the shell and its hinge, and at the end of each description he briefly states that the animal is a "so-and-so," using a combination of Linné's and Poli's names for the molluscs. Thus under his genus *Tapes* he says "the animal is a *Callista*"; similarly of *Mactra* he says the animal is a *Callista*, but of *Pisum* he says the animal is a "*Thetys*."

Lamarck, on the other hand, though also a contemporary, seems to have been entirely ignorant of Poli's magnificent work.

Swainson, however, in his Treatise on Malacology (1840) shows that he was fully aware of the fact that the generic names proposed by Poli were only applicable to the animals, for on p. 16 he remarks: "In estimating the merits of these three great men—Poli, Cuvier, and Lamarck—in regard to their arrangement of the testaceous Mollusca, it may be stated that the first confined his system entirely to the animal, giving to it a different name to that of the shell, so that if the animals of two conchological genera (as *Avicula* and *Lima*) were nearly alike, they were placed in his system in one and the same genus."

So far as I can ascertain, Leach (in 1852)[2] was the first to introduce some of Poli's generic names into our conchological nomenclature, under the erroneous impression that they were applicable to shells. In the following year (1853) Mörch[3] used several of Poli's names in the same manner, and although this publication was merely a sale-catalogue the names used and proposed by him have always been regarded as properly published. A few years later the brothers H. and A. Adams, in their "Genera of Recent Shells," the latter portion of which was issued in 1856–8, adopted most of Mörch's

[1] Der Gesellsch. Naturforsch. Freunde, Berlin Magasin (1811), p. 38.
[2] "Synopsis of the Mollusca of Great Britain," edited by J. E. Gray, 1852.
[3] Cat. Conch. Comes de Yoldi, part ii, Hafniæ, 1853.

names, including those derived from Poli. They have since been used by many authors on the Continent and in America.

Having now explained Poli's method of nomenclature, and the use which was subsequently made of some of his names, I will now briefly consider whether any usage of them can be justified under modern regulations.

In the first place it may be argued that it does not matter what the original intention of Poli may have been, for since both the shell and the animal are now recognized to be parts of one and the same organism, a name applied to the one can now be applied to both. Hence, if Poli was the first to distinguish and to give a name to any Molluscan animal, or generic group of animals, that name can be used in our modern nomenclature.

This argument, however, can only hold good in cases where no displacement of a Linnean or other older name is involved. It may apply to one or two of the cases where only single species are quoted by Poli. Thus *Glossus* was the name given by him to the animal of the shell called *Chama cor* by Linnæus and afterwards generically separated by Lamarck under the name of *Isocardia cor*. I do not see that any reasonable objection can be made to the adoption of Poli's name *Glossus*, which antedates that of Lamarck. The specific name given to the animal by Poli will, of course, be dropped in favour of the Linnean name *cor*; neither is there any necessity to use the term *Glossoderma*, because that was only introduced after the description and naming of the *Glossus* animal.

In other cases, however, where Poli's malacological genus included the animals of two or more Linnean genera of shells the circumstances are different, and I think that his use of the name for a group of animals apart from their shells should have been properly understood and respected. No one ought to have applied the name *Callista*, for instance, to certain species of *Venus*, since it was Poli's express intention to include species of *Mactra* as well as *Venus* under this denomination, and he had no idea of interfering with Linnæus' nomenclature of the shells. Such a use of the name *Callista* is not in any sense Poli's use of it, but is a new and different application of it by later authors, such as Leach and Mörch; if, therefore, the name *Callista* is to be admitted into modern nomenclature it must date from one of these authors and not from Poli.

Now since neither Leach nor Mörch specified a type for their genus *Callista*, the type of the genus must be determined in accordance with the rule recently adopted by the International Zoological Congress at Boston.[1] So far as I can ascertain, the first author to designate a type was Meek, in 1876.[2] He gives *Venus chione* as the type; whence it follows that Mörch's use of the name (1853), and not Leach's (1852), must be accepted as the original date for the genus *Callista*.

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[1] See *Science* for October 18th, 1907.

[2] U.S. Geological Survey of the Territories, Reports, vol. ix, p. 177 (1876).

It appears to me that all Poli's genera must be examined in this manner with the object of deciding whether they should date from Poli himself or from some later author, and further I think that none but the names which have already been imported into conchological nomenclature should hereafter be revived. *Hypogæa*, for instance, has not been used by any conchologist since Poli proposed it for a group of animals belonging to a certain species of the Linnean genera *Pholas*, *Solen*, *Tellina*, and *Donax*, and in my opinion it ought not to be revived for any section or subgenus of any of these genera.

On the other hand, if one of Poli's names has already been so used it seems better to confirm its use than to burden our nomenclature with another new name for the same thing. Thus *Peronæa*, proposed by Poli to designate the animals belonging to certain other species of *Tellina* and *Donax* (Linnæus), was employed by Mörch for a section of the shell genus *Tellina*, represented by *T. planata*, Linn., and *T. nitida*, Poli. He did not indicate a type, however, and so far as we can ascertain the first author to designate a type for *Peronæa* was Stoliczka in 1871,[1] that type being *T. planata*. In 1900 Dr. W. H. Dall, who unreservedly rejects all Poli's names whether adopted by others or not, proposed the name *Peronidia* for the same section of *Tellina*,[2] with *T. nitida* (Poli) as the type. I can see no reason why *Peronæa* should not be accepted from Mörch with *T. planata* as its type, and consequently think that *Peronidia* should be abandoned as a synonym.

The following is a list of Poli's generic names, those which have been used conchologically by subsequent authors being indicated by an asterisk; these need investigation and fixation to some particular type, but the remainder should be relegated to oblivion:—

Hypogæa.	*Glaucus.*
**Peronæa.*	*Daphne.*
**Callista.*	*Echion.*
**Arthemis.*	*Peloris.*
Cerastes.	*Chimæra.*
**Loripes.*	*Callitriche.*
Limnæa.	**Argus.*
Psilopus.	**Axinæa.*
**Glossus.*	

It only remains to consider what use has been made of the names employed by Poli for the shelly coverings of his Molluscan genera. Mörch revived three of them—*Peronæoderma* for a section of *Tellina*, *Daphnoderma* for a section of *Arca*, and *Cerastoderma* for certain species of *Cardium*. I think that *Peronæoderma* should not be used as well as *Peronæa* for a section of *Tellina*; *Cerastoderma* could only be used for *Cardium edule*, Linn., and its congeners, if regarded as a separate section of the genus; *Daphnoderma* can also be used by anyone who thinks that *Arca Domingensis* represents a group of sufficient importance to bear a sectional name.

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1 "Cretaceous Pelecypoda" in Palæont. Indica, p. 117.

2 "Synopsis of the Family Tellinidæ": Proc. U.S. Nat. Mus., vol. xxiii, p. 291 (1900).

ON THE KNOWN RECENT SPECIES OF THE GENUS *VANIKORO*, QUOY & GAIMARD.

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

Read 10th April, 1908.

IN working out a species of *Vanikoro* from South Africa I had occasion to consult the monographs which have been published upon this genus, with the result that there seems to be much confusion respecting several of the species, especially in the monographs by the late G. B. Sowerby in Reeve's "Conchologia Iconica," vol. xx, and the "Thesaurus Conchyliorum," vol. v. The last, for the most part, is, in respect of the illustrations, practically a reproduction of the former, the various errors of identification being also continued. Tryon ("Manual of Conchology") in one or two cases has followed Sowerby's erroneous determinations, besides perpetrating several absurd 'lumpings' of species. Sowerby's monograph is almost valueless with respect to the references he gives, as no pages are quoted, and in some cases they are wholly wrong.

The genus *Vanikoro* or *Narica* was first monographed by Récluz, in the Proc. Zool. Soc., 1843, pp. 136–141, in the *Revue Zoologique* for 1844, in Chenu's "Illustrations Conchyliologiques" in 1845, and in the same year in the *Magasin de Zoologie.* The three works appear to have been unknown to or entirely disregarded by Sowerby. The coarseness of many of the figures in the "Conchologia Iconica" gives a totally wrong impression of the sculpture of the species. It is hoped that the following comments may prove of some utility to conchologists, as they are based upon an examination of the actual types of many of the species.

MM. Quoy & Gaimard, the authors of the work on the Mollusca obtained by the "Astrolabe," recognized certain differential characters in the animal of *Sigaretus cancellatus*, Lamk., and appear at one time to have thought of forming a genus for it, as distinct from *Velutina*, in which they eventually placed that species, the designation they suggested for the supposed new genus being *Vanikoro*, which is the name of an island in the Pacific, north of the New Hebrides group.

Since this, however, was not put forth as a distinct genus, it is questionable whether it should now be adopted in preference to *Merria* of Gray, which was published seven years afterwards.[1] As, however, it is commonly in use, it seems advisable to retain it. With regard to the genus *Narica*, which is preferred by Fischer, Crosse, Bergh, and others, under any circumstances it is antedated both by *Merria*, Gray, and *Leucotis*, Swainson. The first publication of *Narica* appears to be in D'Orbigny's work on the Mollusca of Cuba, vol. ii, of

[1] Gray (P.Z.S., 1847, p. 156) adopted *Vanicoro* (*sic*), placing his *Merria* as a synonym.

which pp. 1–112, according to Wiegmann's Archiv Naturg., 1843, p. 116, appeared in 1842. Philippi, however, in his "Handbuch der Conch. und Malacozool.," p. 184, gives 1836 as the date of that work. I think, however, that he was wrong, and Mr. Davies Sherborn, who has to a great extent worked out the dates of Sagra's "Histoire," agrees with me also. The first actual generic description of *Narica* is that given by D'Orbigny in the Paléont. Franç., where he accredits the genus to himself. At the same time, in a footnote, he refers to the three species which he described in the Moll. Cuba, in which work he states that M. Reclus (*sic*) has the intention of forming a distinct genus of shells under this denomination, *Narica*. It seems, therefore, that this genus, if adopted, must be assigned to D'Orbigny, and not to Récluz.

In the following list only the original localities are given, and a few in the Museum collection about which there is no doubt. Liénard[1] quotes seven species from the Mauritius, and Martens eleven in his work on the Mollusca of the Mauritius and the Seychelles; but were the shells they had before them the same as identified by me? It will be observed that most of the species of the genus are insular.

The identification of the species of this genus is especially difficult as we get no assistance from colour, for, with the exception of *V. rosea*, which I think is probably only the young of *V. Cuvieriana*, all the species are white. Moreover, also, it is very difficult in such figures as those given by Sowerby and Tryon to convey a correct idea of the surface sculpture.

VANIKORO, Quoy & Gaimard.

Vanikoro, Quoy & Gaimard: Voy. Astrolabe, Zoologie, vol. ii, p. 239; name only mentioned, not regarded as a genus (1832); Deshayes, in Lamarck's Anim. sans Vert., 2nd ed., vol. viii, p. 559 (1838).

Merria, Gray:[2] Zool. Beechey's Voy., p. 137 (1839). Type, *Sigaretus cancellatus*, Lamk.

Leucotis, Swainson: Treatise on Malac., p. 346 (1840). Type, *Sigaretus cancellatus*, Lamk.

Narica (Reclus), D'Orbigny: in Ramon de la Sagra's Hist. Cuba, Mollusques, vol. ii, p. 39 (1842). Type, *Sigaretus cancellatus*, Lamk.

Narica, D'Orbigny: Paléont. Franç. Terr. Crét., vol. ii, p. 170 (1842).

Narica, Récluz: Rev. Zool., 1844, p. 4; Mag. de Zool., 1845, p. 1.

1. Vanikoro cancellata (Chemn.), Lamk. B.M.[3]

Nerita cancellata, Chemnitz: Conch. Cab., vol. x, p. 304, pl. clxv, figs. 1596–7.

Sigaretus cancellatus, Lamk.: Anim. s. Vert., vol. vi, pt. 2, p. 208.

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[1] Cat. Faune Mal. Maurice, p. 47 (1877).

[2] The date of this genus is erroneously given by Melvill & Sykes as 1842, Proc. Malac. Soc., vol. iii, p. 227.

[3] B.M. in the margin signifies that the species is in the British Museum.

Merria cancellata, Gray: Zool. Beechey's Voy., p. 137.
Leucotis cancellata, Swainson: Treatise on Malac., p. 346.
Narica cancellata, Récluz: Mag. de Zool., 1845, p. 17, pl. cxix; Bergh, Verhandl. zool.-botan. Gesell., 1896, vol. xlvi, p. 202, pls. ii, iii (anatomy).
Vanikoro cancellata, Sowerby: Conch. Icon., vol. xx, pl. i, figs. 1*a*, 1*b*; Thes. Conch., vol. v, p. 167, pl. 482, fig. 7; H. & A. Adams, Genera Moll., vol. iii, pl. xli, figs. 5–5*c*; Tryon, Man. Conch., vol. viii, p. 67, pl. xxix, figs. 60, 61.
Narica Quoyi, Récluz: Proc. Zool. Soc., 1843, p. 137.
Narica Petitiana, Récluz: Proc. Zool. Soc., 1843, p. 138; Rev. Zool., 1844, p. 5; Mag. de Zool., 1845, p. 24, pls. cxxii, cxxiii.
Vanikoro Petitiana, Sowerby: Conch. Icon., fig. 5; Thes. Conch., fig. 18 (both figures with spire too elevated); Tryon, Man. Conch., vol. viii, p. 68, pl. xxix, fig. 64.
Narica cidaris, Récluz: Proc. Zool. Soc., 1843, p. 137; Rev. Zool., 1844, p. 5; Mag. de Zool., 1845, p. 20, pl. cxxi, fig. 1.
Vanikoro cidaris, Sowerby: Conch. Icon., fig. 4; Thes. Conch., vol. v, p. 167, pl. 482, fig. 10.

Hab.—Oomaga Reef and Lizard Island, North Australia, Borneo, Andaman Is., Seychelles Is., Aden (Brit. Mus.); Vanikoro I. (Quoy & Gaimard); Philippine Is. and Lord Hood I. (Cuming); Mauritius (Liénard, Martens); Nicobar Is. (Chemnitz); Persian Gulf and Karachi (Melvill & Standen).

I fail to distinguish any specific differences in *Petitiana* and *cidaris* of Petit. *Vanikoro cancellata* is the largest species of the genus, and characterized by the reticulated surface and very large aperture. It has been figured by H. & A. Adams, who give original figures of the animal and operculum, by Quoy & Gaimard, who first described the anatomy, and whose figure of the animal has been reproduced by Récluz, Fischer, Tryon, Gray, Keferstein, and possibly others. The shell has been figured over and over again in manuals and elementary treatises, and the more detailed anatomy has been given by Bergh. The latter does not, however, venture an opinion upon the systematic position of the genus, but is content with merely referring to the place assigned to it by Fischer.[1]

2. Vanikoro ligata (Récluz). B.M.

Narica ligata, Récluz: P.Z.S., 1843, p. 138; Rev. Zool., 1844, p. 5; Mag. de Zool., 1845, p. 22, pl. cxxi, fig. 2.
Vanikoro ligata, Sowerby: Conch. Icon., fig. 6; Thes. Conch., fig. 19; Tryon, Man. Conch., fig. 65 only, copy of Sowerby's.
Narica Deshayesiana, Récluz:[2] Proc. Zool. Soc., 1843, p. 138; Mag. de Zool., 1845, p. 48, pl. cxxx, figs. 1, 2.

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[1] Man. Conch., p. 761.
[2] Quoted by Melvill & Sykes from the Andaman Is. and by Angas from Watson's Bay, New South Wales.

Vanikoro Deshayesiana, Sowerby: Conch. Icon., figs. 12*a*, *b* (too coarsely cancellated); Thes. Conch., vol. v, pl. 482, fig. 17; Tryon, Man. Conch., vol. viii, pl. xxix, fig. 69 (copy of Conch. Icon.).
Narica Blainvilleana, Récluz: Proc. Zool. Soc., 1843, p. 141; Mag. de Zool., 1845, p. 53, pl. cxxxi, fig. 2.
Vanikoro Blainvilleana, Tryon: pl. xxix, fig. 71 (after Récluz).
Vanikoro helicoidea, Sow. (*non* Récluz): Conch. Icon., fig. 19; Thes. Conch., fig. 20; Tryon, fig. 68.

Hab.—Philippines (*ligata*, type in B.M.); Philippines, Borneo, N.W. Australia (*Deshayesiana*, type in B.M.); Moluccas for *Blainvilleana*.

With this species Tryon has united *V. cidaris*, *Petitiana*, *helicoidea*, *plicata*, *Deshayesiana*, *Blainvilleana*, *Souleyetiana*, and *delicata*. The absurdity of this 'lumping' may be appreciated by comparing the figures in the Mag. de Zool. of *V. helicoidea* and *V. plicata*. I should mention, however, that his figure of *helicoidea*, copied from Sowerby, has nothing whatever to do with the true *helicoidea* of Le Guillou, which is very badly figured by Sowerby and Tryon under the name *Souleyetiana*, Récluz, a very different species. I have already pointed out that *V. cidaris* and *Petitiana* belong to *V. cancellata*. I am inclined, with Tryon, to consider *Deshayesiana* the same as *ligata*, and *N. Blainvilleana* appears to be merely the young state of the same species. The true *helicoidea* is also like *ligata* in some respects, but more narrowly umbilicated, and with the plications almost obsolete on the whole of the body-whorl.

3. Vanikoro helicoidea (Le Guillou). B.M.

Sigaretus helicoideus, Le Guillou: Rev. Zool., 1842, p. 105.
Narica helicoidea, Récluz: Mag. de Zool., 1845, p. 51, pl. cxxxi, fig. 1.
Non *Vanikoro helicoidea*, Sowerby: Conch. Icon., fig. 19; Thes. Conch., fig. 20; Tryon, fig. 68 = *ligata*.
Vanikoro Souleyetiana, Sowerby (*non* Récluz): Conch. Icon., fig. 11; Thes. Conch., fig. 21, probably; Tryon, fig. 68 (copy of Sowerby).

Hab.—Amboina (Le Guillou).

We have in the Museum the actual shell figured by Sowerby as *V. helicoidea*, and it is undoubtedly a specimen of *ligata*. The true *V. Souleyetiana* is altogether a very distinct species, quite unlike the shell figured by Sowerby.

4. Vanikoro plicata (Récluz). B.M.

Narica plicata, Récluz: Rev. Zool., 1844, p. 7; Mag. de Zool., 1845, p. 40, pl. cxxviii, fig. 1.

Hab.—Ilias I., Philippines. Type in B.M.

This species is very distinct from the shell figured by Sowerby in the Conch. Icon., fig. 3, and the Thes. Conch., fig. 9, and copied by Tryon, pl. xxix, fig. 67. A comparison with Récluz's figure shows at a glance the great difference. Sowerby describes his shell as "rather thin, with numerous thin ribs and spiral striæ; apex rather acuminated," and this description agrees with his figure. On the contrary, the true *plicata* is rather solid, and is coarsely and obtusely plicate, the plicæ extending over the whole of the body-whorl. Moreover, the spire is less raised than in the shell figured by Sowerby and Tryon.

V. plicata was not described in the Proc. Zool. Soc. as stated by Sowerby.

5. Vanikoro Gueriniana (Récluz). B.M.

Narica Gueriniana, Récluz: Proc. Zool. Soc., 1843, p. 139; Rev. Zool., 1844, p. 7; Mag. de Zool., 1845, p. 43, pl. cxxviii, fig. 2.

Vanikoro Gueriniana, Sowerby: Conch. Icon., fig. 2; Thes. Conch., fig. 8 (bad); Tryon, fig. 62 (copy of Con. Icon.).

Hab.—Capul I., Philippines. Type in B.M.

Allied to *plicata*, but more widely umbilicated, with the last whorl less globose. Costæ rather similar, but more oblique. Melvill & Standen have recorded this species from Lifu, Loyalty Is.

6. Vanikoro Montrouzieri (Souverbie).

Narica Montrouzieri, Souverbie: Journ. de Conch., 1879, p. 136.

Hab.—Lifu, Loyalty Is.

This species, which has never been figured, is 11·5 mm. in length, rather strongly costate, and spirally striate upon and between the ribs. The umbilicus is deep, rather broadly funnel-shaped.

7. Vanikoro Gaimardi, H. & A. Adams. B.M.

Vanikoro Gaimardi, H. & A. Adams: Genera Moll., vol. i, p. 375.

Vanikoro Quoyiana, A. Adams:[1] Proc. Zool. Soc., 1853, p. 175, pl. xx, fig. 4.

Vanikoro Gaimardi, Sowerby: Conch. Icon., fig. 9; Thes. Conch., fig. 13; Tryon, fig. 91 (copy of Sowerby).

Hab.—Chusan. Type in B.M.

A. Adams described this species under the name *V. Quoyiana*, and not *Quoyi* as given by Sowerby and Tryon, nor was it a manuscript name as stated by the former. The species is quite distinct from *V. Orbignyiana*, with which it has been united by Tryon.

8. Vanikoro foveolata (Montrouzier).

Narica foveolata, Montrouzier: Journ. de Conch., 1866, p. 138, pl. vi, fig. 6.

Vanikoro foveolata, Tryon: p. 70, pl. xxix, fig. 95 (copy of Montrouzier).

Hab.—Art I., Loyalty Is.

A small strongly cancellated species, about the size of *V. Gaimardi*, but with closer ribs and more spiral liræ.

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[1] Watson's Bay, New South Wales (Angas, P.Z.S., 1867, p. 212).

9. VANIKORO RUGATA, A. Adams. B.M.

Vanikoro rugata, A. Adams: Proc. Zool. Soc., 1853, p. 174; Sowerby, Conch. Icon., figs. 8*a*, *b* (bad); Thes. Conch., fig. 22; Tryon, p. 68, fig. 63 (36 on plate by error; copy of Sowerby).

Hab.—Unknown. Type in B.M.

Erroneously stated by Sowerby to be a manuscript name. In his figures the spiral liræ are not numerous enough, so that in fig. 8*b* the shell appears to have a distinctly cancellated appearance, which is not really the case.

10. VANIKORO EXPANSA, Sowerby. B.M.

Vanikoro expansa, Sowerby: Journ. Malac., vol. viii (1901), p. 102, pl. ix, fig. 3.

Hab.—N.W. Australia, Holothuria Banks, and Baudin Island, 11–15 fathoms (J. J. Walker). Type in B.M.

Judging by a specimen in Mr. Melvill's collection labelled "Australia, Cox Collection," the shell described by Sowerby is merely the young of a species which attains a diameter of 14 mm. It has the remarkably strong cancellation of the spire as described and figured by Sowerby, but this, almost suddenly, alters upon the body-whorl into spiral delicate threads, at first crossed by fine oblique plicæ, which are somewhat nodulous upon the threads. These plicæ gradually die out, so that the last half of the whorl is merely finely spirally sculptured and crossed by fine oblique growth-striæ. Another specimen also in Mr. Melvill's collection, "ex Lombe Taylor Coll.," has a similarly sculptured spire, but the threads on the body-whorl are coarser. The umbilicus in this shell is wider than that of the other.

11. VANIKORO DISTANS (Récluz). B.M.

Narica distans, Récluz: Proc. Zool. Soc., 1843, p. 140; Rev. Zool., 1844, p. 7; Mag. de Zool., 1845, p. 45, pl. cxxix, fig. 1.
Vanikoro distans, Sowerby: Conch. Icon., figs. 13*a*, *b*; Thes. Conch., p. 169, fig. 14; Tryon, p. 70, fig. 93 (copy of Conch. Icon.), fig. 13*b*.

Hab.—Bohol, Philippines. Type in B.M.

The remote oblique costæ, with the fine transverse striæ, are the distinguishing features of this species.

12. VANIKORO SCALARINA, Gould.

Vanikoro scalarina, Gould: Proc. Bost. Soc. Nat. Hist., 1859, vol. vii, p. 44; Otia, p. 110.

Hab.—Loo Choo (Gld.).

Known only by the description. A small species, 10 mm. in length, widely umbilicated, with remote elevated imbricating liræ, decussated with revolving threads.

13. Vanikoro Orbignyana (Récluz).

Narica Orbignyana, Récluz: Proc. Zool. Soc., 1843, p. 140; Rev. Zool., 1844, p. 6; Mag. de Zool., 1845, p. 30, pl. cxxiv, fig. 2.

Vanikoro Cumingiana, Sowerby, *non* Récluz: Conch. Icon., figs. 7*a–b*; Thes. Conch., p. 169, fig. 24; Tryon, p. 70, figs. 90, 92 (*nec* 91, = *Gaimardi*).

Narica tricarinata, Récluz, MSS.: Sowerby, Conch. Icon., sp. 7 in synonymy.

Hab.—La Nouvelle Hollande, sur les côtés de l'île Maria. Can this be Maria I. of the Paumotus?

The shells figured by Sowerby as *V. Cumingiana* certainly belong to the present species.

14. Vanikoro Cumingiana (Récluz).

Narica Cumingiana, Récluz: Proc. Zool. Soc., 1843, p. 139; Rev. Zool., 1844, p. 6; Mag. de Zool., 1845, p. 27, pl. cxxiv, fig. 1 (not good).

Vanikoro clathrata, Tryon (*non* Récluz): p. 68, fig. 76 (copy of Récluz).

Hab.—Island of Samar, Philippines. Type in B.M.

Allied to *V. Orbignyana*, but possibly separable on account of its finer sculpture and less pronounced spiral ridges. It certainly can hardly be the same as *V. clathrata*, with which Tryon has united it. Melvill & Standen have quoted *V. Cumingiana* as a variety of *clathrata* from the Persian Gulf and Jask, on the border of the Mekran Coast.

15. Vanikoro sulcata (D'Orbigny).

Narica sulcata, D'Orbigny: Hist. Cuba, Moll., vol. ii, p. 39, pl. xvii, figs. 26–27 (bad; not 28); Récluz, Mag. de Zool., 1845, p. 38, pl. cxxvi, fig. 2 (bad).

Vanikoro sulcata, Tryon: p. 69, pl. xxix, fig. 78 (copy of D'Orbigny, even to wrong colour).

Narica granulosa, Récluz:[1] Proc. Zool. Soc., 1843, p. 140; Rev. Zool., 1844, p. 6; Mag. de Zool., 1845, p. 32, pl. cxxv, fig. 1.

Vanikoro granulosa, Sowerby: Conch. Icon., fig. 16; Thes. Conch., p. 168, fig. 4 (spire too high); Tryon, p. 68, fig. 74 (copy of Conch. Icon.).

Narica clathrata, Récluz: Mag. de Zool., 1845, p. 42, pl. cxxvii, fig. 1.

Vanikoro clathrata, Sowerby: Conch. Icon., fig. 14 (bad); Tryon, p. 68, fig. 73 (copy of Sowerby).

Hab.—Cuba, St. Lucia, Jamaica (D'Orb.); St. Vincent, St. Thomas (Brit. Mus.) for *sulcata*. Type in B.M.

Moluccas, New Holland, Lord Hood and Annaa Is., Zanzibar (Récluz), for *granulosa*; South Pacific? (Récluz) for *clathrata*. Type in B.M.

After a careful study of the descriptions and specimens of these three so-called species I have failed to discover any characters which

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[1] From Persian Gulf and Hindarabi Island (Melvill & Standen); Port Jackson (Angas, as *granulata* (*sic*)).

will separate them, and I was at one time inclined to think that there must be some mistake in the localities assigned to *V. granulosa*. *N. sulcata* is undoubtedly West Indian. Tryon also united *V. clathrata* and *granulosa*, and respecting *V. sulcata* observes, "only distinguished from forms of the last species [*clathrata*] by locality." D'Orbigny's figure of *sulcata* is a very poor one, and coloured pale purplish, although he correctly describes the shell as "blanc uniforme." The shell he figures (fig. 28) as the young of this species has, in my opinion, nothing to do with it, but represents a species of the genus *Fossarus*. The spiral whorl of *sulcata* is smooth and convex, and the following ones are coarsely cancellated. Tryon has reproduced D'Orbigny's figure, and appears to have followed that author in considering it the very young of the present species.

In vol. ix of his Manual, pl. lii, fig. 6, he again reproduces the same figure of D'Orbigny's under the name of *Fossarus Orbignyi* of Fischer. The latter author gave this name to the fig. 28 on pl. xvii of D'Orbigny's work, recognizing that the shell there depicted was distinct from that represented by figs. 26 and 27 on the same plate.

V. Cumingiana, Récluz, and *V. semiplicata*, Pease, are not synonymous with *V. clathrata*, as suggested by Tryon, but quite distinct, and *Narica anomala*, C. B. Adams, which he thought was probably the same as *V. sulcata*, is the well-known type of the genus *Isapis*, H. & A. Adams.

In vol. ix of his Manual, p. 273, he cites this form under *Isapis* among the "unfigured" species. If he had looked at the original description of the genus,[1] he would have found that it was the only species quoted, and that a very good figure was given by the authors. More remarkable still is the fact that four years previously he had reproduced this figure in his "Structural and Systematic Conchology," vol. ii, pl. lxix, fig. 41.

16. VANIKORO GRANIFERA (Pease).

Narica granifera, Pease: Amer. Journ. Conch., vol. v, p. 78, pl. viii, fig. 13 (1869).

Vanikoro granifera, Tryon: p. 69, fig. 77 (copy of Pease, as synonym of *clathrata*).

Hab.—Jarvis Island, Polynesia.

In the figure of this species there is little trace of an umbilicus, although described by the author as "umbilico patulo." It must be very near *clathrata* (= *sulcata*) as suggested by Tryon.

17. VANIKORO SOLIDA, Sowerby. B.M.

Vanikoro solida, Sowerby: Conch. Icon., fig. 20; Thes. Conch., p. 168, fig. 1; Tryon, p. 70, fig. 88 (copy of Thesaurus).

Hab.— ? Type in B.M.

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[1] H. & A. Adams, Genera Recent Moll., vol. i, p. 320, pl. xxxiii, fig. 8.

A solid, finely granulated species, and peculiar on account of its very small umbilicus. The upper whorls are cancellated, as stated by Sowerby, but the radiating costæ are much stronger and more conspicuous than the spiral liræ upon and between them. The spiral liræ on the body-whorl are finely granose through being crossed by the oblique lines of growth, although this feature is not mentioned in the brief original description.

18. VANIKORO SEMIPLICATA, Pease. B.M.

Vanikoro semiplicata, Pease: Proc. Zool. Soc., 1860, p. 435; Sowerby, Conch. Icon., fig. 22 (bad); Thes. Conch., p. 169, fig. 5 (bad); Tryon, p. 68, fig. 75 (copy of Thesaurus, as synonym of *clathrata* = *sulcata*).

Hab.—Sandwich Is. Type in B.M.

This species is not "tenuiter decussata" as described and figured by Sowerby, but "ornamented with spiral raised striæ" (Pease), with still finer interstitial striæ, and the lines of growth are only faintly apparent. The umbilicus is moderately large and finely grooved within.

19. VANIKORO JAPONICA, Pilsbry. B.M.

Vanikoro japonica, Pilsbry: Cat. Marine Moll. Japan, p. 70, pl. i, fig. 5 (1895).

Hab.—Chikewa, Boshiu, Japan.

A very distinct species, very narrowly perforate, with the last whorl "sculptured with many subequal spiral cords" (Pilsbry). Only the upper whorls are cancellated.

20. VANIKORO RÉCLUZIANA, A. Adams & Angas. B.M.

Vanicoro Récluziana, A. Ad. & Angas: Proc. Zool. Soc., 1863, p. 424; Angas, P.Z.S., 1867, p. 212; Sowerby, Conch. Icon., figs. 18*a*, *b* (spire too high); Thes. Conch., p. 170, fig. 2 (description and figure bad); Tryon, p. 70, fig. 87 (copy of Thesaurus).

Hab.—Port Jackson and Camp Cove, New South Wales. Type in B.M.

A thin, widely umbilicated species, very finely spirally striated, and with the spire strongly cancellated; the body-whorl is broad and the aperture rather patulate.

21. VANIKORO SIGARETIFORMIS (Potiez & Michaud).

Velutina sigaretiformis, P. & M.: Galerie Moll., vol. i, p. 508, pl. xxxv, figs. 21, 22 (bad).

Narica sigaretiformis, Récluz: Proc. Zool. Soc., 1843, pp. 137, 141; Mag. de Zool., 1845, p. 55, pl. cxxxii, fig. 3.

Hab.—New Holland.

The original figure of this species is quite useless, but that given by Récluz, from a specimen he received from M. Potiez, is a very good representation of the previous species (*V. Récluziana*) excepting that the spire does not show the cancellation. This, however, is accurately described in the diagnosis, and I think there is little doubt that they are one and the same species. *Natica margaritacea*, Pot. & Mich., may be identical.

22. Vanikoro imbricata, Pease. B.M.

Vanikoro imbricata, Pease: Proc. Zool. Soc., 1860, p. 435; Sowerby, Conch. Icon., fig. 17 (fair); Thes. Conch., p. 170, fig. 11; Tryon, p. 70, fig. 86 (copy of Thesaurus, as young of *V. acuta*).

Hab.—Sandwich Is. Type in B.M.

A thin, very widely umbilicated species, oblique, closely, obliquely, and finely lirate, with close spiral striæ between the liræ, neither visible to the naked eye. The strong plicæ within the umbilicus are quite evident, however, without the aid of a lens. *V. acuta*, with which this species was united by Tryon, has no oblique liræ, and is not of the same oblique form.

23. Vanikoro striata (D'Orbigny). B.M.

Narica striata, D'Orbigny: Hist. Cuba, Moll., vol. ii, p. 40, pl. xvii, figs. 29, 31; Récluz, Rev. Zool., 1844, p. 47; Mag. de Zool., 1845, p. 57, pl. cxxxii, figs. 1, 2; Tryon, p. 69, pl. xxix, fig. 80.

Hab.—Cuba. Type in B.M.

I do not think *V. oxychone* and *V. vitrinæformis* of Mörch are synonymous with this species, as suggested by Tryon. Both are very small species possessing characters not found in *V. striata*.

24. Vanikoro Natalensis, n.sp. B.M.

Narica acuta, var. γ, Récluz: Mag. de Zool., 1845, p. 61.

Testa *V. striatæ* simillima, sed striis gracilioribus, anfractibus superioribus magis tenuiter cancellatis. Diam. maj. 10·5, alt. 10 mm.

Hab.—Scottsburgh (H. Burnup); Bluff, Durban (G. W. Westcott); Natal (Récluz).

It is with some hesitation that I have ventured to regard this form from Natal as distinct from the West Indian *V. striata*, d'Orb. The striation of the body-whorl certainly is finer, and the cancellation of the antepenultimate whorl is decidedly less coarse. Mr. Burnup's specimen, the dimensions of which are given above, consists of four and a half whorls. Of these the first, forming the minute apex, is smooth, reddish, convex, the next exhibits about ten fine radiating plicæ with fine spiral striæ between them, and the third has about fifteen much coarser radiating riblets. A few more distant faint plicæ are then visible upon the commencement of the penultimate whorl, and the last exhibits only oblique delicate lines of growth crossing the fine spiral striæ, which cover the entire surface, excepting in the rather open umbilicus. The extreme apex of this shell is more raised than that of *V. striata*. It is only by placing specimens side by side, and carefully examining them, that the differences pointed out between these two species can be satisfactorily appreciated.

25. Vanikoro elata, Sowerby. B.M.

Vanikoro elata, Sowerby: Conch. Icon., fig. 23; Thes. Conch., p. 170, fig. 6; Tryon, p. 69, fig. 84 (copy of Conch. Icon.).

Hab.—China Sea. Type in B.M.

A very narrowly perforate shell, very finely spirally striated, striæ crossed by faint lines of growth, not decussated as described by Sowerby. The first whorl is wanting, but the second exhibits two spiral keels. The columella is expanded and reflexed, partly concealing the umbilicus.

26. Vanikoro acuta (Récluz). B.M.

Narica acuta, Récluz: Rev. Zool., 1844, p. 47; Mag. de Zool., 1845, p. 60, pl. cxxxiii, figs. 1, 2.

Vanikoro acuta, Sowerby: Conch. Icon., figs. 21*a*, *b* (very coarse); Thes. Conch., p. 169, fig. 12; Tryon, p. 69, fig. 85.

Hab.—Lord Hood I.; Moluccas. Type in B.M.

An exceedingly finely spirally striated species, widely umbilicated, with rather strong growth-lines within the umbilicus. This species is quite distinct from *V. lamellosa*, D'Orb., and *V. imbricata*, Pease, which have been united with it by Tryon. Evidently he came to that conclusion without having specimens before him for comparison.

27. Vanikoro disparilis, Deshayes.

Vanikoro disparilis, Deshayes: Maillard's Ile Réunion, vol. ii, p. 77, pl. xxxvi, figs. 15, 17; Tryon, p. 69, fig. 83 (copy of Deshayes, as synonym of *V. clathrata*).

Hab.—Ile Réunion.

Known to me only by the description and figure, but evidently, from its minutely decussated surface, it is quite distinct from *V. clathrata*, with which it is united by Tryon.

28. Vanikoro Souleyetiana (Récluz).

Narica Souleyetiana, Récluz: Mag. de Zool., 1845, p. 67, pl. cxvii (animal), pl. cxviii (anatomy), pl. cxxxv, fig. 1 (shell).

Hab.—Bohol, Philippine Is. (Récluz).

This species appears to be hardly separable from *N. acuta*, but certainly is very distinct from *V. ligata*, with which it is united by Tryon. Sowerby's figure of *Souleyetiana* represents *V. helicoidea*, and not the present species. Melvill & Standen state that it occurs at Lifu, Ceylon, and the Paumotus Islands.

29. Vanikoro Cuvieriana (Récluz). B.M.

Narica Cuvieriana, Récluz: Mag. de Zool., 1845, p. 63, pl. cxxxiv, figs. 1, 2.

Vanikoro Cuvieriana, Sowerby: Conch. Icon., figs. 10*a–b*; Thes. Conch., p. 169, fig. 23 (bad); Tryon, p. 70, fig. 94 (copy of Thesaurus).

Hab.—Probably South Pacific (Récluz). Type in B.M.

The thread-like lines are peculiarly raised, very fine and numerous, and rough to the touch, as described by Récluz. I am inclined to think that *V. rosea* is the young state of this species.

30. Vanikoro rosea (Récluz).

Narica rosea, Récluz: Proc. Zool. Soc., 1843, p. 140; Rev. Zool., 1844, p. 6; Mag. de Zool., 1845, p. 36, pl. cxxvi, fig. 1.

Vanikoro rosea, Sowerby: Conch. Icon., fig. 15; Thes. Conch., p. 169, fig. 3 (?); Tryon, p. 69, fig. 82 (copy of Conch. Icon.).

Hab.—Moluccas.

A very small species, or possibly only the young stage of the preceding. Sowerby's description in the Thesaurus appears to be correct, as far as it goes, but the figure he cites, fig. 15, evidently represents another species. His fig. 3, which is rose-tinted, is possibly a poor representation of *rosea*.

31. Vanikoro delicata (Pease).

Narica delicata, Pease: Amer. Journ. Conch., vol. iii, p. 282, pl. xxiii, fig. 25 (1868).

Vanikoro delicata, Tryon: p. 68 (as young of *ligata*), fig. 72 (copy of Pease).

Hab.—Paumotus.

Rather like *V. Cuvieriana* in form, but differently sculptured. It has no relationship whatever with *V. ligata*, of which Tryon considered it the young. *V. ligata* has the upper whorls distinctly plicate and never rose-tinted, and its form is more globose and the umbilicus much narrower.

32. Vanikoro cryptophila, Carpenter. B.M.

Vanicoro cryptophila, Cpr.: Cat. Mazatlan Shells, p. 262.

Hab.—Mazatlan, West Mexico. Type in B.M.

This is a very small shell, and might well be the young stage of some larger species.

33. Vanikoro aperta (Carpenter).

Narica aperta, Cpr.: Ann. Mag. Nat. Hist., 1864, vol. xiii, p. 477.

Hab.—Cape St. Lucas, Lower California.

Another very small form, only about 7 mm. in diameter.

34. Vanikoro insculpta (Carpenter).

Narica insculpta, Cpr.: Proc. Zool. Soc., 1865, p. 280.

Hab.—Acapulco, West Mexico.

A very small form, about 7 mm. in diameter, allied to *V. aperta* and *V. cryptophila*. None of these three species has yet been figured.

35. Vanikoro lamellosa (D'Orbigny). B.M.

Narica lamellosa, D'Orb.: Hist. Cuba, Moll., vol. ii, p. 41, pl. xvii, figs. 32–34.

Vanikoro lamellosa: Tryon, p. 69 (as young of *V. striata*), fig. 81 (copy of D'Orbigny).

Hab.—Cuba, Martinique, and Guadeloupe. Type in B.M.

Mörch[1] considered this species the young of *V. acuta*, and Tryon placed it as the probable early age of *V. striata*. Both conclusions are quite incorrect, as a comparison of specimens of all three forms at once clearly shows. Neither Mörch nor Tryon could have had shells for examination or they would not have made such mistakes. It may be regarded as a rather aberrant form for the genus.

36. Vanikoro oxychone, Mörch.

Vanikoro oxychone, Mörch: Malak. Blätt., 1877, vol. xxiv, p. 94.

Hab.—St. Thomas, West Indies.

A small species, 4 mm. in height, differing from *V. lamellosa* in having a distinct keel circumscribing the umbilicus. Of course it has no relationship with *V. striata*, D'Orb., with which it is united by Tryon.

37. Vanikoro Vincentiana (Angas). B.M.

Adeorbis Vincentiana, Angas: Proc. Zool. Soc., 1880, p. 417, pl. xl, fig. 9; Tryon, Man. Conch., vol. x, p. 86, pl. xxx, fig. 100 (copy of Angas).

Hab.—Aldinga Bay, St. Vincent's Gulf, South Australia. Type in B.M.

This shell seems to me more closely related to *Vanikoro* than to *Adeorbis*. In form it approaches *V. Cuvieriana*, but it is more depressed. It has the kind of sculpture met with in most species of *Vanikoro*, that is to say, a different kind of ornamentation on the spire than upon the body-whorl. The latter is very finely spirally striated, and the antepenultimate whorl is distinctly (under the lens) plicate. This is not referred to by Angas, probably having been overlooked, as the type, presented by him to the British Museum, is not in very fresh condition.

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[1] Malak. Blätt., 1877, vol. xxiv, p. 94.

The following species are referable to other genera, or are beyond recognition :—

1. *Vanikoro semisoluta*, Sowerby: Conch. Icon., fig. 24. I consider that this species would be better located in the genus *Fossarus*. Type in B.M.
2. *Narica tuberosissima* (Montagu), Récluz: P.Z.S., 1843, p. 136. This may be the very young stage of *V. sulcata*, but it is very uncertain.
3. *Narica glaberrima* (Brown), Récluz: P.Z.S., 1843, p. 136. This appears to be a species of *Neritina*.
4. *Narica Mauritiæ*, Récluz: Mag. de Zool., 1845, p. 19, pl. cxx; Chenu, Man Conch., vol. i, p. 331, figs. 2403, 2405. Probably merely the embryo of something.
5. *Narica* (?) *anomala*, C. B. Adams: Contributions to Conch., p. 109. Is the type of *Isapis*. B.M.
6. *Narica ovoidea*, Gould: Boston Journ. Nat. Hist., 1853, vol. vi, p. 380, pl. xiv, fig. 10.

   Narica (*Isapis*) *ovoidea*, Gould: Otia Conch., p. 185.

   As intimated by the author in his "Otia," this species belongs to *Isapis*, in which genus, under the *unfigured* (!) forms, it appears in Tryon's work.
7. *Narica scalaris*, Récluz: Liénard, Cat. Faune Mal. Maurice, p. 47 (1877). Récluz has not described such a species.
8. *Vanikoro gracilis*, Brazier: Proc. Linn. Soc. N.S.W., 1894, p. 169, pl. xiv, fig. 4.

   This species has been shown by Hedley to belong to the genus *Couthouyia* (op. cit., 1900, p. 506, pl. xxvi, fig. 13).

NOTE ON *LANISTES MAGNUS*, FURTADO.

By Edgar A. Smith, I.S.O.

Read 10th April, 1908.

This species was described[1] from a single specimen collected by the Portuguese explorers, Messrs. Capello and Ivens, in the River Luapula in North-Eastern Rhodesia. The British Museum last year received two specimens from Mr. R. L. Harger which he obtained from the same river. He observes that "these molluscs constitute the main food of the Stork (*Anastomus lamelligerus*), which birds probe the mud and sudded marshes in flocks of hundreds, leaving the surface strewn with broken and whitened shells, so that perfect specimens can only be found by feeling about in the mud and water vegetation."

This is the largest known species of the genus *Lanistes*, and is chiefly distinguished from other species by its great size. The two shells obtained by Mr. Harger differ somewhat in form and sculpture from the type, having a shorter spire and a broader body-whorl, and besides the strong lines of growth the surface in places is more or less distinctly malleated. The periostracum of one specimen is of the ordinary olivaceous tint common to many species, but in the other example which is older it is quite black, although not a dead shell. The operculum is very thin, yellowish horny beneath, and coated above with a thin dirty whitish incrustation. For so large a shell it is decidedly small, and does not close up the aperture until it has been drawn within fully two inches from the peristome.

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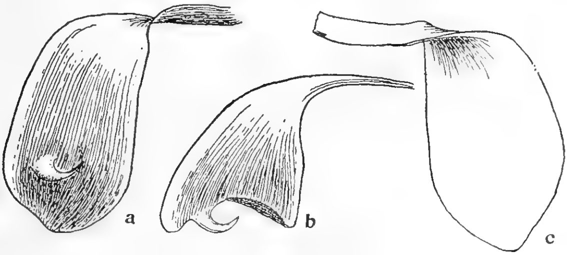
[1] Journ. de Conch., 1886, vol. xxxiv, p. 147, pl. vi, fig. 3.

NOTE ON THE CLAUSILIUM OF A CHINESE SPECIES OF *CLAUSILIA*.

By Professor H. A. PILSBRY.

Read 10*th April*, 1908.

IN the course of some studies on Chinese Clausiliæ I had occasion to examine the structure of *C. Bocki* described by our fellow-member Mr. E. R. Sykes in these *Proceedings*.[1] This species is reckoned by its author to be a member of the section *Pseudonenia*. It agrees fully with that group in characters of the shell and in the general shape of the clausilium; but there is, on the outer face of the latter, at its lower third, a stout acute hook, arising near the palatal side, and directed transversely to the length of the plate, as shown in Figs. *a* and *b*. No such structure has been observed in any other *Pseudonenia*, or in fact in any other *Clausilia* known to me. The only comparable



Clausilium of *Clausilia Bocki*, Sykes. *a*, external view; *b*, view from above; *c*, inside.

structure, so far as I know, is found in the section *Parazaptyx*, Pils.,[2] in which there is a transverse plate or buttress across the outside of the clausilium. *Parazaptyx* is a Loochooan form, not at all nearly related to *C. Bocki*. It belongs to another line of specialization.

In the case of *Parazaptyx* I had thought the function of the transverse buttress might be to strengthen the clausilium; but obviously no such idea can be entertained regarding the hook of *C. Bocki*. The hook on this clausilium reminds one of those inwardly projecting hooks in the apertures of some Polygyras, which seem adapted to catch and hold intending intruders rather than to exclude them.

[1] Proc. Malac. Soc., vol. i, p. 263 (1895).
[2] Proc. Acad. Nat. Sci. Philad., 1904, p. 834, pl. lvii, figs. 101, 104.

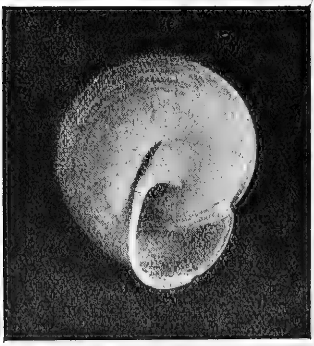
DESCRIPTION OF A NEW SPECIES OF *RHAGADA* FROM WESTERN AUSTRALIA.

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

Read 10*th April*, 1908.

Rhagada Radleyi, n.sp.

Shell discoidal, depressed, white, painted above the periphery with two greyish-brown bands, and below with five bands of the same colour; whorls 4½, transversely marked with lines of growth, the last whorl descending; sutures well impressed; aperture rather oblique, roundly lunate; peristome expanded, scarcely reflexed; columella descending obliquely, expanded over and *almost* sealing the umbilicus and diffused above into a light parietal callus. Alt. 8·5, diam. maj. 15 mm.; aperture, alt. 6, diam. 4 mm.



Hab.—Western Australia.

Allied to *R. Reinga*, Gray, but smaller, and much more depressed; the umbilicus also is not quite closed, as is invariably the case in that species.

ORDINARY MEETING.

Friday, 8th May, 1908.

B. B. Woodward, F.L.S., President, in the Chair.

Professor G. C. Bourne and Mr. H. O. N. Shaw were elected members of the Society.

The following communications were read:—

1. "On the Radulæ of the British Helicids." By Rev. E. W. Bowell, M.A.
2. "Fossil Pearl-growths." By R. Bullen Newton, F.G.S.
3. "Description of a new species of *Batissa* from the Fiji Islands." By H. B. Preston, F.Z.S.
4. "Notes on *Planorbis* and its subdivisions." By Dr. W. H. Dall.

Mr. G. B. Sowerby exhibited the unique specimen of *Conus excelsus*, since acquired by the British Museum.

The President exhibited specimens, both recent and fossil, of *Pisidium personatum*, Malm.

Dr. W. G. Ridewood exhibited specimens of separated cerata or dorsal processes of two species of Nudibranch Mollusca, either *Tethys* or *Melibe*, from Ceylon and Japan. The Ceylon specimens were three in number, and were sent by Mr. James Hornell, Marine Biologist to the Government of Ceylon, and Inspector of Pearl Banks; the Japan specimens were three in number, and were collected by Mr. R. Gordon Smith, who described them as smelling strongly of eucalyptus when caught. Both were obtained by the trawl, and both exhibited lively movements for some considerable time after capture, and responded fairly readily to mechanical irritation. The Ceylon specimens were $1\frac{1}{2}$ inches long and 1 inch wide; the Japan specimens measured 3 inches by $2\frac{1}{2}$.

Dr. Ridewood reviewed the literature bearing upon the subject, and pointed out that in the first reference to such bodies, by Cavolini in 1785, they were identified as the gills of a *Tethys*. Renier, however, in 1807, took them to be external parasites on the *Tethys*, and called them *Hydatula varia*. Rudolphi (1817) also regarded them as parasites, and named them *Phœnicurus varius*, and Otto (1823) adopted the same view and named them *Vertumnus tethydicola*. Delle Chiaje, again, in 1823, described the bodies as Planarian Worms parasitic upon *Tethys*, and he explained the regularity in their arrangement in paired series along the body as due to the fact that they attached themselves by their mouths to the nipple-like projections that occur in two regular rows along the back of the *Tethys*, each in the middle of a gill.

Macri (1825), on the other hand, agreed with Cavolini in regarding the structures as gills or similar organs of the *Tethys*, and he divided the genus according to the number and arrangement of these organs. Verany (1840) and Krohn (1842) also regarded the bodies as parts of the *Tethys*, and Dujardin (1845), in his treatise on Worms, refused to acknowledge them as Worms, and took the same view as Verany and Krohn.

Lacaze-Duthiers, however, in 1874 (Arch. Zool. Exp. et Gen., iii, p. 30), took the opposite attitude, and described a *Tethys* covered with parasites which, he said, had long been known under the name *Fœnicurus*. This opinion was not shared by Bergh, who in his monograph on *Tethys*, in 1875 (Malak. Unters. (C. Semper, Reisen im Archipel der Philippinen, II, ii, Wiesbaden), Heft ix, pp. 345 et seq.), showed that the bodies definitely belonged to the Mollusc, and that they were homologous with the dorsal processes of *Eolis*, a view also held by von Ihering in the year following (Morph. Jahrb., ii, 1876, pp. 27 et seq.).

Lacaze-Duthiers, writing again in 1885 (Comptes Rendus, ci, pp. 30–5), still regarded the bodies as parasites on *Tethys*. In this paper he described how they contracted and changed in form repeatedly after being separated from the body of the host. He noted that they were acœlomate animals, with a much branched digestive system, with no anus, with a definite muscular system, and with a nervous system consisting of two ganglia and two principal nerves arising from them, and a nerve commissure between the ganglia. The conclusion he came to, as the result of his investigation, was that the animals were Dendrocœl Planarians, degraded by a parasitic mode of life. He failed to find any reproductive organs, but this he attributed to the fact that he collected his specimens in May, when presumably they were not ripe for breeding.

By way of rejoinder, Bergh asserted in the following year (Arch. Zool. Expérim. (2), iv, 1886, pp. 73–6) that the dorsal appendages of such Nudibranchs as *Tethys* fall off readily, and retain their vitality for several hours after separation, that the alimentary canal of the 'Phœnicure' is a branched prolongation of the hepatic cæcum of the *Tethys*, and that the papilla to which the mouth of the 'parasite' is attached is the torn stalk of the hepatic cæcum. Lacaze-Duthiers, far from being convinced, followed with a complete description of the anatomy of *Phœnicurus varius*, illustrated by two coloured plates (ibid., pp. 77–108). He adhered to his former view that the body in question was a Dendrocœl Worm parasitic on the Mollusc, and concluded by remarking that he would not believe that the Phœnicure was an appendage of the *Tethys* until specimens of that Mollusc had been bred in captivity and found to develop such bodies.

In the course of the discussion which followed the President called attention to the suggestion made by Professor Herdman and Mr. Clubb that the chief function of the cerata or dorsal papillæ of Nudibranch Mollusca is in some cases to protect the animal by contributing to their inconspicuous appearance, and in other cases to render the animal conspicuous, and to warn predaceous animals of some offensive property (Trans. Liverpool Biol. Soc., iv, 1890, p. 131; also W. A. Herdman, Quart. Journ. Micro. Sci., xxxi, 1890, p. 55).

Mr. R. H. Burne exhibited two partially dissected specimens of *Spirula*. The most perfect of these comprised the whole animal with the exception of the head and funnel, and showed many important points in the anatomy of this rare Cephalopod, more particularly with regard to the relation between the shell and the animal. The broken-off 'neck' lay deep down within the cavity of the mantle, and, by its distance from the mantle-edge, gave some indication of the depth of the pallial inpushing upon all sides of the neck. The fins, which occupy a peculiar position at the extreme hinder end of the body, were also well preserved. They lie in the *vertical* plane, extending backwards on either side of a central boss-like disc, which, from its form (being excavated in the centre), has been regarded as a sucker, though probably without good reason. The shell, although almost completely covered by overgrowths of the mantle, is exposed through two oval windows with smooth unbroken margins, one in the dorsal and one in the ventral body-wall. Through the dorsal window could be seen the last whorl of the shell, and through the ventral one its older coils. The shell was thus clearly seen to be vertical in position to the body, and coiled towards the ventral side (endogastric).

The second specimen consisted of the same parts, but was not in so perfect a state of preservation as the first. Both specimens are in the stores of the College of Surgeons Museum, and probably formed part of the material dissected and described by Owen.

ORDINARY MEETING.

Friday, 12th June, 1908.

E. A. Smith, I.S.O., Past-President, in the Chair.

The following communications were read :—

1. "The Habitat of certain species of *Clausilia* from Dalmatia, Herzegovina, and Bosnia." By Rev. A. H. Cooke, M.A., F.Z.S.
2. "The Dispersal of Land Shells by the agency of Man." By Lieut.-Colonel H. H. Godwin-Austen, F.R.S.
3. "On the Genera of Veneridæ represented in the Cretaceous and Older Tertiary deposits." By A. J. Jukes-Browne, B.A., F.G.S.
4. "Descriptions of new species of New Zealand Marine Shells." By Henry Suter.

Mr. G. B. Sowerby exhibited a series of *Vermetus lumbricalis* and *V. spiratus*, also a specimen of *V. imbricatus* changing into *V. maximus*.

NOTES.

NOTE ON THE OCCURRENCE OF *PISIDIUM PERSONATUM*, MALM, IN THE BRITISH ISLANDS. (*Read 8th May*, 1908.)—For some time past in the course of my studies of the British representatives of the genus *Pisidium* it has been borne in upon me that more than one form had been included under the species *P. nitidum*, Jenyns. Recently, thanks to a specimen most kindly sent me by Dr. A. C. Johansen, and a second example in the Norman collection at the Natural History Museum, I have been able to determine satisfactorily that the form which was perplexing me belonged to the distinct species to which Malm in 1855 gave the name of *P. personatum*. The task of picking the examples out from others of my series is not yet complete, but the following is a list of the localities from which it has so far been recognized:—Barnes Common (Surrey); Keston (Kent); Colchester (Essex); Sigglesthorne Stokon (Norfolk); Fordingbridge (Hants); Bristol (Gloucestershire); Sutton Coldfield (Warwickshire); Lancaster (Lancs); Huddersfield and Swinton (Yorks); Lochmaber (Dumfriesshire); Glenshesk (Antrim); Enagh (Londonderry); MacDara's I. (Galway); Brown's Bay (Sligo); Portmarnock (Dublin).

In the Holocene it occurs at Copford and in the Kennet Valley. The species is therefore widely distributed and probably common in these Islands, though hitherto overlooked.

B. B. WOODWARD.

ON THE RADULÆ OF THE BRITISH HELICIDS. (Part I.)

By Rev. E. W. Bowell, M.A.

Read 8th May, 1908.

Some few years back English malacologists were distinguished for the persistency with which they retained "the old genus *Helix*," and refused to accept, for ordinary use, the various subdivisions which have been made by writers dealing with larger faunas. In other branches of zoology there has been a similar unwillingness to narrow the genera to which Linnæus gave the classical name of the animal. But it now seems to be generally recognized that our Helices form the local representatives of a family rather than of a genus, and the system of nomenclature used by Mr. B. B. Woodward in his paper read before the Conchological Society on January 14th, 1903, is familiar to all conchologists.

It is the object of this paper to suggest that the study of the radulæ of Helicids affords a means of estimating the importance of the subdivisions of the old genus *Helix*. Some possible misconceptions of this view are here to be anticipated. *The actual number of the teeth on any given radula may be a matter of comparatively little importance*; certainly some of the estimates given in the older literature of the subject are at variance with ordinary fact, just as the measurements of shells have in many cases been shown to be. It becomes a question how many of the extreme marginal rows shall be counted as teeth; and in some forms (e.g. *Planorbis*), though not conspicuously in the Helicids, this is a very difficult question, owing to the presence of numerous rows that consist of basal plates only. Again, the number of teeth at the growing end of the organ, that are reckoned as existent, will largely depend upon the operator and his methods and instruments, and if it be thought necessary to take all into account that are just beginning to be teeth, one will have to add six or seven transverse rows to the ordinary computations. The imperfect rows which always occur at the front or older end of the radula must not be considered as the representatives of complete rows that have formerly existed; they form a valuable index of the actual number of rows that existed in the embryonic or sub-embryonic stage of the animal's life. Another point that sometimes causes unnecessary perplexity is the question of the existence or non-existence of an endocone when that part of the tooth is apparently reduced to a mere corner, which may be more or less clearly demonstrated by using various kinds of illumination. In all the Pulmonata that have come under my notice, with the exception of the Testacellidæ and the Physidæ, each lateral tooth possesses a central cusp which is flanked by the more or less prominent folds called ectocone and endocone. The point of first importance to consider seems to be whether this central cusp is itself single, as is generally the case, or double, as in the larger species of *Vitrea* (laterals) and *Helix* s.s. (marginal), or *Vitrina* (both lat. and marg.). In the group now under notice the prevailing characteristic is the presence of a deposit of chitin which more or less completely fuses the central cusp with the 'endocone' in the adult radula; the earlier condition, in which these two were markedly separate, may be seen in the embryo, and in the skeleton teeth at the growing end. Relatively to the basal plates, the teeth are always turned inwards, except in the case of the central tooth. Hence there is always a tendency for the endoconic fold to become hidden and obliterated, and for the ectoconic one to assume greater importance. This latter factor is especially noticeable in small species; in the larger ones the tongue tends to become wide and flattened, and consequently the distinction between the central and lateral teeth is less and less marked. A mechanical reason for this may be found in the fact that the actual size of the teeth does not vary uniformly with the actual size of the animal.

The radula of *Punctum pygmæum* is totally unlike those of the true Helicids; but it is evidently very near to the type prevailing in the Succineidæ. The laterals and marginals are multicuspid, the two larger cusps representing the mesocone. The teeth are long and pointed. *Carychium minimum* presents a very similar state of things, but is much closer to the type prevailing in the Succineidæ. It may be worth mentioning that *Carychium* has a maxilla composed of separate plates, very much like that of a small *Planorbis*. The radula of *Vertigo Moulinsiana* is of the same type as that of *Punctum*.

Pyramidula rupestris is an almost exact copy, on a very small scale, of *Chilotrema lapicida*. It has not the slightest resemblance to *P. rotundata*. This latter species has a radula very easily distinguished from those of other Helicids, and apparently it is an earlier form; for it unites some features (tendency to multicuspid marginals, especially in young examples) which remind us of the Pupidæ, with a general facies like that of the group next to be considered. I am here speaking entirely of the radula, neglecting for the occasion our other sources of information bearing upon phylogeny. In the sequel I hope to make some suggestions as to their relative importance.

The next group, judging by the radula, is a large one. It will include *virgata*, *Itala*, *caperata*, *cantiana*, *granulata*, *hispida*, *sericea*, *revelata*, and *rufescens*. These are all very much alike; the differences which divide them are not greater than those which divide the group of large species of *Vitrea* which have lately been so much under consideration. All of them show a strong resemblance to the Arionidæ, especially to *A. hortensis*. Here the mesocone in the marginals is represented by a single point, shaped like the blade of a pocket-knife. In other particulars they show an approximation to the true Helices—if such a phrase may be allowed.

Cochlicella barbara presents a radula as anomalous as the rest of its structure. It even possesses slightly bifid marginal mesocones; while there is also present a tendency to pectinate form in the extreme marginals that suggests relationship with the Pupidæ.

Hygromia fusca appears to be out of place. Its radula is very distinctive, but evidently has affinities with those of *lapicida*, *arbustorum*, *rupestris*, and (more distantly) of *obvoluta*.

Acanthinula aculeata resembles *Vallonia* except in the possession of a very much greater number of laterals. The marginals in these (three or more?) species are regular little combs, and quite similar to those found in the Vertiginidæ. Several varieties of *Vallonia* occurring in this country possess distinct forms of radulæ; they have a great tendency to asymmetric laterals, one or two rows being enlarged at the expense of the others. The laterals of *aculeata* are exceptionally regular—another instance of character inversion in closely allied species.

Helicodonta obvoluta is distinguished by the unusual angularity of the cusps throughout the radula; they form a pattern very suggestive of holly-leaves. In *Helicigona lapicida*, on the contrary, every cusp is rounded off, almost squared off; but the teeth do not appear to be exceptionally strong in build. Yet their general disposition is similar to that seen in *Helicodonta*; it might be supposed that (with those of *fusca*?) they were the prototypes of the true Helices.

The radula of *arbustorum* seems intermediate between these (*Helicigona*) and those of the true Helices. The tendency is towards the latter, but they are still quite separate from them.

Of the remaining species, *aspersa*, *pomatia*, *nemoralis*, *hortensis*, and *Pisana*, it may be said that they form a very well-defined group, easily separable at once from the others. The marginal mesocone is always pronouncedly blunt and bifid, resembling a little hand with an extra thick thumb, the fingers being apposed. Each of these five species may be distinguished by special points of minor importance, but their general resemblance is great. The South European group, of which *splendida* is an example, also belongs here.

According to this evidence, *Helicella* and *Hygromia* would be classed together, or regarded as closely allied, excluding *barbara* as a form archaic or aberrant, and *fusca* as being plainly near to *Helicigona* and *Helix* (s.s.). To the group of minor Helices, distinguished by Arionid radulæ, *rotundata* may perhaps be added. *Acanthinula* and *Vallonia* are close together, and closer to the Vertiginids than to any Helicids. *Helix* (s.s.) remains a well-marked group, and its relationship to *Helicigona* is certain. *Helicigona* should include *rupestris*, and *Punctum pygmæum* may remain in the Endodontidæ.

These suggestions are made solely on the evidence arising from the radulæ, and I should be the last person to neglect the other evidence, derived from shell, maxilla, diverticula of reproductive system, and even from geographical distribution. But I put them forward here in order to show that the comparative study of radulæ may be a great help to systematic malacology or conchology. The radula is a comparatively hard and unalterable organ, and its characters are more constant than those of the diverticula above mentioned, the functions and physiology of which (not to mention their embryology) are still for the most part unknown.

(*To be continued.*)

FOSSIL PEARL-GROWTHS.

By R. Bullen Newton, F.G.S.

Read 8*th May*, 1908.

PLATES IV and V.

I. Introduction.

Although much has been written on the history of modern pearls, very few records appear to exist calling attention to the occurrence of such bodies in the fossil state. John Woodward, in 1723 (" An Essay towards a Natural History of the Earth," 3rd ed., p. 24), briefly referred to the fact that fossil shells, as well as recent, had " pearls and the like still actually growing upon them." In 1836 Goldfuss[1] figured a natural internal cast of an example of *Inoceramus Cripsii* (*non* Mantell) from the German Cretaceous deposits, with numerous pittings which were doubtless the result of pearly protuberances developed on the inner surface of the valve.

The late Professor John Morris[2] published some interesting notes in 1851, with illustrations, which are of sufficient interest to reproduce: " *Pearl-like bodies.*—Most persons are aware that some forms of the conchiferous mollusks are subject to certain abnormal secretions, assuming a more or less regular form, and composed of fibro-calcareous matter generally arranged in a concentric manner; sometimes it is solidly attached to the inner layer of the shell, of which it forms a portion; at others it is found perfectly free in the fleshy substance of the mollusk itself, of a symmetrical shape, as in the perfect pearl. Evidence of phenomena resulting from similar conditions has been detected in certain fossil genera, but few, if any, instances have been recorded. The collection of Mr. Wetherell contains many illustrative specimens; in one, a *Gryphæa* [*dilatata*] from the Drift of Muswell Hill, and probably coming from the Oxford Clay [really Kimeridge], is an irregular elongated body, free at both ends, but attached by a considerable portion of its surface, the external lamina being continuous with the shell; the outer layers do not, however, show the regular fibrous arrangement of a perlaceous body, but this may have been changed by subsequent mineralization. In another specimen the pearly body is attached to the interior of an *Inoceramus*, and shows the concentric arrangement of the fibrous substance, and which is better exhibited in the specimen showing a complete section of one of considerable size, quite unattached to any shell, from the Chalk of Kent." The material which formed the subject of Professor Morris' statements is now in the collection of the British Museum.

Ten years later (1861) Professor H. G. Seeley[3] described *Perna oblonga*, the valves of which occurred as natural casts in the phosphatic

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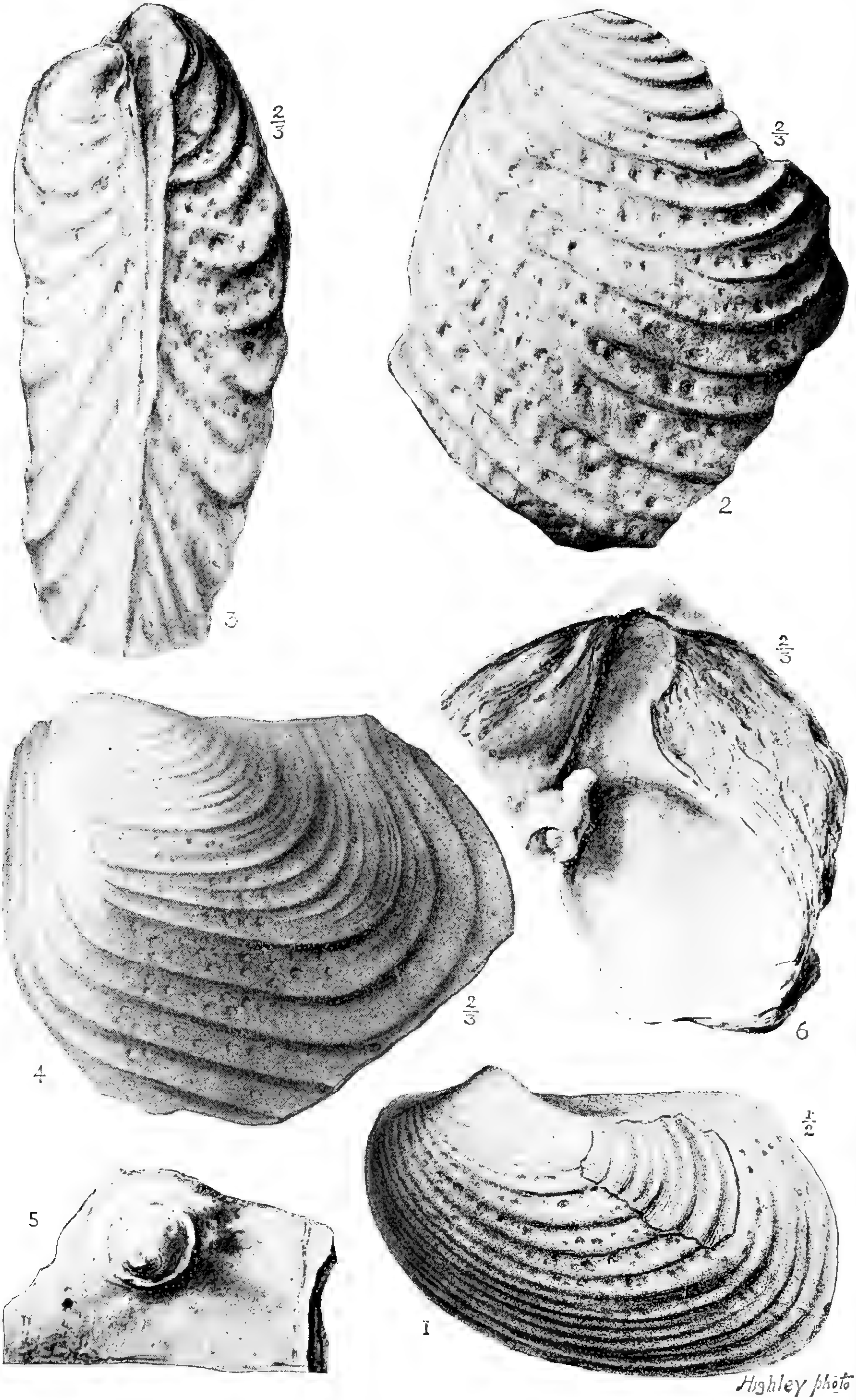
[1] Petrefacta Germaniæ, 1836, vol. ii, p. 116, pl. cxii, fig. 4*d*.
[2] Ann. Mag. Nat. Hist., 1851, vol. viii, p. 85, pl. iv, figs. 12, 13, 14, 16.
[3] Ann. Mag. Nat. Hist., 1861, vol. vii, p. 121, pl. vi, fig. 6.



FOSSIL (MESOZOIC) PEARL REMAINS.

beds of the so-called Cambridge Greensand. The sides of these casts were found to be frequently covered with rounded pittings, the origin of which was fully acknowledged by the author to be due to the former presence of pearls on the original interiors of the valves.

Another internal cast of an *Inoceramus* (*Inoceramus sagensis*, var. *quadrans*) with rounded cavities, from the Cretaceous rocks of New Jersey, was figured by Professor R. P. Whitfield[1] in 1885. Somewhat similar pittings were figured by Professor Yokoyama[2] as being present on an *Inoceramus* cast from the Upper Cretaceous rocks of Japan, and mention may also be made of isolated pearls occurring in the marine Post-Pliocene deposits of the Clyde Basin at Garvel Park, which have been referred to by Mr. D. Robertson.[3]

As a final statement under this heading, reference may be made to numerous minute spherical bodies varying in diameter from $\frac{1}{1000}$ to $\frac{1}{200}$ of an inch, which were detected in some examples of Chalk from Cherry Hinton near Cambridge, Swaffham in Norfolk, and other localities, by C. B. Rose[4] during 1859, who mentioned their occurrence in connection with some observations on "Geological Pearls." Mr. Rose was of opinion that if these minute spheres were to be recognized as pearls, then they might be considered as 'seed-pearls.' Later investigations have, however, proved that such structures are not pearls, but represent the disunited cells of Globigerinæ and other Foraminiferal remains, a fact clearly demonstrated by Messrs. W. Hill and A. J. Jukes-Browne,[5] whose microscopical researches have included the examination of specimens of chalk obtained from the same localities as those referred to by Mr. Rose.[6]

II. Occurrence and Formation of the Pearl.

According to S. P. Woodward's "Manual of the Mollusca," pearls are found in quite a number of shells, the chief of which are the Oriental pearl-oyster, *Margaritifera vulgaris*; the British river mussel, *Unio margaritiferus*; the common oyster, *Ostrea edulis*, *Anodonta cygnæa*, *Pinna nobilis*, *Mytilus edulis*, *Spondylus gæderopus*, *Arca noæ*, and *Anomia cæpa*. Similar prominences or concretions occur in the interiors of some porcellanous shells, as for instance in *Turbinella scolymus* and *Strombus gigas*, which are of pink colour, but these are not true pearls, not being nacreous, and are said to lose their colour in course of time.

A popular theory as to the origin of the pearl was that particles of sand were accidentally confined between the mantle and the shell,

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[1] Mon. United States Geol. Survey, 1885, vol. ix, p. 79, pl. xiv, fig. 16.
[2] Palæontographica, 1890, vol. xxxvi, p. 175, pl. xviii, fig. 6.
[3] Trans. Geol. Soc. Glasgow, 1883, vol. vii, pt. i, p. 31.
[4] The Geologist, 1859, vol. ii, p. 295.
[5] Quart. Journ. Geol. Soc., 1886, vol. xlii, p. 228; and "The Cretaceous Rocks of Britain (Upper Chalk)," vol. iii, Mem. Geol. Surv. United Kingdom, 1904, pp. 302–48.
[6] I am indebted to Mr. C. D. Sherborn, F.G.S., for calling my attention to Mr. Rose's paper.

giving rise to irritation and the subsequent secretion by the animal of perlaceous growths. Although this view might occasionally hold good, it is distinctly proved by modern researches that the majority of pearls are derived from an organic nucleus due to certain parasitical worms which infest the soft parts of the mollusc. Such a discovery is by no means new, and we owe it to very early investigators, going back to Rondeletius in 1558 and even before his time. The more systematic work was, however, accomplished by Professor F. de Filippi[1] in the early fifties, who demonstrated that the Trematode parasite, *Distomum duplicatum*, was the cause of pearl-formation in the fresh-water mussel *Anodonta*. Küchenmeister,[2] working on the same lines, extended this view to other pearl-producing shells and to other parasites, and he found that pearls were most abundant in the quiet waters of the River Elster, Saxony, where water-mites (*Limnochares anodontæ*) existed most numerously. In 1857 Kelaart[3] investigated the natural history of *Margaritifera vulgaris*, the pearl-oyster of Ceylon, and was probably the first to prove the presence of parasitical worms in the soft parts of that animal, to which he traced the origin of the pearl concretions. Without quoting the later writers on this subject, it is enough to refer the student to Professor Herdman's comprehensive "Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar," published in five volumes by the Royal Society between the years 1903 and 1906. For this work Messrs. A. E. Shipley and James Hornell have contributed a most valuable memoir on "The Parasites of the Pearl Oyster," which are regarded by them as belonging to three groups of the Entozoa, viz. Cestodes, Trematodes, and Nematodes (1904, vol. iv, pp. 77–106, pls. i–iv), whilst Professor Herdman, in conjunction with Mr. J. Hornell, has written a special chapter on "Pearl Production," which is of the highest importance (1906, vol. v, pp. 1–42, pls. i–iii).

According to Dr. H. Lyster Jameson,[4] the term 'blisters' is applied to "internal excrescences of the shell, caused by the intrusion of foreign bodies between the mantle and the shell, or by the secretion of a nacreous cicatrix to close the perforations of boring molluscs, worms, or sponges. These are sometimes referred to as 'attached pearls,' or even as 'pearls,' but have a totally different mode of origin, and should never be confused with the latter." Valves of *Mytilus edulis* are sometimes furnished with the so-called 'blisters,' which may have been produced in the manner indicated, as minute perforations are observable on the external surface of some examples in the zoological department of the British Museum.

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[1] "Sull' origine delle Perle": Il Cimento (Torino), 1852, vol. i, pp. 429–37. This paper was translated by Küchenmeister in Müller's Archiv Anat. Physiol., 1856, pp. 251–68.

[2] Müller's Archiv Anat. Physiol., 1856, pp. 269–81.

[3] "Introductory Report on the Natural History of the Pearl Oyster of Ceylon": reviewed by J. S. Dallas in the Ann. Mag. Nat. Hist., 1858, vol. i, pp. 81–100.

[4] "On the Origin of Pearls": Proc. Zool. Soc. London, 1902, vol. i, p. 147.

III. Artificial Pearls.

That pearls could be produced by artificial means has long been demonstrated by Linnæus and others. Even from the thirteenth century the Chinese adopted methods for the production of pearls in the valves of the large fresh-water mussel, *Barbala* (*Dipsas*) *plicata*, found in the rivers of their country. They inserted mother-of-pearl or metal plates of small size, so fashioned as to represent images of Buddha, which were cleverly introduced between the mantle of the animal and its shell, to the number of eleven or twelve, with their heads directed in one way, mostly postero-vertically. This mechanical device was accomplished during the life of the mollusc, the valves being returned to the river-beds, when, after some months, a nacreous secretion was found to cover the images, the valves in that condition being ultimately sold as curios by the natives. Dr. J. E. Gray[1] has written some interesting papers on this industry, as well as many other authors.

IV. Fossil Pearls.

These calcareous concretions, or pearl-growths, found occasionally adherent on the inner surface of certain fossil pelecypod valves, or even in the free condition, may occur either in great numbers, when they would be moderately small, or singly, when they might be of considerable size. It is generally admitted that pearls are of similar structure to the shells in which they are found, and like them consist of three layers; in the case of adherent specimens the inner layer of the shell is easily seen to form the outer layer of the pearl.

So far as present researches have gone, it is worthy of note that fossil pearls have only been observed among the genera *Volsella* of the family Mytilidæ, *Inoceramus* and *Perna*, members of the Aviculidæ, and *Gryphæa*, one of the Ostreidæ. Such relics are apparently most rare, those known to the writer and which are referred to in this paper being chiefly of Mesozoic age. There is no reason why certain Palæozoic Pelecypods should not exhibit similar structures, yet no authentic account can at present be traced.[2] The British Pliocene (Crag) deposits have yielded pearl-structures, but these, in the opinion of the writer, are most probably derived and had their origin in the Chalk.

The various examples of pearl-growths found in the fossil state which have come under my notice during the preparation of this

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[1] "On the Structure of Pearls, and on the Chinese mode of producing them of a large size and regular form": Annals of Philosophy, 1825, vol. ix, pp. 27–9. "Figured Pearls of the Chinese": Ann. Mag. Nat. Hist., 1854, vol. xiii, p. 238.

[2] Allusion may be made here to certain minute spherical bodies described by Professor W. J. Sollas from the Wenlock Limestone near Cardiff, which were found associated with *Favosites fibrosus* (=a coral). From their pearly lustre and slight translucency, these spheres resembled a number of small pearls, but as they only showed a concentric structure without any trace of radiating fibres they were regarded as oolitic grains formed by a deposition of carbonate of lime from solution. (Quart. Journ. Geol. Soc., 1879, vol. xxxv, pp. 501, 502.)

paper will now be referred to under the particular shell with which they are associated, some of the material being in the collection of the British Museum, which includes the 'Morris' specimens described in 1851.

Family MYTILIDÆ.

Volsella modiolus (Linnæus).

Mytilus modiolus, Linnæus: Syst. Nat., 1758, 10th ed., p. 706.
David Robertson: Trans. Geol. Soc. Glasgow, 1883, vol. vii, pt. i, p. 31.

The Geological Department of the British Museum possesses several small isolated pearl bodies which were presented by David Robertson, Esq., in 1883, who collected them in the marine Post-Pliocene deposits of the Clyde Basin at Garvel Park. Some of these attain a diameter of 3 millimetres, whereas others are very much smaller. Externally they present a shiny nacreous appearance, their inner structures being composed of concentric layers in combination with the usual radial structure. Similar specimens are listed by Mr. Robertson in his paper "On the Post-Tertiary Beds of Garvel Park" as belonging to *Mytilus modiolus* of Linnæus, a specific determination which is here retained, although placed under Scopoli's genus *Volsella*, that having priority of Lamarck's *Modiola*, with which the species is usually associated.

Geological age.—Post-Pliocene (marine glacial beds).
Locality.—Garvel Park, Clyde Basin, Scotland.
Collection.—British Museum (D. Robertson Coll.) [L. 980].

Family AVICULIDÆ.

Inoceramus Goldfussianus, Orbigny. Pl. IV, Fig. 1.

Inoceramus Cripsii, Goldfuss (*non* Mantell): Petrefacta Germaniæ, 1836, vol. ii, p. 116, pl. cxii, fig. 4*d*.
Inoceramus Goldfussianus, Orbigny: Paléontologie Française, Terr. Crétacés, Lamellibranchia, 1845, p. 517, pl. 411; Prodrome Pal. Strat., 1850, vol. ii, p. 250.

The specimen figured by Goldfuss is a convex natural cast representing the interior of a left valve, studded with numerous small pittings, which are generally of uniform size. A patch of the original shell is still preserved, showing the nearly equidistant concentric ridges with their fine lineations, which extend as well over the surface of the sulcations. The pittings are of fairly regular arrangement, and follow the concentric character of the sculpture, appearing to be absent on the umbonal surface of the valve and on the region immediately below the dorsal line. As pointed out originally by Goldfuss, they represent cavities for the reception of wart-like prominences that would be present on the internal surface of the valve. No mention is made, however, of the fact that such tubercles would indicate pearl-growths, although there is no doubt that this is their true interpretation. The illustration published by Goldfuss forms probably the earliest known figure of a fossil shell showing the remains of pearl-structures. It has been more or less customary for Continental palæontologists to regard this form as Mantell's *Inoceramus Cripsi*, whereas the English species has much more median umbones, being consequently of different contour, besides belonging to an older stage (Cenomanian) of the Cretaceous series. D'Orbigny recognized a distinction, and gave the name *Goldfussianus* to the shells figured and described by Goldfuss as *Inoceramus Cripsi* of Mantell. At a later date the same author in his "Prodrome" restricted the species *Goldfussianus* to the specimen represented by fig. 4*d* of Goldfuss's pl. cxii—figs. 4*a*, *b*, and *c* of that same plate being recognized as his *I. regularis*. Both these species, *Goldfussianus* and *regularis*, are of Upper Senonian (Campanian) age, being known to occur, at the time of description, in Westphalia (Haldem, Dulmen, etc.) and certain areas of France (Royan, etc.).

A preliminary note on the nomenclature of some of these Senonian *Inocerami* has been recently published by Dr. Joh. Böhm, who promises a more extended account on completion of his researches ("Über *Inoceramus Cripsi*, Mant.": Monatsber. Deutsch. Geol. Ges., 1907, No. 4, p. 113).

The specimen now referred to, as delineated in the original figure, measures 125 mm. in length and 65 mm. in height.

Geological age.—Cretaceous (Campanian).

Locality.—Haldem, Westphalia, Germany.

INOCERAMUS EXPANSUS, W. H. Baily. Pl. IV, Figs. 2, 3.

Inoceramus expansus, W. H. Baily: Quart. Journ. Geol. Soc., 1855, vol. xi, p. 462, pl. xiii, fig. 5; H. Woods, Annals South African Museum, 1906, vol. iv, p. 299.

This species of *Inoceramus* is one of the most characteristic Pelecypods of the Upper Cretaceous rocks of Pondoland in South Africa. It frequently occurs with the original shell-structure preserved, although just as often it is represented by convex natural casts of the interior. Some of these casts exhibit the equidistant concentric ridges, separated by wide sulcations, and an entirely smooth surface; others, as in the specimens figured (a left valve), bear numerous small rounded cavities of nearly equal size, arranged concentrically with the sculpture-markings, and agreeing in all respects with what has been observed in *Inoceramus Goldfussianus*. These pittings are present on both valves, as shown by the specimen representing a fragmentary cast, with parts of both valves exhibiting the postero-umbonal view. These specimens are also furnished with some feeble radial striations, emanating from the umbonal region, and extending to the ventral margin, being more obvious on the lateral areas than elsewhere.

A wax impression of the single valve yields a beautiful result, the rounded and elevated prominences showing out quite clearly, as well as the faint radial striations. No mention is made in Baily's original description of the pittings now called attention to, nor has Mr. H. Woods noticed this phenomenon in his more recent account of the shell. The single valve has a length of 95 mm. and a height of 105 mm., whilst the specimen with both valves in the closed condition shows a diameter of 60 mm. and a height of 130 mm.

Geological age.—Cretaceous (Campanian).
Locality.—Pondoland (Umtamvuna River district), South-East Africa.
Collection.—British Museum [L. 8644].

INOCERAMUS sp.

Inoceramus sp., Yokoyama: Palæontographica, 1890, vol. xxxvi, p. 175, pl. xviii, fig. 6.

An excellent figure of another internal natural cast of *Inoceramus*, said to have affinities with Mantell's *I. Cripsi* and showing similar rounded cavities between the grooves, has been published by Professor Yokoyama, from the Senonian of Japan. The author regards the pittings as the result of disease, without mentioning that they originated from the former presence of pearly protuberances on the inner surface of the valves. This specimen is a left valve having a length measurement of 120 mm.

Geological age.—Cretaceous (Senonian).
Locality.—Near Urakawa, Japan.

INOCERAMUS SAGENSIS, D. D. Owen, var. QUADRANS, R. P. Whitfield. Pl. IV, Fig. 4.

Inoceramus sagensis, var. *quadrans*, Whitfield: Mon. United States Geol. Survey, 1885, vol. ix, p. 79, pl. xiv, fig. 16.

"The middle of the cast, for about two-thirds the width, is marked by strong, rather deep pits, connected by shallow furrows, showing that the interior of the shell was covered by strong pearl-like protuberances, which progressed with the growth of the shell as does a muscular scar, and I presume they were connected in some way with the vascular system as were the lines of dots or interrupted striæ on other species of the genus."

According to this statement Professor Whitfield appears to regard these perlaceous remains as part of the animal organization, and related in some way to the vascular system, but if we accept the view referred to by Mr. W. S. Dallas (Ann. Mag. Nat. Hist., 1858, vol. i, p. 95) that pearl-structures are abnormal growths brought about by certain causes unconnected with the mollusc itself, it is manifest that the former idea as to the origin of these bodies must be cancelled. Judging from Dr. Whitfield's figure, the dimensions of this specimen show a length of 103 mm. and a height of 85 mm.

Geological age.—Cretaceous (Senonian: Lower Marls).
Locality.—Near Burlington, New Jersey, United States.

INOCERAMUS LABIATUS (Schlotheim). Pl. V, Fig. 1.

Ostracit, Knorr: Die Naturgeschichte der Versteinerungen, 1768, vol. ii, p. 84, pl. B ii, *b***, fig. 2.

Ostracites labiatus, Schlotheim: Taschenbuch Mineralogie, 1813, vol. vii, p. 93.

Mytulites problematicus, Schlotheim: Die Petrefactenkunde, 1820, p. 302.

Inoceramus mytilloides, Mantell: Fossils of the South Downs, or Illustrations of the Geology of Sussex, 1822, p. 215, pl. xxviii, fig. 2.

This example is an interior of a left valve with well-preserved shell-structure, on the surface of which is a series of small pearly tubercles, varying slightly in size, and situated chiefly on the anterior surface and some distance from the hinge-line, being arranged more or less concentrically as in the other shells previously mentioned.

Although fragmentary, being without the postero-ventral region, this specimen is important as showing the partial interior of an *Inoceramus* valve, a condition of some rarity among members of that genus. The early synonymy of the species may be thus explained: Schlotheim founded his species *labiatus* on a valve figured by Knorr from the Pirna sandstone of Saxony. The name *problematicus* was given subsequently by the same author for precisely the same shell, and cannot therefore be retained. The Mantellian name of *mytilloides* was established still later for a British form of *Inoceramus* which is now generally acknowledged to be identical with the *labiatus* of Schlotheim, and therefore this latter name should be adopted.

The species is a useful form from the horizonal point of view, being characteristic of the Turonian division of the Upper Cretaceous rocks, which includes that part of the 'Quaderstein' of Germany containing the Pirna sandstone, from whence Knorr's original specimen was obtained. This particular valve has a length of 70 mm. and a height of 105 mm.

Geological age.—Cretaceous (Turonian).

Locality.—Blue Bell Hill, Burham, Kent.

Collection.—British Museum (S. J. Hawkins Coll.) [L. 10384].

Inoceramus. Pl. IV, Fig. 5.

Inoceramus, J. Morris: Ann. Mag. Nat. Hist., 1851, vol. viii, p. 89, pl. iv, fig. 12.

The example here referred to and refigured is the original as described by John Morris. It represents a single rounded pearl concretion attached by the whole of its base to a portion of an *Inoceramus* shell. The various layers, being fractured in places, show the exposed edges and their fibrous structure. This is a fairly large relic of pearl-growth, and measures 13 mm. in diameter.

Geological age.—Cretaceous (Senonian).

Locality.—Northfleet, Kent.

Collection.—British Museum (N. T. Wetherell Coll.) [L. 20845].

Inoceramus. Pl. V, Figs. 2, 3.

This specimen consists of an elongate pearl-structure of pyriform contour, longitudinally adherent to a fragment of *Inoceramus* shell. It starts with being a rounded smooth body, and subsequently developing a narrow, elongate extension on each side. A section of this gives the concentric, radial structure in the rounded top of the concretion, whereas the more fibrous character is observed in the lateral prolongations. Length of pearl-growth, 36 mm.; diameter of spherical part, 14 mm.

Geological age.—Cretaceous (Senonian).

Locality.—Charlton, Kent.

Collection.—British Museum (Rev. Norman Glass Coll.) [44676].

INOCERAMUS. Pl. V, Figs. 4–6.

Inoceramus, J. Morris: Ann. Mag. Nat. Hist., 1851, vol. viii, p. 89, pl. iv, figs. 13, 14.

Morris's section (his fig. 14) represents another pearl concretion of considerable size, its diameter measuring 20 mm., this measurement being obtained from the illustration, as its presence among British Museum specimens has not been satisfactorily determined. It is stated to be an unattached form, of which there are two or three other examples, although much smaller than exhibited by the 'Morris' section. One of these appears to be the original of fig. 13 of the 'Morris' plate, which exhibits an exactly similar radio-concentric structure to the attached form previously mentioned, and from its lithological resemblance would doubtless have originally belonged to an *Inoceramus* shell, being so regarded by John Morris. Under a strong lens the external surfaces of the concentric layers are observed to be of minute prismatic structure.

A magnificent section of a further example, figured on Pl. V, Figs. 4, 5, of this paper, from the same locality as those represented by figs. 13 and 14 of the 'Morris' plate, has been most kindly placed at my disposal for reference in this paper by its possessor, Mr. B. B. Woodward, F.L.S. It has a diameter of 11 mm., and not only shows the normal structure of the exquisitely fine and straight radial striations crossed by the periodical concentric lines, but the nucleus under a $\frac{1}{4}$ inch objective appears to be of cellular or prismatic structure. It seems probable that this cellular character of the nucleus may represent the encysted larval condition of Cestode or other parasitical worms, such as has been figured by Messrs. Herdman and Hornell in connection with modern pearl structures ("Pearl Production": Report to the Government of Ceylon, etc., 1906, pt. v, pl. i, fig. 14).

Geological age.—Cretaceous (Senonian).

Locality.—Northfleet, Kent.

Collection.—British Museum (N. T. Wetherell Coll.), and collection of B. B. Woodward, Esq.

INOCERAMUS.

The British Museum collection also contains some isolated examples of spherical pearl bodies, which occur in the Crag deposits of Suffolk (Orford Castle district and Waldringfield), and which vary from 3 to 10 mm. in diameter. Sections exhibit the usual concentricity of formation, as well as the radial structure as seen in specimens from valves of *Inoceramus*. Externally the growth layers can be seen by their fractured edges, and sometimes the surface is pierced by minute and larger perforations, the work of a boring organism of some kind.

It is quite possible that these specimens were originally derived from the Chalk, because in general appearance and size they agree remarkably well with pearl-growths associated with the genus *Inoceramus* of Cretaceous rocks. Externally they are straw-coloured, but perfectly white inside; this, taken in connection with the presence of annelid or molluscan perforations, which were probably made long after their transportation from the Chalk sea, is strongly in favour of their derivative character.

Mr. F. W. Harmer, F.G.S., has shown me a similar pearly concretion of small size collected in the Waltonian zone of the Red Crag at Little Oakley, near Dovercourt, Essex, the same deposit having also yielded a fragmentary example of *Belemnitella*, a characteristic Cephalopod of Upper Cretaceous (Senonian) times. This occurrence would seem further to favour the derivative theory for these interesting spherical bodies. Several papers have been written on the derived fauna of the Crag beds, one of the earliest being by Searles V. Wood,[1] *Belemnites* being listed as originally coming from the Upper Cretaceous. Pearl-structures, however, from the Crag beds, whether regarded as derived or occurring *in sitû*, do not appear to have been mentioned in connection with the Pliocene fauna.

Geological age. — Cretaceous (Senonian). Found in the Crag deposits as probably derivative fossils from the Chalk.

Localities.—Near Orford Castle, and Waldringfield, Suffolk.

Collection.—British Museum (Robert Bell and Edward Charlesworth Colls.) [L. 21228 and L. 21229].

PERNA OBLONGA, H. G. Seeley. Pl. V, Fig. 7.

Perna oblonga, H. G. Seeley: Ann. Mag. Nat. Hist., 1861, vol. vii, p. 121, pl. vi, fig. 6; H. Woods, Cretaceous Lamellibranchia England, Mon. Pal. Soc., 1905, vol. ii, pt. ii, figs. 19A, B, E, woodcuts on p. 94 (=reproduction of type figures).

Professor H. G. Seeley founded this species on some internal casts common to the phosphatic deposits of Cambridge. He noticed that the sides of the valves were frequently furnished with numerous small cavities, proving that the animal must have been a pearl-producer "in prodigious numbers." He further remarked that pearl-like bodies "are often met with detached, sometimes as large as peas: they mostly have a yellowish colour . . . but, besides the free pearls, pearls attached to the shell were far from uncommon, and in some individuals so numerous as to remind one more of artificial productions in the Chinese *Anodon* than of a natural growth. No nacreous specimens have been found which can satisfactorily be considered as attached pearls; but their impressions, left on phosphatic casts, are unmistakable."

[1] Wood, Searles V., "On the Extraneous Fossils of the Red Crag": Quart. Journ. Geol. Soc., 1859, vol. xv, p. 38.

Mr. Henry Wood refers, also, to this subject, and supplies woodcuts of two additional specimens (figs. B and E) as well as a new figure of Professor Seeley's type, the whole of which material is in the Sedgwick Museum at Cambridge.

Geological age.—Albian (commonly called the Cambridge Greensand, which is a phosphatic derivative deposit).

Locality.—Cambridge.

Collection.—British Museum [L. 9062].

Family OSTREIDÆ.

GRYPHÆA DILATATA, J. Sowerby. Pl. IV, Fig. 6.

Gryphæa dilatata, J. Sowerby: Min. Conch., 1816, vol. ii, pl. cxlix.
Gryphæa, J. Morris: Ann. Mag. Nat. Hist., 1851, vol. viii, p. 89, pl. iv, fig. 16.

A Jurassic example of pearl-growth is met with on the interior of a lower valve of *Gryphæa dilatata*, which assumes an elongate, irregular, somewhat pyriform body, measuring 20 by 13 mm., and adherent in great part to the adductor muscular scar region, and, as mentioned originally by Morris, it is free at both ends. The external lamina of this specimen is continuous with the shell, whilst the outer layers are said not to exhibit the usual fibrous character of a perlaceous concretion, having probably been altered by subsequent mineralization. The valve on which this specimen is adherent has a length of 70 mm. and a height of 85 mm.

Geological age.—Jurassic (Kimeridgian), found in the Drift.

Locality.—Muswell Hill, near London.

Collection.—British Museum (N. T. Wetherell Coll.) [L. 21230].

EXPLANATION OF PLATES.

PLATE IV.

Inoceramus Goldfussianus, Orbigny.

Senonian (Campanian): Haldem, Westphalia.

FIG. 1.—Natural cast of the interior of a left valve with a fragment of original shell *in sitû*, showing numerous rounded pittings caused by pearly protuberances on the original inner surface of the valve. Reduced ½ from the original fig. 4*d* in the "Petrefacta Germaniæ."

Inoceramus expansus, W. H. Baily.

Senonian (Campanian): Pondoland, S.E. Africa.

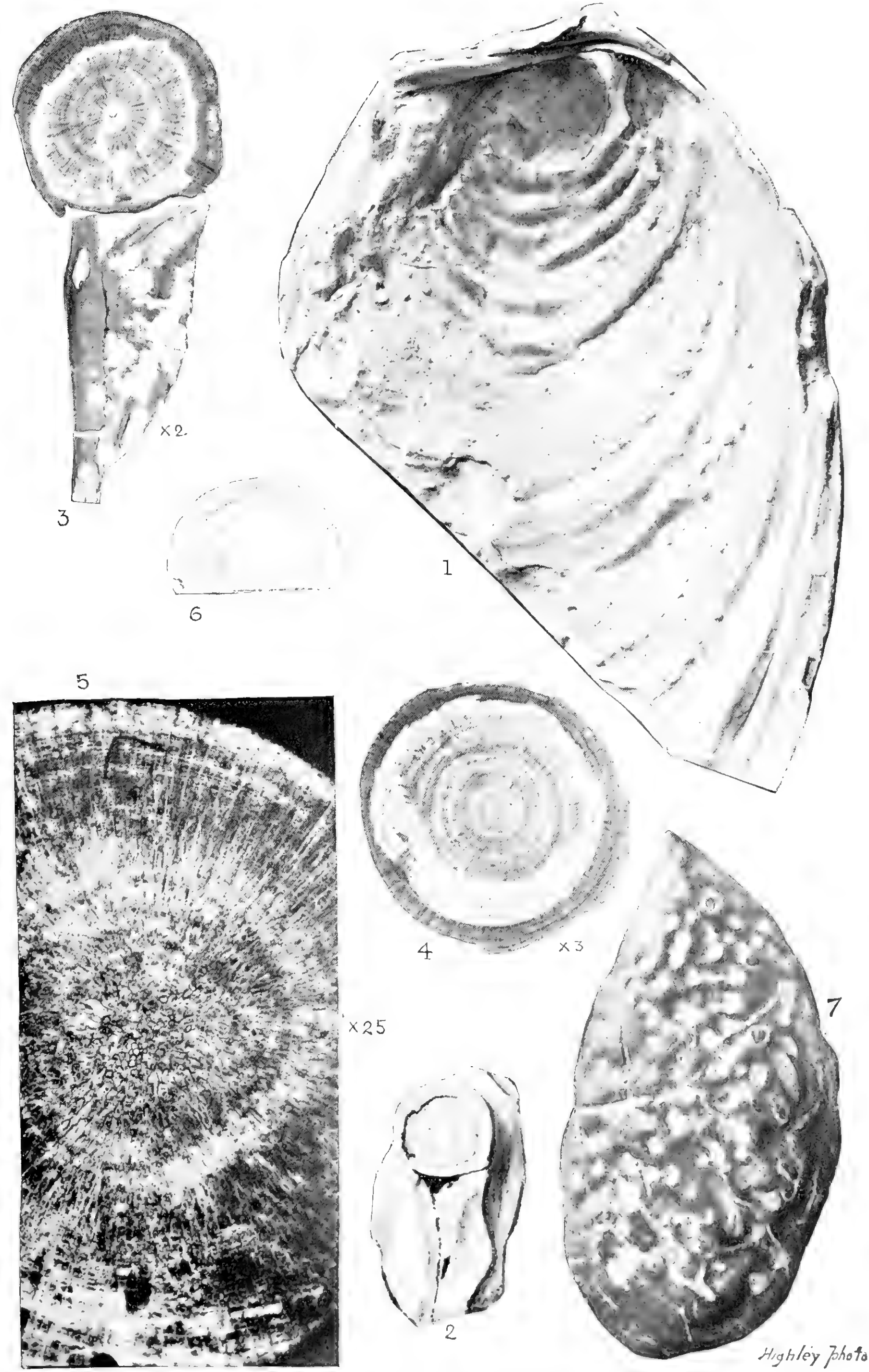
FIG. 2.—Natural cast of a fragmentary left valve showing a series of rounded pittings. ⅔ nat. size. [British Museum, L. 8644.]

FIG. 3.—Natural cast of another specimen showing both valves in the closed condition, studded with numerous pittings as before. ⅔ nat. size. [British Museum, L. 8644.]

Inoceramus sagensis, D. D. Owen, var. *quadrans*, R. P. Whitfield.

Senonian: near Burlington, New Jersey, United States.

FIG. 4.—Natural cast of the interior of a left valve, showing numerous rounded pittings and fine radial striations, copied from Whitfield's original fig. 16 published in 1885. ⅔ nat. size.



FOSSIL (MESOZOIC) PEARL REMAINS.

Inoceramus.

Senonian (*Micraster cor-anguinum* zone): Northfleet, near Gravesend, Kent.

FIG. 5.—An adherent pearl-structure on the inner surface of shell of *Inoceramus*, representing Morris's original specimen figured on pl. iv, fig. 12, of the "Annals" for 1851. [British Museum, L. 20845.]

Gryphæa dilatata, J. Sowerby.

Kimeridgian (Drift): Muswell Hill, near London.

FIG. 6.—Interior of a lower valve, showing an elongate pearl-growth partially adherent to the adductor muscular scar, taken from the original specimen in the British Museum, which was figured by Morris in the "Annals" for 1851, but without the whole of the valve. $\frac{2}{3}$ nat. size. [British Museum, L. 21230.]

PLATE V.

Inoceramus labiatus, Schlotheim.

Turonian: Blue Bell Hill, Burham, Kent.

FIG. 1.—Interior of a left valve, showing a part of its surface covered with small pearly tubercles. [British Museum, L. 10384.]

Inoceramus.

Senonian: Charlton, Kent.

FIG. 2.—Sectioned surface of a pyriform pearl-structure adherent to a fragment of *Inoceramus*, showing lateral extensions proceeding from the spherical portion of the body. [British Museum, 44676.]

FIG. 3.—A glass-section prepared from the same specimen (Fig. 2), showing the concentric and radial details. × 2.

Inoceramus.

Senonian: Northfleet, Kent.

FIG. 4.—A glass section made from an isolated pearl-structure, showing the concentric and radial characters, with an apparently cellular or prismatic nucleus. × 3. In the collection of B. B. Woodward, Esq., F.L.S.

FIG. 5.—An enlargement of the nuclear portion as seen in the same section, somewhat resembling the central structure of a modern pearl as figured by Messrs. Herdman and Hornell on pl. i, fig. 14, of part v of their report. × 25.

Inoceramus.

Senonian: Northfleet, Kent.

FIG. 6.—Section of an unattached pearl-like body of considerable size, showing the concentric and radial structure, copied from Morris's original fig. 14 of the "Annals" paper of 1851.

Perna oblonga, H. G. Seeley.

Albian ("Cambridge Greensand"): Cambridge.

FIG. 7.—Natural cast of the interior of a left valve, exhibiting numerous rounded cavities formed by pearl protuberances. [British Museum, L. 9062.]

Note.—Unless mentioned to the contrary, the figures on the plates are represented of the natural size.

DESCRIPTION OF A NEW SPECIES OF *BATISSA* FROM THE FIJI ISLANDS.

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

Read 8th May, 1908.

Batissa Fijiensis, n.sp.

Shell irregularly subtrigonal, high, somewhat compressed, smooth, covered with an olive-green periostracum, and marked with concentric lines of growth; anterior side slightly produced; posterior side short, descending rather rapidly; ligament large, prominent; interior of shell posteriorly pale violet, fading to bluish white anteriorly and towards the umbonal region; umbones deeply eroded. Length 60, width 62·5 mm.

Hab.—Fiji Islands.

Allied to *Batissa producta*, Desh., but more trigonal in shape and smoother in texture; the dorsal margin is also more inflated on the anterior side.

NOTES ON *PLANORBIS* AND ITS SUBDIVISIONS.

By Dr. William Healey Dall.

Read 8th May, 1908.

In the last number of the Proceedings of this Society there are some observations by Mr. A. S. Kennard on *Planorbis* and some of its subdivisions, which suggest the mention of some data which have accumulated since the writing of my "Land and Freshwater Mollusca of Alaska."

We have in the Jeffreys Collection, now in the U.S. National Museum, his original types of *P. glaber* of 1834, as well as those which served as the types for the "British Conchology." They are of the same species, and identical with *P. lævis*, Alder. Some of the former are milky white, though not 'dead shells.' That Jeffreys sent Alder a young *P. albus* by mistake for a specimen of his new species does not invalidate the species.

I have compared *P. glaber* with *P. parvus*, Say, and find that what I have always regarded as the typical *parvus* is smaller, flatter, with a more nearly circular and less oblique aperture. The vertical diameter of *parvus* of the same size is decidedly less than in *glaber*. But among over two hundred lots of *parvus* I find quite a number which seem very similar to *glaber*, and it may be that in this country we have confused the two. I have not time to study these small freshwater forms, which are doubtless in need of a severe critical revision.

Mr. Kennard seems to doubt the propriety of the sections *Diplodiscus* and *Paraspira*. I hold no brief for the importance of any of these sections of *Planorbis*, but if we adopt some, in order that the divisions shall be of as nearly equal weight as possible, these were needed. If the whole, after due anatomical investigation, proved to be merely aids for the convenient assorting of the uncomfortably large number of species, I should not regret the conclusion.

However, *Diplodiscus* is untenable as a Mollusc name, having been used by Diesing for a worm in 1850. Von Martens in 1899 revived a *nomen nudum* of Hartmann's *Spiralina* for the same group. This is not *Spiralina*, Chaster, 1900.

In the *Nautilus* for January, 1906, I have given some data for forgotten *Planorbis* names published by Benson in 1855, some of which modify my revision of 1905 in the Alaska book. One of these is *Omalodiscus*, Benson, apparently proposed as a substitute for the preoccupied *Spirorbis*, Swainson, of which the type was *P. rotundatus*, Poiret. *Omalodiscus* in that case would take the place of my *Paraspira*.

These sections may not be worth much, but if I have sinned in adopting them it was in such good company as Swainson, Mörch, Von Martens, and Benson. If Poiret's species has got lost since Swainson's time I am sorry, but American students can hardly be expected to keep guard on European species, which should be herded by their compatriots.

THE HABITAT OF CERTAIN SPECIES OF *CLAUSILIA* FROM DALMATIA, HERZEGOVINA, AND BOSNIA.

By Rev. A. H. Cooke, M.A., F.Z.S.

Read 12*th June*, 1908.

A recent excursion into Dalmatia, Herzegovina, and Bosnia gave me an opportunity of making some observations upon certain of the Land Mollusca. The results of these observations may prove interesting to those who study, not the shell, nor the 'animal,' but the habits and modes of life of the creature as a whole.

The first point that struck me was this. Although April was well advanced (I was in the country from the 11th till the 28th), and the warmth considerable, summer clothes being a necessity even at Sarajevo, 1,800 feet above the sea, the Mollusca were still hibernating, with certain remarkable exceptions. *Clausilia*, *Pupa*, and *Pomatias* were lively and abundant; of the Helicidæ, the only species that could be said to be 'out' was *austriaca*, Mühl., but *Velebitana*, Zieg., and *setosa*, Zieg., appeared to be just awakening, while others had to be hunted out in their lairs. The great *Zonites* (*acies*, L., *compressus*, Zieg.) and *Glandina* (*Algira*, L.) were still in winter retirement, some way below the surface of the ground. It looked as though the smaller-sized genera were better equipped for resisting cold than the larger, or perhaps their more elongated form makes it impossible for them to feed up for the winter, and to get into such good condition as their larger brethren.

It was therefore to *Clausilia* that my attention was more particularly directed. One cardinal fact soon impressed itself with regard to this genus. Variety of habitat was its prime characteristic. The first species which occurred was at Pola, where a form of the common *Cl. papillaris*, L., was nestling in twos and threes in shaded cracks of dry walls and rocks. In the mountains behind Spalato, at a height of about 1,200 feet, *Cl. fulcrata*, Zieg., was found in quantity under similar conditions. But at 1,000 feet lower level, where the River Jadro issues fully-grown from the face of the limestone cliff, *Cl. archilabris*, Küst., was found plentifully on smooth rocks, never in groups, like the two species just named, but almost invariably one at a time. On the Monte Mariano, about 600 feet above Spalato, *Cl. semirugata*, Zieg., occurred abundantly under large stones, but not in the open, although rocks abounded all round, while in the same locality *Cl. Cattaroensis*, Küst., was found on the rocks, but never under stones.

A further contrast was noticeable at the lovely defile of Almissa, to which I made a special expedition in order to obtain the magnificent species—surely the largest *Clausilia* in Europe—which takes its name from the spot. So fine a shell is it, that I could hardly believe my good fortune when my eyes lighted upon the first individual. But it was no use looking for it in cracks, or in old walls, or under stones, or in any of the haunts usually dear to *Clausilia*. It occurred on the bare open face of the cliffs, in spots where a slight trickle of water kept the great smooth slabs perpetually moist. This was its regular habitat, though now and then an individual might be found in the dry. A variety, *major*, was afterwards detected in a somewhat similar habitat at Duare. Associated with it at Almissa was another species not half the size, as yet unidentified, but belonging to the *Cattaroensis* group. This species only occupied the cracks, or nestled under the ledges, while *Almissana* paraded about boldly in the open, a most conspicuous object.

At Ragusa I found several species, each under circumstances peculiarly its own. *Cl. exarata*, Zieg., lives on hollow damp limestone rocks, not merely gregariously, but under circumstances which suggest extreme overcrowding. I must have taken from 10 to 15 individuals, several times over, from one small hole in the rock. And this tight packing was not due to scarcity of suitable domicile, for there were quantities of similar holes quite unoccupied; they evidently loved to squeeze closer together than I have ever seen *Clausilia* live. At the island of Lacroma a more slender form of the same species occurred in cracks of rocks which hung over the sea. It was quite a new sensation, gathering *Clausilia* with one's feet in the sea-water. At Lacroma also *Cattaroensis* occurred, in complete contrast to *exarata*, in single and solitary specimens on a damp old wall.

An expedition to the source of the Ombla, behind Gravosa, taught me a fresh lesson about *Clausilia*. For I knew there must be a species there, but though I looked on walls, in cracks, in damp places, under herbage growing on rocks, I could find nothing. At last a happy accident revealed to me the fact that *celestina*, Küst., cares for none of these places, but hangs on bare and very dry rock faces, provided only they do not look full south. Its colour greatly resembles that of the rock. When I grasped this fact I found them in dozens, never crowding together like *exarata*, nor at long distances apart like *Cattaroensis*, but evenly and abundantly distributed over the whole rock surface.

After an expedition to Castelnuovo, on the Bocche di Cattaro, which was fruitless as regards *Clausilia*, but which yielded a few specimens of the fine *Pomatias auritus*, I came through Mostar, the capital of Herzegovina, to Jablanića, at the head of the great Narenta defile, hoping for rich booty. Never was I more disappointed. The rocks were of that soft disintegrated slaty type which never yields anything, and complete failure seemed imminent. I argued, however, that if I went back to where the defile narrows sharply (Jablanića is on a marked widening out of the valley) I should get upon the harder limestone again, with a better chance of success. For a long time this plan was without result, but it was again a case of looking in the wrong place. For, this time, it was not the limestone slabs or crannies themselves, but a peculiar band of conglomerate running through the limestone near Prenj, that furnished *Cl. albocincta*, Pfr., in considerable numbers. A vein of clay ran in and out of the conglomerate, and on this, apparently a most unpromising locality, the species clung in quantity. What its food could be puzzled me at the time, for there was nothing green anywhere near, but a theory suggested itself, to which I recur later on.

At Sarajevo, my next objective, it was a joy to find that fine species *Cl. Dacica*, Friv., under grass in the cracks of rocks on the banks of the Miljaška, not five minutes from the Rathhaus. One does not usually find a giant *Clausilia* so near to the walls of the town hall of a capital city.

From Sarajevo the next move was to Jajce, and on the road I had yet another lesson that it takes more ways than one to find *Clausilia*. At a junction called Laśva we had 15 minutes to wait, and I strolled down a shabby path past an engine-house, at the foot of the railway embankment. Here was a scree of small black stones; I turned one or two over, not expecting any result, and found the under side swarming with *Cl. vetusta*, Zieg. This species seemed to live by preference among the roots of dead or decaying grass.

Jajce, besides its extreme natural beauties, is a fine locality for the collector. The castle walls yielded *Cl. decipiens*, Rossm., and *vetusta*, Zieg., the former abundant, the latter scarce, but both living between the stones of which the castle wall is composed. The same locality, it may be mentioned, gave me *Zonites acies*, L., and *compressus*, Zieg., with *Helix planispira*, Lam. Now came a more serious piece of work. In Dr. Norman's collection of European Land Mollusca, acquired by the British Museum, there is a noble species of *Clausilia*, labelled by Dr. Brancsik "*Cl. Bosnensis*, Zieg., var. *Plivæ*, Brancs., Jajce, Felsen am rechten Plivaufers." I naturally determined to have it, and spent most of an afternoon hunting the rocks on the southern bank of the Pliva, just before it falls into the Urbas in that beautiful cascade. Not a sign of it could be seen. At last a cliff was visited, at the foot of which a few dead specimens were noticed. Then one and then more living specimens were found, until a fair number had passed into the collecting-box. But it was another instance of looking in the right place. All localities, however promising, were vain, until I discovered that it was again the fact that the creature preferred absolutely bare rock to those clothed with greenery. Here were a few scanty mosses, and on these, in the late afternoon, the creature emerged to feed, leaving the ledges and deep cracks in the limestone in which it had hidden during the day.

Yet once more was the lesson impressed upon me that the ways of *Clausilia* are not learned in a week. From Jajce I drove 45 miles to Banjaluka. On the way I closely observed the rocks of the grand defile, and detected nothing at all. The post waggon stops at a little place called Boćac for midday meal, and while it was preparing I strolled along the road examining the cliffs, which were full of admirable and attractive cracks, well supplied with green food, and absolutely destitute of *Clausilia*. The road at a certain point makes a tiny cutting through the rock, and leaves, on the side opposite to the cliff, a little isolated crag of bare limestone. I strolled past this crag without examining it, as it appeared quite hopeless. On my return, entirely empty-handed, it struck me—"that rock will be in shade, the cliff is all in sun." In 15 minutes, with the help of two little Bosnian maidens, who, in return for sundry coin of the realm, turned themselves into ardent naturalists, I had amassed 179 specimens of the fine *Cl. Bosnensis*, Zieg., from this single dry limestone crag, the face of which measured perhaps 12 yards by 3.

This brings me to my final point. I feel quite certain that the food of many species of *Clausilia*, and I think it probable that I might add of *Pupa* and of *Pomatias*, is not green herbs of any kind. I believe that they devour the surface of the limestone on which they live. If we rub the limestone with our finger something 'comes off,' and leaves a mark. I believe this is what *Clausilia* devours, for I have frequently seen them living in spots where no green thing was accessible, and I have good reason for believing that normally they feed every day. Probably some minute organisms—of what nature I do not here discuss—live on the disintegrated surface of the limestone, and it is on these that the animals feed. Further, I believe that they do so, not by selecting the organisms themselves, but by swallowing the soft surface of the limestone whole, after rasping it off with their radulæ. In the case of *Cl. Almissana*, noticed above as preferring to live on bare limestone cliffs where there was a trickle of water, the food is probably minute water organisms, devoured in a similar way. And in confirmation of this view I may be permitted to refer to an article in the *Journal of Malacology*, vol. xii, pp. 74–5, in which I advanced the theory, based upon a chemical examination of the excreta, together with a consideration of its life-habits, that *Helix desertorum* nourishes itself by swallowing large quantities of sand, on which minute gelatinous organisms (*Nostoc* and the like) find a home.

THE DISPERSAL OF LAND SHELLS BY THE AGENCY OF MAN.

By Lieut.-Colonel H. H. Godwin-Austen, F.R.S.

Read 12th June, 1908.

During the past year some interesting cases of shell dispersal have come to my notice, which I think are worth placing on record.

In June, 1905, I read a paper before this Society on "The Extension of the genus *Macrochlamys* to the Island of Mauritius," based on specimens collected and sent to me by Monsieur E. Dupont, of that island. There were two species—one (A) in its shell, having a very short right shell-lobe, the other (B) only the animal, no shell (*vide* Proc. Malac. Soc., vol. vi, pl. xviii, figs. i and vii respectively). The form of the left shell-lobe also differed in the two species (figs. ii and vi). The species A was dissected and its anatomy found to be in every respect similar to the typical Indian species of the genus. I could not, however, at the time match the shell with any species known to me and in my collection at that date.

Since then I have received, through the kindness of Mr. F. Ede, of Silchar, Cachar, Assam, a number of species, preserved beautifully in spirit, found in that district, and among them is a shell which tallies exactly with the Mauritian one in form, colour, and sculpture. The only difference I notice lies in the colour of the animals, those from Cachar being extremely colourless, not gray; but this may be due to the alcohol having bleached the animals. This Cachar shell is an undescribed form or variety of *Macrochlamys indica* of Calcutta.

I think we may assume the two species to be identical, and that the home of the Mauritian shell was Cachar. The manner of its transit I believe to be as follows:—There is a very numerous Hindustani population in the Mauritius, and a large proportion of them are rice-eaters. In the districts of Sylhet and Cachar the principal cultivation is rice, which is exported in boats, almost direct from the threshing-floors near the villages in the form of *dhan*, i.e. the unhusked grain. The large grain-boats drop down the River Soorma to the Brahmaputra, and on to Calcutta or Chittagong, their cargoes to be finally shipped in steamers and native sailing craft to the Mauritius and other places. While the unhusked rice is lying on the threshing-floors, open to the air, there is nothing to prevent these snails and fertile eggs getting mixed up in the grain and retaining their vitality until turned out upon the floors of the grain-yards in the Mauritius or elsewhere, and in sufficient numbers to become established, particularly as the threshing-places have frequently plantain-trees growing near them, a favourite haunt of species of *Macrochlamys*. The time of transit would not be very long, and the *dhan* would be sufficiently damp to keep them alive.

The dispersal of our common slugs to many parts of the world is well known; they make themselves quite at home at the Cape, in Australia, and the Mascarene Islands. Among a collection of shells in spirits sent me by Mons. E. Dupont, was a tube of slugs. On first examination they appeared to have a very decided European look, and on dissection a comparison with the admirable figures and descriptions in Mr. John W. Taylor's "Monograph of the Land and Freshwater Mollusca of the British Isles," which is quite an indispensable work, showed them to be without doubt *Agriolimax agrestis*. Very shortly after this I received from Dr. N. Annandale, Superintendent of the Indian Museum, Calcutta, some material he had collected in the N.W. Himalaya on a trip in the hills near Simla. Again an undoubted European slug turned up in *Agriolimax maximus*, var. *unicolor*, corresponding with fig. 4, pl. vi of the above monograph. The examination of the anatomy was equally satisfactory.

The discovery of this species is most interesting, because it was found on the Tibet road, some 30 miles beyond Simla. In that station, where its numerous residents must frequently be receiving plants and roots, such as dahlias, from England, the introduction of our common slugs is to be expected. Dr. Annandale mentioned to me that close by where he took this *Agriolimax*, crawling over the rocks by the roadside, a fruit orchard had lately been established. If these young trees had been brought from Simla there is a possible means of further extension; once established, there are many ways in which this slug might be carried about, a very possible one being upon the loads carried on the backs of coolies, who frequently put down their loads on the rocks by the roadside when resting and cooking their meals.

When I was in Calcutta in 1876–7 an African species of *Achatina* had spread all over the gardens in Chowringhi and the suburbs to Howra on the other side of the River Hoogly and to Barrackpur, about 15 miles north. It had been introduced originally into Calcutta by Mr. Benson some 20 years before, after his arrival from the Cape and the Mauritius. Among some shells in spirit sent me last year by Dr. Annandale, collected at Rajmahal, which is some 170 miles from Calcutta on the line of railway, were three very young specimens of this *Achatina*. In this case their transport has probably been on the railway trucks, either by crawling on to them or their being loaded up with country produce. Spread of land shells in this way would be very rapid.

ON THE GENERA OF VENERIDÆ REPRESENTED IN THE CRETACEOUS AND OLDER TERTIARY DEPOSITS.

By A. J. Jukes-Browne, B.A., F.G.S.

Read 12*th June*, 1908.

PLATE VI.

I. Introductory Remarks.

Having being led to study the shells of the recent species of the family Veneridæ, with the view of revising the many generic and subgeneric groups which have been proposed by various writers, and of constructing more satisfactory definitions of them than exist in any current textbooks, I found that it was necessary to include the fossil representatives of the family within the scope of my review.

The family doubtless originated during the course of Jurassic time, but it is doubtful whether any representatives of it exist among the Jurassic faunas of England or of Northern France. Several genera, however, make their appearance in the Lower Cretaceous rocks of both countries, and a still greater variety of forms is found in the Eocene series.

It would be interesting to ascertain whether the Veneridæ developed from one centre, or along two different lines of descent; the possibility of the latter mode of origin being suggested by the great difference which is observable among the Cretaceous representatives. *Dosiniopsis*, for instance, by its possession of posterior lateral teeth is unquestionably a link between *Cyprina* and *Dosinia*, while the Tapesine genus *Baroda*, by its elongate shape and by the simplicity of its hinge-teeth, seems to have had a very different origin.

With regard to the later Tertiary species (of Pliocene and Pleistocene age), most of them can be referred without difficulty to recent genera, but some of the Eocene and Cretaceous species exhibit differences which make it necessary to regard them as distinct genera or subgenera, while at the same time they illustrate the lines along which the recent genera have developed.

In this paper I shall concern myself with those species of Cretaceous, Eocene, and Oligocene age which occur within the limits of the Anglo-Parisian region, i.e. in the South of England and the North of France. In our own country palæontologists have hitherto been content to catalogue the British species under the names of *Venus* and *Cytherea* (or *Meretrix*), and up to about 1885 French palæontologists were content with the same generic nomenclature, except that Deshayes had described two species of *Tapes*, several supposed *Venerupis*, and a shell to which he gave the generic name of *Psathura*. In 1886, however, the Veneridæ of the Parisian Eocene were the subject of careful study and description by M. Maurice Cossmann, who recognized eleven different genera, of which number three were new, and he also divided his genus *Cytherea* into five sections or subgenera, and his *Venus* into three.[1]

[1] Ann. Soc. Roy. Mal. Belg., tom. xxi, p. 104.

Still more recently Dr. W. H. Dall has investigated the American recent and Tertiary species, and has published a synopsis of the family Veneridæ,[1] in which he has redescribed and defined all the recent and fossil genera. This synopsis is unquestionably the most complete account of the family which has yet been published, and gives new information about some of the generic groups; but it has special reference to American species, and is not an entirely reliable guide with regard to European fossils. He also makes many alterations in the nomenclature, some of which have not gained acceptance in this country.

By British conchologists the Veneridæ have certainly been much neglected, for no one has published any adequate account of the recent genera since the appearance of Messrs. Adams' "Genera of Recent Mollusca" in 1858, nor has any critical revision of the fossil representatives been attempted.

My attention was called to the need of such revision by Mr. H. Woods, who, knowing of my interest in the Veneridæ, sent me some of the specimens which he then had under examination for description in his "Monograph of the Cretaceous Lamellibranchia." I then, for the first time, realized the peculiar characters of certain Cretaceous species, and perceived how greatly most of them differed from any recent shells. Subsequently it became evident that it would be very desirable to compare the Cretaceous and Eocene species, and I put myself in communication with M. Cossmann, who was kind enough to send me specimens from the Parisian Eocene to illustrate the subgeneric groups which he had proposed in 1886.

By kind permission of Dr. Teall I have had the advantage of studying the excellent series of Eocene and Oligocene Veneridæ in the possession of the Geological Survey at the Museum of Practical Geology; through the kindness of Mr. H. Woods I have also been able to examine the fine specimens in the Sedgwick Museum at Cambridge, and I have to thank Mr. Woods for other assistance and for advice given during correspondence on the subject.

The following is a list of the genera and subgenera which have been recognized as occurring in the Cretaceous and Eocene deposits, or have been proposed for species found therein, including some which are now indicated for the first time:—

Dosiniopsis, Conrad.
Callista, Mörch.
Chionella, Cossmann.
Aphrodina, Conrad.
Dollfusia, Cossmann.
Tivelina, Cossmann.
Pitaria, Roemer.
Atopodonta, Cossmann.
Circe, Schumacher.
Gouldia, Adams.
Sunetta, Link.
(?) *Ptychomya*, Agassiz.
Clementia, Gray.
Cyprimeria, Conrad.
Cyclorisma, Dall.
Psathura, Deshayes.
Venerella, Cossmann.
Mercimonia, Dall.
Chione, Megerle.
Textivenus, Cossmann.
Veneritapes, Cossmann.
Tapes, Roemer.
Baroda, Stoliczka.

[1] Proc. U.S. Nat. Mus., vol. xxvi (1902), pp. 335–412; see also Trans. Wagner Free Inst. Sc., vol. iii, pt. 6 (1903), "Tertiary Fauna of Florida."

I propose to give some account of all these genera, and to mention the species which have been or can be referred to them. I have not, however, been able to see the Edwards Collection in the British Museum, and cannot therefore include all the species which were named by Edwards, but many of which have never yet been described. Again, there are many fossil shells which were called *Venus* or *Cytherea* by the older writers, but which are now known to belong to other genera; consequently it will be useful in the first place to give a list of the species which have thus been eliminated from the Veneridæ, and need not be considered in the present paper. These are the following:—

Venus angulata, Fleming (a *Cyprina*).
V. fenestrata, Forbes (a *Cardita*).
V. lineolata, Sow. (a *Cyprina*).
V. Nysti, Br. & Corn. (an *Eriphyla*).
V. lucina, Br. & Corn. (an *Eriphyla*).
V. striato-costata, Forbes (an *Astarte*).
V. submersa, Sow. (type lost, possibly a *Cyprina*).
V. tenera, Sow. (a *Lucina*).
V. truncata, Sow. (a *Cyprina*).
V. pectenifera, Sow. (an *Anisocardia*).
Cytherea scutellaria, Lam. (a *Cyprina*).

II. Description of Genera and Subgenera.

1. Dosiniopsis, Conrad. Pl. VI, Fig. 1.

This genus was founded in 1864,[1] the type being a Lower Eocene fossil to which Conrad gave the name of *D. Meeki*. The original description was very inadequate, the presence of a posterior lateral tooth not being noticed, and only a left valve being figured. He does, however, mention *Cytherea lenticularis*, Rogers, as a closely allied species from which *D. Meeki* differs in being "proportionally more elevated and convex."

It was not till 1901 that Conrad's type was well figured by Messrs. Clark & Martin,[2] who consider it to be merely a variety of the previously described *D. lenticularis* of Rogers. They adopt the genus *Dosiniopsis*, but do not give any definition of it; and they regard *D. lenticularis* as the type, but do not give any fresh description of it, merely quoting that of Rogers. They state that *D. lenticularis* "is a moderately thin shell with a weak hinge, while the form described by Conrad is a heavy shell with a broad solid hinge. Every possible gradation between the extremes has been observed."

From the figures given by Messrs. Clarke & Martin it is seen that the older and thicker shells (*D. Meeki*) are as tall as they are broad, while the thinner form (*D. lenticularis*) is broader than it is high. Although no mention of the posterior lateral tooth is made in the text, it is shown very clearly in the figures, and it is of course more conspicuous in the shells which have a thick hinge-plate than in those with a weak one.

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[1] Proc. Acad. Nat. Sci. Philad., 1863, p. 212.
[2] Maryland Geological Survey: "The Eocene Deposits of Maryland," p. 171, pl. xxxv.

M. Maurice Cossmann had recognized the existence of species of *Dosiniopsis* in the Lower Eocene of France as far back as 1885,[1] but he only gives a translation of Conrad's description of the type, and then remarks: "The form of the sinus, the crenulation of the nymph, and the (elongate) lateral tooth appear to me to justify the creation of a genus and consequently the adoption of Conrad's." No mention is made of a posterior lateral tooth.

Dr. W. H. Dall seems to have been the first to recognize the existence of posterior lateral teeth in *Dosiniopsis*.[2] He gave a complete fresh generic description, and mentions "the distinct posterior right lateral which fits into an excavated socket in the left valve"; then adding: "This is the only genus of the family with a distinctly developed posterior lateral tooth, and if it were not for the number of cardinals and the presence of a pallial sinus it might be referred to *Cyprina*." Dr. Dall, however, does not seem to have been aware of Messrs. Clark & Martin's observations (as above quoted), for he takes *D. Meeki* as the type, and his generic description includes the word 'heavy' as applied to the shell, and the words 'strong' and 'stout' applied to the lateral teeth. It seems desirable, therefore, to give an amended description of this genus, and I have drawn up the following, after examination of English and French species, and inspection of the excellent figures of the type form in the "Eocene Deposits of Maryland."

DOSINIOPSIS, Conrad, 1864.

Types—*Cytherea lenticularis*, Rogers, and var. *Meeki*, Conrad. Shell suborbicular or rounded-oval; concentrically striated. Lunule slightly impressed, but often indistinctly circumscribed; escutcheon not defined. Hinge generally strong, cardinal teeth three in each valve, all separate and entire except the right posterior, which is bifid; a posterior lateral in each valve, that of the right, being the stronger; an anterior lateral in the left valve, elongate, parallel to shell border, more or less rugose, and fitting into a corrugated pit in the right valve. Nymphs of both valves finely granulated. Margins of valves smooth. Pallial sinus ascending, not very deep, rounded or angular.

To *Dosiniopsis* I refer the Cretaceous shells hitherto known as *Cytherea caperata*, Sow., and *C. subrotunda*, Sow., both from the Selbornian Sands of Blackdown. There are three species in the Lower Eocene of the Paris Basin, and I think that all of them also occur in our Thanet Sands and London Clay; these are *D. orbicularis*, Edw., *D. fallax* (Desh.), and *D. bellovacina* (Desh.). A fourth species has been named by Edwards *D. pseudorbicularis*, but has not yet been figured.

2. DOSINIA, Scopoli, and SINODIA, n.subgen. Pl. VI, Fig. 2.

During my examination of the Cretaceous and Eocene Veneridæ I have been struck with the Dosinioid aspect of many of the shells,

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[1] Ann. Soc. Malac. Belg., vol. xxi (1886), p. 125.

[2] "Synopsis of the Family Veneridæ": Proc. U.S. Nat. Mus., vol. xxvi (1902), p. 342.

and at the same time by the fact that none of them could actually be referred to the genus *Dosinia* as usually defined. I was thus led to study the recent forms of that genus more particularly, and found that, while the great majority of species agree with the definition given in conchological manuals, there are a few species which do not. Of these the most striking and abnormal is *D. trigona* (Reeve), which differs in the following respects:—

The shell is not orbicular, but ovately and bluntly trigonal, the fore-part of the shell being well developed, so that the umbones are subcentral. It is not compressed, but decidedly ventricose. The lunule is not impressed, but large and superficial. There is no escutcheon. The hinge differs in correlation with the anterior development of the shell, the anterior lateral being strong, erect, and distant from the anterior cardinal; similarly, in the right valve there is a deep and distant pit for its reception. The postero-dorsal margin of both valves is grooved for a long distance to receive the bevelled edge of the opposite valve. The pallial sinus is not elongate, but rather short, wide, and rounded.

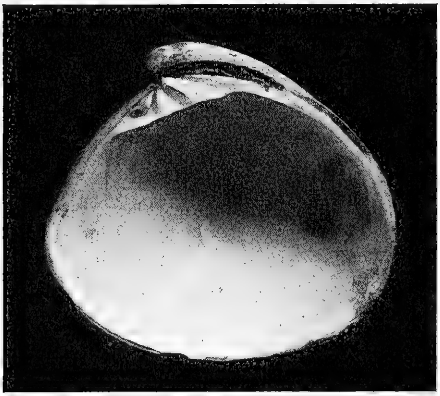

Fig. 1.—*Dosinia* (*Sinodia*) *trigona* (Reeve). Slightly enlarged.

There are some other species which resemble *D. trigona* to a greater or less extent: these are *D. tripla*, Roem.; *D. derupta*, Roem.; *D. sphæricula*, Roem.; and to a less degree *D. excisa*, Chem., and *D. subtrigona*, Sow., which are more nearly orbicular.

Now if the well-known Oligocene shell which goes by the name of *Cytherea incrassata* be carefully examined, it will be seen that it resembles *D. trigona* in all the points above mentioned, and that it further resembles *Dosinia* in the thickness of the shell and in the massive hinge-plate, in the occasional rugosity of the anterior lateral tooth, in the manner in which the right posterior cardinal springs from the end of the incurved anterior margin, and also in the long narrow pedal scar which runs under the hinge-plate below the two anterior teeth of the left valve.

For some time I was inclined to agree with M. Cossmann in considering *C. incrassata* to be a *Pitaria*, but a more careful study of a large number of interiors and a comparison with *C. Lyelli* from the Hamstead Beds have convinced me that both species are more nearly related to *Dosinia*. *C. Lyelli* is, in fact, still more *Dosinia*-like than *C. incrassata*, having a very small lateral tooth and a very shallow pit, while in the right valve the anterior cardinal is directed forward as in so many species of *Dosinia*.

I am consequently of opinion that these shells are ancestors of *Dosinia*, and that *D. trigona* and its congeners are direct descendants of the ancestral form which have persisted to the present day. Seeing also that they differ in so many ways from *Dosinia* proper, it seems desirable that they should be separated as a distinct subgenus under a new name. For this I propose *Sinodia*, which is an anagram of *Dosinia*, and for the type I take *D. trigona* (Reeve) (see Fig. 1), hoping that the animal may soon be examined to see if it also differs from that of *Dosinia*.

So far as I can ascertain, no true *Dosinia* has yet been discovered either in Cretaceous or Eocene strata, the *D. cretacea* of Zittel (1864) being either a *Cyprimeria* or a *Cyclorisma*, and the '*Dosinia* sp.' of Holzapfel (1889) being only so named from the resemblance in external shape. A true *Dosinia* has, however, been described from the Oligocene of Florida by Dr. Dall.

If my view be correct, the typical orbicular form of *Dosinia*, with its deeply impressed lunule, is a specialized and comparatively recent type, not appearing in Western Europe until the Miocene epoch, while *Sinodia* was specially prevalent in Oligocene time, and was probably developed from *Pitaria*, which certainly existed in early Eocene times. I find this latter view is in accord with the opinion expressed by Stoliczka,[1] who suggested a connection between *Dosinia* and *Caryatis* (i.e. *Pitaria*) through the species *D. trigona* and *D. sphæricula*. Moreover, in most *Pitaria*, in the Eocene *Atopodonta*, and in the cognate *Callocardia*, the teeth are arranged in a manner which resembles that described by Bernard as occurring at a certain stage in the development of the hinge, the special point being that the right anterior cardinal and the front half of the bifid posterior cardinal are connected by a curved lamina which forms an arch over the median tooth.

The characters of the *Sinodia* group have practically been given above in distinguishing it from *Dosinia*, but it may be useful to indicate the points in which it differs from *Pitaria* or the latter from it. *Pitaria* is generally of a more regularly oval shape; it has a larger lateral pit in the right valve with more or less well developed lateral teeth above and below; the anterior cardinal is always parallel to the median, but is connected with the posterior in the manner above-mentioned. The pallial sinus is so variable that no distinctive character can be based upon it.

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[1] "Cretaceous Fauna of Southern India," vol. iii, Pelecypoda: Pal. Indica, 1871, p. 155.

There is an Eocene species which may belong to *Sinodia*, but not having seen specimens of it I cannot yet be sure of its affinities. This is *C. despecta*, Desh., which is described by him as an oval shell, thick and solid, becoming subtriangular with age, and the figure shows that the umbones are subcentral. The hinge-plate is broad and thick, and the anterior lateral is small and conical, fitting into a small round depression in the right valve. If this turns out to be really a *Sinodia* it will be the earliest species of the group.

3. Callista, Mörch, *non* Poli.

This genus has been accepted by most recent authors as derived from Poli (1791), but is rejected by Dr. Dall on the ground that Poli was not a binomial author. It is true that Poli had a double system of nomenclature, i.e. one set of names for the animal and another for the shell, but each was binomial. His method of nomenclature has been described and discussed by me in a previous paper,[1] in which it was shown that Poli's name *Callista* was applied to the animal only, and that in mentioning the various species of shells he used the Linnæan names, both of genus and species. Consequently I do not think the name *Callista* can be derived from Poli.

By some later writers, however, the name has been used in a conchological sense. Thus Leach in 1852 and Mörch in 1853 both applied it to groups of the Linnæan genus *Venus*, but neither of them specified a type. So far as I can ascertain, the earliest designation of a type for *Callista* (as a genus of shells) was made by F. B. Meek[2] in 1876, who adopted *Venus chione*, Linn., and as this species formed one of Mörch's *Callista* group the name with the type *C. chione* may be dated from Mörch's use of it.

Callista has an oval shell, smooth, or concentrically grooved, but in the recent forms always having minute radial discontinuous ingrained striæ beneath the vernicose periostracum, especially on the posterior slope. The hinge has three cardinal teeth in each valve; in the right valve the anterior and median cardinals are close together and have flat opposing faces, while in the left the corresponding teeth are united at the top and diverge like the sides of an obliquely written A; moreover, the median is always the thicker. In the left valve there is a single prominent anterior lateral; in the right an isolated pit for its reception, bordered by a small tooth below and a smaller one above. The pallial sinus is ample, horizontal, and pointed in front.

The genus is represented in Cretaceous rocks, but none of the species agree altogether with the above description, so that a distinct section or subgenus will have to be created for them.

In the Eocene series there are species which undoubtedly belong to the typical group of *Callista*, though some are referable to a special section of it. These latter were described under the name of *Callista* (as a section of *Cytherea*, Lam.) by M. Cossmann in 1886 (op. cit.,

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[1] Proc. Malac. Soc., vol. viii, p. 99 (1908).

[2] "Cret. and Tert. Fossils of the Upper Missouri": Rep. U.S. Geol. Surv. Terr., vol. ix.

p. 113), but they really belong to the section *Macrocallista* of Meek (op. cit., 1876, p. 177). *C. lævigata* (Desh.) (Pl. VI, Fig. 5), at any rate, is referable to this section, while *C. proxima* and *C. suberycinoides* are similar in shape and in hinge-characters; but I have not seen specimens of *C. Heberti* (Desh.), the hinge of which, as figured by Deshayes, seems to resemble that of *Pitaria.*

Three other Eocene species of *Callista* were separated by M. Cossmann under the name of *Chionella*, and though he recognized their resemblance to *Cytherea chione* in shape and in surface-characters, he appears to have regarded them as more closely related to *Pitaria* than to other sections of the old genus *Cytherea.* In this view I find myself unable to concur, for I cannot see that they differ in any essential particular from recent forms of the *C. chione* group. Dr. W. H. Dall came to the same conclusion in 1902,[1] and as he did not recognize the name *Callista* he adopted *Chionella* as applicable to the whole of the large group of recent shells, which includes *C. chione*, though he was obliged to make it a section of a genus *Macrocallista* (Meek). I see no reason for this method of procedure, but regard the name *Chionella* as merely a synonym of the *Callista* of Mörch and of Meek.

I am indebted to M. Cossmann for sending me specimens of his type species of *Chionella* (*Ch. ovalina*, Desh.), and these I have carefully compared with young specimens of *Callista chione* and other species of the genus. The hinge of *C. ovalina* is identical with that of *Callista*, and the only point in which the shell differs from the generic type is the rounded and slightly ascending pallial sinus, a character which is common to many of the Eocene Veneridæ, and is not sufficient to warrant even sectional separation.

There remain, however, some other contemporaneous species which have the hinge of *Callista*, but differ in the surface sculpture of the shell, this consisting either of fine concentric striæ like those of *Pitaria* or else of sharp concentric ribs like those of *Hysteroconcha* (*Venus dione*, Linn.), and in neither case showing any trace of the minute radial markings of *Callista.* By M. Cossmann these species were distributed under several of his sections, without sufficient regard to the details of the hinge. I propose to separate them under the name of *Calpitaria*, to indicate its connection with both *Callista* and *Pitaria*, and would define the group as follows, taking *C. sulcataria*, Desh., as the type.

CALPITARIA, n.subgen.

Shell ovate, fairly convex, concentrically striated or sharply ribbed. Cardinal teeth like those of *Callista*, anterior and median cardinals of left valve united at the top and barely reaching to the shell-border, anterior pit in right valve deep, and generally separate, but sometimes having a narrow thread-like channel which passes in front of the anterior cardinal. Pallial sinus generally short, and always rounded, varying in direction from horizontal to ascending.

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[1] Synopsis in op. cit., p. 351; see also Wagner, Free Inst. of Science, vol. iii, p. 1252 (Philadelphia, 1903).

This subgenus is certainly intermediate between *Callista* and *Pitaria*, and its existence makes it difficult to regard these two larger groups as separate genera. How many Eocene species will have to be referred to *Calpitaria* I cannot yet say, but think the following belong to it: *C. ambigua*, Desh., *C. Saincenyensis*, Desh., *C. Suessoniensis*, Desh. (= *tenuistriata*, Sow.), *C. fastidiosa*, Desh., and *C. elegans*, Lam.

Callistina, n.sect.

One of the earliest representatives of the *Callista* group is the well-known '*Cytherea plana*,' Sow., from the so-called 'Greensand' of Blackdown. This has the cardinal teeth of *Callista*, but the left anterior lateral is a long narrow ridge, grooved or corrugated on the sides, and fitting into a shallow corrugated pit in the right valve, which pit occupies only a small area in the flat anterior part of the hinge-plate. This part of the plate, in fact, resembles *Dosinia* more than *Callista*. The surface of the shell is smooth, and as a rule, nothing but concentric lines of growth are visible, but a specimen in the Sedgwick Museum shows some irregular radial striæ like those of *Callista*. The pallial sinus is ascending and subangular in *C. plana*, but in some other species it is rounded. *C. subplana*, d'Orb., and *C. polymorpha*, Zittel, belong to the same group, for which I propose the name *Callistina*, with *C. plana*, Sow., as the type.

4. Aphrodina, Conrad (genus or subgenus). Pl. VI, Fig. 4.

This name was given to an American Cretaceous shell which Conrad had previously described as *Meretrix tippana*. Though he had only a single left valve before him at the time, Conrad made this the type of a new genus,[1] which he described as follows:—"*Generic character.*—Shell rounded or suboval, striated or sulcated; hinge in the left valve with three diverging cardinal teeth, the anterior tooth as thick as the middle or thicker, and a straight compressed transversely rugose lateral tooth parallel with the margin of the shell above it; pallial sinus deep and similar to that in *Caryatis*, Roemer."

The figure given by Conrad shows that the anterior cardinal curves forward so as to point directly to the anterior lateral; also that the pallial sinus is wide, deep, and subangular. The type has quite recently been figured and described by Mr. Stuart Weller,[2] but he calls the shell *Meretrix tippana*, without saying anything of Conrad's proposed genus, and his description of it is short. Moreover, he states that the right valve has only two cardinal teeth, which must be either a misprint or a mistake, for Dr. Dall describes it as having three cardinals in each valve, as indeed the structure of the left valve would lead us to expect (Synopsis cit., p. 355).

The generic affinities of this shell do not seem to be properly understood even in America, and in Europe it has practically been ignored.

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[1] Amer. Journ. Conch., vol. iv (1869), p. 246, pl. xviii, fig. 5.
[2] "Report on the Cret. Palæont. of New Jersey": Geol. Survey of N.J., vol. iv of Pal. Series, pl. lxviii, figs. 1 and 2 (1907).

Meek, in 1876,[1] appears to have correctly appreciated its general characters, for he adopted it as forming a subgenus in a large *Callista* genus, and places it after *Caryatis* (= *Pitaria*). Dr. Dall, on the other hand, separates it entirely from *Callista*, and puts it as a subgenus of the *Venus puerpura* group, which he chooses to call *Cytherea* (Bolten, *non* Lam.); he gives no reason for this grouping, but in all probability the point which weighed with him was the direction of the anterior cardinal, for the hinge of the *V. puerpura* group is certainly similar in that respect.

Now it is interesting to find that shells of exactly the same general facies as Conrad's *Aphrodina tippana* occur in European Eocene beds, and that M. Cossmann had separated them from the other Cythereas of the Parisian Eocene, when he revised the group in 1886 (op. cit.). For these species he retained the name *Cytherea* (sensu stricto), and the first on his list was *C. nitidula*, Lam., with which species the *C. lucida* of Sowerby is identical. From examination of many specimens of the latter I am able to recognize the left valves as answering in every respect to the description of *Aphrodina*, and it follows that in these Eocene shells we have the material for a complete description of Conrad's genus or subgenus. I have therefore drawn up the subjoined definition of it:—

Shell oval, somewhat expanded anteriorly, surface smooth or finely striate; lunule slightly impressed, lanceolate and circumscribed; escutcheon not defined. Hinge with three divergent cardinals in each valve; in the left the posterior one is slightly bifid, the anterior is thick, flattened in front, and curved forward; in the right the posterior is broadly bifid, and the anterior small, slender, and directed forward. The strong elongate anterior lateral of the left is received by a pit between two small elongate teeth in the right valve. The nymphs are corrugated in *A. nitidula*, but are said to be smooth in *A. tippana*. The pallial sinus is large and deep, more or less ascending, and rounded at the end.

In general shape, in the character of the lunule, and in some particulars of the hinge, *Aphrodina* shows a close resemblance to *Callista*. It differs, however, in the direction of the anterior cardinals, in the feeble median, and in the grooved posterior cardinal of the left valve. Moreover, I have not been able to detect any trace of radial striation even in well-preserved Eocene specimens.

With regard to the rugosity of the anterior lateral, this is hardly discernible in *A. nitidula*, so that I do not regard it as a group character, but as a primitive character in the Cretaceous shell (*A. tippana*). On the whole, therefore, I think *Aphrodina* should be classed as a subgenus of *Callista*.

Other Eocene species referable to *Aphrodina* are *C. tranquilla*, Desh., and *C. nitida*, Desh. *C. corbulina* also probably belongs to it, but *C. despecta* and *C. Saincenyensis* certainly cannot be included.

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[1] Rep. U.S. Geol. Surv. Terr., vol. ix, p. 177.

5. Pitaria, Roemer, emend. Dall. Pl. VI, Fig. 3.

This group was founded by Roemer in 1857 under the name 'Pitar' (after Adanson), but in 1862 he proposed to substitute the name *Caryatis*; this, however, is preoccupied in Lepidoptera (Hubner, 1816), and Dr. Dall has very properly pointed out that Roemer's original name should be adopted and Latinized into *Pitaria*, just as the 'Dosin' of Adanson was converted into *Dosinia*.

The type of this group is *Venus tumens*, Gmelin, and the species belonging to it were included by Gray in his genus *Dione* (1847), which name is also preoccupied by Hubner. The division was recognized by Cossmann in 1886 under the name of *Caryatis*, as represented by many species in the Eocene of France.

Pitaria has an oval shell which is smooth or finely striate; the lunule is circumscribed and superficial, not impressed. The hinge has already been partly described, but it may be added that the median and anterior cardinals of the left valve are united at the top, and are separated from the shell-border by a sulcus or channel, into which fits the arch formed by the union of the anterior and posterior teeth of the right valve. The strength of the bridge in the right valve and the consequent breadth of the corresponding channel in the left valve vary considerably both in recent and fossil species. Lastly, the anterior cardinal of the right is short and is undercut by a channel connecting the anterior lateral pit with the socket between the anterior and median cardinals. The pallial sinus is variable, sometimes small and sometimes deep, sometimes pointed and in others rounded, but generally ascending.

Species referable to *Pitaria* are believed to occur in Cretaceous rocks, but I have not been able to recognize any among those from English Cretaceous deposits. Many species from the Lower Cretaceous of France are still only known from casts, and consequently they cannot be referred to their proper genera. *Venus Orbigniana*, Forbes, may possibly be a *Pitaria*, but neither Mr. Woods nor I have been able to obtain sight of a specimen that shows the interior. Stoliczka supposed that *V. Rotomagensis*, d'Orb., was a *Pitaria*, and he may be right, but again we have not yet succeeded in seeing one which shows the hinge of either valve.

Many species of *Pitaria* occur in the Eocene, the commonest and best known being *P. Parisiensis*, Desh., and *P. obliqua*, Desh., though both have always been catalogued in this country as '*Cytherea*.' *Cyth. incurvata* (Edw. MS.) is also a well-characterized species of *Pitaria*, remarkable for its transverse elongation and for its prominent recurved umbones. *C. transversa*, Sow., *C. Bartonensis* (Edw. MS.), and *C. striatula*, Desh., also seem to belong to *Pitaria*.

6. Atopodonta, Cossmann.

This name was proposed by M. Cossmann in 1886 (op. cit., p. 110) for two small shells occurring in the Parisian Eocene, the first and type being *Venus conformis*, Desh., and the second *A. tapina*, Cossm. (then first described).

M. Cossmann gives full descriptions both of the genus and of the two species, but he does not seem to have rightly understood the composition of the hinge. He says, "the cardinal plate is thick and excavated (*échancrée*), without an anterior pit, bearing four teeth in the left valve and three in the right"; he proceeds to describe the peculiar arrangement of these teeth, and appears to regard all of them as cardinals. In this I think he is mistaken; it seems to me that the front tooth of the left valve, which is described as being small and pointed, must really be a diminutive anterior lateral, like that of *Cyth. Lyelli*, or the recent *Venus verrucosa*. In these shells the corresponding pit in the right valve is often so small and shallow as to be nearly obsolete, and I assume this to be the case in *Atopodonta*.

In the left valve what seem to be the anterior and median cardinals are united at the top and are separated from the shell-margin by a sulcus (as in *Pitaria*); behind these there is a simple and normal posterior cardinal. In the right valve there are two teeth of a reversed V-shape, one above the other, and behind these is a long narrow grooved posterior tooth. This is also comparable to the arrangement in *Pitaria* and *Callocardia*, but represents an earlier stage of development. The lower Λ is the primitive element of the median tooth, the upper one represents the bent lamina which would become the anterior cardinal and the bridge uniting it to the posterior tooth.

Dr. Dall appears to have perceived the true structure of the *Atopodonta* hinge, for in his Synopsis (op. cit., p. 353) he briefly dismisses the name as a synonym of *Callocardia*. In such dismissal, however, I think he goes too far, for though the two agree in the absence of a pallial sinus, the teeth-connections are in a different stage; moreover, in *Callocardia* the anterior lateral is strong, elongate, and sharp, fitting into a distinct pit in the right valve. The two shells are also very different in shape and in thickness of substance. It will, therefore, be convenient to retain *Atopodonta* as a distinct type, though for the present it may be regarded as a subgenus of *Callocardia*.

7. Tivelina, Cossmann. Pl. VI, Fig. 6.

This is a group of small shells separated from other species of *Cytherea* by M. Cossmann in 1886, but very inadequately defined. The following is a translation of his descriptive remarks:—"I group in this section, under a new name, shells which are thin, triangular, more transversely elongated than the true *Tivela*, more or less clearly grooved (*sillonnées*), with a large lanceolate lunule, a short sinus, and a hinge distinct from *Callista*. Contrary to what holds in the preceding groups, the shape of *Tivelina*, even in one and the same species, varies considerably."[1] The first species and the one which he regards as the type is *Cyth. tellinaria*, Lam.

From the name selected and from his reference to *Tivela* it would seem that M. Cossmann regarded *Tivelina* as in some way related to that genus, yet he gave no other indications of such

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[1] Ann. Soc. Roy. Malac. Belg., vol. xxi, p. 119.

relationship. Probably the points which he had in mind were the somewhat triangular shape and the short pallial sinus, but there is no resemblance in the hinge-characters. Of them he only says that the hinge is distinct from that of *Callista* without specifying the exact points of difference.

Fischer[1] did not express any opinion on the precise relationship of *Tivelina*, merely stating that *Chionella* and *Tivelina* were names proposed for some fossil groups of *Meretrix*, and giving the following brief description of the latter: "Forme subtrigone; surface lisse; un pli sinueux en arrière." The sinuous fold, however, does not exist in all the species referred by M. Cossmann to *Tivelina*.

Dr. Dall, in 1902, placed the group as a subgenus of *Pitaria*, giving only a brief account of it, and stating the hinge to be "as in *Pitaria*." In his later memoir, however (op. cit., 1903, p. 1265), he says "hinge as in *Chionella*," but still retains the group as a subgenus of *Pitaria*, an arrangement with which I cannot agree. In any case it seems desirable to print a more complete and diagnostic description of *Tivelina*, and as M. Cossmann has kindly supplied me with specimens of eight of the principal species, I have carefully examined and compared these in order to express the distinctive characters which are common to all.

Shell oval, compressed, anteriorly expanded and posteriorly attenuated, frequently showing a shallow fold or depression which slightly sinuates the ventral border. Surface smooth or finely striated. Umbones small. Lunule long, lanceolate, and defined by incised lines, but never impressed, and sometimes the area is gibbous. Hinge-plate weak and narrow, elongated anteriorly and attenuated posteriorly, so that the cardinal area is short. The teeth resemble those of *Callista*, but are small and weak; in the left valve are three divergent cardinals, the middle being thickest, and a prominent triangular anterior lateral; in the right a narrow feebly-grooved posterior, while the median and anterior cardinals are short and nearly parallel, and in front are two narrow anterior laterals bordering a deep, narrow, elongate pit. The pallial sinus is always short and rounded.

On the whole it appears to me that *Tivelina* is more nearly allied to *Callista* than to any other genus. It differs, however, in the absence of radial striæ, in the umbones being small and nearer the middle line of the shell, in the curiously short and narrow hinge-plate, and in the narrowness of the right posterior cardinal; also in the small rounded pallial sinus. Whether these characters are of generic importance or not it is difficult to say, but they seem of rather more diagnostic value than those which distinguish *Pitaria* from *Callista*.

Meretrissa, n.subgen. Pl. VI, Fig. 7.

Although the genus *Meretrix*, as restricted by Gray and Deshayes, and typified by *Meretrix morphina*, does not seem to have come into

[1] Manuel de Conchyliologie, 1887, p. 1080.

existence before the Miocene period, it is interesting to find that two little shells of Oligocene age approach very closely to those which are grouped under that name. They were regarded by M. Cossmann as species of *Tivelina*, but they differ in several respects from the typical forms of that group, and are unquestionably a link between *Tivelina* and *Meretrix*, so that they might be placed as a subgenus of either. Since they have hitherto been referred to *Tivelina* I retain them in that genus, but give them the distinctive name of *Meretrissa* to indicate their affinities.

The shells I refer to are *Cytherea depressa*, Desh., and *C. Stampinensis*, Desh. Deshayes' figures of the latter species are not good, and M. Cossmann informs me that the specimens from Pierrefitte, described by Stan. Meunier[1] under the name of *C. dubia*, are really identical with Deshayes' *Stampinensis*; I am also indebted to him for examples of both *depressa* from Jeures and of *Stampinensis* from Pierrefitte, thus enabling me to compare them with the species of *Tivelina* which he had previously sent me.

These shells are very small, *depressa* being only 8 mm. in transverse width and 7 mm. in height, while *Stampinensis* varies somewhat, but is often only 7 by 6 mm. They are subtrigonal, approximately equilateral, and have a smooth outer surface marked only by lines of growth.

From *Tivelina* they differ in being much shorter transversely, and consequently more equilateral and trigonal; the teeth are more widely and equally divergent, the right anterior cardinal sloping forward so as to point toward the pit of the anterior lateral; in the left valve the anterior lateral is longer and comes closer to the anterior cardinal. Again, the right posterior cardinal is not bifid, but entire or only slightly grooved as in some recent species of *Meretrix*; while the median teeth of both valves show a tendency to become bifid.

From *Meretrix* they differ in their very small size, in the approximation of the lateral to the cardinal teeth, and in having a distinct pallial sinus. *M. depressa*, which may be taken as the type, is rather a thin shell, with a weak hinge, and is thus very different from the solid recent forms of *Meretrix*; *M. Stampinensis* is rather stronger, but the hinge-plate is still weak and narrow. In the latter the sinus is small and placed high up by the adductor scar; in *depressa* it is rather deeper, but does not reach the middle of the shell; in both it is obtusely rounded.

8. Dollfusia, Cossmann.

This was proposed as a genus in 1886, but as it was based on a single right valve, and no other specimens have been found, it is impossible to be sure whether this valve is a normal one or a malformation of some other shell.

In the first place it is very small, only 6 mm. in length; secondly, it differs in shape from all other known members of the Veneridæ,

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[1] Nouv. Arch. du Muséum, 1880, p. 243, pl. xiii, figs. 17, 18; see also Cossmann and Lambert, Mém. Soc. Géol. France, 1884, p. 82, pl. i, fig. 18.

being quadrangular or trapezoidal, with opposed subcentral umbones. M. Cossmann summed up its characters in the following terms: "The hinge is almost identical with that of *Dosinia*, but the short, open, rounded sinus is rather that of some *Tivelina*. By its shape one would take this shell for a species of the family Cardiidæ, but from that it is completely separated by its sinus and its hinge" (op. cit., p. 128).

With regard to the hinge, as shown in M. Cossmann's figure, I cannot see that it has any special resemblance to that of *Dosinia*;[1] still less can I see any likeness between its dentition and that of *Tivela*, near which Fischer placed it,[2] being apparently under the erroneous impression that there were two posterior cardinals instead of a single bifid one. The general arrangement of the teeth is similar to that of *Callista* and *Tivelina*, the anterior and median cardinals being close and nearly parallel, while the posterior is divergent and bifid; the somewhat different look of the hinge being really due to the shortening of the hinge-plate as a consequence of the peculiar shape of the shell. The short pallial sinus also resembles that of *Tivelina*, and is very different from the forms of sinus found in the genus *Dosinia*.

So far, therefore, as it is possible to form an opinion from the characters of a single valve and from a figure only, *Dollfusia* seems to me more closely related to *Tivelina* than to any other group of Veneridæ, and it may especially be compared with *T. sphenarium*.

9. Circe, Schumacher.

No shells referable to the typical group of the genus *Circe* have yet been found either in Cretaceous or Eocene deposits, those from the Gosau Beds which were described by Zittel in 1864 as *Circe* having since been transferred to *Cyprimeria*, while the shells referred to *Circe* by M. Cossmann in 1886 belong to its subgenera.

In the Oligocene, however, there is a shell which certainly seems to belong to the typical section of the genus, as exemplified by *C. litterata*, Linn. This was described as *Cyth. variabilis* by Stan. Meunier in 1880,[3] and was recognized as a *Circe* by M. Cossmann[4] in 1891. It is found at Étampes, south of Paris. The shell varies considerably in shape, from broadly oval to suborbicular. The external surface is concentrically grooved. The hinge exhibits the characteristic three straight and slightly divergent cardinal teeth of *Circe* proper, the anterior one being vertical and the other two oblique. The pallial line is slightly sinuated.

Of the four Eocene species referred to this genus in 1886 by M. Cossmann (op. cit., p. 126), *C. vetula*, Desh., and *C. Goodallioides*, Cossm., seem to belong to the section *Circenita* of Jousseaume, which

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[1] Having written to M. Cossmann on this point, I am glad to find that he does not now maintain its affinity with *Dosinia*.

[2] Manuel de Conchyliologie, 1887, p. 1079.

[3] Nouv. Arch. du Muséum, ser. II, p. 242, pl. xiii, figs. 15, 16.

[4] "Revue de la faune du terr. Olig. d'Etampes": Journ. de Conch., 1891, p. 274.

has convex valves (not compressed), and no defined escutcheon nor sunken ligament.

On the other hand, *C. circularis*, Desh., and *C. pusilla*, Desh., seem referable to the subgenus *Gouldia*, as exemplified in our recent *G. minima*. *Gouldia* differs from other sections of the genus in the wide divergence of the teeth, the anterior cardinal of the right valve sloping forward so as to point to the middle of the anterior lateral pit; another peculiarity is the union of the anterior adductor and the pedal scars, which in all other forms of *Circe* are separate from one another. In specimens of *C. pusilla* with which M. Cossmann has kindly supplied me, the pedal scar does seem to merge into that of the adductor; the shell is so minute that it is difficult to be sure, but I cannot see any separate scar. The teeth are certainly those of *Gouldia*.

Another species of *Circe* was afterwards described by M. Cossmann under the name of *C. Dumasi*, from the Middle Eocene of Bois Gouët in the Loire Inférieure,[1] and as he has also been kind enough to send me specimens of this I am able to say that it undoubtedly belongs to *Circenita*, and that it possesses the small round separate pedal scar which characterizes all members of the genus except *Gouldia*.

10. Ptychomya, Agassiz.

This shell has been referred to different families by different authors. By Agassiz (1842) it was classed near *Mya*; by d'Orbigny (1844) it was described as a *Crassatella*; and it was referred to the same family both by Pictet and Campiche (1866) and by Stoliczka (1871); but Dames in 1873 gave reasons for regarding it as nearly related to the recent *Crista* (a subgenus of *Circe*). Fischer (1887) seems to have concurred in this view, but was evidently doubtful about the existence of an anterior pit in the right valve, and so far as I can ascertain no one has yet seen the hinge of a left valve.

By the kindness of Mr. Woods I have been able to examine the specimen from which his figure of the hinge of the right valve was drawn.[2] As might be inferred from the figure, it is not clear from this specimen that there were really three cardinal teeth; only two of them are quite distinct, these being a small anterior and a thick median; a posterior tooth may have been present, but, if so, it was fused with the nymph and has been broken off, all that remains being a broad flat plate below the deeply inset trough which held the ligament. The anterior portion of the shell is also broken, but enough remains to show that the area in front of the cardinals was small and that the border of the hinge-plate ran nearly straight to the anterior side, forming a ridge with a small hollow or trough above it. This may have received an anterior lateral tooth, if one existed in the left valve.

The shell agrees with *Crista* in being very thick, in bearing strong

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[1] Bull. Soc. Sci. Nat. de l'Ouest.
[2] "Cretaceous Lamellibranchia": Pal. Soc. Mon., vol. ii, pl. xxvii, figs. 24–6.

radiating ribs, of which some are divaricate, in having apparently three divergent cardinal teeth and possibly an anterior lateral, in the entire absence of any escutcheon, and in the deeply sunk ligament; also in the crenulation of the valve margins, and in the absence of a pallial sinus. It differs from *Crista* in not having the large anterior expansion of the hinge-plate bearing the lateral teeth, in not having a distinct posterior cardinal separated by a groove from the nymph, and lastly in the divaricate ribs being on the anterior side, while in *Crista* they are on the postero-dorsal side; on that side of *Ptychomya* there is only a series of short tubercular ridges.

On the whole I incline to think that the resemblances outweigh the differences, but until the existence of an anterior lateral tooth is established the affinity with *Crista* must remain doubtful.

11. Sunetta and subgenus Meroëna. Pl. VI, Fig. 8.

The existence of the genus *Sunetta* as far back as early Eocene time was first pointed out by M. Cossmann in 1886, who referred four species occurring in the Parisian Eocene to this group, though *S. multisulcata* is probably only a variety of *S. semisulcata*, Lam. He does not, however, seem to have noticed that these early forms differ from all recent species in having smooth inner margins instead of crenulated edges. Moreover, the dorsal border of the Eocene shells is not so deeply inflected, so that the ligament is not so deeply sunk, and the upper angle of the escutcheon is more obtuse. The hinge is similar to that of the recent species, except that the posterior cardinal of the right valve is deeply grooved, whereas in recent species it is narrow and entire, or very feebly grooved. Lastly, the Eocene shells are much less inequilateral, the umbones being subcentral and the shell subtrigonal.

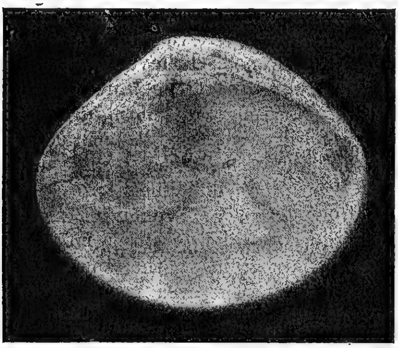

Fig. 2.—*Sunetta* (*Meroëna*) *trigonula*, Desh. Ovate variety; from a specimen in the British Museum.

These differences are certainly of sufficient importance to deserve recognition, and are all of them more important than the smoothness of the outer surface and more rounded shape, for which Jousseaume has proposed to separate one or two recent species under the name of

Sunettina. I propose, therefore, to distinguish these Eocene shells by the name of *Meroëna*, and consider that they should rank as a subgenus. In reality, of course, they are ancestors of our modern assemblage of species known as *Sunetta*, and they represent a stage in its evolution from a more generalized form.

The name *Meroëna* is derived from Schumacher's name for the genus (Meroë), and as type I take the first on M. Cossmann's list (*S. trigonula*, Desh., see Fig. 2), which is a common shell in our Barton Beds, as well as in the equivalent deposits of the Paris Basin. The other two species are *M. semisulcata*, Lam., and *M. polita*, Lam., with which M. Cossmann unites *Cyth. separata*, Desh. Another species, has, however, been recently described by him, which forms an interesting link between *Meroëna* and typical *Sunetta*, for in shape, dentition, and sharpness of the dorsal angle it comes near to some recent forms, but has the smooth inner margins of *Meroëna*. This species is *S. Caillaudi* from the Middle Eocene of Bois Gouët (Loire Inférieure).

12. Cyprimeria, Conrad, 1864.

This genus was founded on a right valve of the American Cretaceous shell previously known as *Cytherea excavata*, Morton, and was described [1] as having (in that valve) a bifid oblique posterior cardinal and two oblique anterior teeth, "with an intermediate pit for the reception of the tooth in the opposite valve." By this, Conrad evidently meant that between the posterior and median teeth there is a wide space into which a broad left median tooth would fit.

As the generic characters of *Cyprimeria* are not correctly given either in Fischer's "Manuel de Conchyliologie" or in Eastman's edition of Zittel's Palæontology, Conrad's description of the right valve may be supplemented by the following:—The left valve has three separate and divergent teeth, the median being thick, triangular, and bifid, the others narrow and entire. There are no lateral teeth, and the anterior cardinal is parallel to the lunular border. The pallial line is only slightly indented below the posterior muscular scar. In shape the shell is orbicular and compressed.

The genus *Cyprimeria* is supposed to be essentially Cretaceous, and since species have been found in France, Germany, Bohemia, India, and North America, it is rather surprising that none have yet been discovered in British Cretaceous rocks. But, although the genus has only yet been recognized in deposits of Cretaceous age, there is, of course, no reason why it should not have survived into Eocene time, and in the Eocene of the Paris Basin there is a shell described by Lamarck as *Venus obliqua*, which seems to be referable to *Cyprimeria*, notwithstanding its small size.

V. obliqua has recently been well figured by M. Cossmann in his "Iconographie Complète des Fossiles Eocèniques des Environs de Paris" (1906), pl. ix, fig. 48*b* (three views), the interiors of both valves being shown. From these figures it can be seen that the hinge-teeth

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[1] Proc. Acad. Nat. Sci. Philadelphia, 1864, p. 212.

agree with those of *Cyprimeria*, as do also the other features of the shell, which, however, is very small, its length from side to side being only $9\frac{1}{2}$ mm., and its height $9\frac{1}{4}$, so that it is nearly orbicular. The only other point of difference is in the posterior tooth of the right valve, which, though bifid, is narrow, while in *Cyprimeria* it is more broadly bifurcate. It occurs in the Sables de Cuise (Yprésien) and in the Calcaire Grossier (Lutétien).

This shell was regarded by M. Cossmann in 1886 as a species of '*Mercenaria*' (now *Mercimonia*, see p. 169), and as no change was made in his later monograph I wrote to enquire whether he was aware of the resemblance of *Venus obliqua* to *Cyprimeria*. In reply, he admits that *V. obliqua* has some special characters, but he still considers that it belongs to the same group as *Mercimonia Bernayi* and *M. cythereæformis*, "malgré de légères différences dans la charnière."

M. Cossmann, however, was at the same time kind enough to send me a specimen of each valve of *V. obliqua*, and an examination of these valves only confirms the opinion I had formed from his photographic figures. The differences of the hinge seem to me much more than slight: thus in the left valve of *Mercimonia* the median tooth is entire, and of nearly equal thickness from end to end, differing much from the bifid triangular tooth of *V. obliqua*; in the right valve of *Mercimonia* the posterior is broader and more deeply cleft, and the other teeth are not directed so far forward, while in both valves there is a concave extension of the hinge-plate in front of the anterior teeth.

When it is remembered that *V. obliqua* agrees with *Cyprimeria* in being compressed and suborbicular in shape, and in having a nearly entire pallial line, I think that most conchologists will agree with me that it should be placed under that genus, especially if it is compared with such a form as *Cyprimeria discus*. I only regret that M. Cossmann cannot yet bring himself to share this opinion.

13. Cyclorisma, Dall. Pl. VI, Fig. 9.

This group was first separated from *Cyprimeria* by Conrad in 1875, who proposed to call it *Cyclothyris*,[1] but this name having been appropriated by McCoy for a Brachiopod in 1844, Dr. Dall altered it to *Cyclorisma*.[2] The type is *C. carolinensis*, Conrad.

Up to 1875 many species of *Cyclorisma* had been described as *Cyprimeria* (notably by Stoliczka), because both in general shape and in the dentition they agree with that genus, but the type of *Cyprimeria* (*C. excavata*, Morton) has no pallial sinus, and it was solely on this ground that *Cyclorisma* was separated from it.

The size and shape of the pallial sinus in *Cyclorisma* vary considerably, and we find similar variations in some other early groups of Veneridæ, such as *Tivelina* and *Mercimonia*; consequently we must be on our guard against attributing too much importance to the sinuation of the pallial line, and to the length of the siphons which is connoted by it. If, therefore, this is the sole difference between the

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[1] In Kerr's Report for 1875, Geol. Survey of N. Carolina, vol. i, App. I, p. 8.
[2] Proc. U.S. Nat. Mus., vol. xxvi (1902), p. 357.

two groups I should agree with Dr. Dall in ranking *Cyclorisma* as merely a subgenus (or even a section) of *Cyprimeria*.

It appears, however, that *Cyclorisma* varies considerably in shape, the typical form, as well as many of the Indian species, being nearly orbicular; others, like the British Cretaceous shell which has hitherto been known as *Venus vectensis*, Forbes, are suborbicular, and lastly we have the allied species *Venus faba*, Sow., which has the essential hinge-characters of *Cyclorisma*, but resembles a *Tapes* in shape.

I cannot find that any adequate description of the hinge of *Cyclorisma* has yet been published. The following has been drawn up partly from the figures of Stoliczka, but mainly from an examination of specimens of *C. vectensis* preserved in the Sedgwick Museum at Cambridge. There are three cardinal teeth in each valve, the posterior of the right being always deeply bifid, and the left median being sometimes bifid. There is no anterior lateral, but the hinge-plate is prolonged anteriorly, and forms a more or less concave space in front of the anterior cardinal very like that in the hinge of *Clementia*.

In the right valve the two anterior teeth are nearly parallel, and are directed forward, so that sometimes the anterior seems to end in the concavity, while the median runs into the rim of the hinge-plate. The posterior tooth is not merely bifid, but is actually double, consisting of two separate laminæ, one of which curves forward to meet the top of the anterior tooth (as in *Pitaria*), while the hinder one runs in a nearly straight but oblique line across the hinge-plate. In some species this division of the posterior cardinal is so complete that the hinge seems to consist of four separate teeth; even Stoliczka was thus deceived, for he describes the hinge of the right valve as consisting of "two diverging pairs of thin laminar cardinal teeth, each pair originating from one point, and thus preserving the character of a single bifid tooth."[1] In the left valve the anterior and median teeth are united at the top and form a Λ-shaped tooth which barely reaches the margin of the shell; the posterior tooth is entire, not very long, and is slightly curved so as to reach down to the inner margin of the hinge-plate (as in *Dosinia* and some species of *Pitaria*).

The hinge of *C. faba* only differs from the above in regard to the relative strength of the left anterior and median teeth. In *vectensis* the median is the thicker, and may have been grooved; in *faba* both teeth are entire and equally strong.

No true *Cyclorisma* seems to have survived the Cretaceous period, at any rate in Western Europe, but some of the Eocene shells, now known by the name of *Mercimonia*, resemble *Cyclorisma* in the bifid structure of the posterior cardinal and in the anterior concavity of the hinge-plate.

14. Clementia, Gray, and Flaventia, n.subgen. Pl. VI, Fig. 10.

A species of *Clementia* exists in the higher part of the Parisian Eocene series, and was described by M. Cossmann in 1886 (op. cit.,

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[1] "Cret. Fauna of South India": Pal. Indica, 1871, vol. iii, p. 157.

p. 115) under the name of *C. Deshayesi.* It agrees in all essential characters with the recent typical species (*C. papyracea*, Gray), and has a similar thin fragile shell.

Nothing like a true *Clementia* has yet been found in beds of Cretaceous age, but the species which has hitherto been known by the name of *Venus ovalis,* Sow., offers many points of resemblance. In shape and general aspect *V. ovalis* resembles a *Callista*; indeed, the resemblance to *Callistina plana* is so great, not only in shape, but in the arrangement of the cardinal teeth, that unless the anterior part of the hinge-plate was exposed, the shell might easily be mistaken for a small specimen of *C. plana.* The place of the anterior lateral and its corresponding pit is taken by a concave space of elongate triangular form, similar to that on the hinge-plate of *Clementia.* The pallial sinus is deep, ascending, and rounded.

The only other genus with which it can be compared is *Cyclorisma*, but the position of the teeth is quite sufficient to distinguish them, for in *C. ovalis* the anterior and median cardinals cross the hinge-plate nearly vertically, instead of being directed obliquely forward as in *Cyclorisma*, while the posterior, though bifid, is not the double tooth of *Cyclorisma.*

From *Clementia* it differs, not only in the greater thickness of the shell, and consequently of the hinge-plate, but also in the form of the right posterior cardinal, which in *Clementia* is a short, straight, narrowly bifid tooth, consisting of two equal united laminæ; while in *V. ovalis* this tooth consists of two diverging laminæ, the hinder of which is much longer than the other; it is, in fact, exactly like the posterior tooth of *Callistina plana.* Lastly, *V. ovalis* has a circumscribed lunule.

In other respects the shell agrees with *Clementia*, and I am certainly of opinion that it may be regarded as the ancestor of this genus, but the differences are such that I think it should rank as a subgenus, and consequently should have a distinctive group-name. As the best specimens come from the Blackdown Beds, and are often of a golden-yellow colour, the name may be taken as indicative of that colour, and also as being formed on the same model as *Clementia.*

I think it very probable that some other Cretaceous species will have to be associated with *F. ovalis*, such as the *Tapes faba* of Holzapfel (*non* Sow.), from the Gosau Beds, as well as some French Lower Cretaceous species, but these latter cannot yet be determined, because their hinges are at present unknown. Again, a recent shell from the west coast of America has been referred to *Clementia* by Dr. Dall,[1] under the name of *Cl. solida*, the single right valve known being described as "large and solid for the genus"; but the teeth of this unique valve are neither like those of other *Clementia* nor those of *Flaventia*, so that, till other specimens have been found, its precise affinities can hardly be discussed.

Finally, there is the remarkable shell which was named *Psathura* by Deshayes, and of which only two valves are yet known. This only

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[1] Proc. U.S. Nat. Mus., vol. xxvi (1902), p. 401, pl. xiv, fig. 4.

differs from *Clementia* in the absence of any pallial sinus, and if we bear in mind the great variability of the sinus in the *Cyprimeria-Cyclorisma* group (see p. 166), the absence of a sinus will not prevent our regarding *Psathura* as a subgenus of *Clementia.* If this broader view of the genus *Clementia* be accepted, its definition must be modified so as to include *Flaventia* and *Psathura* as subgenera. This can be done as follows:—

Shell transversely oval, inequilateral, convex, concentrically striated or undulated, without defined escutcheon and without lunule (except in *Flaventia*); pallial line deeply sinuated (except in *Psathura*); hinge bearing three cardinal teeth in each valve; in the right the anterior and median are nearly vertical, the posterior oblique and bifid; in the left there are three diverging teeth.

Clementia (sensu stricto).—Shell thin, fragile, white. Pallial sinus deep, ascending, rounded. Right posterior tooth short, straight, and narrow, consisting of two parallel laminæ; the left median thicker than the others.

Flaventia.—Shell fairly strong, with a defined lunule. Right posterior tooth long and deeply bifid, the two laminæ being of unequal length.

Psathura.—Shell thin and fragile. Hinge like *Clementia*, the right posterior very short, left valve with three equal and entire teeth. Pallial line entire.

15. Mercimonia, Dall. Pl. VI, Fig. 11.

This is a group of small shells which have hitherto only been found in the Eocene of the Paris Basin. They were included in the '*Venus*' of Deshayes, and were referred to *Mercenaria* by M. Cossmann in 1886, but were distinguished by Dr. Dall in 1902 under the name of *Mercimonia* (op. cit., p. 361), *Venus Bernayi*, Cossm., being taken as the type.

Mercimonia differs from *Mercenaria* and *Chione* in several respects, and notably in having smooth inner margins. Dr. Dall regards it as a section of *Katelysia*, which he located as a subgenus of his *Marcia* group. There is certainly much resemblance between *Marcimonia* and *Marcia*, but I can see little between the former and *Katelysia*, which I should not place in the same genus, because it has two grooved or bifid teeth in each valve, and is more nearly akin to *Tapes* and *Hemitapes*.

It is a question whether *Venus exalbida*, Dillw., is the rightful type of *Marcia*, but this is the shell with which *Mercimonia* may be best compared, and it is briefly described by Dall as a *Venus* (i.e. *Mercenaria*) "without hinge rugosities, radial sculpture, or marginal crenation." *Mercimonia*, however, possesses some special characters of its own, and for the present I prefer to let it stand by itself as a separate genus, until its affinities are better understood and the '*Marcia*' question has been satisfactorily settled.

M. Cossmann gave no general description of *Mercimonia*, though he described *M. Bernayi* in detail, and Dr. Dall's definition was only a brief one, so I have judged it well to frame a fuller account from M. Cossmann's description of *M. Bernayi*, and from specimens of *M. cytheræformis*, Desh., which he has kindly sent me.

Group characters.—Shell oval, equally rounded at each end, tumid, with prominent umbones, which are inclined forwards, and slightly recurved, so that the front view of the closed valves is cordiform. The lunule is large, and feebly defined by a faint line. Escutcheon not defined.

The hinge-plate is thick, and the teeth are fairly strong; there are three in each valve, divergent and unequal; the right posterior is curved and strongly bifid throughout its length; in the left the anterior and median are united at top and do not quite reach the shell-border, and both are entire (not grooved). The anterior part of the hinge-plate forms a small concavity under the lunule. The pedal scar is merged in that of the anterior adductor. The hinge-plate and teeth have, in fact, quite as great a resemblance to that of *Venus lamellata* as to that of *V. exalbida*.

Such being the characters of the type species and of several others, namely, *cytheræformis*, Desh., *inopinata*, Desh., and *delicatula*, Desh., it becomes a question whether some of the other species referred to *Mercimonia* by M. Cossmann can remain in it. Thus, two of the species, *V. solida*, Desh., and *V. secunda*, Desh., differ in being much more oblique and in having no anterior concavity, the right anterior tooth being very small and placed directly under the lunule. *M. fallaciosa*, again, is a thin shell with a very small anterior cavity.

Four other species differ still more widely, for in them the right posterior cardinal is entire (not bifid), and is widely separated from the other teeth, the hinder part of the hinge-plate being excavated and abbreviated. They appear to me to belong to the group which M. Cossmann called *Venerella*, and I shall refer to them again under that head.

It will be noticed that in the above description no mention is made of the pallial sinus, the reason being that it is curiously variable; thus, in the type species there is hardly any sinus, *inopinata* has a small but distinct triangular sinus, *cytheræformis* has a deeper triangular one, and in *fallaciosa* it is deep, but horizontal and rounded. It is clear, therefore, that the sinus presents no constant character, and that the siphons of *Mercimonia* must have varied in length to a remarkable extent.

16. Chione, Megerle.

This genus is represented by a single species in the Oligocene of Pierrefitte in the district of Étampes. It was first figured and described as *Venus Loewyi* by Stan. Meunier in 1880,[1] and again by Messrs. Cossmann & Lambert in 1884.[2] It was recognized as a *Chione* by M. Cossmann in 1887, and is the earliest known member of the typical group of this genus in Europe.

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[1] Nouv. Arch. du Muséum, ser. II, p. 241, pl. xiii, figs. 11, 12.
[2] Mém. Soc. Géol. de France, ser. III, vol. iii, p. 79, pl. i, fig. 22.

It is a fairly large shell, varying in transverse length from 32 to 46 mm. (i.e. up to 1¾ inch). It is oval in shape, with a thick shell, and a strong hinge-plate, bearing three stout widely-divergent teeth, the anterior one being close under and parallel to the lunular border. The pallial sinus is short and evenly rounded. The valve-margins are crenulated. The surface-sculpture has the combined radial and concentric elements of *Chione*, the concentric ribs being the more conspicuous. It resembles such recent species as *C. pectorina* or *C. asperrima*, except in the relative dominance of the concentric ribs.

Textivenus, Cossmann.—Two small Eocene shells were separated under this name by M. Cossmann in 1886, on account of their remarkable surface-sculpture. This consists of fine divaricate raised thread-like ridges, which cross one another in trellis-fashion on the ventral portion of the valves. I place these shells under *Chione*, because they agree with species of that genus in all essential characters, excepting only in the crenulation of the inner margins, which are smooth; but the outer layer of the shell with its raised pattern projects slightly beyond the inner layer, and forms a narrow frilled or festooned border.

The type of this subgenus is *Venus texta*, Lam., and it differs from *Mercimonia* in having an impressed lunule, and an escutcheon bordered by a ridge where the sculpture ceases. The teeth are more widely divergent, and the left median has a tendency to become bifid. The pallial sinus is fairly deep and angular or subangular.

17. Baroda, Stoliczka, and Venerella, Cossm. Pl. VI, Fig. 12.

The type of this genus was described by d'Orbigny under the name of *Venus fragilis*,[1] and was separated by Stoliczka in 1871 under the name of *Baroda*, two other species from the Cretaceous rocks of India being at the same time described. The group is placed both by Fischer and Dall as a subgenus of *Tapes*, but the characters of the hinge seem to remove it so far from *Tapes* proper that it is more convenient to regard it as a distinct genus, especially as I find a close relationship between it and *Venerella*, in spite of the difference in shape.

In *Baroda* the arrangement of the hinge-teeth is as follows:—In the right valve two short entire teeth under the umbo, sometimes slightly divergent, sometimes both directed forward; a posterior tooth also entire, elongated, and directed backwards, while the space intervening between it and the other teeth is deeply indented or excavated. In the left valve the teeth are similar, but more equally divergent, and the hinge-plate is excavated between each of them.

The only recent species of *Tapes* which shows an approach to the *Baroda* type of hinge is *T. sulcaria*, Lam., the hinge-plate of which is similarly excavated, but in the right valve both the median and posterior teeth are bifid, and the latter is much shorter than in *Baroda*, while in the left valve the median is a broad triangular bifid

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[1] Palæont. Franç. Terr. Cret., vol. iii (1844), pl. 385, figs. 11, 12.

tooth which fills the space in the other valve, so that the differences are considerable. No species of *Baroda* has yet been found in England.

VENERELLA.—This name was proposed by Cossmann in 1886 (op. cit.) for a small group of Eocene shells which had been wrongly referred to *Venerupis* by Deshayes. He enumerated five species, the first being *V. Hermonvillensis*, Desh., which has been accepted as the type.

After indicating the points in which these shells differ from *Venerupis* he says: "They have, in fact, the greatest affinity to *Venus*, so that I propose to make them merely a group of this genus under the name of *Venerella*." It is evident that by *Venus* he meant a comprehensive genus such as that adopted by Fischer in his "Manuel de Conchyliologie" (1887), a genus with many subgenera, all of which are now regarded as separate genera. It is to be noted, however, that Fischer did not place *Venerella* under *Venus*, but under *Tapes*, in which he also included *Baroda*. Dr. Dall, in his Synopsis of the Veneridæ (1902), places it near the group which he calls *Venus* (i.e. *Mercenaria*), and as a section of *Katelysia* (Roemer), but the affinity of *Venerella* with these groups seems to me very remote.

The following description of *Venerella* is compiled from the particulars given by M. Cossmann, and from a study of specimens of two species for which I am indebted to him:—

The shell is small and ovate, concentrically striated, with a superficial circumscribed lunule. The hinge has three cardinals in each valve; in the right the anterior and median are short and directed forward; the posterior is simple (not bifid), and nearly parallel to the nymph, so that it makes nearly a right angle with the other teeth, while the intervening part of the hinge-plate is deeply excavated. In the left valve both the median and posterior teeth slope backward, while the hinge-plate is excavated in front of the median, and is truncated beneath the posterior tooth. The pallial sinus is deep, ascending, and rounded. The valve-margins are smooth.

The resemblance of the hinge, above described, to that of *Baroda* will easily be perceived; and while M. Cossmann was amply justified in separating the group from all other Eocene forms of *Venus*, I think that Fischer had good reason for placing it near to *Tapes* and *Baroda*.

Venerella may also date its existence from Cretaceous time, for the *Tapes nuciformis* of Holzapfel,[1] from the Chalk of Aix-la-chapelle, seems to be referable to it, having similar teeth and being nearly orbicular in shape.

Besides the five Eocene species which were included in this group by M. Cossmann, it appears to me that four of the species which he placed under *Mercimonia* must really belong to *Venerella*, if their hinges are correctly represented in the figures of Deshayes. As a matter of fact M. Cossmann did not give any definition of *Mercimonia*, nor did he indicate how it differed as a group from *Venerella*.

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[1] "Die Mollusken der Aachener Kreide": Palæontographica, vol. xxxv (1889), p. 165.

The two most obvious points of difference are the deep excavation and abbreviation of the hinge-plate in the latter, and the non-bifid character of the right posterior cardinal. Judged by these points, the *V. deleta*, *V. Geslini*, *V. puellata*, and *V. quadrata* of Deshayes all belong to *Venerella*, and not to *Mercimonia*.

Of *V. deleta* Deshayes himself says, "la charnière est étroite, et ressemble à celle de nos *Venerupis*"; he notes the wide separation of the right posterior tooth, which he describes as "étroite allongée et simple." From his figures and those in the more recent "Iconographie Complète" of M. Cossmann, *V. Geslini*, *V. puellata*, and *V. quadrata* appear to have simple teeth.

18. Tapes, Megerle.

It is not quite certain whether the genus *Tapes*, as distinguished from *Baroda*, is represented in the Cretaceous fauna, but a species described by Zittel (*T. Rochebrunei*), from the Gosau Beds, does seem from his figure [1] to have the hinge of *Tapes*.

The genus *Tapes* should, I think, be restricted to such shells as can be included in the sections enumerated by Fischer, without any of those which he ranks as subgenera. As thus understood, *Tapes* has a small hinge-plate bearing three small cardinal teeth in each valve, placed near together, and as a rule only slightly divergent; moreover, two in the right and one or two in the left valve are grooved or bifid, only the anterior of the right and the posterior of the left being always entire. The bifidness of the teeth is always apparent in young and youngish specimens, though sometimes obscure in old individuals.

It is interesting to find that three species of *Tapes* occur in the Eocene deposits. One of these was described as *Venus tenuis* by Deshayes in 1824,[2] and recognized as a *Tapes* by Pictet in 1855,[3] but it is difficult to say whether it belongs to any particular section of the genus. Another species (*T. Parisiensis*) was described by Deshayes in 1860,[4] and this evidently belongs to the group which is represented in our seas by *Tapes aureus*, and in the Mediterranean by *T. texturatus* and others.

The third species has not yet been described or figured, but has been named *T. Comptoni* by Edwards, and only one specimen of a right valve is known, this being preserved in the British Museum. For the following account of it I am indebted to Mr. R. Bullen Newton:—"The *Tapes Comptoni* is a much worn right valve with a fractured anterior margin. Externally it is covered with fine, closely-set radial striations, which are crossed by somewhat distant concentric lines of growth. The internal margins are smooth. The sinus is deep, but its form is somewhat obscure, the marking having the appearance of being angulate, though in reality it may be rounded

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[1] "Bivalven der Gosaugebilde in den Nordöst Alpen": Denkschr. k. Akad. Wissensch. Wien, vol. xxiv (1865), p. 124, pl. iii, fig. 4.

[2] Traité de Paléont., 2nd ed., vol. iii, p. 441.

[3] Description des coq. foss. des Env. de Paris, p. 143, pl. xxiii, figs. 18, 19.

[4] Anim. sans Vert. Bassin de Paris, p. 414, pl. xxix, figs. 5, 6.

as in *T. decussatus*. The specimen comes from the Middle Eocene of Brook in the New Forest. In contour and in sculpture it resembles the *Venus* (i.e. *Tapes*) *decussatus*, figured and described by Deshayes in 1824,[1] and stated to have been found at Orsay, south of Paris, in beds now classed as Oligocene."

The resemblance of *T. Comptoni* to the shell figured by Deshayes and to the recent *T. decussatus* is curious, but, in view of the horizon from which it was obtained, it is hardly likely to be really identical with either. Moreover, Messrs. Cossmann and Lambert have expressed their opinion that the shell figured by Deshayes is only a rather worn specimen of the *Venus Loewyi*, Meun., mentioned on p. 170.[2] It should be remarked, however, that *V. Loewyi* has crenulated margins, whereas *T. decussatus* has not.

III. Summary and Conclusions.

It will doubtless be a long time before the workers in any branch of zoology will agree as to what characters should be regarded as essentially of generic value, and what are only of subgeneric or sectional importance; but such agreement can never be expected unless everyone who studies a large family like the Veneridæ states the reasons on which he bases his grouping. My study of recent and fossil Veneridæ has led me to form some definite opinions on the relative value of the various special characters which have been used as criteria, and these I now proceed to state.

In the first place I am convinced that, in this family at any rate, the characters of the hinge afford the best and most convenient means of distinguishing the generic (and often the subgeneric) groups from one another. By this I do not mean that other characters can be neglected, or that a genus may be established solely because its teeth exhibit small peculiarities of shape or position. I mean that the hinge-plate, as a whole, exhibits a larger number of small but appreciable differences than any other portion of the shell does; the development of the teeth from the primitive laminæ of the plate being a process which gives scope for a large number of variations or combinations in the disposition of the broken-up laminæ.

It is really remarkable, too, how constant the teeth remain in size, number, structure, and relative position in many large groups, notwithstanding great variation in the shape of the shell. Take the genus *Callista*, for instance, which includes some of the most transversely elongate members of the family, as well as some in which the proportion of length to height is only as 5 to 4, yet the teeth maintain exactly the same relative positions, the only differences being in the length of the posterior cardinals, and in the distance separating the anterior cardinal from the anterior lateral.

By some authors the differences exhibited by the pallial sinus are still regarded as having much diagnostic importance, partly perhaps because the pallial line is an expression of obvious differences in the

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[1] Op. cit., p. 142, pl. xxiii, figs. 8, 9.

[2] Terr. Olig. Marin d'Etampes: Mém. Soc. Géol. Fr., ser. III, vol. iii (1884), p. 80.

living animal. The depth of the sinus, however, depends on the length of the siphons, and in most cases the length of the siphons depends on the depth at which the animal buries itself below the surface of the sea-floor. The sinus therefore only represents a functional character, and not one of any great phylogenetic importance.

As a matter of fact I have been impressed with the great variations in the depth and form of the sinus exhibited by some fossil species of Veneridæ, which must, from their other characters, be grouped in the same genus. In some cases this variation extends from a slight sinuation to the presence of a deep and ascending sinus. It seems reasonable to conclude that some of these species had accustomed themselves to live at a much less depth below the surface of the sand than others, and consequently that their siphons had degenerated into short non-retractile tubes. Whatever the reason, the fact remains, and consequently I do not think that a shell should be placed in a separate genus merely because it has no pallial sinus, and when it agrees with other species in all other essential respects.

On the whole it appears to me that those characters of the animal which impress themselves on the interior of the shell are not of generic value, though they are useful in the establishment of subgenera and sections. These characters are the sinuation of the pallial line and the scars of the adductor and pedal (or protractor) muscles. In the discrimination of genera more satisfactory results can be obtained by giving preference to certain characters of the shell itself; these are (1) the hinge-plate and its teeth, (2) the features of the lunule and escutcheon, (3) the smoothness or crenulation of the valve-margins.

In accordance with these considerations I would tabulate the various genera and subdivisions which have been described in the preceding pages as follows:—

Genera.	Sections.	Subgenera.
Dosiniopsis.		
[*Dosinia.*]	... ...	*Sinodia.*
Callista.	*Calpitaria.* *Macrocallista.* *Callistina.*	*Pitaria.* *Aphrodina.*
Tivelina.	*Meretrissa.* *Dollfusia.*	
[*Callocardia.*]	*Atopodonta.*	
[*Sunetta.*]	... ...	*Meroëna.*
Circe.	*Circenita.*	*Gouldia.*
Ptychomya.		
Clementia.	... ...	*Flaventia.* *Psathura.*
Cyprimeria.	... ...	*Cyclorisma.*
Chione.	... ...	*Textivenus.*
Mercimonia.		
Baroda.	... ...	*Venerella.*
Tapes.	... ...	*Veneritapes* (?).

Of these various groups only six or seven occur in the Cretaceous rocks of England and France; these are *Dosiniopsis*, *Callistina*, *Ptychomya*, *Cyclorisma*, *Flaventia*, *Baroda*, and possibly *Calpitaria*. It will be noticed that none of these has any modern representatives, unless possibly in the case of *Calpitaria*; in other words, all (or nearly all) the Cretaceous shells belong to groups that have become extinct.

In the Eocene, however, we find several genera and subgenera which are certainly identical with recent groups; these are *Callista*, *Macrocallista*, *Pitaria*, *Circenita*, *Gouldia*, *Clementia*, and *Tapes*, while *Meroëna* is not far removed from *Sunetta*.

In the Oligocene three other groups make their appearance, viz., *Sinodia* (if not represented in the Eocene), *Circe*, and *Chione*; while in *Meretrissa* we have a near approach to *Meretrix*.

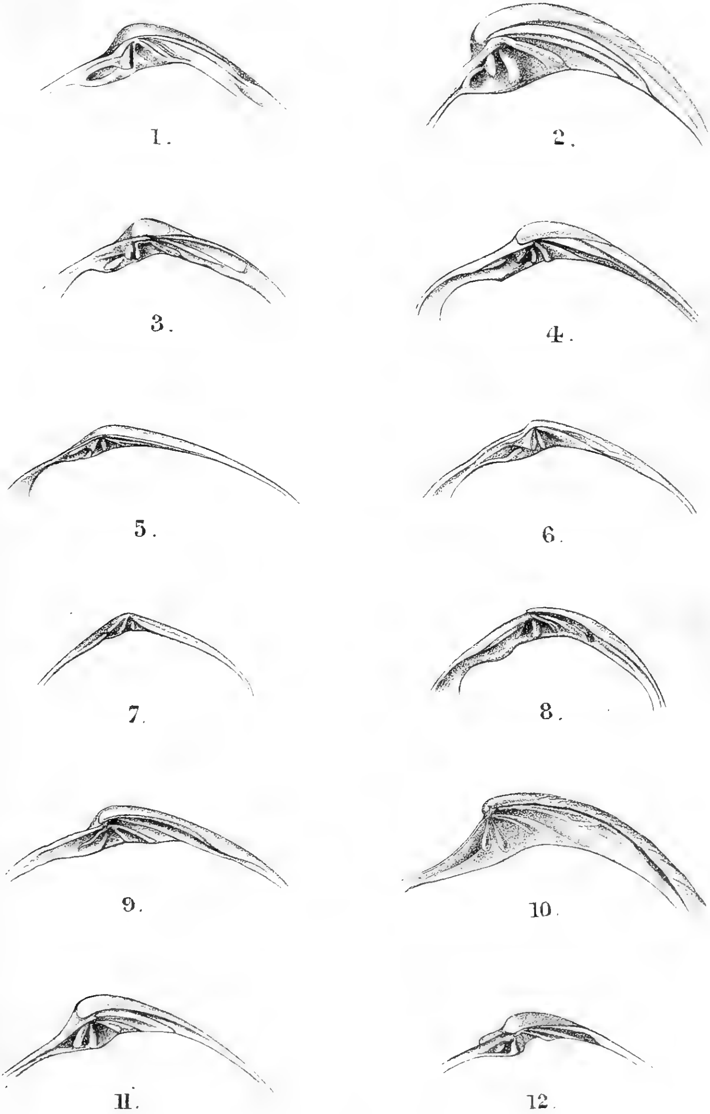
There are a few groups which do not seem to have continued to exist beyond Eocene or Oligocene times; these are *Atopodonta*, *Aphrodina*, *Tivelina*, *Dollfusia*, *Cyprimeria*, *Mercimonia*, *Psathura*, *Textivenus*, and *Venerella*; unless the last named is still represented by a West American shell which was described by P. P. Carpenter under the name of *Clementia subdiaphana*, but is referred to *Venerella* by Dr. W. H. Dall.

Another point which a study of these fossil forms has pressed upon my attention is the more generalized and less differentiated facies of the cognate Eocene groups. This is perhaps most apparent in the case of *Callista* and *Pitaria*; thus several species, which by their hinge seem to belong to *Callista*, have the external surface and the shorter ascending pallial sinus of *Pitaria*, and I have therefore been compelled to establish an intermediate group for their reception.

Again, in *Tivelina* we seem to have a group of shells which has branched off from the common ancestor of *Callista* and *Pitaria*, for in some of the species the hinge resembles that of *Callista*, in others it is like that of *Meretrix*, and in some it makes a near approach to *Pitaria*. *Tivelina* seems to have been a plastic group, i.e. one which had a special tendency to develop variations while still retaining a certain general facies; thus it varies in shape, in surface sculpture, and in depth of sinus, as well as in the hinge-characters.

With regard to the peculiar minute discontinuous radial striæ which are a special feature of the recent genera *Callista* and *Meretrix*, these are plainly visible on good specimens of *Chionella ovalina* and *Macrocallista lævigata*, but they do not seem to be present in *Aphrodina nitidula*, for, though the surface was certainly smooth and may have had a vernicose periostracum, I have not been able to detect any such striæ even in the best-preserved specimens.

Finally, it may be noted that in *Meroëna* we seem to have a link between *Callista* and *Sunetta*—the smooth valve-margins, the more obtuse escutcheon-borders, and the breadth of the posterior tooth, marking a less degree of differentiation; and in good specimens of *M. trigonula* I have detected the characteristic ingrained striæ of *Callista*.



J. Green del. et. lith.

HINGES OF SOME CRETACEOUS AND EOCENE VENERIDS.

EXPLANATION OF PLATE VI.

Hinges of the Right Valves of some Cretaceous and Eocene Forms of Veneridæ.

Fig. 1.—*Dosiniopsis orbicularis*, Edw. Copied from Deshayes' Anim. sans Vert., pl. xxix, fig. 11; natural size.

,, 2.—*Dosinia* (*Sinodia*) *incrassata*, Sow. From a specimen in the British Museum; nat. size.

,, 3.—*Callista* (*Pitaria*) *Parisiensis*, Desh. From a specimen in the British Museum; nat. size.

,, 4.—*Callista* (*Aphrodina*) *nitidula*, Lam. From a specimen in the British Museum; nat. size.

,, 5.—*Callista* (*Macrocallista*) *lævigata*, Lam. From a specimen in my collection; nat. size.

,, 6.—*Tivelina tellinaria*, Lam. From a specimen in my collection; nat. size.

,, 7.—*Tivelina* (*Meretrissa*) *depressa*, Desh. From a specimen in my collection; enlarged four times.

,, 8.—*Sunetta* (*Meroëna*) *trigonula*, Desh. From a specimen in the British Museum; nat. size. In this figure the teeth are not drawn sufficiently straight and distinct.

,, 9.—*Cyprimeria* (*Cyclorisma*) *vectensis*, Forbes. From a specimen in the Sedgwick Museum, Cambridge; nat. size.

,, 10.—*Clementia* (*Flaventia*) *ovalis*, Sow. From a specimen in the Sedgwick Museum, Cambridge; nat. size.

,, 11.—*Mercimonia cythereæformis*, Desh. From a specimen in my collection; somewhat enlarged.

,, 12.—*Baroda* (*Venerella*) *Hermonvillensis*, Desh. Copied from Deshayes' Anim. sans Vert., pl. xxviii, fig. 4; enlarged twice.

DESCRIPTIONS OF NEW SPECIES[1] OF NEW ZEALAND MARINE SHELLS.

By Henry Suter.

Read 12th June, 1908.

Trophon (Kalydon) columnaris, n.sp. Pl. VII, Fig. 1.

Shell very small, fusiform, turreted, thin, with a sharp spire, very strong axial ribs, and distant spiral cords. Sculpture consisting of distant, high, and rounded axial ribs, obsolete on the shoulder and the lower part of the base, about nine on a whorl, crossed by rather distant spiral cords, absent upon the shoulder, three on the spire-whorls, and about nine on the body-whorl, the lowest of which is more prominent; they pass over the axial ribs, usually without becoming nodulous. Fasciole not very well marked. Colour fulvous, rarely with a white band below the angle of the whorls; aperture light brown within. Spire elevated, conic, turreted, of the same height as the aperture with canal. Protoconch small, papillate, of one and a half smooth and convex whorls, the globose nucleus slightly excentric. Whorls 6, regularly increasing, with a narrow concave shoulder, convex below; base contracted above the canal. Suture not deep, undulating. Aperture oblique, narrowly oval, broadly angled above, produced below into a short, slightly oblique, and recurved open canal. Outer lip sharp, strengthened by an axial rib, angled above, smooth inside. Columella vertical, straight, twisted and narrowed below; inner lip thin and narrow, spreading over the lightly excavated parietal wall, narrowed below. There is no umbilical fissure. Operculum unknown. Diameter 4·3, height 8·3 mm.

Hab.—Near the Bounty (type) and Snares Islands, in 50 fathoms (Captain J. Bollons).

This shell has the aspect of a miniature of *T. Paivæ*, Crosse; the axial sculpture, however, is bolder, and the spirals are more distant and much less numerous.

Trophon (Trophonopsis) crispulatus, n.sp. Pl. VII, Fig. 2.

Shell very small, fusiform, turreted, very thin, white, translucent, reticulated by numerous axial crispate varices and a few spiral liræ. Sculpture consisting of close, fine, and sharp varices, usually twenty to twenty-five on a whorl, but occasionally their number is reduced to about fifteen; they are either straight or strongly crispate lamellæ, retractive on the shoulder, but vertical below it; on the base they extend as fine striæ upon the neck of the canal; they are reticulated by distinct spiral threads, sometimes, however, inconspicuous, the points of crossing raised into sharp, short spines; the spire-whorls with three spirals, the first carinating the shoulder, body-whorl with five cingula, the lower part of the base without spirals, the interstice between the first and second spiral is always broader than the

[1] The types of all these species are in my own collection.

succeeding ones. Fasciole minute, transversely striated. Colour white. Spire conical, turreted, higher than the aperture with canal. Protoconch small, papillate, of one and a half smooth and convex whorls, the globose nucleus slightly lateral. Whorls 5, regularly increasing, shouldered and keeled; base contracted above the canal. Suture well impressed, the varices passing across it. Aperture somewhat oblique, oval, biangulate above, with a short, slightly oblique, and recurved open canal. Outer lip sharp, prominently angled above, a little strengthened by the last varix, smooth inside. Columella subvertical, straight twisted and tapering below; inner lip very thin and narrow, polished, spreading over the lightly excavated parietal wall, narrowed below to a fine point. Operculum unknown. Diameter 1·9, height 4 mm.

Hab.—Near the Snares Islands, in 50 fathoms, type (Captain J. Bollons); 21½ miles north-east of Wreck Reef, Stewart Island, in 50 to 54 fathoms (Edgar R. Waite); 24 miles south-east of Long Point, in 120 fathoms (E. R. Waite).

Allied to the Pliocene *T. Gouldi*, Cossmann (= *crispus*, Hutton, *non* Gould), which, however, is a larger shell, with much less axial costæ, more spirals, and the outer lip strongly dentate within.

Mitrella stephanophora, n.sp. Pl. VII, Fig. 3.

Shell small, ovoid, smooth and polished, translucent, yellowish, with spiral bands of brown zigzag lines on the body-whorl. Sculpture consisting of a few close spiral threads upon the short beak. Colour yellowish white, with fulvous zigzag markings on the later spire-whorls, and continued on the periphery of the body-whorl, a second similar spiral band upon the base. Spire rather short, conical, a little higher than the aperture; outlines faintly convex. Protoconch papillate. Whorls 5, regularly increasing, flatly convex, the last ventricose and rounded; base somewhat contracted. Suture not much impressed. Aperture narrow, angled above, not much narrowed below, and without a distinct canal. Outer lip straight above, convex below, smooth inside. Columella subvertical, lightly turned to the left below; inner lip very narrow and thin, smooth, spreading over the straight parietal wall. Operculum unknown. Diameter 2·4, height 4·5 mm.

Hab.—New Zealand, exact locality unknown. One specimen was found by Mr. E. A. Annett, of Crawley, Sussex, who collected shells in New Zealand some years back, and kindly gave me the specimen.

Mitrella pseudomarginata, n.sp. Pl. VII, Fig. 4.

Shell small, subulate, smooth, and polished, whitish, with light-brown zigzag markings, translucent. The only sculpture consists of a few spiral ridges on the neck of the base. Colour yellowish white, with fulvous zigzag markings, interrupted on the body-whorl by a narrow whitish spiral band below the periphery; lower part of base white. Spire high, acuminate, conic, about one and a half times the height of the aperture; outlines straight. Protoconch papillate, of one and a half smooth whorls. Whorls 6, regularly increasing, flat, body-whorl lightly convex, contracted below. Suture linear, false-margined, as is very often the case in *Eulima*. Aperture slightly oblique, narrow, sub-channelled above, but little narrowed below, without a canal. Outer lip vertical, rounded below, somewhat thickened and denticulate within. Columella vertical, slightly bent to the left below; inner lip narrow and smooth, very thin on the straight parietal wall. Operculum unknown. Diameter 2·75, height 6·6 mm.

Hab.—Bay of Islands.

Distinguished from the nearly allied *M. choava*, Reeve, by the larger size and much higher spire.

MITRELLA SUBANTARCTICA, n.sp. Pl. VII, Fig. 5.

Shell small, acuminate, smooth to the naked eye, polished, semi-transparent, fulvous. Sculpture consisting of fine and dense microscopic spiral striæ on all the whorls, lightly decussated by the fine and somewhat oblique growth-lines. Colour yellowish brown, with a darker band below the suture, produced by the lower part of the preceding whorl. Spire high, conic, nearly one and a half times the height of the aperture; outlines straight. Protoconch of one and a half whorls, papillate. Whorls 6, regularly increasing, lightly convex, the last whorl rounded and a little contracted at the base. Suture impressed, but not deep. Aperture oval, subvertical, with a very short, widely open canal. Outer lip sharp, not much thickened, convex, smooth inside, sometimes with a slight contraction below. Columella vertical, somewhat arcuate, bent to the left toward the base; inner lip narrow, smooth, extending over the faintly excavated parietal wall. Operculum unknown. Diameter 2·7, height 5·4 to 6 mm.

Hab.—Near the Bounty Islands, in 50 fathoms (Captain J. Bollons).

Nearly allied to *M. paxillus*, Murdoch, but not so slender, the spiral striæ closer, more numerous, and always present, and the body-whorl not angled.

MITRELLA LEPTALEA, n.sp. Pl. VII, Fig. 6.

Shell small, subulate, smooth, shining, thin and pellucid, yellowish. Sculpture consisting of almost obsolete fine microscopic spiral striæ, and a few faint spiral ridges on the lower part of the base; growth-lines fine, straight. Colour light yellowish. Spire subulate, a little higher than the aperture; outlines nearly straight. Protoconch small. papillate, the nucleus somewhat oblique. Whorls 5, regularly increasing, very lightly rounded, the last convex, contracted at the base. Suture linear, false-margined below. Aperture narrow, angled above, slightly contracted below, but without a canal. Outer lip thin and sharp, smooth within, lightly convex, somewhat contracted below. Columella vertical, a little convex; inner lip narrow, smooth, spreading as a very thin glaze over the lightly arcuate parietal wall. Operculum unknown. Diameter 1·8, height 4·5 mm.

Hab.—Near the Bounty (type) and Snares Islands, in 50 fathoms (Captain J. Bollons).

ALCIRA SANGUINEA, n.sp. Pl. VII, Fig. 7.

Shell small, elongately ovate, smooth, not shining. There is no sculpture except the fine growth-lines. Colour crimson; dead shells are pinkish. Spire high, conic, about one and a half times the height of the aperture; outlines straight. Protoconch sometimes slightly oblique, of one and a half smooth whorls, papillate. Whorls 6, regularly increasing, flattish, the last rather large, rounded, and contracted at the base. Suture impressed. Aperture vertical, narrowly ovate, lightly channelled above, with a short and widely open canal below. Outer lip thick, with a blunt edge, smooth inside, almost straight above, curved below. Columella vertical, arcuate, with a distinct oblique fold below, bending to the left; inner lip narrow and very thin, smooth. Operculum unknown. Diameter 2·7, height 6·2 mm.

Hab.—Near the Bounty Islands, in 50 fathoms (Captain J. Bollons).

ALCIRA LÆVIGATA, n.sp. Pl. VII, Fig. 8.

Shell small, thin, translucent, smooth, faintly shining, elongately oval. Sculpture confined to a few oblique ridges on the lower part of the base. Colour yellowish white, sometimes faintly marbled with pure white. Spire elevated, conic, about the same height as the aperture; outlines almost straight. Protoconch of one and a half smooth, porcellanous and smooth whorls, the nucleus a little oblique. Whorls 5, regularly increasing, lightly convex, the last rounded and contracted at the base. Suture deep. Aperture subvertical, high and narrow, lightly channelled above, and with a very short, widely open canal below. Outer lip slightly curved, sharp, but little thickened. Columella vertical, with a deep-seated oblique fold at the base; inner lip very narrow and thin, extending over the flattish parietal wall. Operculum unknown. Diameter 1·8, height 4·1 mm.

Hab.—Five miles south of Cuvier Island, in 38 fathoms, type (Captain J. Bollons); off Great Barrier Island, in 110 fathoms.

ALCIRA ANGULATA, n.sp. Pl. VII, Fig. 9.

Shell small, elongate fusiform, turreted, spirally ribbed, fulvous. Sculpture: the protoconch smooth, all the succeeding whorls sharply spirally ridged; two fine spiral threads on the shoulder, the upper close to the suture, a third strong spiral cord upon the angle of the whorls, and three smaller ones below, the lowest fine and margining the suture; the spiral ornamentation is continued over the whole of the body-whorl, the spirals on the base being closer together; interstices above the base slightly broader than the cingula, with fine growth-lines. Colour yellowish brown, the base lighter. Spire elevated, conic, turriculate, about one and a half times the height of the aperture. Protoconch conical, smooth, of two whorls, the nucleus small, the second whorl relatively high. Whorls 6½, regularly increasing, distinctly shouldered, lightly convex below the angle; body-whorl high, moderately convex, contracted below. Suture linear, bimarginate. Aperture narrow, subrhomboidal, the margins parallel, angled above, with a very short and broad canal below.

Outer lip vertical at the middle, lirate within, the liræ corresponding to grooves on the outside, edge sharp. Columella straight above, forming a blunt angle with the parietal wall, slightly turned to the left below, smooth, twisted, and with a distinct fold at the base; inner lip narrow and thin. Operculum unknown. Diameter 3, height 7·1 mm.

Hab.—Foveaux Strait.

This species may at once be distinguished from all the other New Zealand species of the genus by the shouldered whorls, a somewhat exceptional feature in this family.

Atilia biconica, n.sp. Pl. VII, Fig. 10.

Shell small, biconic, very thin, translucent, not shining, yellowish white, with a distinct canal. Sculpture consisting of oblique spiral threads upon the neck; the growth-lines are microscopic, fine and dense. Colour yellowish white, with a few light-brown zigzag markings. Spire elevated, conic, of about the same height as the aperture with canal; outlines straight. Protoconch papillate, of one and a half smooth whorls. Whorls 5, regularly increasing, flattish, the last well rounded at the periphery, considerably contracted below. Aperture high and narrow, oblique, angled above, produced below into a straight, short, and widely open canal, truncated at its base. Outer lip distinctly convex at the middle, contracted below, thin and sharp. Columella subvertical, lightly convex in the middle, the spirals of the neck passing over it; inner lip obsolete. Operculum unknown. Diameter 2·1, height 4·7 mm.

Hab.—Hauraki Gulf, in 25 fathoms.

The two specimens I have do not appear to be full-grown.

Fulguraria (Alcithoe) depressa, n.sp. Pl. VII, Fig. 11.

Shell moderately large, ovate, solid, with a short spire and large aperture, the last two or three whorls with nodules on the angle of the shoulder, with a few brown zigzag lines. Sculpture: the penultimate whorl with a row of distant, roundish nodules above the suture, the body-whorl with a row of elongated, prominent nodules on the angle of the shoulder, their number being about eight or nine. Colour very likely yellowish white, with a few longitudinal fulvous zigzag bands, indistinctly arranged into three spiral bands on the body-whorl, and a fourth above the fasciole; outer lip with a few brown spots. Spire low, conoidal, its height about one-third that of the aperture. Protoconch much worn and nucleus lost in my specimen. Whorls about 5, the last very large, the upper whorls lightly convex, the last two broadly shouldered, the slope flattish, body-whorl flatly convex at the periphery and somewhat contracted below; the fasciole broad, hardly raised, flattish. Suture distinct, but not deep. Aperture high, triangular, narrow above, widened below, with a narrow upper channel, very broadly truncated and rather deeply notched at the base. Outer lip oblique, its upper part nearly straight, the lower moderately curved, much thickened, rounded, smooth, but not reflected, retrocurrent toward the suture. Columella subvertical, straight, with six somewhat inequidistant, subequal, strong, and flat plaits, sometimes with an additional small plait above; the columella slightly twisted below, and produced into a narrowly rounded beak, extending beyond the inferior end of the outer lip; inner lip thin, spreading broadly over the body and the convex parietal wall, with a roundly-raised outer edge below. Diameter 35, height 70 mm.

Hab.—Spirits Bay, North Island (Captain J. Bollons, C. Cooper).

Only much worn specimens have hitherto been available, and the description is therefore somewhat deficient.

MARGINELLA (s.s.) STEWARTIANA, n.sp. Pl. VII, Fig. 12.

Shell small, elongately oval, smooth and polished, white, with an elevated spire. There is no sculpture. Colour white. Spire elevated, conic, with a pointed apex, its height a little less than half that of the aperture. Protoconch small, smooth, rounded. Whorls 3, the last high, moderately convex, narrowed towards the base; spire-whorls flatly rounded. Suture lightly impressed, narrowly margined below. Aperture oblique, high and narrow, lightly channelled above, truncated and not notched below. Outer lip oblique, straight, and thickened at the middle, lightly retrocurrent and with a narrow sinus above, smooth inside. Columella faintly concave, with four subequidistant, slender, and oblique plaits, the lower two more prominent, the last extending to the basal margin; inner lip thin and transparent. Diameter 2·3, height 4·6 mm.

Hab.—Port Pegasus, Stewart Island, in 18 fathoms (Captain J. Bollons).

This species is very closely allied to ***M. hebescens***, Murd. & Sut., but it is more elongate, the spire more acuminate and with a much sharper apex, and the suture is less impressed.

MARGINELLA (GLABELLA) PARVISTRIATA, n.sp. Pl. VII, Fig. 13.

Shell very small, oviform, semitransparent, dull, white, with a short spire, axially finely striated. Sculpture consisting of minute, close, and straight axial striæ, continuous over the spire to the body-whorl. Colour white or yellowish white. Spire short, conoidal, with a blunt apex, its height about one-fifth that of the aperture. Protoconch smooth, broadly convex. Whorls 3, flat on the spire, body-whorl high, moderately convex, slightly narrowed towards the base. Suture indistinct. Aperture high and narrow, a little wider below, sub-channelled above, roundly truncated at the base. Outer lip slightly convex, vertical, a little retrocurrent toward the suture, thickened and rounded, smooth inside, with an outer varix extending a short way up the spire and across the basal margin. Columella a little oblique, with four oblique, nearly equidistant, strong plaits; inner lip broad and thin, distinct only outside the columella; parietal wall lightly convex. Diameter 1·7, height 3·1 mm.

Hab.—Foveaux Strait, in 15 fathoms.

MARGINELLA (GLABELLA) LURIDA, n.sp. Pl. VII, Fig. 14.

Shell very small, narrowly oval, smooth and shining, white, translucent when fresh, with a moderately elevated spire. There is no sculpture. Colour white, but fresh shells are vitreous. Spire elevated, conic, about half the height of the aperture. Protoconch obtuse, rounded. Whorls 3, the last high, moderately convex, narrowed towards the base, the spire-whorls flattish. Suture superficial. Aperture oblique, narrow, widening below, lightly channelled above, truncated and flatly rounded at the base. Outer lip slightly convex, thickened at the middle, with a low outer varix, smooth inside, retrocurrent towards the suture, and with a shallow sinus. Columella oblique, with four equidistant strong plaits, the lowest twisted and extending to the basal margin. Diameter 1·5, height 3 mm.

Hab.—Foveaux Strait, in 15 fathoms; type, near the Snares and Bounty Islands, in 50 fathoms (Captain J. Bollons).

Marginella (Glabella) amœna, n.sp. Pl. VII, Fig. 15.

Shell small, ovate, rather solid, smooth and polished, with a moderately raised spire, white. There is no sculpture. Colour white, fresh shells vitreous. Spire conoidal, with a blunt apex, a little less than half the height of the aperture; outlines straight. Protoconch very small, broadly rounded. Whorls 3, the spire-whorls flat, body-whorl large, convex, somewhat inflated above, narrowed towards the base. Suture indistinct, not impressed. Aperture slightly oblique, high and narrow, the margins subparallel, lightly channelled above, truncated and not notched below. Outer lip somewhat convex, thickened, the inner margin faintly and minutely crenate, with an outer varix which does not extend much upon the spire, lightly sinuate above. Columella oblique, straight, with four nearly equidistant strong plaits, the upper two almost transverse, the lower two more oblique, the lowest extending to the basal margin; inner lip thin and transparent. Diameter 2·4, height 4·2 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Captain J. Bollons).

This species is very nearly allied to *M. hebescens*, Murd. & Sut., but is distinguished from it in being a little larger and more ventricose, having the spire slightly lower and broader, the spire-whorls flat, the protoconch much smaller, the suture not impressed, and the outer lip minutely crenate.

Drillia chordata, n.sp. Pl. VII, Fig. 16.

Shell small, fusiform, fairly solid, whitish; suture strongly margined, whorls angulated by a row of large nodules, spire high, anal sinus moderately deep. Sculpture consisting of a row of large oval nodules on the middle of the whorls, about fourteen on a whorl, those on the last two whorls somewhat stretched out towards the suture below, and incised in the middle by a spiral linear groove; a very strong spiral cord margines the suture below, and a fine thread above; the latter is continued as a rather strong cord on the body-whorl, and is succeeded below by a similar cord; the base of the body-whorl is adorned with fine spiral threads, close together upon the beak; the whole sculpture crossed by very fine, strongly flexuous, and oblique growth-lines. Colour whitish. Spire high, conic, somewhat less than twice the height of the aperture. Protoconch of two whorls, which are microscopically spirally striate, the nucleus oblique, rounded, the second volution with a sharp median keel. Whorls 7, regularly increasing, roundly angled at the middle by the nodules, concave above and below it; body-whorl slightly convex, contracted at the base. Suture linear, bimarginate. Aperture oblique, oval, angled above, produced below into an oblique, short, and open canal, slightly notched at its base. Outer lip sharp, somewhat strengthened outside, moderately convex, contracted below, with a fairly deep and rounded sinus in the depression above the row of nodules. Columella slightly arcuate, excavated on meeting the parietal wall; inner lip thin and narrow, drawn out to a point towards the margin of the canal. Operculum unknown. Diameter 3·9, height 9 mm.

Hab.—Dredged off Otago Heads (A. Hamilton).

Allied to *D. Wanganuiensis*, Hutt., from the Pliocene, by the very strong sutural cord.

DRILLIA LÆVIS PARVA, n.subsp.

Distinguished from the species by its much smaller size, the broader shoulder, and the slender, short, oblique costæ, sometimes reduced to pointed tubercles on the last whorl, their number being twelve to fourteen on a whorl. Diameter 3·5, height 8 mm.

Hab.—Near Cuvier Island, in 37 fathoms; type, near the Snares Islands, in 50 fathoms; Port Pegasus, Stewart Island, in 18 fathoms (Captain J. Bollons).

BELA NEOZELANICA, n.sp. Pl. VII, Fig. 17.

Shell small, ovate, solid, slightly turriculate, with blunt axial ribs and spiral liræ, maculated with brown and white below the shoulder. Sculpture consisting of rather distant, low, rounded axial costæ, nine to ten on the body-whorl, extending on the spire-whorls from the angle to the suture below, but only over the periphery on the body-whorl; they are crossed by subequal, flat, spiral liræ, fine on the shoulder, broad upon the base, separated by linear interstices. Colour: the protoconch is flavescent, the other spire-whorls yellowish or brownish white, maculated with brown and white below the shoulder, the ribs usually white, the interstices brown; body-whorl light brown below the maculations on the periphery; aperture fulvous inside. Spire conic, turriculate, very little higher than the aperture. Protoconch papillate, of two smooth convex whorls. Whorls 6, the last high in proportion, with a sloping, broad, and lightly excavated shoulder, slightly convex below the inconspicuous angle; body-whorl convex, but faintly contracted at the base. Suture distinct, but little impressed. Aperture lightly oblique, elongately oval, angled above, with a rudimentary, broad, and truncated canal below. Outer lip convex, rather thin and sharp, smooth inside, with a very slight broad sinus below the suture. Columella vertical, excavated toward the parietal wall, slightly turned to the left below; inner lip narrow, thin, spreading over the convex parietal wall, tapering to a fine point below and extending to the base of the canal. Operculum very small, length 2·1 mm., oval, the nucleus apical. Diameter 4·8, height 10 mm

Hab.—Whangareï Heads, in 3–4 fathoms (C. Cooper).

This is the second species of the genus recorded from New Zealand waters.

MITROMORPHA GEMMATA, n.sp. Pl. VII, Fig. 18.

Shell small, ovate, thin and fragile, semitransparent, white, axially costate and spirally striate, the crossing-points gemmate. Sculpture: all the whorls below the smooth protoconch are axially, equidistantly, and closely costate, about eighteen on the last whorl, the interstices narrow; towards the base the riblets are getting obsolete; they are crossed by equidistant spiral cords of nearly equal strength, the points of intersection produced into transversely oval gemmules; the interstices between the spirals of about the same width as the cords, but that below the first spiral is slightly broader and deeper than the others; on the body-whorl there are about fifteen spirals, of which the lowest six are smooth. Colour white. Spire elevated, conic; outlines somewhat convex, but little higher than the aperture. Protoconch a little oblique to the axis, of one and a half smooth whorls, the nucleus globose. Whorls 6, the last high and somewhat ventricose, convex, attenuated towards the base. Suture not deep, undulating, bimarginate. Aperture slightly oblique, high and narrow, angled above, with a rudimentary broad canal below, its base truncated. Outer lip convex, thin, crenated on the outside by spiral sculpture, with a shallow sinus below the suture. Columella subvertical, almost straight, with two rounded, short plaits above, absent in young examples; inner lip thin and narrow, spreading over the straight parietal wall. Operculum unknown. Diameter 3·1, height 7·2 mm.

Hab.—Near the Snares Islands, in 50 fathoms, type (Captain J. Bollons); 24 miles south-east of Long Point, in 120 fathoms; off south-east of Cape Saunders, in 100 fathoms (Edgar R. Waite).

In form and sculpture somewhat resembling *Daphnella vestalis*, Hedley.

BATHYTOMA GRATIOSA, n.sp. Pl. VII, Fig. 19.

Shell very small, fusiform, white, thin, turriculate, spirally distantly ribbed and with numerous axial threads. Sculpture: the spire-whorls below the smooth protoconch have a fine thread margining the suture below, a second very prominent spiral cord on the angle of the shoulder, and a third equally strong cord at the middle between the angle and the suture below; the interstices concave and broader than the cords; body-whorl with six spirals from the angle down toward the base, the upper three of which are strong, the others closer together and not so high; base with a few indistinct spirals. Axial sculpture consisting of subequidistant fine threads, slightly retrocurrent on the shoulder, flexuous further down; on the body-whorl they are becoming more irregular, fine growth-lines appearing in the interstices. Colour whitish. Spire conic, turriculate, about the same height as the aperture. Protoconch globular, smooth, of one and a quarter whorls. Whorls 4, with a very distinct and but slightly sloping shoulder; base somewhat contracted. Suture superficial, margined. Aperture subpyriform, angled above, with a short and broad canal below, slightly emarginate at the base. Outer lip angled above, then convex, contracted below, thin and sharp, crenulated on the outside by the spirals, sinus rounded, not deep, situate just above the carina. Columella straight, smooth, concave on meeting the parietal wall, bent to the left toward the canal below; inner lip thin, narrow, extending over the faintly convex parietal wall, tapering to a fine point below. Operculum unknown. Diameter 2, height 3·7 mm.

Hab.—Port Pegasus, Stewart Island, in 18 fathoms (Captain J. Bollons).

MANGILIA DEVIA, n.sp. Pl. VII, Fig. 20.

Shell small, fusiform, turriculate, with distant nodulous axial ribs, continuous over the whorls, spirally distantly lirate, whitish, with indications of two brown spiral bands. Sculpture: the protoconch has a sharp carina on the nucleus, two on the succeeding half volution, and this is continued on the next three spire-whorls, the upper spiral on the angle of the shoulder, the second midway between angle and suture; on the following whorl a third spiral appears just above the angle of the shoulder, and on the penultimate whorl an additional fine spiral above it, thus giving these lower whorls a more convex outline, the shoulder becoming inconspicuous on the body-whorl, which has five additional spirals in front of the aperture. The axial sculpture consists of rather distant, slightly oblique, broad, and distinct ribs, about ten on the last whorl, strongly nodulous at the points of intersection, continuous over the whorls, and on the base to the siphonal fasciole; the interstices slightly broader than the ribs. Colour yellowish white, with indications of two brown spiral bands above and below the periphery. Spire produced, conic, turreted, nearly one and a half times the height of the aperture with canal. Protoconch with the nucleus distinctly oblique, flat above the carina. Whorls $6\frac{1}{2}$, the upper ones distinctly shouldered, the lower ones convex, base contracted. Suture inconspicuous. Aperture oblique, pyriform, broadly angled above, produced below into a short, oblique, truncated canal. Outer lip convex, strengthened on the outside by the last axial rib, smooth inside, contracted below, the sinus inconspicuous, shallow. Columella vertical, smooth, obliquely truncated below, concave at the junction with the parietal wall; inner lip thin and narrow, drawn out to a fine point on reaching the left margin of the canal. Diameter 3, height 7·2 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Captain J. Bollons); a single specimen.

In sculpture this species somewhat resembles *M. dictyota*, Hutt., but this has not the tilted and carinated protoconch and coarse spiral sculpture of the base. *M. epentroma*, Murd., has a similar protoconch.

MANGILIA QUADRICINCTA, n.sp. Pl. VII, Fig. 21.

Shell very small, fusiform, thin and fragile, white, semitransparent, turriculate, clathrate. Sculpture: the first whorl below the smooth protoconch has a fine spiral cord on the sharp angle of the shoulder, the following a second below the carina, and the body-whorl has four cords, of which the two lower ones are closer together and in front of the upper part of the aperture; they are crossed by equidistant, straight, thin, axial riblets, about eighteen on the last whorl, extending over the greater part of the base, the interspaces much broader than the riblets, and ornamented with very fine growth-lines. Colour white. Spire conic, gradate, but little higher than the aperture. Protoconch of one and a quarter smooth, convex whorls, the nucleus globose, oblique. Whorls 4, shouldered and prominently keeled, straight above and below the keel; base contracted. Suture linear. Aperture somewhat oblique, pyriform, very broadly angled above, with an oblique, moderately long, open and truncated canal below. Outer lip strongly convex, lightly angled above, contracted below, crenated on the outside by the spirals, somewhat strengthened by the last axial riblet; sinus close to the suture, broad and shallow. Columella vertical, concave towards the parietal wall, slightly twisted and drawn out to a narrow ridge towards the margin of the canal; inner lip very thin, narrow, smooth, spread over the flat parietal wall. Diameter 2·1, height 4·4 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Captain J. Bollons); one specimen only.

Allied to *M. murrhea* and *infanda*, Webst., both of which, however, have a spirally striate base and a short, straight canal.

Mangilia cophinodes, n.sp. Pl. VII, Fig. 22.

Shell small, elongate oval, white, with traces of a brown spiral band, axially costate and spirally lirate. Sculpture consisting of narrow, rounded, axial costæ, about eighteen on the last whorl, getting obsolete on the base; they are slightly oblique and curved, the interstices of the same width as the riblets; crossed by spiral cords, with linear interspaces, six on the spire-whorls, about eighteen on the body-whorl, the spirals on the beak much finer; points of intersection very slightly nodulous. Colour whitish, with a trace of a brown spiral band below the periphery. Spire conical, slightly higher than the aperture; outlines almost straight. Protoconch conic, of two smooth whorls, the nucleus broadly rounded. Whorls 6, regularly increasing, moderately convex, base contracted. Suture well impressed. Aperture subrhomboidal, roundly angled above, with a short, oblique, broad canal below, its base very slightly notched. Outer lip lightly convex, somewhat strengthened on the outside by the last axial rib, smooth inside, with a broad and shallow sinus below the suture. Columella vertical, excavated towards the parietal wall, slightly convex below, bent towards the margin of the canal; inner lip thin and narrow, smooth. Diameter 3·1, height 7 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Captain J. Bollons).

A near ally of this species is the Pliocene *M. Hamiltoni*, Hutt., which has more prominent smooth axial ribs; they number only twelve to fifteen on a whorl, and the spirals are mostly inconspicuous and not passing over the ribs, which extend over the whole of the base.

DAPHNELLA TOTOLIRATA, n.sp. Pl. VII, Fig. 23.

Daphnella lacunosa, Suter, *non* Hutton: Suter, Trans. N.Z. Inst., vol. xxxi (1899), p. 75.

Shell minute, narrowly fusiform, thin, semitransparent, spirally lirate. Sculpture: the protoconch is microscopically finely spirally striate; the succeeding whorls have three and the body-whorl ten to twelve equidistant fine spiral liræ, the interstices smooth and slightly broader than the threads. Colour white. Spire narrowly conical, about one and a half times the height of the aperture. Protoconch of one and a half convex whorls, the nucleus narrowly rounded, oblique. Whorls 4 to 5, regularly increasing, lightly convex, somewhat flattened below the suture; base slightly contracted. Suture not much impressed. Aperture high and narrow, angled above, with a very short, broad, and truncated canal below. Outer lip convex, straightened below the suture, with a very shallow, broad sinus at the suture, smooth inside, crenated on the outside by spiral sculpture, thin and sharp. Columella vertical, straight, lightly excavated towards the flat parietal wall; inner lip very thin and narrow, smooth. Diameter 1·1, height 2·8 mm., with 5 whorls.

Hab.—Foveaux Strait, in 15 fathoms, type (A. Hamilton); Whangaroa Harbour (C. Traill); near the Snares Islands, in 50 fathoms (Captain J. Bollons); Chatham Islands.

This species, no doubt, is in form and sculpture very much like *D. lacunosa*, Hutt., but the fossil form is nearly twice as high (5 mm.), and there is no evidence that the protoconch is striate. I therefore consider it advisable to make the recent form the type of a new species. It is much smaller than the also nearly allied *D. chariessa*, Sut., which has more spirals on a whorl and a much higher and smooth protoconch.

DAPHNELLA ACICULA, n.sp. Pl. VII, Fig. 24.

Shell minute, acicular, the last whorl very high and spirally striate. Sculpture consisting of equal fine spiral threads with linear grooves between them, on the last whorl only, and more distinct on the base. Colour flavescent, the protoconch purple. Spire subcylindrical, slightly higher than the aperture, the outlines faintly convex. Protoconch comparatively large, papillate, of one and a half smooth whorls, the nucleus oblique, broadly rounded. Whorls 4, the last two very rapidly increasing, faintly convex, very little attenuated towards the base. Suture linear. Aperture high, triangular, narrowly angled above, with a broad rudimentary canal below. Outer lip sharp, slightly thickened, somewhat convex, with a broad, shallow sinus at the suture, thence advancing in a broad curve toward the base, smooth inside. Columella oblique, forming a straight line up and over the parietal wall; inner lip very thin, inconspicuous. Diameter 1·3, height 3·6 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Captain J. Bollons).

Daphnella tenuistriata, n.sp. Pl. VII, Fig. 25.

Shell very small, subulate, thin and fragile, minutely spirally striate. Sculpture consisting of very fine, dense, and equal spiral striæ from the protoconch down to the base, the former most likely smooth. Colour flavescent to fulvous, the protoconch purple. Spire elevated, conic, somewhat higher than the aperture; outlines faintly convex. Protoconch broken off in all the four specimens at my disposal. Whorls 5 to 6, lightly convex, rather rapidly increasing; base contracted. Suture linear, well impressed. Aperture subrhomboidal, the sides parallel, angled above, with a short, broad, and slightly emarginate canal below. Outer lip moderately convex, acutely curved, and sometimes a little contracted below, sharp, with a shallow, broad sinus below the suture. Columella vertical, straight, excavated on meeting the faintly convex parietal wall; inner lip thin and very narrow. Diameter 2, height of three whorls without protoconch 5, with it probably about 6 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Captain J. Bollons).

Although none of the specimens are quite perfect, I do not hesitate to describe this elegant species, especially as there is no prospect of getting more material in the near future. One specimen has part of the protoconch left, showing its colour and smoothness. It is nearly related to *D. acicula*, but is larger, the sculpture extending not only over the body-whorl, and the canal is more distinct.

Daphnella amphipsila, n.sp. Pl. VII, Fig. 26.

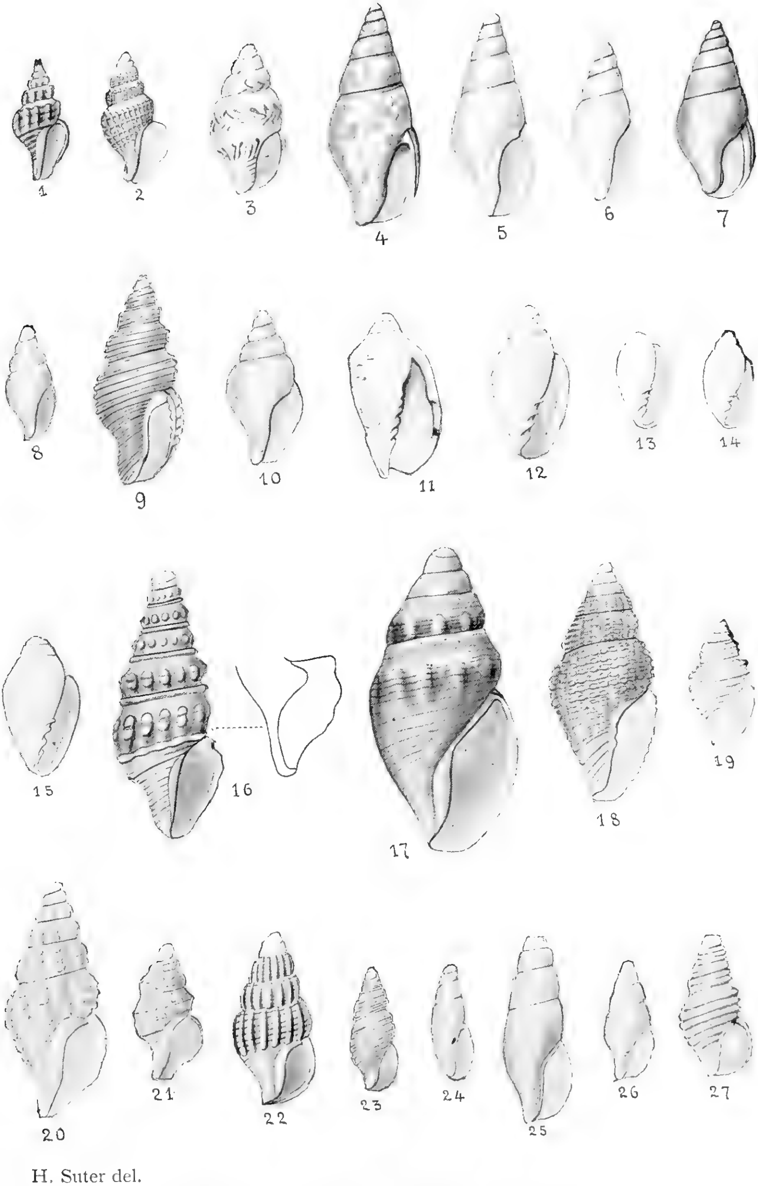
Shell very small, narrowly fusiform, thin, white, translucent, smooth. The sculpture consists of a number of spiral striæ on the base, and a few indistinct microscopic spiral lines on the whorls; growth-lines very fine and dense. Colour white, vitreous. Spire conic, a little higher than the aperture, outlines straight. Protoconch mamillary, of two smooth whorls, the nucleus minute, the succeeding whorl rather swollen. Whorls 5, regularly increasing, lightly convex, base contracted. Suture linear. Aperture subrhomboidal, the sides subparallel, angled above, produced below into a somewhat oblique, but distinct, short, broad, and truncated canal. Outer lip moderately convex, straightened at the middle, contracted below, smooth inside. Columella straight, excavated toward the flat parietal wall, lightly curved below towards the margin of the canal; inner lip thin and narrow, smooth. Diameter 1·6, height 3·5 mm.

Hab.—Near the Snares Islands, in 50 fathoms (Captain J. Bollons).

The species is nearly allied to *D. psila*, Sut., which is larger and has distinct spiral lines.

Daphnella crassilirata, n.sp. Pl. VII, Fig. 27.

Shell very small, elongate fusiform, white, with stout spiral cords, turriculate. Sculpture: the protoconch, the shoulder on the following whorls, and the base are smooth; the lower spire-whorls have four strong spiral cords, separated by narrow interstices, the uppermost forming the angle of the narrow and but little sloping shoulder; body-whorl with six or seven spiral cords, the greater part of the base



H. Suter del.

MOLLUSCA FROM NEW ZEALAND.

in front of the aperture smooth; growth-lines very fine. Colour white. Spire elevated, conic, turriculate, one and three quarter times the height of the aperture. Protoconch papillate, of one and a half smooth and convex whorls. Whorls $4\frac{1}{2}$, rather rapidly increasing, narrowly and flatly shouldered, convex below; base slightly contracted. Suture linear. Aperture broadly oval, angularly rounded above, with a broad, short canal below, which is often wanting, faintly emarginate at the base. Outer lip slightly angled above, straightened at the middle, rounded or contracted below, smooth inside. Columella vertical, excavated towards the lightly concave parietal wall, somewhat bent to the left below; inner lip thin and narrow. Diameter 1·5, height 3·2 mm.

Hab.—Near the Snares Islands, in 50 fathoms, type (Captain J. Bollons); Stewart Island, in 15 fathoms (A. Hamilton); 23 miles north of Wreck Reef, Stewart Island, in 50 to 54 fathoms (Edgar R. Waite).

The species may be at once distinguished from the nearly allied *D. totolirata* and *chariessa*, Sut., by the stout spirals with linear interstices.

EXPLANATION OF PLATE VII.

Fig.
1. *Trophon columnaris*, n.sp. 4·3 × 8·3 mm.
2. ,, *crispulatus*, n.sp. 1·9 × 4 mm.
3. *Mitrella stephanophora*, n.sp. 2·4 × 4·5 mm.
4. ,, *pseudomarginata*, n.sp. 2·8 × 6·6 mm.
5. ,, *subantarctica*, n.sp. 2·5 × 6 mm.
6. ,, *leptalea*, n.sp. 1·8 × 4·5 mm.
7. *Alcira sanguinea*, n.sp. 2·7 × 6·2 mm.
8. ,, *lævigata*, n.sp. 1·8 × 4·1 mm.
9. ,, *angulata*, n.sp. 3 × 7·1 mm.
10. *Atilia biconica*, n.sp. 2·1 × 4·7 mm.
11. *Fulguraria depressa*, n.sp. 35 × 70 mm.
12. *Marginella Stewartiana*, n.sp. 2·3 × 4·6 mm.
13. ,, *parvistriata*, n.sp. 1·7 × 3·1 mm.
14. ,, *lurida*, n.sp. 1·5 × 3 mm.
15. ,, *amœna*, n.sp. 2·4 × 4·2 mm.
16. *Drillia chordata*, n.sp. 3·9 × 9 mm.
17. *Bela Neozelanica*, n.sp. 4·8 × 10 mm.
18. *Mitromorpha gemmata*, n.sp. 3·1 × 7·2 mm.
19. *Bathytoma gratiosa*, n.sp. 2 × 3·7 mm.
20. *Mangilia devia*, n.sp. 3 × 7·2 mm.
21. ,, *quadricincta*, n.sp. 2·1 × 4·4 mm.
22. ,, *cophinodes*, n.sp. 3·1 × 7 mm.
23. *Daphnella totolirata*, n.sp. 1·1 × 2·8 mm.
24. ,, *acicula*, n.sp. 1·3 × 3·6 mm.
25. ,, *tenuistriata*, n.sp. 2 × 5 mm.
26. ,, *amphipsila*, n.sp. 1·6 × 3·5 mm.
27. ,, *crassilirata*, n.sp. 1·5 × 3·2 mm.

ERRATA, Vol. VIII.

p. 29, l. 20, *for* Rissoina *read* Rissoa.
p. 30, l. 19, *for* callus *read* callous.
p. 36, l. 3 from below, *for* lips *read* lip.
p. 41, l. 13, *for* lips *read* lip.
p. 41, l. 37, for *Rissoina* read *Rissoa*.

H. Suter.

ORDINARY MEETING.

Friday, 13th November, 1908.

B. B. Woodward, F.L.S., President, in the Chair.

The following communications were read:—

1. "Note on *Diplommatina Strubelli*." By E. A. Smith, I.S.O.
2. "Descriptions of new species of *Terebra*, *Pleurotoma*, *Trochus*, *Tellina*, *Dosinia*, and *Modiola*." By G. B. Sowerby, F.L.S.
3. "Descriptions of new species of *Macrochlamys* and *Pseudodon* from Siam." By H. B. Preston, F.Z.S.
4. "Description of a new species of *Oliva*." By F. G. Bridgman.

Mr. E. R. Sykes exhibited, on behalf of J. H. Ponsonby, living and dead specimens of a *Helix*, probably *H. Mooniridiana*, Tate. The specimens had been collected by Mr. Matthews at Bridgeport, on the Murray River.

The Rev. E. W. Bowell exhibited an album of photographs of radulæ.

Mr. R. H. Burne exhibited the animal of *Hippopus*, showing the apparently inverted position of the animal with regard to the shell. It was pointed out by the President that the inequality of growth was probably due to the action of gravity, and he contrasted the action of this force upon *Hippopus* and *Mytilus*.

ORDINARY MEETING.

Friday, 11th December, 1908.

B. B. Woodward, F.L.S., President, in the Chair.

Mr. Alfred W. Oke, B.A., and Mr. Maxwell Smith were elected members of the Society.

The following communications were read:—

1. "*Carelia Pilsbryi*, n.sp., from the Hawaiian Islands." By E. R. Sykes, B.A., F.L.S.
2. "On the Radulæ of the British Helicids." Part II. By Rev. E. W. Bowell, M.A.
3. "Descriptions of six new species of *Plectopylis* from Tonkin." By G. K. Gude, F.Z.S.
4. "A preliminary list of Recent Middlesex Mollusca." By J. E. Cooper and A. Loydell.
5. "The application of the names *Gomphina*, *Marcia*, *Hemitapes*, and *Katelysia*." By A. J. Jukes-Browne, B.A., F.G.S.

The President exhibited shells from prehistoric beds of the Nile at Khor Ambukoe, on the east bank, 12 kilometres south of the Dam, at a height of 125 metres, and at Mens, 30 kilometres south of the

Dam, on the west bank, 120 metres above sea-level. The Nile, even when held up by the Dam, does not attain a height above sea-level of more than 106 metres at the present time, and at the earliest historic period, about 6000 B.C., its level was probably about 114 metres.

Also an *Anomia* grown on a Buccinoid.

Mr. G. K. Gude exhibited specimens of *Dyakia Smithiana*, Gude, and *Hemiplecta striata*, Gray, from Sumatra.

Mr. E. A. Smith exhibited malformed specimens of *Strombus Luhuanus*, *Harpa conoidalis*, *Conus virgo*, and *Plekocheilus gibbonius*. Also Hanley's "Photographic Conchology."

Mr. E. R. Sykes exhibited a copy of the proofs of Leach's "Mollusca of Great Britain."

Mr. J. E. Cooper exhibited a collection of thirty-eight species of shells from the Falkland Islands.

Mr. R. Bullen Newton exhibited specimens of opalized shells from the Cretaceous of New South Wales.

Mr. A. S. Kennard exhibited specimens of *Paludestrina Jenkinsi* from Germany and a species of *Pomatias* from the Red Crag.

Mr. H. B. Preston exhibited a sinistral form of *Volvaria Verdensis*, Smith, from Aden; also *Teredo Senegalensis* from Senegal, having its home in a reed; also an example of *Ostrea Guineensis*, detached from a French cruiser after three years service on a West African station.

ORDINARY MEETING.

Friday, 8th January, 1909.

B. B. Woodward, F.L.S., President, in the Chair.

The following communications were read:—

1. "Holocene and Recent non-marine Mollusca from the neighbourhood of Perranzabuloe." By Rev. R. Ashington Bullen, B.A., F.L.S.
2. "Further data on Poli's Generic Names." By Dr. W. H. Dall.
3. "Descriptions of new species and subspecies of New Zealand Mollusca, with notes on a few species." By Henry Suter.

The President exhibited skiagraphs of shells.

Mr. G. B. Sowerby exhibited an interesting series of specimens of *Magilus*, stating that a study of the shells of divers forms and in different stages of growth had led him to revert to the old opinion that Rüppell's genus *Leptoconchus* was founded simply upon the young state of *Magilus*. He observed that the forms of the spiral whorls of the adult *Magili* presented almost as much variation as those of the so-called species of *Leptoconchus*, the type of the latter genus, *L. striatus* (Rüppell), representing exactly the spiral portion of the most usual form of *M. antiquus*; another specimen exhibited, a fine adult *Magilus*, had a spiral nucleus exactly corresponding with *L. Lamarcki* (Desh.); other specimens showed strong resemblances to Deshayes' species *Rüppelli*, *Cuvieri*, and *Cumingi*. The absence of an operculum in Rüppell's species was referred to as remarkable, but the fact that some of the supposed *Leptoconchi* (notably *L. Lamarcki*) have opercula was noted. One species, *L. Robillardi* (Liénard), Mr. Sowerby would relegate to the genus *Coralliobia* (H. & A. Adams).

Mr. H. B. Preston exhibited a malformed specimen of *Bulimus melanocheilus*, Nyst, from Peru; a specimen of *B. pulcherrimus*, H. Ad., originally described in P.Z.S., 1866, from an imperfect shell; and a specimen of a new genus of operculate land shells possessing internal lamellæ.

Mr. A. S. Kennard exhibited fossil pearls from the Coralline Crag.

The Rev. R. Ashington Bullen exhibited non-marine Mollusca from Moncerrat, Cataluna, from 3,300 feet O.D., and others from Tarragona, near the Roman Aqueduct.

NOTES.

NOTE ON *DIPLOMMATINA STRUBELLI*, SMITH. (*Read 13th November*, 1908.)—In the Annals and Magazine of Natural History, 1894, vol. xiii, p. 463, in a paper giving an account of the land shells of the Natuna Islands, the above species was described. It was subsequently noticed that another species from the Molucca Islands, bearing the same name, had already been published in the year 1891 by Dr. O. Boettger. It was therefore proposed to apply the name *D. Brunonis* to the Natuna shell in association with Herr Strubell's Christian name. As this change of name was made in an obscure footnote in the Proc. Zool. Soc., 1895, p. 124, which appears to have escaped the attention of the Zoological Record, it has been thought advisable to again refer to this alteration.

E. A. SMITH.

NOTE ON "PHOTOGRAPHIC CONCHOLOGY" OF SYLVANUS HANLEY. (*Read 11th December*, 1908.)—This work, which seems to be scarce and little known, was published in 1863, and, as far as I can ascertain, extended only to parts i–iii. Apparently the method of illustration was not deemed successful, or the sale of the work may not have been sufficient to warrant its continuance.

It is referred to by Crosse under "Bibliographie" in the Journal de Conchyliologie, 1864, vol. xii, p. 392; by Lea in his "Synopsis of the family Unionidæ," 1870, p. 178; by Hanley himself in the "Conchologia Indica," pp. 6 and 55; by Troschel in the Archiv für Naturgeschichte, 1865, vol. ii, p. 121.

These references to it, therefore, must be regarded as establishing its publication, although from enquiries recently made of Messrs. Sotheran nothing is now known by them of this work.

Its full title is "Photographic Conchology, a second, or Photographic series, of the Conchological Miscellany of Sylvanus Hanley." Samuel Musgrave was the photoprinter and Willis & Sotheran the publishers.

It appeared in quarto form, and altogether consisted of seven plates with explanations, but no descriptive text accompanies them. The figures are mostly much reduced, and the coloration not always very successful. The method of production by photography secured correctness of outline, but the surface ornamentation is much obscured owing to reduction and the superimposed colour and gum-wash. The photographs were printed and then cut out and pasted on sheets of stiff white paper about 8½ by 5½ inches, which were then pasted on quarto sheets of thinnish paper of a pale-green tint. The method was very clumsy and laborious, and probably the time spent upon it made its production too tedious for further continuation, or unremunerative. Upon the covers of the parts it is stated that it is "the first application of photography to scientific natural history." The price was 1*s.* per plate coloured, or 8*d.* plain, so that the whole work, as far as it appears to have been issued, cost only a few shillings.

Plates i–v include illustrations of Unionidæ only, and plates vi and vii species of Corbiculidæ (*Batissa*, *Cyrena*, and *Corbicula*).

Altogether fifty-six species are figured, which with one exception were known forms. The specimens were in Mr. Hanley's own collection, and of these twenty are now in the British Museum, having been given by Mr. Henry Harvey, the present possessor of the collection.

The apparent scarcity and curious form of this work must be my apology for these few remarks.

E. A. SMITH.

PARADIONE, N.N., VICE *CHIONELLA*. (*Read 8th January*, 1909.)—In my Synopsis of the Veneridæ (Proc. U.S. Nat. Mus., 1902, vol. xxvi, p. 351) I adopted the name *Chionella*, Cossmann, 1886, for a section of *Macrocallista*, Meek, 1876. *Chionella*, however, had been previously used by Swainson ("Malacology," 1840, p. 335, note), and I will now substitute for it the name *Paradione*, with the type *Cytherea ovalina*, Deshayes.

W. H. DALL.

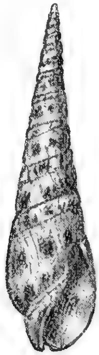
DESCRIPTIONS OF NEW SPECIES OF *TEREBRA*, *PLEUROTOMA*, *TROCHUS*, *TELLINA*, *DOSINIA*, AND *MODIOLA*.

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

Read 13*th November*, 1908.

Terebra Caledonica, n.sp.

Testa acuminata, pallide straminea, nitens, maculis subfuscis ampliusculis triseriatim ornata; spira elongato-acuta; anfractus leviter convexi, læviusculi, tenuissime confertim oblique plicati, sulco brevissimo supra medium secti, sutura angusta sejuncti; anfractus ultimus $\frac{1}{3}$ longitudinis testæ superans; columella contorto-plicata; apertura sub-ampla. Long. 47, diam. maj. 11 mm.



Hab.—Isle of Pines, New Caledonia.

This pretty shell bears some resemblance to the West African *T. Senegalensis*, Lamk., but the last whorl is shorter and more convex, and the plicæ on the upper whorls are very much thinner, closer, and less prominent.

Pleurotoma millepunctata, n.sp.

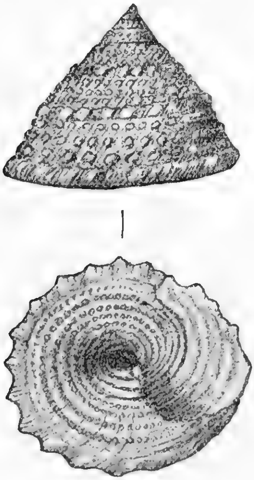
Testa elongato-turrita, luteo-albida, ad apicem fusca, punctis fuscis minutissimis pernumerosis undique notata, interdum flammulis paucis obliquis tenebrosis ornata; spira elongata, acuta, gradata; anfractus 10, apicales læves, deinde angulatim carinati, spiraliter tenuiter lirati, supra angulum leviter concavi, sutura angustissime canaliculata sejuncti; anfractus ultimus spira brevior, convexiusculus, infra angulatus, concavo-constrictus, brevissime rostratus; apertura ovata; canalis brevis, latus; labrum acutum, serratum; columella lævis, levissime contorta. Long. 38, diam. maj. 13 mm.

Hab.—I. Monac, New Caledonia.

This species is nearly related to *P. cingulifera*, Lamk., from which it is at first sight distinguished by the absence of spots on the angle, so characteristic of that species; the posterior angle is also more prominent, and the basal angle and anterior constriction more pronounced.

Trochus (Infundibulum) optatus, n.sp.

Testa late conica, albida, viridi tincta, fusco pauci-flammulata, maculis parvis, nigro-fuscis parum aspersa; anfractus 8, planato-declives, primi lævigati, sequentes triseriatim nodulosi, peroblique densissime filo-striati, plicis irregulariter undulatis sinistrorsum obliquis rugati, ad marginem inferiorem carina crassa tuberculata



instructi; basis planata, pallide virescenti-lutea, liris spiralibus circiter 7 eximie gemmulatis munita; umbilicus profundus, latiusculus, albus, liris spiralibus 4 lævibus crassiusculis instructus; apertura oblique subquadrata, intus margaritacea, crassi-lirata; columella rectiuscula, supra crassi-callosa, infra tenuis. Alt. 25, diam. maj. 30 mm.

Hab.—Manila.

This species bears some resemblance to *Trochus* (*Lamprostoma*) *obesus*, Reeve, but is of a more depressed form, while the characters of the base, columella, and umbilicus are entirely different, showing it to belong to the section *Infundibulum*, as distinguished from *Lamprostoma*.

TELLINA BOUGEI, n.sp.

Testa transversim elongata, oblique elliptica, leviter compressa, albida, striis minutis numerosis perobliquis sculpta, antice producta, postice brevis, obtuse angulata, rugose concentrice plicata; umbones acuti, approximati, prominentes, post medium locati; margo dorsalis utrinque declivis, anticus longus, posticus brevissime spinosus, obtuse angulatus; margo ventralis arcuatus. Dentes cardinales valvæ dextræ duo, divergentes, in valva sinistra una, bifurcata; laterales in valva dextra angusti, elongati. Long. (umb. ad marg. vent.) 9, lat. 13·5 mm.

1½

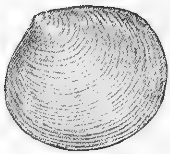
Hab.—I. Monac, New Caledonia.

An obliquely oval white shell, with prominent and rather acute umbones, situated rather near the posterior end. The surface of both valves is sculptured with oblique striæ, mostly very fine, but becoming coarser near the ventral margin; the sloping posterior dorsal margin is armed with very short blunt spines or scales.

I know of no species to which this shell bears any close resemblance, though it might be placed near *T. gargadia*, Linn., which is the type of Bertin's section *Quadrans*.

DOSINIA EXILIUM, n.sp.

Testa subquadrato-ovalis, inæquilateralis, tenuis, convexiuscula, alba, concentrice creberrime lirata; umbones acutiusculi, approximati, antice inclinati; margo dorsalis anticus truncatus, posticus levissime declivis, rotunde angulatus; lunula elongata, paulo impressa; ligamentum tenue, immersum. Dentes cardinales 3, divergentes. Impressiones musculorum normales; sinus pallii trigono-angulatus. Long. 20, lat. 22 mm.



Hab.—Sarawak, Borneo.

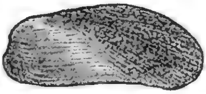
This fragile white shell bears some resemblance to *D. tenuis*, Réclus, an American species, upon which Dr. Dall[1] has founded the genus

[1] "Synopsis of the Veneridæ": Proc. U.S. Nat. Museum, 1902, vol. xxvi, p. 357.

Cyclinella. The cardinal dentition is, however, somewhat different, the form of the shell is more quadrate, and the concentric ridges are much stronger and more regular.

MODIOLA GRANOLIRATA, n.sp.

Testa elongato-arcuata, crassiuscula, fusca, oblique obtuse angulata, concentrice plicato-striata, utrinque dense grano-lirata, liris posticis pernumerosis, anticis paucis; umbones obtusi, depressiusculi, approximati; margo dorsalis posticus elongato-arcuatus, anticus brevissimus, abrupte truncatus; margo ventralis incurvus. Long. 25, lat. 11, crass. 11 mm.



Hab.—Bay of Manila.

This shell is somewhat allied to *M. striatula*, Hanley, but of a shorter stouter build, and its sculpture is very much stronger. The posterior liræ, continuing quite to or even beyond the middle of the valve, are crisply granulated, and a few liræ of the same character are found at the anterior extremity, beneath the umbones, the intervening space being transversely plicated and striated.

DESCRIPTIONS OF NEW SPECIES OF *MACROCHLAMYS* AND *PSEUDODON* FROM SIAM.

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

Read 13th November, 1908.

Macrochlamys rex, n.sp. Pl. VIII, Fig. 2.

Shell narrowly perforate, somewhat tumid, semitransparent, pale yellowish horn colour, not polished above; whorls 6½, sculptured with fine transverse lines of growth; suture impressed, margined below; base of shell polished, shining; umbilicus narrow, deep; columella descending obliquely; peristome simple; aperture lunate. Alt. 16, diam. maj. 30 mm.; aperture, alt. 11, diam. 12 mm.

Hab.—Nan-ko, Siam.

Allied to *M. pumicata*, Morel.,[1] but more tumid, and possesses a higher spire than does that species; the umbilicus is also slightly narrower, the last whorl shows no sign of angulation at the periphery, the columella descends more obliquely, the aperture is narrower, and there is no indication of a violet coloration on the sutural margin.

Pseudodon ponderosa, n.sp. Pl. VIII, Fig. 1.

Shell solid, moderately convex, sub-trapezoidal, covered with a coarse, black, scaly periostracum which becomes laminiferous towards the posterior side; anterior side bluntly rounded; posterior side rounded above, somewhat rostrate below; dorsal margin slightly arched; ventral margin almost straight; umbones large, prominent; interior of shell nacreous, iridescent, tinged with pinkish mauve, deepening posteriorly. Long. 66, lat. 117 mm.

Hab.—Nan-ko, Siam.

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[1] Séries Conch., xii, p. 248, pl. xii.

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FIG. 1.—PSEUDODON PONDEROSA, N.SP.
FIG. 2.—MACROCHLAMYS REX, N.SP.

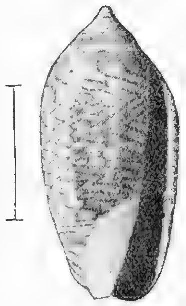
DESCRIPTION OF A NEW SPECIES OF *OLIVA*.

By F. G. Bridgman.

Read 13*th November*, 1908.

Oliva Brettinghami, n.sp.

Shell rather small, ovately cylindrical, yellowish, with a fine reticulation of well-defined zigzag lines of a light-brown colour, the reticulation upon the upper part of the body-whorl below the suture being more open and the lines rather darker than those upon the rest of the whorl; spire rather conical, with a distinctly channelled suture, with a papillate apex consisting of about three somewhat convex whorls of a uniform light brown or dirty white colour; the three remaining spire volutions are obliquely flattish, fulvous, with the upper acute sutural margin, also that of the body-whorl, whitish, marked with dark spots or short lines. Aperture rather narrow, bluish white, with a deep chocolate-brown interrupted line or band or blotches within the somewhat thickened labrum; columellar callus with a few rather well-marked plicæ above that part which is reflexed over the end of the body-whorl; this portion is white, and exhibits about four distinct oblique folds. Length 18, diam. 8 mm.



Hab.—N.W. Australia (Captain Becket).

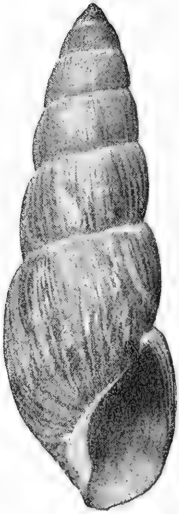
This species is very similar in size and form to *O. faba*, Marrat, but is distinguishable on account of the finer reticulated markings, different spire, and slightly broader aperture, which is of a darker colour. In *O. faba* the labrum is pale within the aperture, whereas in the present form it is stained with chocolate brown. The sutural channel in *O. faba* is broader and the whorls narrower than in *O. Brettinghami*. Named after Mr. G. Brettingham Sowerby. Type in the British Museum.

CARELIA PILSBRYI, N.SP., FROM THE HAWAIIAN ISLANDS.

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

Read 11*th December*, 1908.

Shell elongate, spire much produced, imperforate; sculpture consisting of well-marked, irregular, longitudinal lines, these gradually becoming weaker towards the protoconch, which is smooth; colour of the last whorl red-brown, gradually fading on the upper whorls till the protoconch is only faintly tinged. Whorls 8, the last measuring more than half the entire length, moderately inflated, with a well-marked suture; mouth lunate, outer lip (broken) hardly thickened at all, the white columellar margin reflexed and slightly expanded. Long. 65, lat. 23 mm.



Hab.—Kauai.

A single specimen, purchased from the collection of the late Mr. Rogers, has remained for some years unnamed in my collection. As other workers have also been unable to identify it, I now give a description and figure.

From *C. bicolor*, Jay, it differs in its larger size and also its colour; from *C. cochlea*, Rve., and *Cumingiana*, Pfr., in the absence of keeling and the more inflated whorls; from *C. Dolei*, Ancey, its size will readily distinguish it; from *C. olivacea*, Pease, it differs in colour and shape; from *C. paradoxa*, Pfr., it may be known by the absence of granular sculpture; from *C. turricula*, Mighels, it may be separated by the colouring, length of the last whorl, and lack of keel at the base. *C. Sinclairi*, Ancey, is unknown to me, and *C. glutinosa*, Ancey, is not, I believe, really a Hawaiian shell. I have only seen a single specimen of *C. Pilsbryi*, and the species is, I should think, an extinct one, like some others of the group.

ON THE RADULÆ OF THE BRITISH HELICIDS. (Part II.)

By Rev. E. W. Bowell, M.A.

Read 11*th December*, 1908.

[The terminology proposed in this paper has been revised in accordance with suggestions made by the President and other members of the Society.]

It is necessary to add to the number of technical terms used for describing the parts of the radula, because the microscopic methods and apparatus now at our disposal give a much more perfect view of the structures in question. It will further be desirable to define the terms now employed.

The *radula* is an oblongate membrane disposed with its long sides roughly parallel to the sides of the snail's body. It is, in the forms now under consideration, enclosed in a muscular organ called the *odontophore*, which is the atrium of the digestive system. In its front portion the odontophore also carries the *maxilla* (= jaw; the 'machoire' of French authors), which seizes the food, and perhaps also assists in holding it in position while it is being rasped into small pieces by the radula. The radula is provided with regularly disposed rows of *unci* or hooks, the front and upper portions of which have long been called teeth. It is not yet certain whether these unci bear any relation to the parasphenoidal teeth of such forms as *Batrachoseps* among the vertebrates.

The *unci* are arranged with their free cutting points directed towards the œsophagus of the animal. These points are called *cones*. Where more than one cone occurs on each uncus, the terms *mesocone*, *ectocone*, and *endocone* will naturally be used. In some cases it may be advantageous to draw a distinction between endocone plus mesocone, and bifid mesocone or bifid endocone; but the truth of such determinations can only be settled by sections showing the groups of cells in the *radular sac* (the infolded inner end of the radula) from which the unci originate.

Rücker[1] has shown the mode of development of the unci in *Helix pomatia*. The mechanical difficulties in sectioning such material are considerable, but it seems certain that each uncus in each longitudinal row is a cast of the same matricial cell or group of cells, situated on the lower wall of the radular sac. (This accounts for the regularity with which any asymmetry in development is repeated throughout the length of the radula.) A question which seems to call for settlement is, how is this cast produced? Is it (*a*) a membrane detached from the top of the matricial cell or cells? (Microscopic examination of unsectioned, but stained, radulæ favour this interpretation.) Or is it (*b*) a chitinous structure actually secreted by all the cells which surround it in the radular sac, and only owing its definite form to the impress of these strangely enlarged and persistent matricial cells?

[1] Bericht d. Oberhass. Ges. Natur. u. Heilkunde, 1883, vol. xxii.

It should be noted that the unci do not attain their full development till they reach the middle of the radula; up to that point they continue to be packed close to a layer of cells which is continuous with the upper cells of the radular sac, and which continually adds to their thickness by contributing more chitin. Here I ought to confess that my information on the subject of the chemistry of chitin is still rudimentary: to some extent I have been able to verify Zander's experiments,[1] which make it probable that chitin is a carbohydrate closely related to glycogen. If this were confirmed by chemical tests of some other kind, the result would be of great value to the student of chemical physiology in the mollusca. The chemistry of glycogen and its derivatives probably contains the secret of the snail's power of hibernation, and upon this, I think, depend the extraordinary modifications of the reproductive organs and processes with which we meet in this group.

Each uncus, as it leaves the matricial region, has a well-defined apex. This is that part which I have hitherto shown as the lower extremity of each 'tooth' in my drawings. For the reasons now apparent I shall treat it as the upper extremity. In many figures of radulæ it is omitted altogether.

The apex is usually provided with a furrow (*fossa apicalis*) into which the hinder part of the preceding uncus fits. It is further furnished in most cases with a vertical notch, a continuation upwards of the fossa.

The underside of the uncus is flattened and forms the *basal plate*; it becomes affixed to the *basal membrane*, or else is in some way, not yet well understood, imbedded in it. But the basal membrane shows no sign of being converted into chitin. I have applied Zander's tests for chitin to denuded pieces of basal membrane without result. Staining processes especially designed to act upon chitinous materials do not colour the basement membrane.

The hinderpart of the basal plate is generally somewhat wing-shaped, and it exhibits a line, more or less parallel to the transverse axis of the radula, approximately in the position which in a bird's wing is occupied by the outer edge of the primary coverts. Examination of isolated unci shows that this line is the edge, often thickened and adhering secondarily, of an actual fold: a relic of the original subconic configuration of the uncus. If one imagines a paper cone so folded that its margin is pointed in front and more or less squared at the back; two slits made in the sides of the cone, between front and back; the pointedness of the front margin increased by infolding along the sides of the slit, and a slight fold made on one or both sides of the squared part of the margin; the thickness of the point and other folded parts increased by dipping in melted paraffin,—a fair idea may be obtained thus of the building up of the uncus. To this fold on the basal plate I wish to give the descriptive term *lacinia*. It appears that in most cases the lacinia forms a kind of articulation with the fossa apicalis of the next uncus, so that the bases of the unci

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[1] Pflüger's Arch. 66, 545 (1897).

Measurements.—Results of examination of selected typical specimens are here given in tabulated form. The numbers indicate micromillimetres.

	A.			B.			C.			D.			E.			F.			G.			H.			I.			K.		
Euparypha Pisana .	39	41	31	34	38	30	30	25	30	19	16	23	—	18	—	22	19	18	15	18	16	10	8	10	5	4	4	—	1	—
Cepæa hortensis . .	53	60	33	42	42	33	30	36	33	—	—	22	—	—	—	25	22	24	16	18	23	12	15	12	—	—	10	—	—	—
Cepæa nemoralis . .	60	62	52	42	48	30	28	34	41	—	—	32	—	—	—	30	32	26	24	26	25	10	12	12	—	—	7	—	—	—
Helicogena pomatia .	92	103	74	61	75	?	59	68	60	32	40	36	—	—	—	39	42	40	25	31	40	16	24	10	8	9	9	—	—	—
Helicogena aspersa .	60	69	40	44	56	28	36	43	40	20	30	28	—	36	—	34	35	27	27	34	25	16	14	16	6	10	10	—	8	—
Arianta arbustorum .	44	54	30	34	46	24	29	36	32	16	27	26	—	—	—	20	24	16	11	20	16	7	10	8	2	2	4	—	—	—
Helicigona lapicida .	31	30	12	21	21	10	14	13	20	—	—	—	—	—	—	18	20	18	18	18	18	9	10	9	—	—	6	—	—	—
Helicodonta obvoluta	26	28	10	19	20	8	16	19	13	[8	10]	10	—	[8]	—	12	14	12	8	10	12	7	6	6	4	2	2	—	—	—

Under each letter the first column gives the length in the case of the centrals, the second in the case of the admedians, the third in the case of the externals.

A = Length of basal plate.
B = From edge of lacinia to apex, in the middle line.
C = From apex to tip of mesocone.
D = From apex to tip of ectocone.
E = From apex to tip of endocone.

F = Width of basal plate across laciniæ.
G = Width of basal plate across ectoconic region.
H = Maximum width of mesocone.
I = Maximum width of ectocone.
K = Maximum width of endocone.

are dovetailed into one another. This is, however, not the case with the external unci of Helicids. In estimating the length of the basal plates this fact must be taken into consideration.

The basal membrane itself exhibits a *reticulum*, to be carefully distinguished from the outlines of the basal plates of the unci. This reticulum may be demonstrated by treatment with silver nitrate, or by staining with Kernschwarz.

In order to see the details of laciniæ and basal plates, and at the same time to avoid the production of an excessive number of false images, it is necessary to mount the radula in styrax.

Each radula (with few exceptions) presents us with unci of three different types, called central, admedian, and lateral; central, admedian, and marginal; or central, lateral, and marginal. (A few other variations of usage may be found.) The term transitional is also used to indicate unci intermediate in form between the second and third of these. To avoid confusion I shall call those unci of the second type, which lie nearest to the centrals, *admedians*; those of the third type I shall call *externals*. It will not be possible to mistake the application of these terms. When I wish to speak of admedian and external unci together I shall call them *pleuræ*, or *pleural elements*, the individual unci being *pleurals*. After careful examination I find I cannot recognize a special transitional type in the pleural unci. It is sometimes possible, in species like *H. lapicida*, to produce by staining the appearance of three vertical rows of unci in each pleura, but control experiments show that the number of vertical rows taking each combination of colouring matter depends upon the time of staining and the concentration of the stain used. The word transitional may, however, be still useful as an adjective to describe pleural unci intermediate between admedians and externals.

ADDITIONAL CHARACTERS.

[The first description in each case is that of the centrals, the second of the admedians, and the third of the externals.]

(*a*) Shape of basal plate.

Pisana. Wide, oblong; sides very little curved; rounded, upright, oblong.

hortensis. Long, narrow; long, narrow; upright, sub-quadrate.

nemoralis. Oblongate triangular, all sides curved; like wing of *Hesperia*; sub-tetragonal.

pomatia. Not regularly incurved except at sides, general shape of a square fitted to a triangle, both with rounded corners; sub-oblong, not markedly alate; very much like admedian, only slightly more quadrate.

aspersa. Truncated triangle, with sinuous sides; foot-shaped, heel displaced to side of hallux; oblong, nearly square.

arbustorum. Pointed oblong; bow-shaped; irregular tetragon.

lapicida. Double heart-shape; rounded truncated triangle; striated part a perfect rectangle.

obvoluta. Oblong, pointed, with convex sides; oblong, doubly angulated; oval.

(*b*) Character of lower corners of basal plate.

Pisana. Slightly curved; nearly straight; conterminous with lacinia, heavily striate.
hortensis. Long, with feathery striation; as central; slightly angular.
nemoralis. Slightly curved; slightly curved; with rounded corner.
pomatia. Rounded off; slightly projecting; nearly a right angle, sub-alate.
aspersa. Pointed, incurved; as central; very much thinned out.
arbustorum. Shape of *Vanessa* wing-tip; shape of *Platypteryx* wing-tip; distinct but blunt points.
lapicida. All small, but distinctly incurved.
obvoluta. Pointed, slightly incurved; sharply incurved; rectangular, erect.

(*c*) Shape of lower edge of basal plate.

Pisana. Nearly straight; straight; scarcely sinuated.
hortensis. Indented, angle 130°; crenulated, sharply descending towards central; straight, internally curved.
nemoralis. Roughly straight, with large indentation; double curve, out and in; irregular.
pomatia. Nearly straight, no indentation; very slightly concave, descending towards central; straight, inclined towards central.
aspersa. Two semicircles side by side; outside a semicircle, inner half a slanting line; irregular.
arbustorum. Fringed; fringed; irregular.
lapicida. Bracket-shaped; slightly curved, inner half crenulated; irregularly convex.
obvoluta. All straight.

(*d*) Shape of apex.

Pisana. Rounded, flattened; as central; roughly squared, central indent and external notch.
hortensis. Bifid, rounded; entire, rounded, but tendency to point on inner side; nearly straight, with two lateral indentations.
nemoralis. Trifid; rounded; irregularly convex.
pomatia. Almost straight, slightly irregular sinuations; as central, but inner third curving downwards; as admedian.
aspersa. Very convex, with additional central convexity; as central; straighter, but with central protuberance.
arbustorum. Like end of a hexagon, but centrally split; rounded; long and pointed.
lapicida. Convex, with central notch; an obtuse angle; bifid, hardly produced.
obvoluta. Nearly straight, with central notch; nearly straight; convex, projecting.

(*e*) Lacinia parallel with lower edge of basal plate or otherwise.
(*No entry means that the lacinia is parallel.*)

Pisana. External almost coincident.
hortensis. External almost parallel with outer side of basal plate.
nemoralis. As *hortensis.*
aspersa. Admedian lacinia angulate; external irregular.
arbustorum. Central and admedian not parallel (diagonal).
lapicida. Conspicuously at right angles to central axis, not following the curves of the margin.
obvoluta. Central and admedian diagonal; external coincident.

(*f*) Number and character of cones visible.

Pisana. 3; 3; 2 (mesocone bifid).
hortensis. Rounded tongue-shaped point, narrower base; as central, but more quadrate base; 2 (mesocone bifid).
nemoralis. 1, blunt, thick, angular at summit; as central; 2 (bifid mesocone and conical ectocone; sometimes additional ectocones).
pomatia. 3; 2; 2 (bifid mesocone, but not rarely found entire).
aspersa. 3 (mesocone ovate and overlapping others); 3 or 2 (endocone only apparent, really part of mesocone); 2 (mesocone bifid; ectocone rarely duplicated).
arbustorum. 3 (long pointed mesocone, small curling ectocones); 2 (as central); 2 (mesocone bifid; sharp, especially ectocone).
lapicida. 1; 1; 2, but ectocones frequently duplicated.
obvoluta. 1 (slight notches representing side cones); 1 (a slight notch representing ectocone); 2 (claw-like bifid mesocone).

It is hoped that the above additional characters may serve for the differentiation of the species in detail; they are therefore tabulated under characters, and not primarily under species. In comparing such minor points allowance must be made for individual variation.

It remains to summarize what appear at present to be the points of diagnostic value; the tables will be found to contain much more, if further confirmation be needed in any case.

Helicogena pomatia is remarkable for showing very little diminution of size in the external unci. The radula is very broad in comparison with that of *aspersa.* The endocones of the external unci are so little prominent as to be hardly noticeable at first sight.

Helicogena aspersa is characterized by the presence of distinct, though small, accessory cones.

Euparypha Pisana has these cones very distinct, otherwise being planned very much on the same lines as *Helicogena.*

The *Cepææ* have the accessory cones absent or obsolescent in mature specimens: *nemoralis* has normally a trifid apex, *hortensis* a bifid one. The basal plates of *hortensis* are much longer in proportion than those of *nemoralis.*

Arianta is marked by the exceptional length of the cones, and yet more clearly by the arcuate shape of the basal plates.

Helicigona cannot well be confounded with those just named. The cones in all regions are very obviously rounded, and the basal plates partake of the same character.

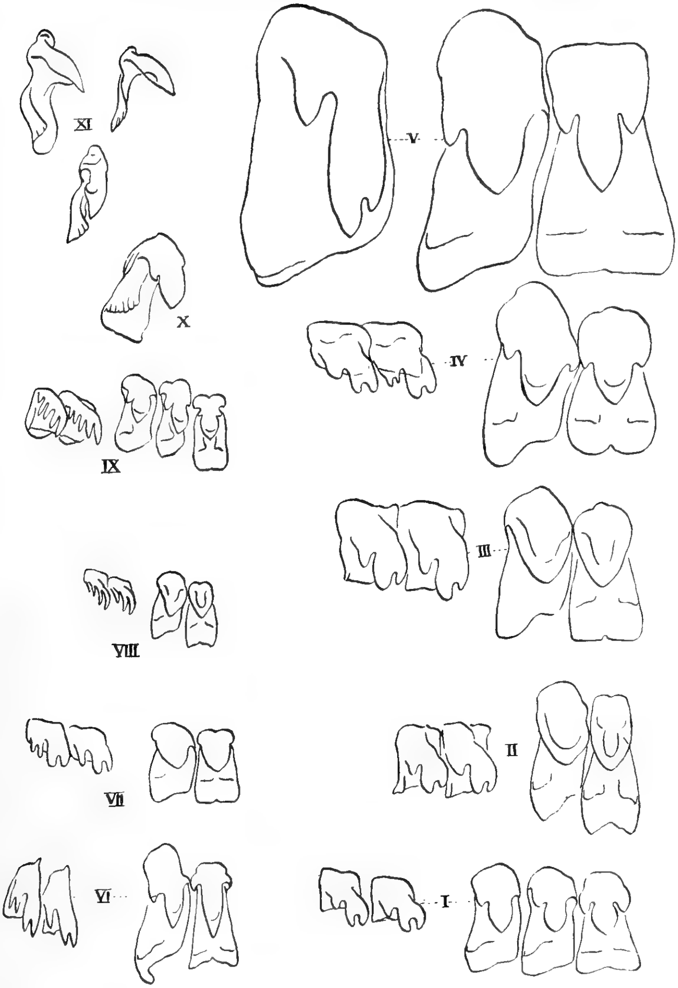


Fig.
I. Typical unci from the radula of *Euparypha Pisana* (Müll.).
II. ,, ,, ,, *Cepæa hortensis* (Müll.).
III. ,, ,, ,, *Cepæa nemoralis* (Müll.).
IV. ,, ,, ,, *Helicogena aspersa* (Müll.).
V. ,, ,, ,, *Helicogena pomatia* (L.).
VI. ,, ,, ,, *Arianta arbustorum* (L.).
VII. ,, ,, ,, *Helicigona lapicida* (L.).
VIII. ,, ,, ,, *Helicodonta obvoluta* (Müll.).
IX–XI, see text, *ad fin.*

Helicodonta may be recognized by the claw-like externals. The long oval shape of the central basal plate is also unmistakable.

On the preceding page figures are given of the species above described. The scale employed is the same throughout; the size of the individual parts may be ascertained by reference to the table on p. 207.

Figs. X and XI are from specimens showing the extreme ends of the radula, stained with carbol fuchsin. They will serve to illustrate what has been said about the lacinia.

Fig. IX is from a young example of *C. hortensis*, and illustrates the point that the accessory cones are always more distinct and visible in the younger examples. At a still earlier stage the radula may be said to be Endodontid in type.

DESCRIPTIONS OF SIX NEW SPECIES OF *PLECTOPYLIS* FROM TONKIN.

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

Read 11th December, 1908.

PLATE IX.

A considerable number of shells belonging to the genus *Plectopylis* have been kindly placed in my hands by Colonel Messager, of the French Colonial Infantry, who informs me they were all collected by him in different localities in the 4th Military Territory of Tonkin, the headquarters of which are at Lao-Kay on the Red River, on the borders of Tonkin and Yunnan. Some of these shells are of special interest from presenting evidence of what I consider to be hybrid origin. Hitherto I have found the armature of *Plectopylis* practically constant, only a slight amount of variation within well-defined and rather narrow limits having been observed; but in examining the armatures of the shells now under consideration I found that some appeared to form connecting links with each other; and this fact at first considerably puzzled me, until at length I was driven to the conclusion—the idea had long been present in my mind in connection with other genera—that some of these molluscs had been interbreeding, and thus had given rise to a number of individuals presenting some features common to both parents. Viewed in this light, their segregation into distinct forms, by the process of elimination of the hybrid forms, no longer presented any difficulty.

I am not aware that the subject of hybridity in molluscs has been seriously discussed. Judging by analogy of what is known in other animals and plants, it is not surprising that molluscs should at times intercross. The orthodox view hitherto has been to unite all extreme forms connected by intermediate links into one group, and to regard these groups as variable species. It certainly is an easy way of disposing of an intricate subject, but it appears to me to be more philosophic to look on these extreme forms as closely allied but distinct species, which in some cases happen to meet on common ground, and thus give rise to progeny deriving their characters through divergent lines of descent.

In adopting this view I do not think we meet with any insuperable difficulty, for it may safely be assumed that a close relationship exists between most of the known species from Tonkin, since they nearly all have one feature in common, i.e. the posterior parietal plate, which is always in these species curved and obliquely descending backwards, giving off a short posterior support from the upper extremity, and these features are constant, however much the other structures anterior to the plate in question, as well as the palatal barriers, may vary. This constancy extends to most of the known species from China, and it is only with the Burmese and Indian forms that the posterior parietal plate is of different character, and gives off horizontal plates and other structures.

PLECTOPYLIS MESSAGERI, n.sp. Pl. IX, Fig. 3.

Shell dextral, very widely umbilicated, discoid, light or dark corneous, finely and regularly ribbed above, becoming smoother below, decussated with very fine spirals. Spire depressed, apex prominent, suture rather deep. Whorls 7, increasing slowly and regularly, slightly convex above, rounded at the side, inflated below, angulated at the upper part of the last whorl, and obtusely subangular round the umbilicus; the last whorl dilated towards the mouth, shortly deflected in front. Aperture elongate-elliptic, oblique, margins slightly convergent, united by a slightly raised flexuous callus on the parietal wall. Peristome thickened and considerably expanded, but slightly reflexed; upper margin arcuate, outer and basal rounded, columellar straight.

Parietal armature composed of two vertical plates, the anterior flexuous, its lower part receding and giving off posteriorly a longish, obliquely descending ridge, and with a slight support anteriorly at the upper extremity, above which occurs a short, free, horizontal fold. The posterior plate is curved, obliquely descending backwards, and with a short posterior ridge at the upper extremity.

Palatal armature consisting of six folds; the first nearly horizontal, low and thin, the next four oblique, semicircular, and flexuous, united by a vertical callus; the second ascending at first, then horizontal, the next three horizontal at first, then ascending; sixth oblique, semicircular, but short. Diam. maj. 18·5, min. 14·5 mm.; alt. 8 mm.

Hab.—Muong-Hum. Type in my collection.

Diam. maj. 16, min. 13 mm.; alt. 6·25 mm.

Hab.—Nat-Son, Pac-Kha, and Trinh-Tuong.

Var. *minor.*—Diam. maj. 12·75, min. 10·75 mm.; alt. 6 mm.

Hab.—Nat-Son.

This new species resembles *P. Moellendorffi*; but, although more elevated in the spire, the axis is relatively shorter, and the last whorl is much less deflexed, the aperture at the same time being more dilated laterally. In the parietal armature it differs in having the anterior vertical plate produced posteriorly below into a descending long ridge, which, with the anterior support of the upper extremity, gives this structure the form of the letter ʒ, while the free horizontal fold occurring below it in *P. Moellendorffi* is here absent. The palatal armature also exhibits some differences, notably in the second fold being in the new species much shorter, and having the four folds united by a transverse callus, a feature not observed in *P. Moellendorffi*.

A specimen from Pac-Kha shows traces of hybrid origin, for while it has the second palatal fold short, as in *P. Messageri*, the anterior parietal plate lacks the posterior long ridge below, and has instead a free horizontal fold as in *P. Moellendorffi*.

A number of shells from Gia-Phu are smaller than the type, measuring only 16 mm. in diameter; they have a relatively higher spire, and have the last whorl more deflexed in front. The species is named in honour of Colonel Messager, who has contributed so largely to our knowledge of the molluscan fauna of Tonkin.

PLECTOPYLIS VERECUNDA, n.sp. Pl. IX, Fig. 4.

Shell dextral, widely umbilicated, conoid, corneous, the nepionic whorls shining, almost smooth, the later ones finely and regularly ribbed, the riblets more pronounced above than below, covered with a thin deciduous cuticle. Spire a little elevated, apex obtuse, suture linear. Whorls 7, increasing slowly and regularly, flattened above, rounded at the side and below, subangulated above the periphery and round the moderately wide, deep umbilicus, slightly dilated towards the mouth, a little descending and abruptly deflexed in front. Aperture crescent-shaped, oblique, margins a little convergent; peristome white, slightly thickened and reflexed, margins united by a raised flexuous ridge, which emits a curved, entering, obliquely ascending fold; upper margin descending, outer basal and columellar regularly rounded.

Parietal armature composed of two vertical plates, the anterior straight, giving off a short ridge anteriorly at the upper extremity and another posteriorly at the lower extremity, giving that structure the form of the letter ⌊; the posterior plate curved, descending backwards, with a short ridge posteriorly from its upper extremity.

Palatal armature consisting of six folds, the first and sixth smallest, nearly horizontal, low, the other four oblique, more elevated, second longest, ascending at first, then horizontal; third, fourth, and fifth horizontal at first, then ascending, the latter with a small denticle above its posterior extremity. Diam. maj. 13·5, min. 11·25 mm.; alt. 7 mm.

Hab.—Phony-Tho. Type in my collection.

Allied to the preceding species, but smaller, with a more conical spire, deeper umbilicus, and the mouth not dilated laterally, and furnished with an entering curved fold on the parietal wall.

In its armature it differs in lacking the free fold above the anterior parietal plate; and this plate is straighter, and gives off posteriorly at its lower extremity a much shorter ridge than in *P. Messageri*. It differs further in the four palatal folds not being united by a callous ridge, in the second fold being longer, and in having a denticle posteriorly to the fifth fold.

PLECTOPYLIS GOULDINGI, n.sp. Pl. IX, Fig. 1.

Shell dextral, widely umbilicated, discoid, corneous, finely ribbed, and decussated with fine spirals, and having, in addition, raised spiral ridges, probably furnished with hairs in the fresh state. Spire flat, apex low, suture a little impressed. Whorls 6, a little convex above, rounded at the side and below, subangulated above, increasing slowly and regularly, last scarcely dilated towards the mouth, slightly descending and deflexed in front. Aperture sub-ovate, oblique, margins distant, united by a strong raised flexuous ridge; peristome whitish, a little thickened and reflexed; upper margin arcuate, outer and basal curved, columellar straight.

Parietal armature composed of two vertical plates, the anterior straight, giving off at the upper extremity a long horizontal thin fold anteriorly and a short ridge posteriorly, while the lower extremity has a short ridge on both sides; below it occurs a moderately long, free, obliquely descending fold; the posterior plate is curved and descends backwards, with a short support posteriorly at the upper extremity.

Palatal armature consisting of six folds, the first low, thin, straight, horizontal, the other five more raised; the second very long, the anterior portion horizontal, the posterior portion vertically descending, with a slight denticle behind and a diffuse callus below its extremity, the next three curved, oblique, bifurcated posteriorly; sixth oblique, straight, short. Diam. maj. 12, min. 10·5 mm.; alt. 5 mm.

Hab.—Nat-Son. Type in my collection.

This new species is named in honour of Mr. Richard W. Goulding, the Librarian at Welbeck Abbey, who has frequently favoured me with advice and assistance. The shell is allied to *P. anterides*, but the anterior parietal plate is not provided with the buttresses so conspicuous a feature in that species, and the plate is united to the upper horizontal fold, which is much longer than in *P. anterides*, as is the lower free horizontal fold; while the palatal folds are not united by a vertical callus and they overlap when viewed from the front, whereas in *P. anterides* they have much more space between.

A larger form from Pac-Kha, measuring 14 mm. in diameter, shows traces of hybrid origin, having the overlapping palatal folds of *P. Gouldingi* with the free upper horizontal parietal fold and the buttresses of *P. anterides*. A still larger form from the same place (16 mm.), while otherwise agreeing in both sets of armature, is provided with buttresses. The species is also allied to *P. tenuis*, but the anterior vertical parietal plate in that species has no support anteriorly at its lower extremity, and has a free fold above it, while its palatal folds are not bifurcate.

Plectopylis anterides, n.sp. Pl. IX, Fig. 2.

Shell dextral, widely umbilicated, discoid, from pale to ruddy corneous, the nepionic whorl shining, the later ones dull, covered with a deciduous cuticle. Spire flat, apex low, suture a little impressed. Whorls 6, slightly convex above, rounded at the side and below, obtusely angulated round the wide, rather shallow umbilicus, increasing slowly and regularly, last scarcely dilated towards the mouth, shortly and abruptly deflexed in front. Aperture subcircular, oblique, margins distant; peristome white, thickened, and reflexed, the margins united by a strongly raised flexuous ridge; upper margin at first slightly ascending, arcuate, outer and basal regularly curved, columellar straight.

Parietal armature composed of two vertical plates, the anterior giving off at its lower extremity a short ridge on each side, with one or two buttresses anteriorly, and having a free, horizontal, thin, longish fold above and below; the posterior curved, descending backwards, with a short ridge posteriorly above.

Palatal armature composed of six folds, the first short, thin, low, horizontal, with a short descending ridge at its posterior extremity, the others raised; the second long, its anterior portion horizontal, its posterior extremity descending and bifurcate; the third has the anterior extremity horizontal, then descends obliquely, and bifurcates posteriorly; fourth and fifth with the anterior extremity vertical, descending obliquely in a curve, bifurcating posteriorly; sixth short, oblique. Diam. maj. 11·5, min. 9·75 mm.; alt. 4·5 mm.

Hab.—Pac-Kha. Type in my collection.

Larger specimens from the same habitat measure 12 mm. in diameter, while others from Long-Ruy (1,500 metres altitude) measure 10·5 mm. in diameter. In addition to the differences already mentioned under *P. Gouldingi*, the first palatal fold has a descending short ridge at its posterior extremity, a feature absent in *P. Gouldingi*.

Plectopylis fallax, n.sp. Pl. IX, Fig. 6.

Shell resembling *P. Moellendorffi*, but the spire is quite flat, and the axis is relatively lower, the last whorl descends much more in front, the aperture is more oblique and more dilated laterally. The anterior parietal plate is shorter, leaving more space between it and the upper and lower free horizontal folds, and it gives off, in addition, an anterior and posterior ridge at the lower extremity; the upper free horizontal fold is also more produced; the four inner palatal folds have their posterior extremities also more horizontal than in *P. Moellendorffi*, showing a tendency to bifurcation. Diam. maj. 17, min. 14·5 mm.; alt. 6·25 mm.

Hab.—Muong-Bo.

More variable in size than *P. Moellendorffi*, the smallest specimen measuring 13·5 mm. in diameter.

Var. major.

This form has the aperture still more distended laterally, the margins of the peristome more expanded, the last whorl more deflexed in front, and the mouth more oblique. Diam. maj. 21, min. 17·5 mm.; alt. 8 mm.

Hab.—Pac-Kha.

At first I was inclined to consider *P. fallax* a variety of *P. Moellendorffi*, but, in addition to the deviations in the armature and other differences indicated above, the shell has such a distinct facies that it seems better to give it specific rank.

Plectopylis cyrtochila, n.sp. Pl. IX, Fig. 5.

Shell dextral, widely umbilicated, discoid, translucent, pale corneous, smooth and polished especially below, finely irregularly striated. Spire depressed, apex obtuse, suture deep. Whorls $6\frac{1}{2}$, convex, increasing slowly and regularly, rounded at the periphery, subangulated round the wide, open, funnel-shaped umbilicus, last whorl slightly deflexed in front, and slightly constricted behind the mouth. Aperture roundly lunate, oblique, margins approaching; peristome whitish, a little thickened and slightly reflexed, the margins united by a slight callus on the parietal wall, regularly curved.

Parietal armature composed of two vertical plates, the anterior slightly descending forward and thickened below, with a short support on both sides of both extremities, those on the lower stout; the posterior plate curved, obliquely descending backwards, with a short support posteriorly above.

Palatal armature consisting of six short and thin folds, the first five nearly horizontal, the sixth oblique, the first and sixth free, the other four united by a transverse ridge, which projects above the second fold curving forward, and below the fifth curving backwards, then shortly upwards. Diam. maj. 9·5, min. 8 mm.; alt. 4 mm.

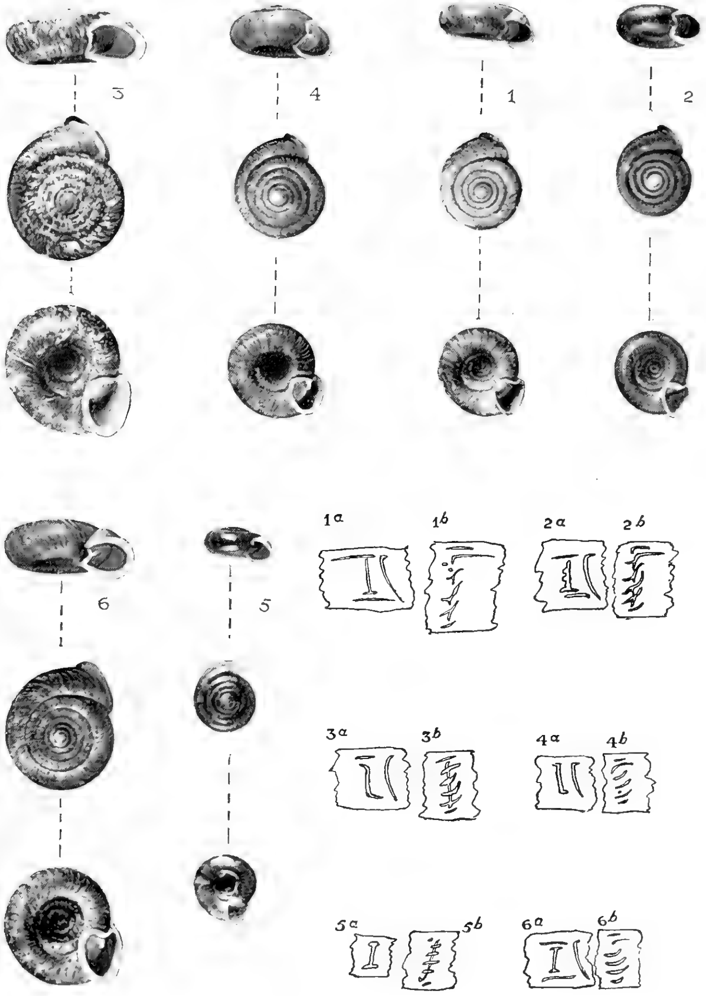
Hab.—Muong-Kong. Type in my collection.

This species is allied to *P. Mansuyi*, but, although having half a whorl less, it is larger; it is also more depressed in the spire, is smoother, the last whorl is scarcely deflexed in front, the parietal ridge at the aperture is not raised and is without entering fold. *P. Mansuyi*, moreover, lacks the supports at both extremities of the anterior parietal plate, and the present species has the four inner palatal folds horizontal instead of oblique, and lacks the posterior row of denticles found in its ally.

EXPLANATION OF PLATE IX.

Fig.			
1.	*Plectopylis*	*Gouldingi*,	n.sp., shell.
1*a*.	,,	,,	parietal armature.
1*b*.	,,	,,	palatal ,,
2.	,,	*anterides*,	n.sp., shell.
2*a*.	,,	,,	parietal armature.
2*b*.	,,	,,	palatal ,,
3.	,,	*Messageri*,	n.sp., shell.
3*a*.	,,	,,	parietal armature.
3*b*.	,,	,,	palatal ,,
4.	,,	*verecunda*,	n.sp., shell.
4*a*.	,,	,,	parietal armature.
4*b*.	,,	,,	palatal ,,
5.	,,	*cyrtochila*,	n.sp., shell.
5*a*.	,,	,,	parietal armature.
5*b*.	,,	,,	palatal ,,
6.	,,	*fallax*,	n.sp., shell.
6*a*.	,,	,,	parietal armature.
6*b*.	,,	,,	palatal ,,

N.B.—By an oversight the posterior parietal plate has been omitted in fig. 5*a*, while in fig. 5*b* the first palatal fold is shown erroneously as a denticle.



NEW SPECIES OF PLECTOPYLIS FROM TONKIN.

A PRELIMINARY LIST OF RECENT MIDDLESEX MOLLUSCA.

By J. E. Cooper and A. Loydell.

Read 11th December, 1908.

We venture to submit the following list, though far from complete, as a contribution towards the census of recent Middlesex Mollusca. So far as we know, no list has been published for the county since 1836 (supplement to Daniel Cooper's "Flora Metropolitana"). The last revision of the Conchological Society's census enumerates eighty species for vice-county twenty-one. We have verified seventy-three of these, and we can also add twenty-one species which are not given in that list, so that with some old records we now enumerate 110 species.

The surface of Middlesex is chiefly London Clay, with considerable stretches of river-gravel on the lower ground and some alluvium along the rivers. In the north there are a few patches of Bagshot Sand and some Drift Clay (both singularly barren of Mollusca), while the Chalk appears in the extreme north-west corner of the county. Very little Chalk lies actually within the county, but its influence is felt by the molluscan life of the Colne Valley.

Some vestiges of ancient woodland still remain round Harefield, Pinner, Harrow Weald, East Finchley, Stanmore, Enfield, and a few other spots, but they do not appear to shelter many snails. *Vitrea pura* and *V. radiatula* are characteristic of these areas.

Since the county is bounded on three sides by rivers—the Colne, the Thames, and the Lea—there is no lack of fresh-water species, and the low-lying land bordering the rivers harbours many slugs and snails.

We are indebted to Mr. B. B. Woodward for identifying the greater part of the *Pisidia*, and for kindly furnishing us with numerous old records which we should not otherwise have seen; we have also to thank Mr. A. S. Kennard and Mr. R. A. R. Priske for various notes of localities.

Where no reference follows the localities enumerated below we have ourselves collected the shells in question. In all other cases we append references, using the following abbreviations:—

T.M. = "A monograph of the land and fresh-water Mollusca of the British Isles," by J. W. Taylor.
B.C. = "British Conchology," by J. Gwyn Jeffreys, 1862.
Rim. = "Land and fresh-water shells of the British Isles," by R. Rimmer, 1880.
J.C. = Journal of Conchology.
S.G. = Science Gossip.

1. Testacella Maugei, Fér.

A single specimen is in the British Museum (Natural History), marked as coming from a garden at Kensington, and Mr. E. A. Smith, I.S.O., kindly informs us it was received in a collection of British shells bequeathed by a Mrs. Robinson in April, 1848.

2. Testacella haliotidea, Drap.

This species has been recorded for Hampstead (C. C. Fryer, S.G., 1889, p. 259); Regents Park, Upper Holloway, Chiswick, and Uxbridge (T.M., ii, p. 11). It appears to be much less common than *T. scutulum.*

We doubt if any *Testacella* is really indigenous to the county. These carnivorous slugs usually appear in nurseries and gardens, seldom, if ever, in fields.

3. Testacella scutulum, Sby.

West Ealing (a living specimen sent us by R. A. R. Priske); Highgate, Hornsey, Stroud Green, Finchley, Ealing, and Isleworth (T.M., ii, p. 19); also the following localities quoted by J. W. Taylor in J.C., v, p. 344—Stamford Hill, Kensington, Hammersmith, Regents Park, Hendon, Hampstead, Middle Temple, Stoke Newington, Whetstone, Haverstock Hill, St. John's Wood, Turnham Green, Winchmore Hill, and Upper Holloway. Mr. Webb records it further at Enfield (Journ. Malac., vi, p. 26, wrongly entered as Herts).

Var. *albina*, G. & F. Chiswick (T. D. A. Cockerell, S.G., 1892, p. 255); Highgate and Hornsey (T.M., ii, p. 17).

Var. *aurea*, Ckl. Bedford Park (T. D. A. Cockerell, S.G., 1885, p. 225).

4. Limax maximus, L.

Harefield, Twickenham, Fulham Palace, and Highgate. Widely distributed, but not very common. It is also recorded for Chiswick, Acton, Whetstone, Upper Holloway, Harrow, and Hampstead (T.M., ii, p. 48).

Var. *cellaria*, d'Arg. West Ealing (R. A. R. Priske), Upper Holloway (T.M., ii, p. 44).

Var. *fasciata*, Raz. Highgate (T.M., ii, p. 42).

Var. *Ferussaci*, Moq. Highgate and Upper Holloway (T.M., ii, p. 45).

5. Limax flavus, L.

Fulham Palace and Highgate. Abundant where it does occur, but it is seldom seen in the daytime, as it feeds at night and is of a very retiring disposition. Other records for this species are Acton, Ealing, Bedford Park, Hampstead, and Muswell Hill (T.M., ii, p. 85).

Var. *umbrosa*, Phil. Hillingdon, Bedford Park, and Highgate (T.M., ii, p. 83).

Var. *Breckworthiana*, Lehm. Ealing, Acton, and Hampstead (T.M., ii, p. 84).

6. Agriolimax agrestis (L.).

Only too common everywhere. It shows great variation in colour, ranging from white through various shades of yellow and brown to a deep chocolate or purple. We have not met with an absolutely white or a black specimen.

7. Agriolimax lævis (Müll.).

Harefield, Yiewsley, Neasden, Hampton Court, and near Colnbrook. It is not uncommon at the margins of ditches and rivers.

Other records for this species are Twickenham (S. C. Cockerell, S.G., 1885, p. 116); Hanwell and Perivale (T.M., ii, p. 128).

8. Milax Sowerbyi (Fér.).

Twickenham, Fulham Palace, Finchley, East Finchley, Highgate, and Neasden. It is plentiful on the higher ground in North Middlesex. The type is the prevalent form.

Var. *nigrescens*, Ckl. Twickenham and Finchley. Also recorded for Acton and Bedford Park (T.M., ii, p. 156).

Var. *bicolor*, Ckl. Ealing (T. D. A. Cockerell, S.G., 1887, p. 187).

Var. *fuscocarinata*, Ckl. Bedford Park (T.M., ii, p. 156).

9. Milax gagates (Drap.).

We have failed to find this slug, although it is said to be fairly common. It is recorded for Hornsey and Islington (T.M., ii, p. 147).

Var. *plumbea*, Moq. Ealing (T. D. A. Cockerell, S.G., 1887, p. 187); Acton, Bedford Park, and Hampstead (T.M., ii, p. 144).

Var. *rava*, Williams. Hornsey and Crouch Hill (T.M., ii, p. 145).

Var. *pallidissima*, Pollon. Highgate (T.M., ii, p. 146).

10. Vitrina pellucida (Müll.).

Harefield, Staines, Stanwell Moor, Hampton Court, Acton, and Neasden. It is a local species and does not appear to live in the eastern part of the county.

11. Vitrea crystallina (Müll.).

Harefield, Uxbridge, Yiewsley, Stanwell Moor, Twickenham, Acton, Fulham Palace, Stanmore, East Finchley, Highgate Woods, Wood Green, and Ponders End. Abundant among rotten leaves in suitable localities.

12. Vitrea lucida (Drap.).

Grounds of Fulham Palace, where it is probably an introduction. We have not met with genuine *V. lucida* anywhere else in the county. It is, however, recorded for Isleworth (F. G. Fenn, S.G., 1887, p. 139, and Mr. B. B. Woodward has specimens thence), South Kensington (T.M., iii, p. 27).

13. Vitrea cellaria (Müll.).

It appears that two species (*V. cellaria*, s.s., and *V. Scharffi*) have hitherto been included under this name. We believe typical *V. cellaria* is not uncommon in Middlesex, but we can only record it with certainty from Muswell Hill and Highgate Woods.

14. Vitrea Scharffi, Kennard.

This newly described species we have found at Harefield, Neasden, Finchley, and East Finchley. No doubt it occurs elsewhere, but we did not attempt to differentiate it from *V. cellaria* until last autumn; consequently our previous notes may refer to either species, and are now useless.

15. Vitrea Rogersi, B. B. Woodward.

Harefield, Yiewsley, Stanmore, Finchley, East Finchley, Highgate Woods, near Hendon, Hampstead, and Muswell Hill. Very widely distributed and abundant in some localities on the higher ground.

Var. *viridans*, Ckl. A single example from near Hendon.

One specimen of the type from Finchley has a flat spire.

16. Vitrea alliaria (Miller).

Harefield, Yiewsley, Bedfont, Stanmore, Hampstead Heath, Muswell Hill, Highgate, Finchley, East Finchley, and Neasden. Widely distributed over the county, but nowhere common. Its usual habitat is among dead leaves in old woodland.

Another record is Hendon (C. C. Fryer, S.G., 1889, p. 259).

17. Vitrea nitidula (Drap.).

The commonest *Vitrea* in Middlesex; it occurs wherever the ground is suitable.

18. Vitrea pura (Alder).

Harefield, Greenford, Acton, Ealing, Willesden, East Finchley, and Highgate. It occurs in colonies, but is not a common shell.

Var. *nitidosa*, Gray. Harefield and East Finchley, with the type.

19. Vitrea radiatula (Alder).

Harefield, Acton, Highgate, Finchley, and East Finchley. Always found sparingly and somewhat rare.

20. Zonitoides nitidus (Müll.).

Harefield, Uxbridge, Yiewsley, near Colnbrook, Stanwell Moor, Greenford, Southall, Bedfont, Alperton, Willesden, Acton, Ealing, Hampton Court, Neasden, and Ponders End. It is common in suitable spots in the Colne Valley, and occurs sparingly in the other localities mentioned.

It is also recorded for Enfield (S. C. Cockerell, S.G., 1883, p. 9).

21. Euconulus fulvus (Müll.).

Harefield, Uxbridge, Yiewsley, and near Colnbrook. Not uncommon on the margins of ditches in the Colne Valley. At Harefield it lives in a wood among dead holly-leaves.

22. Arion ater (L.).

Yiewsley, Twickenham, Fulham Palace, Ealing, Hendon, and Finchley. Widely distributed and rather common; it is usually typical in colour, occasionally brown or creamy-white.

Var. *succinea*, Müll. Immature specimens at Harefield and East Finchley; also recorded for Highgate (T.M., ii, p. 182) and Bedford Park (T. D. A. Cockerell, S.G., 1885, p. 224).

Var. *castanea*, D. & M. Finchley; also recorded for Acton, Bedford Park, Bush Hill Park, Highgate, and near Hendon (T.M., ii, p. 176).

Var. *plumbea*, Roeb. Highgate and Bedford Park (T.M., ii, p. 179).

Var. *rufa*, L. Bedford Park (T. D. A. Cockerell, S.G., 1885, p. 224).

Var. *nigrescens*, Moq. Bedford Park (T. D. A. Cockerell, S.G., 1885, p. 224).

23. Arion subfuscus (Drap.).

Harefield, Finchley, East Finchley, and near Hendon. Not very common, but plentiful where it does occur.

Var. *brunnea*, Lehm. Highgate (T.M., ii, p. 199).

Var. *cinereofusca*, Drap. Harefield and Finchley; also recorded for Highgate (T.M., ii, p. 200).

24. Arion intermedius, Normand.

Yiewsley, Uxbridge, Neasden, and Finchley; probably in other localities besides, but it is easily passed over as juvenile *A. ater*.

25. Arion hortensis, Fér.

Abundant everywhere, especially in gardens.

Var. *grisea*, Moq. Bedford Park (T.M., ii, p. 216).

Var. *cærulea*, Collinge. Ealing (T.M., ii, p. 216).

Var. *subfusca*, C. Pfr. Bedford Park (T.M., ii, p. 217).

Var. *rufescens*, Moq. Bedford Park (T.M., ii, p. 218).

26. Arion fasciatus, Nilsson.

Harefield, Bedfont, Hampton Wick, Fulham Palace, Neasden, Stanmore, East Finchley, Highgate, and Ponders End. Not uncommon. It lives in the open country as well as in woods. It has also been recorded from Hayes, Hanwell, Isleworth, Chiswick, and Muswell Hill.

Var. *Neustriaca*, Mab. Highgate (T.M., ii, p. 232).

27. Punctum pygmæum (Drap.).

Harefield, Yiewsley, and near Colnbrook: apparently rare.

28. Sphyradium edentulum (Drap.).

Uxbridge. The locality was destroyed a few years ago when the new railway line was built.

29. Pyramidula rotundata (Müll.).

Very common everywhere.

Var. *Turtoni*, Flem. Near Hendon.

Var. *alba*, Moq. Finchley.

We have a sub-scalariform example from Chiswick. A sinistral specimen is also recorded for that place (J.C., viii, p. 171).

30. Helicella virgata (Da Costa).

Harefield: a rare shell in Middlesex.

31. Helicella caperata (Mont.).

Harefield, West Drayton, and Acton. It is also recorded for Isleworth (J.C., vi, p. 309).

32. Helicella Cantiana (Mont.).

Acton, Finchley, Ponders End, etc. Scattered colonies occur all over the county. It is abundant round Harefield, and along the valley of the Colne down to Staines.

33. Hygromia granulata (Alder).

Abundant in the valley of the Colne; it also occurs at Bedfont, Acton, and Ponders End.

34. Hygromia hispida (L.).

Common all over the county. The type is the prevalent form, but var. *hispidosa*, Mouss., also occurs. We have not met with characteristic examples of var. *subglobosa*, Jeff., which is now considered a distinct species (= *sericea*, Drap.). This form is recorded for Hammersmith (B.C., i, p. 199).

35. Hygromia rufescens (Penn.).

A common shell everywhere. The vars. *rubens*, Moq., *albocincta*, Ckl., and *alba*, Moq., are found with the type in various localities. A sub-scalariform specimen comes from the side of the Thames near Brentford.

36. Acanthinula aculeata (Müll.).

Harefield, on dead holly-leaves. It has also been recorded at Twickenham (Cockerell, *Zoologist*, xliii, p. 340).

37. Vallonia pulchella (Müll.).

Yiewsley. Typical *V. pulchella* is decidedly rare in Middlesex. In deference to current opinion we give three species of *Vallonia*, though we should prefer to consider them forms of one species.

38. Vallonia excentrica, Sterki.

Harefield, Hampton Court, and Ponders End. Less frequent than *V. costata*. It is also recorded for South Kensington and Ealing (B. B. Woodward).

39. Vallonia costata (Müll.).

Harefield, Uxbridge, Yiewsley, near Colnbrook, Hampton Court, Hampton Wick, Bedfont, and Acton.

40. Helicigona lapicida (L.).

Mr. Jackson (J.C., xi, p. 345) possesses several white examples of this species, given him by Mr. R. D. Darbishire, who stated he collected them on a rough wall in the Zoological Gardens, Regents Park. They were obviously introduced.

41. Helicigona arbustorum (L.).

Harefield, Uxbridge, West Drayton, near Colnbrook, Staines, Bedfont, Chiswick, and Ealing. It appears to be absent from the lower part of the Lea Valley, although it lives at Cheshunt in Herts.

42. Helix aspersa, Müll.

Abundant everywhere. A reversed specimen was found in H. Adams' garden, Notting Hill (Harting, "Rambles in search of Shells," p. 23).

43. Helix nemoralis, L.

Found in most parts of the county. The pink form (var. *rubella*, Moq.) and the yellow one (var. *libellula*, Risso) are equally common.

We have var. *conica*, Pascal, from Finchley. A sinistral example is recorded for West Drayton (F. G. Fenn, S.G., 1888, p. 280).

44. HELIX HORTENSIS, Müll.

Scattered all over the county, but not found in some apparently suitable localities. The form usually met with is the yellow bandless var. *lutea*, Moq.

45. ENA OBSCURA (Müll.).

Highgate and East Finchley, on border of woods (both localities now destroyed); Shepperton, Stanmore, and Northwood.

It is a scarce species in Middlesex. A single specimen has also been recorded from Harrow (Records of the Conchological Society).

46. COCHLICOPA LUBRICA (Müll.).

Under stones and dead leaves everywhere. It varies considerably in size.

47. AZECA MENKEANA (C. Pfr.) [= *tridens*, Pult. (auctt.)].

Is recorded (Sheppard, *Zoologist*, ix, p. 3120) as having been found near Fulham.

48. CÆCILIOIDES ACICULA (Müll.).

Recorded for Ealing (G. D. Brown, S.G., 1882, p. 91).

49. JAMINIA SECALE (Drap.).

Mr. Rich, the dealer, informed Mr. J. E. Harting ("Rambles in search of Shells," p. 30) that this species had been met with on an old wall at Sudbury, near Harrow. Daniel Cooper, on the authority of T. Bell, records its occurrence "on the banks of the Thames."

50. JAMINIA CYLINDRACEA (Da Costa).

Bedfont and Ealing. It appears to be rare.

51. JAMINIA MUSCORUM (L.).

Harefield, in the great chalk-pit. We have not found it elsewhere in the county.

52. VERTIGO ANTIVERTIGO (Drap.).

Yiewsley, on a dead stem of *Typha latifolia*. It is apparently very rare.

53. VERTIGO PYGMÆA (Drap.).

Has been recorded from rejectamenta of the Thames at Twickenham (Records Conch. Soc.) and West Drayton (Cockerell, *Zoologist*, xlv, p. 354).

54. VERTIGO MOULINSIANA (Dupuy).

Near Colnbrook, on the stems of *Arundo phragmites*, in one spot only.

55. BALEA PERVERSA (L.).

Is given by Daniel Cooper, on the authority of J. Carter, as having occurred at Hammersmith, while Sheppard (*Zoologist*, ix, p. 3120) quotes it from Fulham.

56. Clausilia laminata (Mont.).

Is cited by Daniel Cooper, on J. Carter's authority, as having occurred at Hammersmith.

57. Clausilia biplicata (Mont.).

Chiswick, close to the Thames. It was formerly found near Hammersmith, but we believe the locality has been destroyed. It has further been recorded from Fulham and Isleworth (Records Conch. Soc.), and even from Hyde Park, near the Serpentine (Harting, "Rambles in search of Shells," p. 66).

58. Clausilia bidentata (Ström.).

Harefield, Uxbridge, Greenford, Willesden, Hampton Court, East Finchley, and Hampstead. It is plentiful along the river wall at Hampton Court.

59. Succinea putris (L.).

Harefield, Yiewsley, near Colnbrook, Bedfont, near Hendon, and East Finchley.

Some of the Yiewsley specimens are remarkably fine.

60. Succinea elegans, Risso.

Yiewsley, Hendon, Finchley, East Finchley, River Lea at Tottenham, ditches at Ponders End. It is also recorded for Twickenham (S. C. Cockerell, S.G., 1885, p. 116).

Var. *longiscata*, Mor. Banks of the Lea, Tottenham.

Var. *albida*, Taylor. Lower Halliford and Hampton Court.

61. Carychium minimum, Müll.

Harefield, Uxbridge, Yiewsley, near Colnbrook, Hampton Wick, Hampton Court, Fulham Palace, and Ponders End.

62. Ancylus fluviatilis, Müll.

Uxbridge, between the Frayswater and the canal; stream at Lower Halliford. It is also recorded for Brentford (S.G., 1883, p. 262), the Thames at Twickenham (S. C. Cockerell, S.G., 1885, p. 116), and the New River at Palmers Green (G. H. Weaver).

63. Acroloxus lacustris (L.).

Harefield, Uxbridge, Lower Halliford, Finchley, and East Finchley. Other recorded localities are streams at Neasden and Wembley (C. C. Fryer, S.G., 1889, p. 259); River Brent between Brentford and Hanwell (T. D. A. Cockerell, S.G., 1884, p. 138); Twyford (S. C. Cockerell, S.G., 1887, p. 43).

64. Limnæa auricularia (L.).

Canal at Harefield, Frayswater at Uxbridge, West Drayton, River Colne near Colnbrook, Staines, Ickenham Common, Thames at Brentford, canal at Alperton, Hampstead ponds, River Lea at Tottenham, and New River at Enfield. It is also recorded for Hendon (C. C. Fryer, S.G., 1889, p. 259); Regents Park (T. D. A. Cockerell, S.G., 1884, p. 236).

Var. *albida*, Jeff. Queen's River, Bushey Park, and canal at Hackney.

65. Limnæa peregra (Müll.).

Common and generally distributed.
Var. *inflata*, Kob. Moat at Finchley, and West Drayton.
Var. *ovata*, Drap. Bushey Park.
Var. *acuminata*, Jeff. Pond near Ealing.
Var. *labiosa*, Jeff. Hampstead ponds and the moat at Finchley.
Var. *candida*, Porro. Lea Marshes.

A white-banded specimen is recorded from Hendon (C. C. Fryer, S.G., 1889, p. 259). Of these two last species Rich, the dealer, obtained some exceedingly fine specimens, which he retailed as coming from "Hendon" in order to keep the locality secret.

66. Limnæa palustris (Müll.).

Harefield, Uxbridge, West Drayton, near Colnbrook, Staines, Shepperton, Chertsey, Stanwell Moor, near Longford, Lower Halliford, Thames at Teddington, Brent near Hendon, Greenford Green, Bedfont, Bushey Park, East Finchley, and Ponders End. It is also recorded for the lower part of the Brent (T. D. A. Cockerell, S.G., 1884, p. 138); Twyford (S. C. Cockerell, S.G., 1887, p. 43); Enfield (S. C. Cockerell, S.G., 1883, p. 9); Tottenham (Canon Horsley, S.G., n.s., vi, p. 181).

A white-banded form occurs, with the type, in the Brent near Hendon, and also in Hackney Marshes.

67. Limnæa truncatula (Müll.).

Uxbridge Marsh, near Colnbrook, near Longford, Chertsey, West Drayton, between Hampton Court and Kingston Bridge, Staines, Hendon, Finchley Common, and Ponders End. Other recorded localities are: Twickenham (S. C. Cockerell, S.G., 1885, p. 116), Hyde Park (T. D. A. Cockerell, S.G., 1884, p. 236), Hampstead Heath (J. W. Williams, S.G., 1889, p. 164).
Var. *elegans*, Jeff. Thames at Brentford and Finchley Common.
Var. *albida*, Jeff. Frayswater at Uxbridge.

68. Limnæa stagnalis (L.).

Harefield, Uxbridge, West Drayton, Staines, Hendon, Finchley, Ponders End, and many other localities.

A prettily banded form has been taken at Tottenham by Canon Horsley. A turreted example comes from the same locality.

69. Amphipeplea glutinosa (Müll.).

Is recorded by Daniel Cooper, on the authority of James Carter, as occurring "on leaves of *Nymphæa lutea* at Stanmore." It has also been found in a Holocene deposit at Staines by one of the present writers.

70. Planorbis corneus (L.).

In all the rivers and most of the ponds and canals.
Var. *albina*, Moq. Fulham, in the Thames backwater.

71. Planorbis albus, Müll.

Plentiful in the Colne Valley; it also occurs at Bushey Park, Ruislip, Willesden, Finchley, Ponders End, and many other localities.

Var. *Draparnaudi*, Shep. Canal near Harrow (T. D. A. Cockerell).

72. Planorbis glaber, Jeff.

Recorded in the Conch. Soc.'s census. We are informed that it was taken in a private pond at Tottenham by Chas. Ashford in 1885.

73. Planorbis crista (L.).

Harefield, Uxbridge, Staines, Alperton, Ealing, Acton, and Stanmore. It is also recorded for Twyford (S. C. Cockerell, S.G., 1887, p. 43).

74. Planorbis carinatus, Müll.

Harefield, Uxbridge, Longford, Lower Halliford, Bedfont, Brent near Hendon, Perivale, Edgware, East Finchley, Stanmore, Enfield, and Ponders End.

It is also recorded for Neasden and Wembley (C. C. Fryer, S.G., 1889, p. 259), and the Lea at Tottenham (Canon Horsley, S.G., n.s., vi, p. 181). We have a fine scalariform specimen from a pond at Edgware.

75. Planorbis umbilicatus, Müll.

Very generally distributed in ditches and streams all over the county.

76. Planorbis vortex (L.).

Common and widely distributed in ponds and ditches. We have several distorted specimens from a small pond at Finchley.

77. Planorbis spirorbis (L.).

Uxbridge, Perivale, Hendon, Finchley, Hampstead, Hackney, and Lea Marshes. It is a local species, though plentiful where it does occur.

Var. *albida*, Nelson. Finchley Common.

78. Planorbis contortus (L.).

Found in all parts of the county, both in running and in stagnant water.

79. Planorbis fontanus (Lightf.).

Harefield, Uxbridge Marsh, Northwood, West Drayton, near Colnbrook, Stanmore, Acton, Hendon, Finchley, and Wood Green. Other records are: Hampstead (C. C. Fryer, S.G., 1889, p. 259); Enfield (S. C. Cockerell, S.G., 1883, p. 9).

80. Segmentina nitida (Müll.).

Yiewsley, Chertsey, pond near Shepperton, ditch at Ponders End. It is a local species. It is also recorded for Fulham (T. D. A. Cockerell, S.G., 1884, p. 236).

81. Physa fontinalis (L.).

Widely distributed, and common in most of the streams and rivers.

82. PHYSA ACUTA, Drap.

Recorded from the Botanic Gardens, Regents Park (J.C., vi, p. 306).

83. APLECTA HYPNORUM (L.).

One specimen at Lower Halliford. Also recorded from Acton, usually in ditches, scarce (Cockerell, *Zoologist*, xliii, p. 299).

84. PALUDESTRINA JENKINSI (E. A. Smith).

This species has been but recently introduced into Middlesex. Probably the earliest record is 1904, when it was found in a ditch by the side of the Thames above Richmond, near Marble Hill. The shells were evidently carried thither from the lower reaches of the river, and by the overflow of the tide carried to their present habitat. A pond near also contains this species, showing its adaptation to purely fresh-water conditions.

In 1907 it was found abundantly in a bit of marsh by the Frayswater at Uxbridge, and also in the stream itself.

85. BITHYNIA TENTACULATA (L.).

Abundant in both stagnant and running water.

Var. *producta*, Menke. Yiewsley. Beautifully banded specimens are found in the Moat, Finchley. Decollated examples have been taken from a pond at Perivale.

86. BITHYNIA LEACHII (Shepp.).

Harefield, Uxbridge, Yiewsley, West Drayton, near Colnbrook, Lower Halliford, Shepperton, Chertsey, Hackney Marshes, and Ponders End. It is also recorded for the River Brent (T. D. A. Cockerell, S.G., 1884, p. 138); Tottenham (A. S. Kennard).

Var. *albida*, Rim. Near Colnbrook and Hackney Marshes.

87. VIVIPARA VIVIPARA (L.).

In all the rivers and in most of the canals. It was formerly plentiful in one of the Hampstead ponds, while some extremely fine examples have been procured from the Botanic Gardens, Regents Park (B. B. Woodward's coll.).

Var. *efasciata*, Pickering. Grand Junction Canal near Sudbury, River Lea at Tottenham. A dwarf stumpy form is not uncommon in the Thames.

88. VIVIPARA CONTECTA (Millet).

Staines Moor (fine examples in a pond), ditch at Uxbridge Marsh, Bushey Park (moat in enclosed grounds), stream at Lower Halliford. Also recorded for New River, West Drayton (Cockerell, *Zoologist*, xliii, p. 179). It is decidedly rare in the county.

89. VALVATA PISCINALIS (Müll.).

Frayswater at Uxbridge, canal at West Drayton and Yiewsley, River Colne at Staines Moor, Queen's River at Bushey Park, Thames at Hampton Wick, Lower Halliford, Brentford, Bedfont, and Ponders End. It is also recorded for Hendon (C. C. Fryer, S.G., 1889, p. 259); River Lea at Tottenham (Canon Horsley, S.G., N.S., vi, p. 181).

Var. *subcylindrica*, Jeff. Thames at Hampton Wick; also at Hammersmith (T. D. A. Cockerell, S.G., 1884, p. 236). A sinistral example is recorded from Sunbury (J.C., iv, p. 37).

90. Valvata cristata (Müll.).

Harefield, Uxbridge, West Drayton, near Colnbrook, Greenford Green, Acton, Bedfont, Fulham, Hackney Canal, and Ponders End. Other records are Hampstead and Hendon (C. C. Fryer, S.G., 1889, p. 259).

91. Pomatias elegans (Müll.).

Old chalk-pit at Harefield.

92. Neritina fluviatilis (L.).

Colne at Uxbridge Marsh (attached to stems of *Ranunculus fluitans*), also near Staines. Canal at West Drayton, Lower Halliford, Chertsey, Thames at Hampton Wick, Grand Junction Canal in several places, River Lea at Tottenham. It is fairly abundant in the Thames. Other localities are Hendon (C. C. Fryer, S.G., 1889, p. 259); Enfield (S. C. Cockerell, S.G., 1883, p. 9); New River at Palmers Green (G. H. Weaver).

93. Dreissensia polymorpha (Pallas).

Thames at Twickenham (alive), Grand Junction Canal, Alperton (mostly dead shells).

It is said to be abundant in the New River, and has been found in the moat in front of the Royal Mint (*Countryside*, vol. v, p. 6).

94. Unio pictorum (L.).

Canal at Yiewsley and West Drayton, Colne at Staines, Thames at Hampton Wick and Twickenham, canal at Willesden, and Lea at Tottenham.

It has also been taken at Hendon (C. C. Fryer, S.G., 1889, p. 259); River Brent (T. D. A. Cockerell, S.G., 1884, p. 138); Twyford (S. C. Cockerell, S.G., 1887, p. 43); Enfield (S. C. Cockerell, S.G., 1883, p. 9).

95. Unio tumidus, Retz.

Harefield, Colne at Uxbridge, canal at West Drayton and Yiewsley, Southall; Thames at Staines, Hampton Wick, and Twickenham; Paddington Canal, Hampstead ponds, and Lea at Tottenham.

It is also recorded for Hendon (C. C. Fryer, S.G., 1889, p. 259); Enfield (S. C. Cockerell, S.G., 1883, p. 9).

An extremely prettily tinted variety was found when the water was drawn off in Regents Park after the terrible skating accident in 1867, and received at the time the name of *Unio Richensis*, after the dealer who brought it to notice (Harting, "Rambles in search of Shells," p. 37).

96. Anodonta cygnea (L.).

Abundant in rivers, canals, and ponds. The small form (var. *anatina*) is much commoner than typical *A. cygnea*.

97. SPHÆRIUM RIVICOLA (Leach).

Canal at Yiewsley, Thames at Hampton Wick and Shepperton, Brentford, Grand Junction Canal near Willesden, River Lea at Tottenham, canal at Edmonton and Ponders End. It is also recorded for Hendon (C. C. Fryer, S.G., 1889, p. 259).

Var. *flavescens*, Moq. Grand Junction Canal near Willesden, and River Lea at Tottenham.

98. SPHÆRIUM CORNEUM (L.).

Common and widely distributed.

Var. *pisidioides*, Gray. Paddington (B.C., i, p. 6); Regents Park (Rim., p. 4).

Var. *scaldiana*, Norman. River Brent near Hendon, and canal at Yiewsley. It is also recorded for Hampstead (Rim., p. 3).

Var. *nucleus*, Studer. Finchley; also from Hampstead and Hendon (Rim., p. 3).

Var. *flavescens*, Macg. Moat at Finchley, and occasionally with the type in other localities.

99. SPHÆRIUM LACUSTRE (Müll.).

Harefield, Frayswater at Uxbridge, Staines, Bushey Park, Hendon, Neasden, Perivale, Willesden, Fulham, Finchley, Hampstead, Stanmore, and Enfield. Widely distributed, but not a common species.

Var. *Brockoniana*, Bgt. Hornsey (Rim., p. 6).

100. SPHÆRIUM PALLIDUM, Gray.

Recorded from the Grand Junction Canal ("Paddington Canal") near Kensal Green in 1856, when it was described by Dr. Gray (Ann. Mag. Nat. Hist., ser. II, vol. xvii, p. 465). We are not aware of its having been taken in Middlesex in recent years.

101. PISIDIUM AMNICUM (Müll.).

In all the rivers and many of the canals. A small, solid, subtriangular form lives in the Thames at Hampton Wick.

102. PISIDIUM SUPINUM, A. Schmidt.

Thames at Hampton Wick and Twickenham, stream at Bedfont. This species is well known as a Holocene fossil in the Thames Valley, but (with the exception of a few shells in the Gray Collection at South Kensington labelled "Battersea") it does not appear to have been taken alive in this country hitherto. At Hampton Wick it lives in sand; at Twickenham and Bedfont it occurs very sparingly in mud. Compared with *P. subtruncatum* the shell of this species is usually more sharply triangular, the beaks are very prominent, and often have an appendiculum similar to that of *P. Henslowianum*. A variety is more oval in outline; in all cases the shell is much more solid than in any of our other small *Pisidia*, and the teeth are stronger.

103. PISIDIUM HENSLOWIANUM (Shepp.).

Frayswater at Uxbridge, Acton, Bedfont, Bushey Park, Thames at Twickenham. Also from the Red Arches Pond at Hampstead (B. B. Woodward), and West Drayton (W. M. Webb).

104. Pisidium subtruncatum, Malm.

Harefield, Uxbridge, West Drayton, near Colnbrook, Bedfont, Bushey Park, Brent near Hendon, and at Edgware. Also from the Red Arches Pond at Hampstead (B. B. Woodward), Ealing and Fulham Moat (W. M. Webb).

105. Pisidium pulchellum, Jenyns.

Harefield, Bedfont, and Bushey Park. It is a very local species. Another locality is West Drayton (B. B. Woodward).

106. Pisidium Casertanum (Poli) = *P. fontinale*, auct. = *P. cinereum*, Alder.

This species is often identified as *P. pusillum* or *P. pusillum*, var. *cinerea*.

It is not uncommon; we have it from Uxbridge, Bushey Park, Hendon, and Hadley Wood.

107. Pisidium pusillum (Gmel.).

Yiewsley. Genuine *P. pusillum* seems to be very rare in Middlesex.

108. Pisidium nitidum, Jenyns.

Uxbridge, West Drayton, near Colnbrook, Stanmore, Hampstead, and Enfield. It is rather a local species.

109. Pisidium obtusale, Pfr.

Harefield, Greenford, Bushey Park, and Finchley Common.

This is a pond-dwelling species, and is not common in the county.

110. Pisidium Gassiesianum, Dupuy.

Harefield, Acton, West Drayton, near Colnbrook, Bushey Park, Stanmore, Brent near Hendon, Hampstead ponds, Edgware, Enfield, and Ponders End.

The commonest of our small *Pisidia*.

THE APPLICATION OF THE NAMES *GOMPHINA*, *MARCIA*, *HEMITAPES*, AND *KATELYSIA*.

By A. J. Jukes-Browne, B.A., F.G.S.

Read 11*th December*, 1908.

PLATE X.

The shells which form the subject of the following study belong to the family Veneridæ, and have been separated from the older generic groups of *Venus*, *Chione*, and *Tapes*. There is, however, much confusion and difference of opinion with regard to the definition of the groups for which the names *Gomphina*, *Marcia*, and *Hemitapes* were proposed, and certain species have been placed by different authors under each of these heads. Having had occasion to investigate the history of the names, to consider the validity of the accredited type species, and to make a critical examination of the shells themselves, I propose to give some account of all these matters, with the view of arriving at a satisfactory settlement of the questions involved.

In order to state the facts as clearly as possible I shall first give the history of each name separately, and will subsequently define the shell-groups under the names which, as it seems to me, they ought to bear.

I. History of Names and Determination of Types.

1. Gomphina, Mörch.

This name was proposed by Mörch in his catalogue of Count de Yoldi's Collection,[1] a work in which many new generic and subgeneric names were employed, and though in no case was any definition or description given, yet they may be regarded as sufficiently indicated by the species which are referred to them.

Under *Gomphina* (which Mörch placed in the Donacidæ) only two species are mentioned, these being *Venus undulosa*, Lam., and *Venus donacina*, Chem. They stand in the order above given, but as Mörch did not indicate types, it was open to any subsequent author to choose either as the type of *Gomphina*. The first authors to adopt the name were the Messrs. H. & A. Adams in 1857, who, curiously enough, placed *Gomphina* as a subgenus of *Meretrix*,[2] and gave *V. donacina*, Chem., as the only species referable to it, the reason of this being that in the arrangement of the Veneridæ they followed Deshayes' grouping (of 1853), and he had included *V. undulosa* under the genus *Chione*.

Now since the *Gomphina* of Mörch included only these two species, and since the Messrs. Adams expressly excluded the one and included the other, they practically made the group a monotypical one. Under

[1] Cat. Conch. Yoldi, 1852–3.
[2] Genera Recent Moll., 1857, vol. ii, p. 425.

the rules of the International Zoological Congress "a genus proposed with a single original species takes that species as its type"; it seems to follow that if a genus was proposed to include two species only, and if a subsequent author removes one of these species to another genus, he determines the type by elimination. In this view I am supported by the opinion of Dr. W. E. Hoyle.

In the same year (1857), but three months later than the issue of the part of the Messrs. Adams' work dealing with the Veneridæ, E. Römer published a critical review[1] of this family, and this is prefaced by a tabular view of the subdivisions of the Linnean genus '*Venus*' which he adopts. One of these is *Gomphina*, Mörch, of which he gives *V. undulosa* as his example, for the species mentioned in his scheme can only be regarded as examples, not as types.

In 1864–5 Römer published a more complete revision of the Veneridæ.[2] In this he regarded *Gomphina* as a distinct group equivalent in value to such genera as *Mercenaria* and *Tapes*, and he gave a detailed description of its characters in Latin. In this description the part relating to the hinge is specially good, complete, and diagnostic; thus he correctly describes the median tooth of the right valve as thick and triangular, but says nothing about the median of the left, though the anterior and posterior are described. The reason of this is that the left median is solid and entire in *G. undulosa*, but is bifid in *G. donacina*.

In this group Römer included four species, these being *donacina*, Chem.; *æquilatera*, Sow.; *melanægis*, Römer; and *undulosa*, Lam. It is doubtful, however, whether the second and third are more than varieties of *donacina*. No type was indicated by Römer, but his definition of the genus was so good that there ought not to have been any subsequent misunderstanding about it.

In 1884 Tryon regarded *Gomphina* as a subgenus, and made the following significant remark: "Römer describes four species and considers *V. undulosa*, Lam., as the type, while H. & A. Adams quote *V. donacina*, Chem., as the only species, and place it as a subgenus of *Cytherea*."[3] Tryon evidently thought that the examples given by Römer in 1857 should be taken as types, but was in doubt about the action of Messrs. Adams.

In 1887 Fischer placed *Gomphina* as a subgenus of *Tapes*, and gave *V. undulosa* as an example, but this calls for no remark.

In 1902 Dr. W. H. Dall published a "Synopsis of the Family Veneridæ and of the North American recent species,"[4] in which he made many modifications of nomenclature, and proposed several new names for what he regarded as sections or subgenera worthy of being so distinguished. He was also careful to indicate the type of every group, but did not enter into any discussion of these types, or of his

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1 "Kritische Untersuchung der Arten des Molluskengeschlechts *Venus* bei Linné und Gmelin," Cassel, 1857.

2 Malak. Blätt., vols. xi and xii.

3 "Systematic Conchology," vol. iii, p. 177.

4 Proc. U.S. Nat. Mus., vol. xxvi, pp. 335–412.

nomenclature, reserving all explanations for his memoir on the Tertiary Fauna of Florida, which was published in the following year.[1]

Both in his Synopsis and in the larger memoir Dr. Dall places *Gomphina* as a subgenus of *Chione*, in spite of many obvious differences. The type is given as *V. undulosa*, Lam., without comment. On p. 1289 of the later memoir he gives a brief diagnosis of *Gomphina*, which, however, is much less accurate than that given by Römer. The first sentence reads, "valves more or less extended behind and pointed"; he fails to notice the thick triangular tooth of the right valve, but says "the posterior right and two anterior left cardinals grooved."

He proceeds to divide the group into two sections, namely—

Section *Gomphina*, Mörch, s.s. Type, *V. undulosa*, Lam.
,, *Macridiscus*, Dall. ,, *V. æquilatera*, Sow.[2]

The first is defined as having reciprocal rugosities on the right nymph and on the left posterior cardinal, and he then remarks: "*Tapes pinguis*, Sowerby, is really more typical of this group than the nominal type."

Macridiscus is thus defined: "Nymphs and teeth smooth, entire; valves in general more compressed, equilateral, and trigonal than in the preceding section; less heavy and sometimes with feeble striation distally. *V. faba*, Reeve, and *V. fumigata*, Sow., seem to belong to this section. It is *Gomphina*, H. & A. Adams, not Mörch."

Several of these statements are very far from being correct. In the first place, the first sentence about the shape of the valves is not true either of *V. undulosa* or of *V. æquilatera*, though it would apply to *Tapes pinguis* and its allies. *T. pinguis*, however, is so different from *Gomphina*, whether that is typified by *V. undulosa* or *V. donacina*, that no other conchologist has ever placed them in the same subgenus. It was included by Römer in his *Hemitapes*, and is certainly more closely allied to that group than to *Gomphina*. Dr. Dall, therefore, first assumed that certain species should be transferred from *Hemitapes* to *Gomphina*, and then tells us that one of them is more typical than the type!

Again, he asserts in his general description that three of the teeth are grooved, while under '*Macridiscus*' he says its teeth are entire and smooth. Both these statements are incorrect. In most specimens of *V. undulosa* the only grooved tooth is the right posterior, all the teeth in the left valve being entire, but there are occasional specimens in which the median tooth of each valve is grooved. In *V. donacina*, however (and its var. *æquilatera*), both the median teeth are distinctly grooved. As regards smoothness, I have observed that in *V. donacina* the left posterior cardinal always has one or two elongate grooves on its upper side, though it is not so rugose as in *V. undulosa*.

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[1] Trans. Wagner Free Inst. Science, 1903, vol. iii, pt. vi.

[2] He does not explain why he gives *æquilatera* as his type instead of *donacina*, but probably he considered them as identical, and will not acknowledge Chemnitz as a binomial author.

Thirdly, it is absurd to say that *V. æquilatera* is "more compressed, equilateral, and trigonal" than *V. undulosa*. In making such a statement Dr. Dall must again have been thinking of the shells which he considered "more typical than the type."

Lastly, I cannot see that either *V. faba* or *V. fumigata*, which latter is identical with *V. lævigata*, Sow., has any close resemblance to *V. æquilatera*, but both might be classed in the same group as *T. pinguis*.

I regret to find myself so much at variance with Dr. Dall both in regard to facts and in regard to the affinities of certain species, but the result of my investigation is a conviction that his description of the *Gomphina* group must be considerably modified. It is very probable that the effect of the Messrs. Adams' restriction of the name to a single species did not occur to him, or he would doubtless have retained that species as the type. The adoption of *V. donacina* as the type will of course nullify the section *Macridiscus*, and I do not propose to create a new one for *V. undulosa*, as, in spite of some small differences, I do not think there is sufficient reason for splitting *Gomphina* into two sections. The fact is that in all the species of this group there is great variability in the extent to which the teeth are grooved. In some specimens of *donacina* all the teeth but two are more or less grooved, while in *undulosa* the number of grooved teeth varies from one to three.

Finally, though, as above stated, I would exclude *T. pinguis* and its allies from close association with *Gomphina*, there is another small group of shells which should in my opinion be ranked as a section or subgenus of *Gomphina*. This is the group typified by *V. fluctuosa*, Gould, which Dr. Dall separated from *Tapes* in 1870,[1] and considered so distinct as to deserve generic rank, giving it the name of *Liocyma*. I quite agree that it should be separated from *Tapes*, but though the external form does not much resemble that of *Gomphina*, its hinge will be found to agree very closely with that of *G. donacina*.

Dr. Dall describes *L. fluctuosa* as having "three cardinals in each valve, the posterior left and anterior right entire, the others bifid or grooved." As my own three specimens of this species did not agree with this statement, having all the teeth entire except the right posterior, and in one specimen a grooved left median, I asked Mr. E. A. Smith if he would examine the specimens to see if any agreed with Dr. Dall's description. This he was kind enough to do, and wrote as follows: "In some specimens (not in all) I find the teeth as described by Dr. Dall; the grooving, however, is shallow and often so feeble as to be difficult of detection; moreover, it is not constant, for in some instances the posterior of the right and the anterior of the left may be ungrooved."

Here again, therefore, we find the same curious variability and the same tendency to solidity of the teeth which shows itself in *Gomphina*; but as in the latter, so also in *Liocyma*, the teeth which are most

[1] Proc. Bost. Soc. Nat. Hist., 1870, vol. xiii, p. 256; and Am. Journ. Conch., 1871, vol. vii, p. 145.

frequently grooved are the right posterior and the median of both right and left valves.

Gomphina is a Western Pacific group ranging from North Australia to Japan, but *Liocyma* is restricted to boreal seas, and may therefore be regarded as the boreal representative of the former.

2. Marcia, H. & A. Adams.

This name was proposed by the Messrs. Adams in 1857[1] as a subgenus of the genus *Chione*, but the history of the group should begin with Deshayes' "Catalogue of the Veneridæ in the British Museum" (1853), because Deshayes' grouping of the subdivisions of this family was adopted by the Messrs. Adams, who only corrected and improved his nomenclature.

Deshayes had followed Gray and Megerle in recognizing *Chione* as a distinct genus, and he subdivided it into five sections, but did not give names to these, merely describing them as (1) species lamellosæ, (2) species cancellatæ, (3) species decussatæ, (4) species transversim striatæ, (5) species lævigatæ.

The Messrs. Adams not only adopted these sections without change, but furnished them with names, using such as were already in existence for the four first and proposing the name *Marcia* for the fifth section. They also gave lists of the species belonging to each of these groups, following Deshayes in the main, but arranging the names in alphabetical order, so that beyond the brief diagnosis at the head they give no idea of any special type.

It is evident, therefore, that no one could form a proper conception of the group for which the Messrs. Adams proposed the name *Marcia* without being aware of the facts above mentioned, and without referring to Deshayes' catalogue, where the species are not arranged alphabetically; for it is only reasonable to suppose that the first two or three species of Deshayes' list are those which he had more especially in view. Now the first four species in Deshayes' list are the following: (1) *Chione Kochii*, Phil.; (2) *C. fumigata*, Sow.; (3) *C. Ceylonensis*, Sow.; (4) *C. pinguis*, Chem. Here, therefore, we have what may be called the *pinguis* group, since that is the oldest species, of which *Ceylonensis*, Sow., is merely a variety, while *V. Kochii*, Phil., agrees with it in all essential characters, and *V. fumigata*, Sow. (= *lævigata*, Sow.), has much resemblance to the others though differing a little in the teeth. Clearly, therefore, any subsequent author who adopted the Messrs. Adams' name of *Marcia* should have taken care that it included the "*pinguis* group," and should have selected either *pinguis* or *Kochii* as its type.

The first person to adopt the name *Marcia* seems to have been Chenu,[2] and, curiously enough, the only species he gives as an example is *V. undulosa*, Lam., which was certainly, though erroneously, placed under it both by Deshayes and Messrs. Adams.

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[1] Genera Recent Moll., vol. ii, p. 423.
[2] Man. Conchyl., 1862, vol. ii, p. 84.

Römer took no special notice of the "*pinguis* group" in 1857, but in 1864[1] he included the species above mentioned in a group for which he proposed the name *Hemitapes*, without referring to the Messrs. Adams, of whose publication he seems to have been ignorant, as he makes no mention of *Marcia*.

Tryon in 1884[2] seems to have been misled by Chenu, for he cites *V. undulosa* as his sole example of *Marcia* without giving any reason for the selection.

A new departure was made in 1887 by Paul Fischer,[3] who placed *Marcia* under *Tapes*, and gave *V. exalbida*, Chem., as his example, at the same time very properly assigning *V. undulosa* to *Gomphina*. I have not been able to ascertain what led Fischer to select *V. exalbida* out of all the species mentioned by the Messrs. Adams, but anyone referring to his manual will see that it is given as an example only, and is not definitely stated to be the type.

No one else seems to have had occasion to notice or allocate species to the *Marcia* group until 1902, when Dr. W. H. Dall published his Synopsis already mentioned (*ante*, p. 234). In this, postponing discussion of his reasons, he formed a new generic group under the name of *Marcia*, taking *V. exalbida* as the type, but including as subgenera the *Katelysia* and *Hemitapes* of Römer, as well as some assemblages of small fossil shells, but excluding from it the *V. pinguis* and *V. paupercula* group, which was an essential part of the original *Marcia* of the Messrs. Adams.

The reason for this procedure is given by Dr. Dall in his later memoir, and is stated as follows: "Fischer in his Manuel de Conchyliologie cited *Venus exalbida*, Chemnitz (which was included by the Adams brothers in *Marcia*, though it does not agree with their diagnosis, the surface not being smooth), as the type of *Marcia*, and it is probably best to accept this rather than make another change on account of the discrepancy alluded to, which may have been due to the worn condition of their specimen."[4]

The surprising part of this statement is the assertion that Fischer cited *V. exalbida* as the 'type' of *Marcia*. Since this is incorrect, the question at once arises whether Dr. Dall can claim to have fixed the type of *Marcia* or not. If he had definitely selected *V. exalbida* as the type of his genus *Marcia*, with or without reference to Fischer, he would undoubtedly have had a strong claim, but in his own words "he thought it best to accept" Fischer's type, which, as a type, had no real existence.

Feeling, however, that the case was a peculiar one, I wished to obtain the opinion of a competent authority on nomenclature, and I naturally turned to Dr. W. E. Hoyle, who is a member of the Commission of Nomenclature appointed by the International Zoological Congress. He very kindly consented to consider the matter, and eventually sent me the following as his opinion: "It is quite certain

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[1] Malak. Blätt., 1864, vol. xi, pp. 83, 94.
[2] "Structural and Systematic Conchology," vol. iii, p. 177.
[3] Man. de Conchyl., p. 1086.
[4] Trans. Wagner Free Inst. Sc., Philadelphia, 1903, vol. iii, p. 1319.

that Fischer did not fix the type of *Marcia* in the sense of the International rules, and therefore Dr. Dall could not adopt Fischer's type. Further, I think anyone fixing a type must use discretion, and if anyone fixes on a type which is inconsistent with the original definition his action is nullified. For instance, one could not fix a type by drawing lots. This seems to me another good reason for rejecting *exalbida* as type."

Believing, therefore, that I am free to choose another species as the type of *Marcia*, I have no hesitation in selecting *V. pinguis* of Chemnitz as that type, this being one of the small natural assemblages of species to which the majority of those in the Messrs. Adams' list belong. It is also the first species of Römer's second section of *Hemitapes*, that section (*testâ lævi*) being in fact the very assemblage above mentioned, so that my action merely detaches certain species from *Hemitapes* and restores them to *Marcia*. At the same time I agree with Römer in considering the two assemblages to be closely allied, and to be referable to the same genus, but the generic name will be *Marcia*, with *Hemitapes* as a subgenus.

A further consequence of this alteration is that *V. exalbida* remains to be dealt with, but it will be more convenient to do so after giving an account of *Hemitapes* and *Katelysia*.

3. Hemitapes, Römer.

As already mentioned, this name was proposed by Römer in 1864 for a group of shells, some of which had previously been referred to *Tapes* and some to *Chione*. He did not indicate any particular species as a type, but divided the group into two sections or series under the respective headings of (*a*) Testa transversim sulcata, (*b*) Testa lævis.

He then gave a list of the species referable to each subdivision, the first species of the (*a*) series being *T. virginea* (Linn., *non auct.*), with the synonyms *V. flammiculata*, Lam., *V. callipyga*, Lam. (*non* Born), and *V. rimularis*, Lam. From this and from his remarks under the head of *T. edulis* (Chem.) it is evident that he considered the *V. virginea* of Linnæus to be identical with *V. flammiculata*, Lam., and *V. rimularis* to be a variety of the latter.

The first species of his second series (*b*) is *V. pinguis*, Chem., and it is clear that Römer saw no essential difference between the two series, except that of the external surface, a smooth shell in the one and a grooved surface in the other.

A curious mistake was made by Stoliczka in 1871,[1] that of stating that Römer's type of *Hemitapes* was *T. pinguis*, a mistake in which he seems to have been followed by Tryon (1884) and by Fischer (1887), both of whom give *T. pinguis* as their example of *Hemitapes*.

No one seems to have discovered the mistake made by Stoliczka until Dr. Dall studied the Veneridæ in 1902, and then in rectifying the one he only fell into another. In his Synopsis of 1902 a wrong date is given for the establishment of *Hemitapes*, but in his monograph of 1903 the right date and reference are given, and the type is stated

[1] Cret. Fauna S. India, vol. iii, p. 144: Mem. Geol. Surv. India.

to be "*Venus rimularis*, Lam. (as *V. virginea*, L.)." Further, in the text he remarks that "Römer proposed *Hemitapes* for a group typified by *V. rimularis*, Lamarck."

I cannot understand why Dr. Dall made the positive statement that *V. rimularis* was the type of *Hemitapes*, for that name is merely given as a synonym of the first species on Römer's list, and nothing is said by Römer about a type. As already pointed out in the case of *Marcia*, it cannot be maintained that an author determines a type when he erroneously assumes or supposes a type to have been indicated by a previous author. Further, if an error of this kind could be accepted as determinative, then Stoliczka's mistaken belief that *V. pinguis* was the type would have priority of Dr. Dall's mistake.

At the same time, as there is no reason why *V. rimularis*, Lam., should not be taken as the type of *Hemitapes*, and as I do not desire to increase the confusion by selecting any other species, I prefer to take the species which Dr. Dall imagined to be the type, and in order to establish it I merely observe that in my judgment *V. rimularis* is now for the first time properly and definitely determined as the type of *Hemitapes*.

With regard to the second section of Römer's *Hemitapes* (the *pinguis* group), I have already shown that it should bear the name of *Marcia*. I think few conchologists will agree with Dr. Dall that this group should be placed in the genus *Gomphina*; at the same time, there are some other differences between it and the *rimularis* group besides the smoothness of the shell; these are the following:—

The escutcheon of *Marcia* is never defined. The lunule is impressed, but the lunular border of each valve has an outward bulge above the anterior tooth. The hinge-teeth are more widely divergent, the right anterior being parallel to the general trend of the lunular border, not oblique to it; the right posterior is broad and bifid. In the left valve the median and anterior teeth are of nearly the same thickness, and both are grooved.

These differences are hardly of more than sectional or subgeneric value, and *H. variabilis* (Phil.) (= *H. marmorata*, auctorum) seems to be a kind of connecting link between the two groups, so that, as already stated, I regard *Hemitapes* as merely a subdivision of *Marcia*, and am consequently in accord with Römer in this matter.

4. Katelysia, Römer, 1857.

This name was proposed and published in the same year as the *Marcia* of Messrs. Adams, but three months later.[1] Römer's ideas of nomenclature at this time were peculiar; he divided the Linnæan *Venus* into a number of 'subgenera,' which we should now rank as genera, and these subgenera he divided into 'families,' which we should now call sections. In this way he proposed a 'subgenus' *Murcia*, which he again divided into five families, the last of which he named *Katelysia*. The work consists of an introduction, a scheme or tabular view, and a list of species. No types are indicated for any

[1] Krit. Untersuchung der Arten des Moll. Venus, Cassel, 1857.

of his groups, and though in his tabular view he gives in most cases single examples, under *Katelysia* he gives two species, *V. scalarina*, Lam., and *V. exalbida*, Chem., so that it is clear that he meant them all to be taken as examples, not types.

In his later revision of the family[1] he gives a full definition of the group characters in Latin, the part referring to the teeth reading thus: "dentes cardinales valde divergentes, triangulares, obliqui, in valva sinistra dens medianus crassus, bisulcatus, in dextra secundus tertiusque fissi." Moreover, he therein regards *Katelysia* as a 'subgenus' and divides it into three sections, each of which is briefly defined; these sections include the following species:—

§ 1. *K. scalarina*, Lam.; *K. aphrodina*, Lam.; *K. regularis*, Desh.

§ 2. *K. exalbida*, Chem.; *K. lenticularis*, Sow.; *K. quadrangularis*, Ads. & Rve.; *K. tenuilamellata*, Sow.

§ 3. *K. astartoides*, Beck; *K. Creplini*, Dunker; *K. telliniformis*, Phil.

Römer, therefore, did not indicate a type either in 1857 or in 1864, and in this case Dr. Dall does not suppose that he did, but he says that "the first to accept the name was Tryon in 1884, who selected *V. scalarina*, Lam., as type of Römer's group, in which he was followed by Fischer, who changed the name to *Catelysia*."

Whether Tryon can be said to have selected *V. scalarina* as the type or not, it is the species which should be so regarded; and as Dr. Dall accepted it in 1903, I definitely adopt it as the type of a restricted *Katelysia* group, corresponding to the first section of Römer's *Katelysia* of 1864.

It will be noticed that the second section of Römer's *Katelysia* is what may be called the *exalbida* group, for everyone admits that the three species *exalbida*, *lenticularis*, and *quadrangularis* are closely allied. *V. tenuilamellata*, however, must be excluded, as it was based on a shell which is probably a young specimen of *V. Campechiensis*, Gmelin.

When Dr. Dall in 1902 created a genus *Marcia*, with *V. exalbida* as type, he made *Katelysia* a subgenus of it, and placed the species *quadrangularis* and *lenticularis* under the latter as a separate section with the new name of *Samarangia*.[2] His reason for separating these species from *exalbida* seems to have been that he imagined the latter to have four cardinal teeth in the right valve, while he credited the others with the normal number of three.

I have only been able to examine one specimen of *V. exalbida*, which was kindly lent to me by Mr. J. J. MacAndrew, and in this there is nothing but a slight ridge at the base of the nymph, just as there is in *V. lenticularis* and in many other shells, such as *Gomphina donacina* and in several species of *Chione*, especially *Ch. Gnidia* and *Ch. amathusia*. Dr. Dall himself observes that "in a few of the larger species [of *Chione*] a feeble fourth cardinal is sometimes present below the ligament," but he does not for that reason propose to separate these species as a distinct section of *Chione*; why, therefore, should *V. exalbida*

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[1] Malak. Blätt., 1864, p. 169.

[2] Proc. U.S. Nat. Mus., 1902, vol. xxvi, p. 361.

be separated from *lenticularis* and *quadrangularis* merely because there is sometimes a stronger ridge in this place than the other species exhibit?

In all the essential characters of sculpture, strength of hinge-plate, shape of teeth, and pallial sinus *V. exalbida* differs from *Katelysia* proper, and agrees with *V. lenticularis*. More particularly they agree in having only one grooved tooth in each valve, the posterior right and the median left, both the median right and the anterior left being narrow, entire, tall, and sharp, though at the same time slightly rugose.

There is nothing whatever in *V. exalbida* to afford any ground for separating it from *V. lenticularis*; consequently I place it in Dr. Dall's *Samarangia*, and adopt that name for a group which is practically the second section of Römer's *Katelysia*. The hinge of these shells is not that of *Marcia*, and I think they must be regarded as forming a distinct genus. With them, however, I am inclined to place the Eocene fossils which were first separated by M. Cossmann in 1886,[1] and now bear the name of *Mercimonia* (Dall, 1902). These shells also have two entire teeth in each valve, and the left median has a ledge on the anterior side which seems to correspond with the laterally grooved tooth in the left valve of *Samarangia*.

In his description of the American Veneridæ Dr. Dall places two other recent species in the restricted section of his genus '*Marcia*' along with *V. exalbida*.[2] These are *V. Kennerleyi*, Carpenter in Reeve, and *V. rufa*, Lam., better known as *V. opaca*, Sow. I have not been able to obtain or see a specimen of the former, so cannot discuss it, but I have examined *V. rufa*, which is a thick oval shell having many of the characteristics of *Samarangia*, but a somewhat different hinge. The posterior part of the hinge-plate is deeply excavated, so that in the right valve the posterior cardinal is very short, being abruptly truncated by the border of the plate; in the left valve also there is a similar abbreviation of the plate, so that both the posterior and median teeth are short, the latter being grooved in the middle, not at the side. These differences seem to be at least of sectional importance, but at present I refrain from proposing a new name for this single species.

Another shell which looks from Dr. Dall's figure as if it might belong to *Samarangia* is that described by him as *Clementia solida* (op. cit., p. 401). Its hinge differs considerably from that of *Clementia*, and seems to resemble that of *V. exalbida*.

II. Systematic Definition of the Groups.

Having completed the analytical part of my enquiry into the history and characters of these shell-groups, I come now to the synthetical part, i.e., that of estimating their relative taxonomic value, and of compiling descriptive definitions of the genera and their subdivisions.

In the first place, however, something should be said about the mollusca to which the shells serve as coverings, and it is to be regretted

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[1] Ann. Soc. Roy. Malac. Belge, vol. xxi, p. 106.
[2] Proc. U.S. Nat. Mus., 1902, vol. xxvi, pp. 396, 397.

that so little is yet known about the animals of the numerous genera and subgenera of the Veneridæ. I cannot, indeed, find that anyone has described the animal of any single species belonging to the groups I have been dealing with. Under the head of '*Marcia*,' and consequently referring inclusively to *Samarangia*, *Katelysia*, and *Hemitapes*, Dr. Dall says "the soft parts appear to be unknown." It is therefore with much pleasure that I am able to record some notes on the animals of three different species belonging to the *Marcia* group. These are—a specimen of *Hemitapes variabilis* (Phil.) sent me by Lieut. H. S. Brown from the neighbourhood of Mangalore, south-west of India, and one each of *Katelysia scalarina* (Lam.) and *K. corrugata* (Lam.), sent by Dr. J. C. Verco, of Adelaide, South Australia.

Hemitapes variabilis (Phil.). Mantle widely open, with smooth thickened margins, the medial lamina of which is slightly undulating in the spirit-preserved specimen, but is not frilled, nor has it any filaments at the anterior end. The siphons are very short, but are entirely separate. The foot is deep and laterally compressed, but elongate from anterior to posterior end, so as to be hatchet-shaped.

The shell of this specimen belongs to the var. *orientalis*, Reeve. I regard *H. marmorata* (auctorum, but ? Lam.), *H. laterisulca* (Lam.), and *H. ustulata* (Desh.) as mere varieties of *H. variabilis* (Phil.).

Katelysia scalarina (Lam.). The mantle of this has smooth margins. The siphons are short, divergent, and separate, but united at the base; the lower one is thick, tough, and papillose at the end. The foot is large, thick above, but compressed below, and elongated anteriorly.

Katelysia corrugata (Lam.). The mantle and foot as in *K. scalarina*. The two siphons are better preserved in this specimen, are clearly quite separate, though very short, and both the orifices are papillose.

From the above descriptions it will be seen that all three species agree in having smooth mantle-margins, short, separate siphons, and a large compressed elongate foot. Consequently the inference drawn from a study of the shells that they should be placed in the same genus is confirmed by examination of the animals.

As already stated, however, I think that *Gomphina* and *Samarangia* are generically distinct from the *Marcia-Katelysia* group, and consequently believe that three genera must be recognized. The following are descriptive definitions of the genera and their subdivisions, so far as the shells are concerned.

Genus GOMPHINA, Mörch, 1853.

Generic characters.—Shell trigonal, rather thick, compressed, smooth, or concentrically striated. Lunule long, narrow, superficial, and feebly circumscribed; escutcheon not defined; ligament very short. Margins of valves smooth; dorsal margins of both valves grooved on both sides of the hinge-plate to receive the opposing edges. Pallial sinus small and rounded.

Hinge-plate short, broad from the umbo inwards, triangular. Teeth, three cardinals in each valve; rather long, straight, separate, widely and equally divergent. In the right valve the median is broad and triangular, generally solid, the posterior narrow and feebly grooved. In the left valve the anterior is very long, the median thick and feebly grooved, the posterior very thin. The left anterior and the right median are sometimes feebly grooved.

Gomphina, s.s.

Type, *Venus donacina*, Chem.

Shell nearly equilateral, smooth or nearly so, right nymph and left posterior tooth bearing one or two ridges in *donacina*, and having a rugose surface in *G. undulosa*. Pedal scar separate from that of the anterior adductor.

Species.—G. donacina, Chem., with vars. *æquilatera*, *melanægis*; *G. undulosa*, Lam. (= *V. variabilis*, Sow., *non* Phil.).

Liocyma, Dall.

Subgenus. Type, *Venus fluctuosa*, Gould.

Shell ovate-trigonal, inequilateral, concentrically grooved, with a bright vernicose periostracum. Nymphs and teeth smooth. The grooving of the teeth very feeble and sometimes obsolete. Pedal scar not quite separated from the adductor.

Species.—G. (*Liocyma*) *fluctuosa*, Gould (= *V. astartoides*, Phil.); *G.* (*L.*) *Becki*, Dall (North Japan and Alaska); *G.* (*L.*) *viridis*, Dall (North Japan and Alaska); *G.* (*L.*) *Scammoni*, Dall (British Columbia).

Genus MARCIA, Adams, 1857.

Generic characters.—Shell oval, oblong or subtrigonal, inequilateral, smooth, or concentrically striated. Lunule defined and circumscribed, escutcheon not defined, except by absence of sculpture when that is present. Margins of valves smooth. Pallial sinus short or moderately deep, but always rounded. Anterior left and posterior right dorsal margins grooved to receive edge of opposite valve. Hinge-plate short and rather small. Teeth, three in each valve, fairly strong, divergent, and nearly equidistant. In right valve the posterior and median are both bifid or grooved; in the left only the median is bifid, but the anterior is sometimes feebly grooved. The posterior left cardinal and the right nymph bear fine linear riblets, and frequently all the teeth are more or less rugose. The pedal scar is always separate from the anterior adductor.

Marcia, Adams, s.s.

Type, *Venus pinguis*, Chem.

Shell oval or oblong, tumid, sometimes attenuated posteriorly, always smooth with a vernicose periostracum. Lunule impressed, but convex above the anterior teeth. Escutcheon depressed, but not defined. Pallial sinus often extending to centre of valve. Teeth slender and widely divergent; the right median narrow, the left median thick, the one grooved, the other bifid.

Species.—M. pinguis, Chem. (including the vars. *Ceylonensis*, Sow., *triradiata*, Chem., and *nebulosa*, Chem.); *M. paupercula*, Chem. (with vars. *Kochi*, Phil., *ambigua*, Desh., and *Kraussi*, Desh.); ? *M. interrupta*, Koch (Indian Ocean); *M. fumigata*, Sow. (= *lævigata*, Sow.), Australia.

Katelysia, Römer, 1857.

Subgenus. Type, *Venus scalarina*, Lam.

Shell obliquely oval, rather compressed, anterior side short; sculpture consisting of strong concentric ridges or riblets, which are sometimes corrugated by radial striæ. Pallial sinus very small. Hinge-plate short, triangular; teeth nearly straight, upper surfaces of all more or less rugose, median in each valve stout and bifid.

Species.—*K. scalarina*, Lam.; *K. strigosa*, Lam. (= *K. corrugata*, Lam., ? *non* Gmel.); *K. Peronii*, Lam. (?= *aphrodina*, Lam.); *K. regularis*, Desh.

Hemitapes, Römer, 1864.

Subgenus. Type, *V. rimularis*, Lam.

Shell oval or subtrigonal, tumid, with irregular concentric sculpture, or flat ribs and grooves. Escutcheon defined by absence of sculpture, and sometimes by a slight keel. Pallial sinus fairly deep. Hinge-plate small; teeth all short; in right valve the posterior is narrow, curved, and grooved; the median narrow, tall, and grooved; in the left valve the anterior is narrow, but the median is thick and bifid.

Species.—*H. rimularis*, Lam.; *H. flammiculata*, Lam. (= *hiantina*, Lam.); *H. tristis*, Lam.; *H. striata*, Chem. (= *vermiculosa*, Lam., *aurisiaca*, Gray, and *Labuana*, A. Ad. & Reeve); *H. Philippi*, Desh.; *H. cor*, Sow.; *H. variabilis*, Phil. (= *marmorata*, Lam.?, *laterisulca*, Lam., *orientalis*, Desh., *ustulata*, Desh., and *recens*, Sow. *non* Chem.); *H. flammea*, Gmel. (= *radiata*, Chem. and Desh.); *H. recens*, Chem. (and of Wood and Hanley, but not of Sow.).

Genus SAMARANGIA, Dall, 1902.

Generic characters.—Shell oval or subquadrate, inequilateral, with prominent curved umbones, solid, white with a dull surface, concentrically striate or lamellose. Lunule circumscribed, escutcheon not defined; ligament long and thick. Margins smooth. Pallial sinus moderate, angular. Hinge-plate deep and strong, with a flat or concave space in front of the anterior tooth in each valve. Teeth, 3–3, divergent, and unequal in size, only the right posterior and sometimes the left median being grooved. Pedal scar merging more or less into that of the adductor.

Samarangia, s.s.

Type, *V. quadrangularis*, A. Ad. & Reeve.

Shell large, thick, subquadrate, rounded. Lunule flat, impressed, and clearly circumscribed. Nymphs deep, that of right valve sometimes having a ridge or riblet at the base. In right valve the posterior cardinal is strong and bifid, the median long, narrow, entire, and not reaching to top of hinge-plate, the anterior short and small. In the left valve the anterior and median are united at the top so as to fit over the right median. Pallial sinus fairly deep, horizontal.

Species.—*S. quadrangularis*, A. Ad. & Reeve; *S. exalbida*, Chem.; *S. lenticularis*, Sow.; ? *S. Kennerleyi*, Reeve; ? *S. rufa*, Lam. (= *V. opaca*, Sow.).

MERCIMONIA, Dall, 1902 (= *Mercenaria*, Cossmann, 1886).

Subgenus. Type, *V. Bernayi*, Cossm. Eocene of France.

Shell small, oval, tumid. Lunule superficial and feebly circumscribed. Teeth in right valve like those of *Samarangia*, but the median is stouter and semi-triangular; in left valve the teeth are all entire, the median being thick and having a narrow shelf on the anterior side. Pallial sinus rather short, angular; sometimes obsolete.

Species.—*M. Bernayi*, Cossm.; *M. cythereæformis*, Desh.; *M. inopinata*, Desh.; *M. delicatula*, Desh.; and possibly some other species.

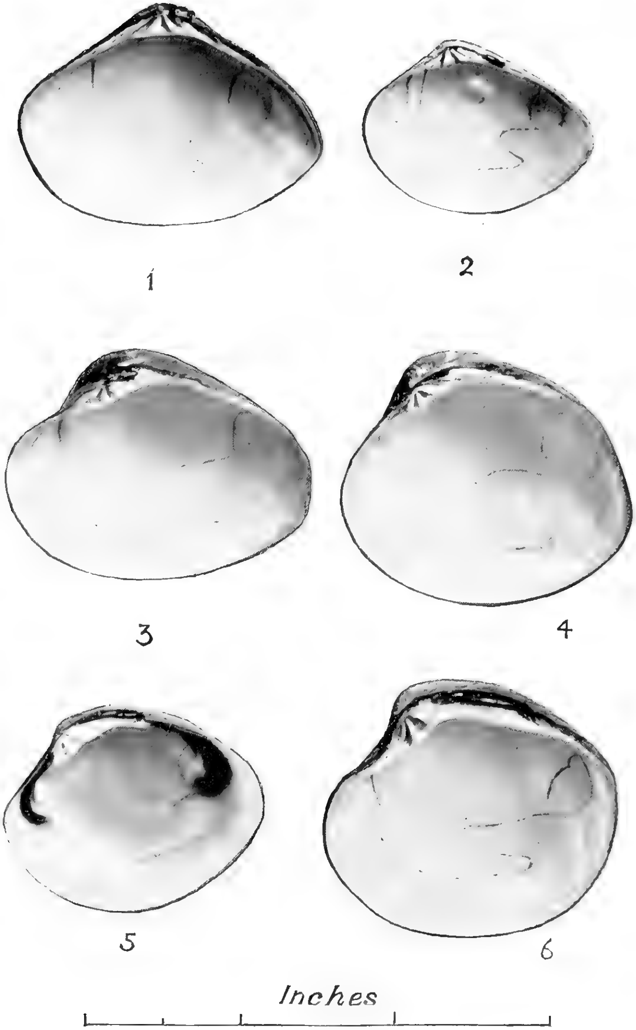
In conclusion, I desire to thank many friends and correspondents for their kind assistance in various ways, especially Dr. W. E. Hoyle, Dr. J. C. Verco, Mr. E. A. Smith, Mr. J. J. MacAndrew, Dr. J. C. Melvill, and Mr. R. H. Burne.

EXPLANATION OF PLATE X.

FIG.

1. *Gomphina donacina* (Chem.).
2. *G.* (*Liocyma*) *fluctuosa* (Gould).
3. *Marcia pinguis* (Chem.).
4. *M.* (*Hemitapes*) *rimularis* (Lam.).
5. *M.* (*Katelysia*) *corrugata* (Lam.).
6. *Samarangia lenticularis* (Sow.).

All the figures are reduced to about four-fifths of the natural size.



RIGHT VALVES OF SOME FORMS OF VENERIDÆ.

HOLOCENE AND RECENT NON-MARINE MOLLUSCA FROM THE NEIGHBOURHOOD OF PERRANZABULOE.

By Rev. R. Ashington Bullen, B.A., F.L.S., F.G.S., F.R.A.I.

Read 8th January, 1909.

The following paper is work which my friend Mr. B. B. Woodward has wanted done for some time past. My opportunity came in November last, and, had the weather been more favourable, the result would have been probably more important.

The Church of Perranzabuloe was unearthed by storms in 1835, after being buried by 'blown sand' for nearly twelve centuries. The place was at once raided for building material and architectural relics, some of which are now in Truro Museum (Royal Institution of Cornwall). The ruins would give a date for anything of the nature of a Holocene deposit, but unfortunately there is none available for examination in the immediate vicinity. There were evidences for kitchen middens near it, as broken marine shells occur at a level 200 feet o.d. I found *Cardium rusticum* and broken fragments of *Mytilus edulis* near, and there were quantities found in 1835, supposed to be St. Piran's waste-heaps, but probably much older, if other evidences yet to be examined are found to belong to the late Bronze or early Iron age. Most of this shell deposit has been carted off by farmers as a fertilizer. The moss is very thick and wet on the lofty slopes of the hollow in which the ancient church lies, affording a suitable habitat for the species of Mollusca that are most moisture-loving.

The rediscovered church is about half a mile from the sea-cliffs, from which it is separated by deposits of shell-sand from 50 to probably 70 or 80 feet in depth, although as the sand dunes are deposited on the varying contours of the underlying Lower Devonian rocks, it is somewhat difficult to estimate their depth.

One of the most interesting points about the work has been the discovery of an old lacustrine deposit in which the Mollusca have been almost entirely of fresh-water species, with the exception of some examples of *Helix aspersa* and *Helicella virgata*, which may mark the former edge of the water, but this is not yet certain; they seem to have been blown into the water and then sunk to the bottom.

The shells indicated belong to a deposit formed on the bed of a shallow lake at about 200 o.d., which deposit overlies evenly stratified shell-sand, beneath which lies the slate rock. This stratified shell-sand is about 3 feet above the present surface, where it has been left, but unfortunately much of the deposit with its most valuable shell-evidence has been removed, and only the indurated sand has been left scattered about the site of the lake. This lacustrine deposit underlies part of the dunes of blown sand, which is 40 or 50 feet in thickness hereabout. The stormy wind fortunately scoops out crater-like hollows in the looser sand, and exposes the lacustrine deposit at the bottom of the 'crater.'

H. aspersa, next to *Helicella barbara*, is the most noticeably abundant species. A large proportion have the light-brown periostracum so peculiar in Iberian specimens. *H. nemoralis* is not relatively so abundant and does not occur at the 200-foot level, but seems confined to some 'brambly' dunes at a level about 50 or 60 feet higher. There are very many thrush-killed *H. aspersa* and *H. nemoralis* lying on the surface here. *H. barbara* is abundant everywhere. The local name for these snails is 'sugar-loaves.' Mr. B. B. Woodward's *Helix nemoralis* zone, above the rubble-drift, occurs at the north cliff of Perranporth, overlain with many feet (4 to 7) of blown sand, in which *H. barbara* is abundant. Further work is needed round the coast-sections. Large specimens of the normal variety of *Arion ater* occur on the south cliff of Perranporth. A brown slug also occurred on the Re Sands, probably *Limax fulva*. The lacustrine Limnæas seem to contain very dwarfed forms of *Limnæa stagnalis* and *L. truncatula*, but some of the forms are so strangely unlike any modern Limnæas that they may be undescribed, or if not, certainly abnormal, species. The dwarfing of the species may be due to saline conditions, as Mr. B. B. Woodward suggests. It may be due to colder conditions than now obtain, just as the dwarfing of Canadian specimens of *L. jugularis* (identical with *L. stagnalis*) undoubtedly is. If further work proves this latter supposition to be correct, it will corroborate Mr. B. B. Woodward's most important paper in the Geological Magazine last year[1] as to the evidence of glacial conditions round Newquay, of which district Perranzabuloe and Perranporth are parts.

I. Holocene.

A.—The shells which I found in the walls of the ruined church were *Vitrea radiatula*, *Limax flavus*, *Limnæa pereger* (dwarfed form).

B.—(i) Those from the lacustrine area were—

Limnæa truncatula.
L. sp. (*a*), narrower and more elongated than *pereger*.
L. sp. (*b*), narrower and straighter than *pereger*.
L. stagnalis. Dwarf specimens.
L. pereger.
L. sp. (*c*), may be an abnormal *L. pereger*.
Helix aspersa. Undoubtedly belonging to this deposit, as they are in the same sub-fossil state.
H. nemoralis. All specimens from 200-foot level, stained with iron oxide, and with a thicker shell than recent specimens.
Helicella virgata. Two specimens (same remark as above as to their state, v. *H. aspersa*).

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1 "Drift and Underlying Deposits at Newquay, Cornwall": Geol. Mag., N.S., dec. v, vol. v, January and February, 1908.

(ii) From the small piece of lacustrine deposit remaining in the 'sand crater' west of above deposit I obtained—

Limnæa truncatula (smaller dwarf form).

L. sp. (*d*); this may be *truncatula*, but has no umbilicus and no reflexion of the columella as is usual in that species.

(iii) From the perpendicular section of stratified sand, and below the level of the small remnant of lacustrine deposit here at about 10 feet away to the eastward, I obtained at a depth of 4 to 7 feet—

Helicella barbara.
Vallonia pulchella.
V. excentrica.
Helix nemoralis (young).
H. aspersa (young).
Cochlicopa lubrica.
Jaminia muscorum.
J. cylindracea.
Limnæa pereger (young and very small).

C.—Recent shells or live specimens found in various parts were—

Vitrea radiatula. At foot of marram grass in 'crater.'
V. alliaria. Ditto.
Arion ater. Cliffs at Perranporth.
Helix aspersa. *Passim.*
H. nemoralis. In one spot only, 250 feet O.D.
Vallonia pulchella. Same habitat as *V. radiatula.*
V. excentrica. Ditto.
Helicella caperata. *Passim.*
H. virgata. *Passim.*
H. itala. *Passim.*
Jaminia cylindracea. At foot of marram grass in 'crater.'
J. muscorum. Ditto.
Cochlicopa lubrica. Not abundant.
Vertigo pygmæa.
Succinea elegans.
S. sp. (may be *S. oblonga*).
Limnæa (probably *truncatula*, dwarf form). Abundant among marram grass in 'crater.'

From the condition of some of these shells and the probable mixing up of Holocene and recent specimens by the action of the wind, it may be found that some of the shells in this list are not recent, though provisionally put therein. The fragment of lacustrine deposit at the base of the 'crater' is undoubtedly being destroyed by the wind, which cuts away the softer underlying sand and so causes the projecting shelf of lacustrine deposit to break off, very much as the recession of Niagara Falls is brought about by water action. The shells get detached from their matrix, and are then whirled up the sand-slope until stopped by the line of marram grass. Here the shells can be scooped up in thousands and examined afterwards at leisure.

TABLE OF SPECIES.

	Cliffs, Perranporth.	St. Piran's Church (650 A.D. buried up).	Lacustrine deposit (Holocene).	Holocene Land Shells.	Recent.
Arion ater, Linn.	–	–	–	–	* [1]
Vitrea radiatula, Alder	–	–	–	–	*
V. alliaria, Müll.	–	–	–	–	*
Vallonia pulchella, Müll.	–	–	–	*	–
V. excentrica	–	–	–	*	–
Cochlicopa lubrica, Müll.	–	–	–	*	*
Helicella itala, Linn.	–	–	–	*	*
H. caperata, Mont.	–	–	–	–	*
H. virgata, Da C.	–	–	*	–	*
H. barbara	*	–	–	*	*
Jaminia cylindracea, Da C.	–	–	–	*	*
J. muscorum, Linn.	–	–	–	*	*
Vertigo pygmæa, Drap.	–	–	–	–	*
Helix aspersa, Müll.	–	–	*	*	*
H. nemoralis, Linn.	*	–	*	*	*
Limnæa sp.	–	–	–	–	–
L. truncatula, Müll.	–	–	*	–	–
L. pereger, Müll.	–	–	*	*	–
L. sp. (*a*)	–	–	*	–	–
L. sp. (*b*)	–	–	*	–	–
L. sp. (*c*)	–	–	*	–	–
L. sp. (*d*)	–	–	*	–	–
Succinea elegans, Risso	–	–	–	–	*
S. sp.	–	–	–	–	*

Marine shells at 200 feet O.D.:

Cardium rusticum. Near St. Piran's Church.
Purpura lapillus. Edge of lacustrine deposit.
Mytilus edulis. Near St. Piran's Church.

It is my pleasant duty to thank Messrs. B. B. Woodward and A. Santer Kennard for help in determining critical species. They both think some of the fresh-water specimens require further study.

[1] Perranporth South Cliff.

FURTHER DATA ON POLI'S GENERIC NAMES.

By Dr. William Healey Dall.

Read 8th January, 1909.

I was interested to read the article on Poli and his nomenclature by Mr. Jukes-Browne in the June issue of the Proceedings of the Society. With his general conclusions I am in full agreement. The question whether Poli used a binomial or Linnæan system of nomenclature can only be answered in the negative, and consequently his names, as such, have only an historical value. They remained available for any binomialist who might choose to validate them, and take date only from such validation. By this I do not mean that a mere reference to a name of Poli would suffice, unless it was made evident that the author had the intention of adopting it binomially.

Mr. Jukes-Browne cites seven of Poli's names which "have been used conchologically" by subsequent authors, by which I understand him to mean that they have been adopted in preference to other names by those authors. He is, however, in error in supposing that I desire to reject or have rejected any names properly proposed which had previously been used by Poli. If he had carried his investigations a little further he would have found that, on the contrary, I had accepted such names, or at least two of them. Let us examine these names in the order Mr. Jukes-Browne has cited them.

(1) *Peronæa* was adopted by Mörch in 1853 (Yoldi Catalogue, pt. ii, p. 12), but Albers had used *Peronæus* for a land shell in 1850; *Peronea*, Curtis, and *Peronia*, Blainville, date from 1824, and *Peronia*, Desvoidy, from 1830. The two latter are of different derivation, but near enough to be confusing. The existence of Albers' name is sufficient, according to present usage, to make a new name necessary for the *Peronæa*, Mörch; for which accordingly I proposed *Peronidia*.

(2) *Callista* was used by Leach (published by Gray in 1852) for a group of Veneridæ, distinct from that for which Poli had used it, and which had been named *Clausina* by Brown in 1827. *Callista* is therefore a synonym of *Clausina*. The different application of *Callista* by Mörch in the Polian sense in 1853 was therefore futile.

(3) *Arthemis* was validated by Oken in 1815, but *Dosinia*, Scopoli, antedated *Arthemis* by thirty-three years.

(4) *Loripes* was validated by Cuvier in 1817, and I have adopted it in my Synopsis of the Lucinacea, 1901, p. 803.

(5) *Glossus* was validated by Oken in 1815, but *Isocardia*, Lamarck, antedates the validation by fifteen years.

(6) *Argus* had been validated by Bohadsch, 1761, and Scopoli, 1777, before Poli took it up in 1795.

(7) *Axinæa* when proposed by Poli in 1791 was already named *Glycymeris* by Da Costa, in 1778, with the type of *Arca glycymeris*, Linné.

Of the names for the shells, as distinguished from the animals, *Daphnoderma* was proposed by Mörch for *Arca Domingensis*, Lamarck, in 1853 (op. cit., p. 40). Poli's name was *Daphnæoderma*. This group had already been called *Acar* by Gray in 1847.

Peronæoderma was proposed by Mörch in 1853 for *Tellina polita*, Poli, and other not congruous species. If adopted, it is probable this should supersede the later *Eurytellina*, Fischer, 1887.

Cerastoderma, Mörch, 1853, based on *Cardium edule* and allied species, was adopted by me in my Synopsis of the Cardiidæ, 1900.

Poli, considering the appliances available at his period, was a remarkable anatomist, and relied much more on his detailed engravings to indicate his discoveries than on his text. As the former preceptor of the reigning monarch, he occupied a position in his community analogous to that which Steenstrup held for many years in Copenhagen. Funds for his profusely detailed anatomical copper-plates were always at his disposal, and a careful study of them for the anatomy of Mediterranean molluscs will often reveal facts not recorded in the manuals of the present day. The third part of his work was posthumously issued in 1826–7 by Della Chiaje.

The only disciple in his nomenclatural system I have noted is Duméril, in 1806, who modified it by adding *arius* to the generic name of the shell to denote the animal; *Pleurotomarius* being intended for the animal of *Pleurotoma*, etc. The superiority of the Linnæan system, however, gave these methods no chance of survival.

DESCRIPTIONS OF NEW SPECIES AND SUBSPECIES OF NEW ZEALAND MOLLUSCA, WITH NOTES ON A FEW SPECIES.

By Henry Suter.

Read 8th January, 1909.

PLATE XI.

Rissoina zonata, n.sp. Pl. XI, Fig. 1.

Shell rather large, oblong, imperforate, indistinctly axially costate and minutely spirally lirate, body-whorl usually with a brown zone. Sculpture consisting of somewhat indistinct axial riblets, about fourteen on a whorl, and very fine microscopic spiral striæ. Colour white, usually with a chestnut spiral band, beginning narrowly on the penultimate whorl above the suture, and broadening very rapidly on the body-whorl, but leaving the base white. Spire high, about twice the height of the aperture; outlines somewhat convex. Protoconch with a flat nucleus. Whorls about 7, very lightly convex and somewhat flattened below the suture; base flattish. Suture not much impressed. Aperture oblique, semicircular, angled above, channelled below. Outer and basal lip regularly arched, thick, with a rounded edge. Columella very short, slightly twisted and turned to the left, forming a distinct short channel with the slightly effuse basal lip; inner lip very thick, connecting the margins over the slightly excavated parietal wall. Operculum unknown.

Diam. 4·5, height 11·5 mm. Type.
,, 5 ,, 10·5 ,,

Hab.—Bay of Islands (Mr. J. C. Anderson).

All the specimens at my disposal are beach-worn, and the axial sculpture is mostly effaced. Type in my collection.

Skenella Pfefferi, n.sp. Pl. XI, Fig. 2.

Shell minute, globosely depressed, thin, pellucid, smooth, shining, umbilicated. There is no sculpture. The colour is amber on the first two whorls, light horn on the last. Epidermis very thin, yellowish, slightly polished. Spire conoidal, very low, convex, its height about one-third that of the aperture. Protoconch flatly convex, rather large. Whorls $2\frac{3}{4}$ to 3, rapidly increasing, convex, the last not descending, ample, with a regularly rounded periphery; base flattish, angled around the umbilicus. Suture deep. Aperture large, subcircular. Peristome convex, sharp, thin. Columella vertical, lightly arcuate; inner lip slightly callous and reflexed, spreading as a distinct callosity over the convex parietal wall. Umbilicus open, about one-sixth of the diameter. Operculum thin, almost colourless, sub-spiral, excentric, the nucleus near the margin, with an elongated, subvertical inner process. Diam. ·8, height ·45 millim.

Hab.—Te Onepoto, near Lyttelton; type (H. S.). Lyall Bay (Miss Mestayer).

I have much pleasure in uniting the name of the distinguished conchologist, Professor Dr. Georg Pfeffer, of Hamburg, with this species.

It is nearly allied to *S. Georgiana*, Pfeffer, from South Georgia, but is much smaller, the spire more depressed, the parietal callus not so strong, and the aperture not semicircular. Type in my collection.

TROPHON (KALYDON) AUCKLANDICUS (E. A. Smith). Pl. XI, Figs. 3, 4.

Euthria Aucklandica, E. A. Smith: Voy. "Southern Cross," Moll., 1902, p. 203, pl. xxiv, figs. 12, 13.

It has been my good fortune to get a specimen with the animal from the Auckland Islands, kindly collected by Captain J. Bollons. The operculum (Fig. 3), with sub-apical nucleus, is muricoid, and the teeth of the radula (Fig. 4) are those of *Trophon*.

The species has also been found at Campbell Island and Preservation Inlet, South Island of New Zealand.

DRUPA BOLLONSI (Suter). Pl. XI, Figs. 5–7.

Purpura striata Bollonsi, Suter: Trans. N. Zeal. Inst., 1905 (1906), vol. xxxviii, p. 331.

Shell (Fig. 5) rather small, ovate, solid, white, with nodulous cingula. Sculpture consisting of strong, somewhat unequal, flatly convex spiral ribs, three on the penultimate and seven on the body-whorl, generally composed of four to six fine spiral threads, the interstices usually a little narrower than the ribs, containing sometimes a fine spiral thread; the cingula are cut up by more or less deep axial sulci into distinct nodules; growth-lines close, oblique, lamellar, reticulating the fine spiral sculpture. Fasciole distinct, lamellar, leaving a deep groove between it and the inner lip. Colour yellowish-white, aperture white within, the outer lip sometimes yellowish or light purple. Spire conic, very variable in height, mostly a little less than the height of the aperture. Protoconch minute. Whorls about 6, flatly convex on the spire, the body-whorl usually more convex, contracted above the fasciole. Suture well impressed. Aperture subvertical, ovate, channelled above, produced below into a short, open, and deeply notched canal. Outer lip convex, crenulate, much thickened inside, very strongly dentate-lirate. Columella subvertical, almost straight, twisted and tapering below; inner lip moderately broad, very broadly extended over the somewhat concave parietal wall, which bears a small tubercle below the suture; with three transverse median folds, excavated below, with a free edge bending over the groove margining the fasciole. Operculum (Fig. 6) with the nucleus lateral.

Diam. 19, height 32 mm. Largest specimen, 6 whorls.
,, 16, ,, 22 ,, Small ,, 6 ,,

Dentition (Fig. 7): central tooth with a long simple median cusp, followed on each side by a quadridentate cusp, with the median tooth large, the inner denticle much smaller, and the outer two minute; towards the margin there are on each side four small denticles, the distal one a little larger.

Hab. — L'Espérance or French Rock, Kermadec Islands; type (Captain J. Bollons). Bay of Islands (J. C. Anderson). Type in my collection.

TEREBRA TRISTIS, Desh., n.subsp. CRASSICOSTATA.

Distinguished from the species by the following characters: the shell is much smaller, the axial costæ are stouter, broadly rounded, of the same width as the interstices; fine spiral liræ are also present. Colour yellowish-white, a light-brown band below the suture, and a white band below the periphery arising from the suture; base fulvous. Diam. 3·5, height 10 mm.

Hab.—Lyall Bay (Miss Mestayer). Type in my collection.

TEREBRA FLEXICOSTATA, n.sp. Pl. XI, Fig. 8.

Shell subulate, axially flexuously plicate, shining, brown, with a pale band below the suture. Sculpture consisting of irregularly spaced, flexuous, flatly rounded axial plications, obsolete on the body-whorl, the interstices with fine growth-lines; indistinct, fine, microscopic, spiral striæ are present. Colour fulvous or flamed with fulvous and white, a light-brown or white band below the suture, no peripheral band on the body-whorl. Spire high, angle about 20°. Protoconch smooth, conical. Whorls about 10, first slowly, then more rapidly increasing, very flatly convex; base rounded, somewhat contracted above the basal rib. Suture impressed. Aperture subvertical, narrowly oval, with a short and rather narrow canal, narrowly notched below. Outer lip broadly convex, sharp. Columella subvertical, lightly convex, narrowly drawn out to a point at the base of the canal, somewhat excavated on joining the flat parietal wall above; inner lip thin and narrow. Operculum unknown. Diam. 5, height 18·5 mm.

Hab.—Cape Maria van Diemen (Captain J. Bollons); Port Waikato (Webster).

The *T. venosa*, Hinds, reported as having been found at Cape Maria van Diemen and Port Waikato by Webster (Trans. N.Z. Inst., xxxvii, p. 280), is no doubt this species; it is allied to the Australian *T. Brazieri*, Angas, but the whorls are flatter, the riblets straighter, and the spire is more slowly tapering. Type in my collection.

TORNATINA BIPLICATA, n.sp. Pl. XI, Fig. 9.

Shell small, cylindrical, mucronate, thin, smooth, with a sharp columellar plait and a broadly rounded fold below it. Sculpture: the perfectly smooth surface shows only indistinct growth-lines. Colour white. Spire slightly depressed, the nucleus raised above the level of the body-whorl. Protoconch papillary, rather small, tilted. Whorls 4, sharply angled above, the last sub-cylindrical, slightly descending; base rounded. Suture channelled. Aperture vertical, very narrow above, much widened below. Outer lip thin, sharp, considerably arched forward at the middle, convex above and at base. Columella with a very oblique, narrow, and sharp plait at the junction with the parietal wall, twisted below, forming a very distinct, broadly rounded fold; inner lip spreading narrowly and thinly over the lightly convex parietal wall. Diam. 2, height 3·8 mm.

Hab.—Lyall Bay, Cook Strait (A. Hamilton). Type in my collection.

TORNATINA CHARLOTTÆ, n.sp. Pl. XI, Fig. 10.

Shell small, oblong, thin, smooth, with projecting nucleus and distinct columellar fold. Sculpture consisting of fine, curved growth-lines only. Colour white. Spire depressed, almost flat, the nucleus only rising above the last whorl. Protoconch papillary, tilted, sinistral. Whorls 4, angled above, the last nearly as high as the shell, angularly rounded above, slightly narrowed at the base, sides straight. Suture channelled. Aperture high, narrow above, widened below. Outer lip thin and sharp, its edge arched forward at the middle, narrowly convex above, broadly and regularly rounded at the base. Columella vertical, slightly arcuate, with a distinct broad fold below, which has a slightly impressed median groove; at the junction with the parietal wall a blunt angle is formed; inner lip thin, indistinct. Diam. 1·6, height 3·1 mm.

Hab.—Queen Charlotte Sound, in 16 fathoms (Captain J. Bollons). Type in my collection.

TORNATINA COOKIANA, n.sp. Pl. XI, Fig. 11.

Shell small, oblong, with slightly raised spire, thin, white, smooth. Sculpture consisting of very fine dense growth-lines only. Colour white. Spire raised, conoidal, one-fifth to one-sixth the height of the aperture. Protoconch papillary, tilted, sinistral. Whorls 3½, slowly increasing and descending, sharply angled above, the last very high, cylindrical, rounded at the base. Suture channelled. Aperture high, narrow above, considerably widened below. Outer lip moderately strong, sharp, narrowly rounded above, regularly convex below, the median part of the edge arched forward. Columella short, oblique, with a slight fold, forming no distinct angle at the junction with the lightly convex parietal wall; inner lip spreading as a thin callosity over the latter. Diam. 1·5, height 3·2 mm.

Hab. — Lyall Bay, Cook Strait (A. Hamilton). Type in my collection.

TORNATINA DECAPITATA, n.sp. Pl. XI, Fig. 12.

Shell small, sub-cylindrical, truncated at the top, very thin, vitreous, smooth. Sculpture formed by exceedingly fine and dense curved growth-lines. Colour white. Spire depressed, the nucleus not projecting above the body-whorl. Protoconch large, papillary, tilted. Whorls 3, angled above, the last being the height of the shell, straight at the middle, narrowed and rounded at the base. Suture canaliculate. Aperture vertical, as high as the shell, narrow above, widened below. Outer lip thin and sharp, narrowly rounded and somewhat ascending above, slightly advancing at the middle, regularly convex at the base. Columella vertical, lightly arcuate, twisted into a not very distinct fold, forming a prominent angle with the parietal wall, which is convex at its lower part, almost straight above. Diam. 1·5, height 2·8 mm.

Hab.—Hohoura Bay, North Island (R. Buddle). Type in my collection.

TORNATINA TENUILIRATA, n.sp. Pl. XI, Fig. 13.

Tornatina pachys, Watson: Murdoch & Suter, Trans. N.Z. Inst., vol. xxxviii, p. 280; not of Watson.

Shell small, cylindrical, mucronate, thin, white, with microscopic spiral striæ on the lower half. Sculpture consisting of distinct, fine, curved growth-lines and inequidistant microscopic spiral lines on the anterior half of the body-whorl. Colour white. Spire depressed, almost flat, the nucleus only projecting above the last whorl. Protoconch papillary, smooth and glossy, tilted. Whorls 4, narrowly angled above, the last cylindrical, but little narrowed below. Suture channelled. Aperture vertical, nearly as high as the shell, very narrow above, prominently widened below. Outer lip thin, sharp, narrowly rounded above, somewhat advancing at the middle, regularly convex at base. Columella slightly oblique, with a deep-seated fold, forming an inconspicuous angle with the moderately convex parietal wall; inner lip spreading over the latter as a very thin glaze. Diam. 1·6, height 3·2 mm.

After careful comparison with Watson's description and figure I have come to the conclusion that this species is decidedly distinct. I also wish to state that the wrong identification rests with me alone.

PHILINE CONSTRICTA, Murdoch & Suter, n.subsp. AURIFORMIS. Pl. XI, Figs. 14–17.

Philine Angasi, Crosse: Hutton, Cat. Mar. Moll. N. Zeal., p. 53; Journ. de Conch., 1878, p. 41; Manual N. Zeal. Moll., 1880, p. 123; not of Crosse.

P. aperta, Linné: Index Faun. N. Zeal., p. 69; not of Linné.

Shell (Fig. 14) auriform, subquadrangular, thin and fragile, spirally finely striated, white. Sculpture the same as in the species. Colour white, iridescent in some parts. Periostracum very thin, transparent, shining. Spire sunken, the outer lip narrowly reflexed over the centre. Body-whorl very large, flatly convex, open from below. Outer lip narrowly convex and projecting beyond the spire above, forming a deep sinus with the body, very little convex in the middle, rounded on joining the basal lip, which is oblique, straight, or lightly convex, regularly arched toward the oblique, high, arcuate, and very thin columella; inner lip very thin, spreading broadly beyond the pillar and upon the short, strongly convex parietal wall.

Diam. maj. 7,	min. 3·5;	height 8·8 mm.	Type.
,, 12	,, 6	,, 13·5 ,,	Large specimen.

Animal (Fig. 15) flattened, elongate, yellowish-white, the head-disc oblong, with a distinct longitudinal median groove, much longer than the posterior quadrangular mantle-shield, which entirely covers the shell. The parapodial lobes long, but not high.

The masticatory plates (Fig. 17) are lozenge-shaped, devoid of perforations, dark brown, outer surface hollowed, with a central longitudinal flat bar, leaving a triangular groove on each side of the middle; inner face convex, the central part with a broad longitudinal median groove. The outer layer of these plates consists of calcium-carbonate, the inner and greater part is chitinous, insoluble in acid and alkali.

The length of the animal figured is 20 mm., that of the gizzard plates 5 mm.

Radula having the formula 1–0–1. There are about twenty longitudinal rows of teeth (Fig. 16), falciform, light brown, finely serrate at the inner lower edge, the denticles simple.

Hab.—Akaroa Harbour, in 4–6 fathoms; type (H. S.). Wet Jacket Arm, near Resolution Island, in 12 fathoms (Captain J. Bollons). Dredged on sandy flats, Rangitoto Channel (Cheeseman).

The sculpture is exactly like that of the species (Trans. N.Z. Inst., vol. xxxviii, p. 278), but the form of the shell is different, not contracted above. It seems to me very probable that if series of these molluscs, obtained at different localities and from various depths, could be examined, intermediate forms would be forthcoming; however, with the scanty material at my disposal, I consider it preferable to keep the two forms separate for the present. The sculpture alone suffices to distinguish the shell from *P. Angasi*, Crosse, and *P. aperta*, L.

No doubt *Philene teres*, Hedley, recommended by Webster to be added to Fauna List (Trans. N.Z. Inst., vol. xxxvii, p. 280), is not Hedley's species at all, but this subspecies. Type in my collection.

SIPHONARIA COOKIANA, n.sp. Pl. XI, Fig. 18.

Shell small, solid, oval, depressed, conoidal, radiately ribbed, with subcentral apex. Sculpture consisting of about seventeen smooth, rounded primary ribs, extending from the summit to the margin, the interstices with one, rarely two or three, secondary riblets, which do not reach the apex; the anterior primary rib above the siphonal groove is thicker than the others and divided by a median groove; growth-lines fine, close, concentric. The riblets are sometimes projecting a little at the margin. Colour black, the riblets white on approaching the base, but usually the shell is greyish-white, the interstices dark brown; interior purplish-brown, polished, the groove white, usually with a broad oval white spot at the centre, the margin white or white and brown. Apex sharply rounded, more or less eroded, situate a little behind the middle and to the left; slope lightly convex all round. Interior with the muscle-scar horseshoe-shaped, interrupted on the right side by the shallow groove. Margin sharp, lightly laciniate. Diam. 9, length 12, height 4·5 mm.

Hab.—Lyall Bay, Cook Strait; type (Miss Mestayer). Preservation Inlet, South Island.

It is allied to *S. exulorum*, Hanley, from Norfolk Island, which, however, is a thinner, more depressed species, with more numerous riblets, and without the interior white central spot and the white groove. *S. amara*, Nutt., from New Guinea, is also a near relation, but also with more numerous riblets and devoid of the central white spot. Type in my collection.

SERPHO MATTHEWSI, n.sp. Pl. XI, Fig. 19.

Shell small, turbinate, perforate, thin and fragile, radially ribbed, not shining. Sculpture consisting of fine, inequidistant, retractive, flexuous radial riblets on the post-nuclear whorls, extending on the base down to the perforation, six to eight per millim.; all whorls have fine and dense microscopic spiral striæ passing over the riblets, and decussating the fine growth-lines of their interstices. Colour: protoconch light yellowish with arcuate radial fuscous streaks, which are sometimes present on the next volution, but then become obsolete, giving place to a uniform light-brown colour, interrupted only by a whitish band below the suture and a white central disc on the base; riblets white. Epidermis thin, dull. Spire elevated, conoidal, apex rather blunt, outlines somewhat convex, its height the same as that of the aperture. Protoconch of $1\frac{3}{4}$ convex whorls, the nucleus very little convexly raised. Whorls $4\frac{3}{4}$ to 5, regularly increasing, convex; periphery regularly arched, base rounded. Aperture oblique, lunate. Peristome simple, sharp. Columella short, slightly arcuate; inner lip lightly callous, reflexed above, and partly covering the distinct narrow perforation; spreading broadly as a thin shining glaze over the parietal wall. Diam. maj. 7·5, min. 6·7; height 6 mm.

Hab.—Kaitaia, North Island (Mr. R. H. Matthews).

The animal being unknown, the generic position is not absolutely certain, but I hope to get some live specimens in the near future.

Named in honour of Mr. R. H. Matthews, of Kaitaia, the discoverer of this very pretty little shell. Type in my collection.

THERASIA ANTIPODA, H. & J., n.subsp. CHATHAMENSIS.
Pl. XI, Fig. 20.

The following characters distinguish the subspecies from the species: the radial sculpture consists of less prominent striæ and plications; the rufous streaks are narrower, more numerous, and often zigzag-shaped; the whorls are much more convex, the last more or less angled at the periphery, never sharply keeled; suture deeper; aperture roundly oval, the outer lip but slightly angled, and the basal lip more convex. Diam. maj. 7·1, min. 6·5; height 4 mm.

Hab.—Chatham Islands; type (Captain Hutton). Stewart Island (C. Traill). Type in my collection.

FLAMMULINA COSTULATA, Hutton, n.subsp. PARVA.

Distinguished from the species by the following characters: the shell is smaller, sub-discoidal, and moderately umbilicated; the sculpture is the same, but the spirals on the protoconch are very faint; colour and colour-markings very similar, the brown streaks, however, extend usually over the base; the spire is very little raised; the umbilicus is moderate, deep, its diameter being ·6 mm. Diam. maj. 2·9, min. 2·4; height 1·3 mm.

Hab.—Henderson, near Auckland, in native bush amongst mould (H. S.). Type in my collection.

ENDODONTA (PTYCHODON) CHILTONI, n.sp. Pl. XI, Fig. 21.

Shell minute, sub-discoidal, umbilicated, very finely radially ribbed, thin and fragile, not shining. Sculpture of the post-nuclear whorls consisting of very fine, close, nearly straight radial riblets, about twenty-five per millim., the interstices with minute growth-lines. Colour yellowish-white, radially streaked with rufous. Spire very low, broadly convex. Protoconch of $1\frac{3}{4}$ smooth and convex whorls. Whorls 5, very slowly increasing, flatly convex; periphery and base rounded. Suture deep. Aperture slightly oblique, rotundly lunate within, with eleven slender, elongated, and low lamellæ: one on the parietal wall above the middle, one on the columellar lip, and nine on the outer wall. Peristome thin, sharp, straight, regularly arched. Columella very short, arcuate. Umbilicus wide, deep, perspective, about one-third of the greatest diameter. Diam. maj. 1·6, min. 1·4; height ·9 mm.

Hab.—Kowai Bush, Canterbury (Professor Chilton). Named in honour of Professor Chas. Chilton, D.Sc., the discoverer of the unique specimen. Type in my collection.

ENDODONTA (CHAROPA) GAZA, n.sp. Pl. XI, Fig. 22.

Shell small, depressed, broadly umbilicated, radially closely costate, and spirally very distinctly lirate. Sculpture of the post-nuclear whorls consisting of equidistant, close, flexuous, rather low radial riblets, about eight to nine per millim., the interstices with numerous microscopic growth-lines, crossed by equidistant, narrow, rounded spiral liræ, separated by well-impressed linear grooves. Colour fulvous, sometimes with a few radial whitish streaks. Epidermis thin, horny, not shining. Spire low, broadly conoidal; in some examples, however, nearly flat. Protoconch of $1\frac{1}{2}$ smooth, convex whorls, flat. Whorls $5\frac{1}{2}$, rather slowly increasing, convex, the last flat above the periphery; base rounded. Suture deep. Aperture oblique, sub-triangular, angled above, broadly rounded below. Peristome sharp, the outer lip very slightly advancing and straight above the periphery, sharply rounded on meeting the broadly convex basal lip. Columella short, arcuate; inner lip lightly callous, but little reflexed above, and spreading as a white smooth callus over the convex parietal wall. Umbilicus wide, perspective, its diameter 1·7 mm. Diam. maj. 4·5, min. 4; height 2 mm.

Hab.—Big King, Three Kings Islands (Captain J. Bollons). The prominent spiral sculpture places this species near *E. egesta*, Gray, and *E. transenna*, Sut. Type in my collection.

ENDODONTA (CHAROPA) KENEPURUENSIS, n.sp. Pl. XI, Fig. 23.

Shell very small, sub-discoidal, moderately umbilicated, radially finely ribbed, thin and fragile. Sculpture of protoconch consisting of about eight fine, somewhat inequidistant spiral liræ; the succeeding whorls have fine, not very close, flexuous radial riblets, about twelve to thirteen per millim., the interspaces microscopically finely reticulated by growth-lines and spiral striæ, the latter being much finer and closer together than on the protoconch. Colour white, with a few distant light-brown streaks. Epidermis thin, not shining. Spire flattish, very little elevated. Protoconch of $1\frac{1}{2}$ convex volutions. Whorls $4\frac{1}{4}$, regularly increasing, periphery and base rounded. Suture deep. Aperture oblique, lunate. Peristome thin and sharp, regularly arched. Columella short, vertical, arcuate; inner lip slightly expanded, and forming a thin callous layer on the parietal wall. Umbilicus moderate, its diam. ·7 millim., deep and sub-cylindrical. Diam. maj. 2·7, min. 2·5; height 1·5 mm.

Hab.—Kenepuru, South Island.

This species is allied to *E. maculata*, Sut., which, however, has much more numerous riblets, about thirty per millim. Type in my collection.

Endodonta (Charopa) vortex, Murdoch, n.subsp. microrhina.

Distinguished from the species by the following characters: the shell is somewhat larger, the radial riblets less elevated and slightly closer together, about twenty-two per millim., the interstices with numerous fine microscopic growth-lines and exceedingly fine and dense spiral striæ. Colour white or very light horny, without any markings. Protoconch smooth, no spiral lines. Diam. 1·9, height 1·1 mm.

Hab.—North Island, near Ormondville; type, Mount Wellington lava-fields. Hunua Range. *E. vortex* was described in these Proceedings, vol. ii, p. 160. Type in my collection.

Laoma (Phrixgnathus) compressa, n.sp. Pl. XI, Fig. 24.

Shell minute, depressed, perforated, yellowish-white, thin, shining. Sculpture of the post-embryonic whorls consisting of fine growth-lines and microscopic very fine spiral striæ, more distinct upon the base. Colour uniformly yellowish-white. Spire low, lightly convex, its height about half that of the aperture. Protoconch convex, smooth. Whorls 4, regularly and slowly increasing, convex; periphery sub-angled, base convex. Suture simple, impressed. Aperture lunate. Peristome thin and sharp. Columella short, arcuate; inner lip somewhat reflexed above. Perforation rather narrow, quite open, deep, about one-tenth of the greatest diameter. Diam. 1·4, height 1·25 mm.

Hab.—Birkenhead, near Auckland (A. Suter). Type in my collection.

Laoma (Phrixgnathus) Trailli, n.sp. Pl. XI, Fig. 25.

Shell small, turbinate, perforated, corneous with light-brown zigzag lines, thin, pellucid, polished. Sculpture: the shell has very fine growth-lines and obsolete microscopic spiral striæ on the base. Colour corneous, with very faint axial, narrow, brown, zigzag lines, sometimes indistinct or absent. Spire conoidal, convex, its height the same as that of the aperture. Protoconch blunt, smooth. Whorls 6, slowly and regularly increasing, convex; periphery sharply angled, base rounded, broadly infundibular around the perforation. Suture impressed, very lightly and narrowly margined below. Aperture lunate, transverse, oblique. Peristome sharp, simple, with an inner white callus; outer lip angled. Columella short, oblique; inner lip expanded. Perforation deep, narrow, open, about one-fifteenth of the greatest diameter. Diam. 4·5, height 3·2 mm.

Hab.—New Zealand, exact locality not known. Collected by the late Mr. C. Traill.

The nearest species is *L. Cheesemani*, Sut., which, however, is not polished, has the base not depressed in the centre, the perforation nearly closed up, and the colour-markings are different. Type in my collection.

LAOMA (PHRIXGNATHUS) LIRATULA, n.sp. Pl. XI, Fig. 26.

Shell very small, turbinate, perforate, corneous with radial brown streaks, not shining, thin, periphery keeled. Sculpture consisting of very fine, dense, oblique growth-striæ and very distinct microscopic spiral lines, which are finer and closer together on the protoconch. Colour corneous, with rather regular, broad, radial streaks, sometimes coalescing on the body-whorl; they are faint or absent on the base. Spire conoidal, its outlines almost straight, height the same as that of the aperture. Protoconch convex, of 1½ turns. Whorls 5, regularly increasing, lightly convex; periphery keeled, base rounded. Suture impressed. Aperture lunate, oblique. Peristome thin and sharp, strengthened inside by a thin callosity; outer lip sharply angled. Columella short, vertical, almost straight; inner lip expanded. Perforation moderate, about one-eighth of the greatest diameter, deep and quite open. Diam. 4·2, height 3 mm.

Hab.—New Zealand, exact locality unknown. Collected by the late Mr. C. Traill.

The rather wide and open perforation separates it from its near congener *L. Cheesemani*, Sut. Type in my collection.

LAOMA (PHRIXGNATHUS) ALFREDI, n.sp. Pl. XI, Fig. 27.

Shell minute, depressed-globose, perforate, corneous, thin, pellucid, polished. The sculpture on the post-nuclear whorls consists of microscopic faint spiral lines, more distinct on the base; growth-lines sometimes rib-striate. Colour corneous; at irregular intervals there are radiate white lines on the last two whorls, produced by the narrow callosity left of former peristomes. Spire conoidal, its height equal to that of the aperture; outlines lightly convex. Protoconch flatly rounded, smooth. Whorls 5, slowly and regularly increasing, convex; periphery sub-angled, base flatly rounded. Suture impressed, faintly margined. Aperture oblique, lunate. Peristome simple, straight, with a conspicuous inner white callus; outer lip descending rapidly and but little arched. Columella short, subvertical, arcuate; inner lip slightly expanded. Perforation narrow, deep, open, about one-twelfth of the greatest diameter. Diam. 2·5, height 1·6 mm.

Hab.—Birkenhead, near Auckland (A. Suter).

This species stands nearest the imperforate *L. lucida*, Sut. It is named after my son Alfred, who discovered it. Type in my collection.

LAOMA (PHRIXGNATHUS) FULGURATA, n.sp. Pl. XI, Fig. 28.

Shell very small, depressed, almost imperforate, horny, with broad streaks and zigzag lines of brown, not shining, thin and pellucid, periphery sharply angled. Sculpture consisting of exceedingly fine and dense growth-lines and distinct microscopic spiral liræ on the base. Colour corneous, with irregular brown streaks on the upper surface, but forming rather regular, broad, zigzag lines on the base. Spire depressed, broadly convex, its height less than that of the aperture. Protoconch flattish, of 1½ smooth volutions. Whorls 4½, regularly increasing, flatly convex, the last rather high in proportion; periphery sharply angled, base convex, a little depressed in the centre. Suture not much impressed, simple. Aperture oblique, transverse, lunate. Peristome thin and sharp, outer lip angled. Columella subvertical, short, arcuate; inner lip reflexed above and almost completely closing up the very narrow perforation. Diam. 3·2, height 2 mm.

Hab.—Waitakerei Range, North Island (H. S.).

Its nearest congener, *L. Ariel*, has distinct radial riblets and the spire much more elevated. Type in my collection.

Laoma (Phrixgnathus) viridula, n.sp. Pl. XI, Fig. 29.

Shell minute, depressed, globose, sub-perforate, corneous, very thin, translucent, lightly shining, smooth. Sculpture microscopic, the post-nuclear whorls with fine oblique growth-striæ, reticulated by distinct fine spiral lines. Colour corneous, with a greenish hue. Spire depressed, conoidal, its height a little less than that of the aperture; outlines almost straight. Protoconch of 1½ convex whorls, smooth. Whorls 4, regularly increasing, convex; periphery rounded, lightly sub-angled, base convex, impressed at the middle. Suture rather deep. Aperture oblique, broadly rotundly lunate. Peristome simple, sharp and thin, regularly arched. Columella short, arcuate; inner lip reflexed above, and almost completely closing the narrow perforation. Diam. maj. 2·5, min. 2·3; height 1·7 mm.

Hab.—Capleston, near Reefton, South Island. Type in my collection.

Tornatellina subperforata, n.sp. Pl. XI, Fig. 30.

Shell very small, conoidal, sub-perforate, thin, pellucid, shining, light corneous. The only sculpture consists of fine oblique growth-lines. Colour very light horny. Epidermis very thin, light brown, very easily rubbed off. Spire elevated conic, a little higher than the aperture. Protoconch globose. Whorls 5, convex, the last rapidly increasing, ventricose; base rounded. Suture impressed, faintly and narrowly margined. Aperture subvertical, ovate, angled above. Peristome thin, sharp; outer lip moderately convex, basal lip narrower, arched. Columella vertical, not twisted; inner lip thin, broadly reflexed above, and partly concealing the very narrow and not deep perforation. Parietal wall with an entering median small lamella. Diam. 2·2, height 3·5 mm.

Hab.—Whangarei Heads; type (Mr. C. Cooper). Near Auckland (H. S.). Raoul Island, Kermadec Islands (Miss Shakespear).

The inflated body-whorl, the straight, not tortuous columella, and the narrow perforation separate it at once from *T. Novoseelandica*, Pfr. Type in my collection.

PECTEN (CHLAMYS) DICHROUS, n.sp. Pl. XI, Fig. 31.

Shell triangularly orbicular, moderately inflated, sub-equilateral, somewhat inequivalve, with rather distant rounded radial ribs; valves differently coloured, ears very unequal, the anterior large, the posterior very small. Beaks approximate, the prodissoconch small, oval, smooth. Anterior and posterior ends similar, slightly concave above, then forming a half-circle with the basal margin; right valve slightly more convex than the left, with a rather large triangular anterior ear with four radial costæ, crossed by strong and close imbricating growth-lines, a distinct byssal sinus below, and a row of teeth below it on the anterior margin (ctenobium); the posterior ear very small, triangular, with a few concentric riblets; left valve with the anterior ear also triangular, the anterior side straight or lightly sinuous, with about six scaly radiate riblets, the intercostal spaces with one or two fine scaly lines. Sculpture consisting of sub-equidistant rounded radial ribs, indenting the margins, their number varying from sixteen to twenty on each valve; they are broadly or acutely rounded, sometimes ornamented with scales, more prominent on the left valve; towards the margin the ribs have often one or several grooves, and in the interstices one to three radial fine riblets may be present; besides this sculpture there are minute divaricating radial lines (the so-called *Camptonectes* striation). The concentric sculpture consists of very fine and rather close undulating and slightly imbricating layers. Colour of right valve whitish, lightly tinged with pink, rarely yellowish-brown all over; left valve always much darker coloured, white with red concentric spots and bands, or reddish or yellowish-brown, sometimes mottled with white. Inside shining, white or stained with red, strongly grooved, the margins sharp, dentate, or crenulate. Hinge-line long and straight, the resilifer triangular, not very deep, its margins rather sharply raised. Ligament external, narrow. Length 32, height 36, diam. 10 mm.

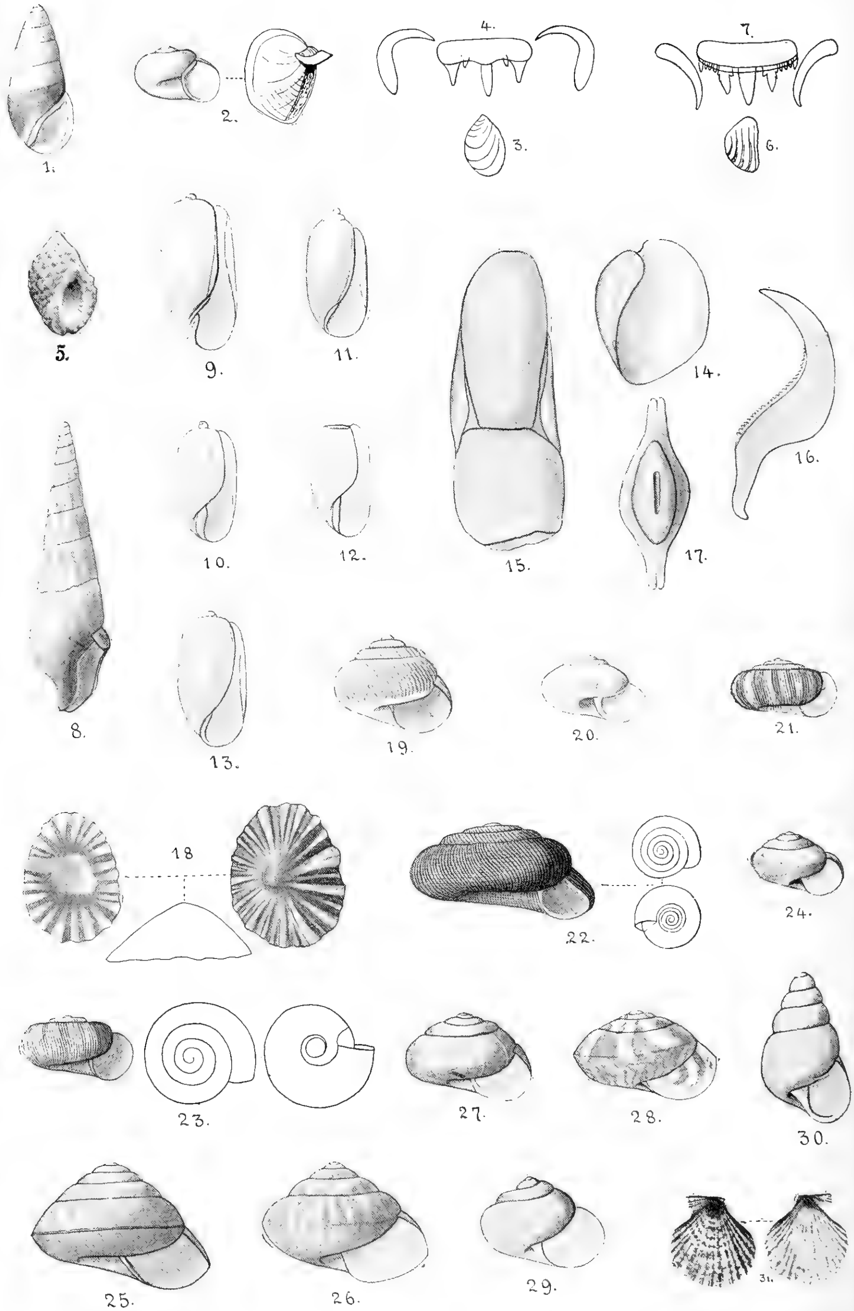
Hab.—A number of valves were found in the stomach of a Blue-Cod (*Parapercis colias*, Forster) caught in Port Pegasus, Stewart Island, and kindly given to me by Captain Bollons. This fish is found in New Zealand waters only: East of Jones Head, in 20 fathoms; 19 miles south of Oamaru, in 40 fathoms; off Lyttelton, in 100 fathoms (Mr. Edgar R. Waite).

This species is allied to the Miocene *P. Chathamensis*, Hutton (Cat. Tert. Moll. N. Zeal., p. 29), but this form has the ribs more scaly, the scales more distant; the ribs show no tendency to division towards the margins. The anterior ear of the right valve is not large, has no byssal sinus, and there is of course no ctenobium. The form and size of the shell and the number of ribs are about the same as in the recent species. Type in my collection.

EXPLANATION OF PLATE XI.

FIG.

1. *Rissoina zonata*, n.sp. 4·5 × 11·5 mm.
2. *Skenella Pfefferi*, n.sp. ·8 × ·45 mm.
3. *Trophon* (*Kalydon*) *Aucklandicus* (Smith); operculum.
4. Id., radula.



H. Suter del.

MOLLUSCA FROM NEW ZEALAND.

FIG.

5. *Drupa Bollonsi* (Suter). 32 × 19 mm.
6. Id., operculum.
7. Id., radula.
8. *Terebra flexicostata*, n.sp. 5 × 18·5 mm.
9. *Tornatina biplicata*, n.sp. 2 × 3·8 mm.
10. ,, *Charlottæ*, n.sp. 1·6 × 3·1 mm.
11. ,, *Cookiana*, n.sp. 1·5 × 3·2 mm.
12. ,, *decapitata*, n.sp. 1·5 × 2·8 mm.
13. ,, *tenuilirata*, n.sp. 1·6 × 3·2 mm.
14–17. *Philine constricta, auriformis*, n.subsp. Shell 7 × 8·8 mm.
18. *Siphonaria Cookiana*, n.sp. 9 × 12 × 4·5 mm.
19. *Serpho Matthewsi*, n.sp. 7·5 × 6 mm.
20. *Flammulina antipoda, Chathamensis*, n.subsp. 7·1 × 4 mm.
21. *Endodonta* (*Ptychodon*) *Chiltoni*, n.sp. 1·6 × ·9 mm.
22. ,, (*Charopa*) *gaza*, n.sp. 4·5 × 2 mm.
23. ,, ,, *Kenepuruensis*, n.sp. 2·7 × 1·5 mm.
24. *Laoma* (*Phrixgnathus*) *compressa*, n.sp. 1·4 × 1·25 mm.
25. ,, ,, *Trailli*, n.sp. 4·5 × 3·2 mm.
26. ,, ,, *liratula*, n.sp. 4·2 × 3 mm.
27. ,, ,, *Alfredi*, n.sp. 2·5 × 1·6 mm.
28. ,, ,, *fulgurata*, n.sp. 3·2 × 2 mm.
29. ,, ,, *viridula*, n.sp. 2·5 × 1·7 mm.
30. *Tornatellina subperforata*, n.sp. 2·2 × 3·5 mm.
31. *Pecten* (*Chlamys*) *dichrous*, n.sp. 32 × 36 × 10 mm.

MALACOLOGICAL SOCIETY OF LONDON.

INCOME AND EXPENDITURE FOR THE YEAR ENDED 31st DECEMBER, 1908.

Dr.		£ s. d.
To Balance from last year		19 17 10
,, Annual Subscriptions—		
Ordinary Members	£34 12 6	
Corresponding Members	19 7 11	
		54 0 5
,, Annual Subscriptions in arrear—		
Ordinary Members	£1 1 0	
Corresponding Members	2 0 0	
		3 1 0
,, Annual Subscriptions in advance—		
Ordinary Members	£1 1 0	
Corresponding Members	3 7 7	
		4 8 7
,, Sale of "Proceedings"		18 1 4
,, Dividends on £50 Metropolitan $2\frac{1}{2}$ % Stock		1 5 0
,, Donations for Illustrations		7 9 0
,, Advertisement Receipts		0 15 0
,, Balance		3 11 3
		£112 9 5

Cr.		£ s. d.
By Cost of "Proceedings"—		
Printing and Postage	£83 18 6	
Illustrations	16 15 9	
		100 14 3
,, Printing Circulars		2 9 6
,, Treasurer's Expenses		1 3 3
,, Linnean Society—		
Expenses incurred by use of Rooms	£3 3 0	
Gratuities to Attendants	2 10 0	
		5 13 0
,, Secretary's Expenses		2 9 5
		£112 9 5

SPECIAL FUND.

Dr.	£ s. d.
To Entrance Fees	3 3 0
,, Composition Fees	7 7 0
	£10 10 0

Cr.	£ s. d.
By Balance in hand	10 10 0
	£10 10 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.

p.p., John H. Ponsonby, Hon. Treasurer.
R. H. Burne.
January 30, 1909.

HENRY WOODWARD }
R. BULLEN NEWTON } Auditors.

ANNUAL GENERAL MEETING.

FRIDAY, 12TH FEBRUARY, 1909.

B. B. WOODWARD, F.L.S., President, in the Chair.

The Rev. E. W. Bowell and Mr. W. M. Webb were appointed scrutineers.

The following report was read:—

"Your Council, in presenting their sixteenth Annual Report, are again able to record a year of progress.

During the past twelve months five new members have been elected. By death we have lost three members, Professor Spiridion Brusina, a worker whose reputation is worldwide, Mr. W. H. Hudleston, and Mr. F. C. Crawford. Five members have resigned, and the names of three others have been removed from the list according to Rule X.

The membership of the Society on December 31st, 1908, stood as follows:—

Ordinary members	78
Corresponding members	83
Total	161

At the end of the year 1907 the total membership was 167, and of 1906, 164.

The financial condition of the Society is not so satisfactory as in previous years, and although not such as to cause uneasiness, calls for the attention of members. The balance-sheet shows an adverse balance of £3 11*s*. 3*d*.[1]; but, on the other hand, £10 10*s*. has been added to the special fund to which it was lately decided that entrance and composition fees should be credited, instead of being merged as heretofore in the annual income; while, in addition, the Society still holds the sum of £50 invested in Metropolitan 2½ per cent. stock.

Since the last Annual Meeting three parts of the 'Proceedings' have been issued as usual, forming the first half of the eighth volume. They consist of 191 pages of text, 7 plates, and 35 text-figures.

The Society is indebted to the following gentlemen who have kindly contributed towards the cost of the plates and other illustrations, or have furnished drawings for reproduction:—Colonel R. H. Beddome, the Rev. E. W. Bowell, A. J. Jukes-Browne, R. Bullen Newton, Professor H. A. Pilsbry, H. B. Preston, A. Reynell, E. A. Smith, G. B. Sowerby, H. Suter, and B. B. Woodward. It is only through such kind help that the 'Proceedings' can be so fully illustrated.

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 previous years, to hold its meetings in Burlington House."

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[1] Through the kindness of certain members this deficit has since been cancelled.

On the motion of Mr. A. S. Kennard, seconded by Mr. W. M. Webb, the above was adopted as the Annual Report of the Society.

The following were elected as Officers and Council for the year 1909:

President.—B. B. Woodward, F.L.S., F.G.S.

Vice-Presidents.—R. H. Burne, M.A., F.Z.S.; Colonel R. H. Beddome, F.L.S.; Rev. R. Ashington Bullen, B.A., F.L.S.; E. R. Sykes, B.A., F.L.S.

Treasurer.—J. H. Ponsonby, F.Z.S., 15, Chesham Place, London, S.W.

Secretary.—G. K. Gude, F.Z.S., 45, West Hill Road, Wandsworth, London, S.W.

Editor.—E. A. Smith, I.S.O., F.Z.S., Natural History Museum, Cromwell Road, London, S.W.

Other Members of Council.—W. E. Collinge, M.Sc.; H. H. Bloomer, F.L.S.; H. B. Preston, F.Z.S.; W. G. Ridewood, D.Sc., F.L.S.; Alexander Reynell; G. C. Crick, F.G.S.

On the motion of the Rev. R. Ashington Bullen, seconded by Mr. H. B. Preston, a vote of thanks was passed to the Retiring Officers and Members of the Council, and to the Auditors and Scrutineers.

ORDINARY MEETING.

Friday, 12th February, 1909.

B. B. Woodward, F.L.S., President, in the Chair.

Professor Dr. K. Kraeppelin, Naturhistorisches Museum, Hamburg, was elected to membership of the Society.

The President delivered his annual address, entitled "Darwinism and Malacology." On the motion of Mr. G. C. Crick, seconded by Mr. R. H. Burne, a vote of thanks was passed to Mr. Woodward for his interesting address, which it was resolved should be printed *in extenso.*

ORDINARY MEETING.

Friday, 12th March, 1909.

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

Mr. Francis N. Balch, Boston, Mass., U.S.A., was elected to membership of the Society.

The following communications were read:—

1. "Description of a new species of *Oliva* from the Andaman Islands." By F. G. Bridgman.
2. "Notes on the genera *Cypræa* and *Trivia*." By H. O. N. Shaw, F.Z.S.
3. "On the Shell Mound at Sidon." By Rev. A. H. Cooke, M.A., F.Z.S.
4. "On the habitat of certain species of *Clausilia* from the coast of Syria." By Rev. A. H. Cooke, M.A., F.Z.S.

5. "Note on the species of *Cyclophorus* found at Hongkong." By Staff-Surgeon K. H. Jones, R.N.
6. "On the 'Conchological Illustrations' by G. B. Sowerby, jun., and the 'Descriptive Catalogue of Shells' by Gray." By C. Davies Sherborn, F.Z.S.
7. "On the dates of issue of Sowerby's Conchological Illustrations." By H. O. N. Shaw, F.Z.S.

Mr. G. B. Sowerby exhibited an enormous specimen of *Cymbium Georginæ*, Gray, measuring 18 inches in length and 12 in diameter.

ORDINARY MEETING.

Friday, 16th April, 1909.

B. B. Woodward, F.L.S., President, in the Chair.

The following communications were read :—

1. "On *Pomatias Harmeri*, n.sp., from the Pliocene (Red Crag) of Little Oakley, Essex." By A. S. Kennard, F.G.S.
2. "On some Fossil Pearl Growths." By J. Wilfred Jackson, F.G.S. Communicated by W. Hoyle, M.A., D.Sc.
3. "The New Zealand Athoracophoridæ, with descriptions of two new forms." By Henry Suter.
4. "Notes on the Family Ampullariidæ, with list of species, varieties, and synonymy, also descriptions of four new species." By G. B. Sowerby, F.L.S.

Mr. E. A. Smith exhibited a malformed specimen of *Strombus lentiginosus*, with scalariform spire.

Mr. B. B. Woodward, examples of *Pisidium supinum*, obtained in gravel from the Thames at Richmond by Mr. H. Overton.

OBITUARY NOTICE.

Spiridion Brusina, a member of this Society for some years, died at Agram, Croatia, on May 21st, 1908, in his 63rd year. He was Professor at Agram University, Director of the Zoological Museum, Agram, and member of several South Slavonic Academies. He was Knight of the Imperial Russian Order of St. Stanislas, Class II, of the Servian Order of St. Sava, Class III, of the Montenegrin Order of Danilo I, third grade, and of the Bulgarian Order of Merit, Class III, etc.

His scientific work was restricted almost exclusively to the study of the Mollusca, especially fossil forms, occurring in the Neogene or Mio-Pliocene deposits of South-Eastern Europe. He published a considerable number of memoirs upon the subject, a few of which are well illustrated, and, as Mr. R. Bullen Newton has observed, "thus rendered most important services to this branch of Palæontology, the value of which is very generally recognized."

He also wrote some important papers upon the living Molluscan fauna of Croatia, Slavonia, Dalmatia, and the Adriatic.

Altogether Professor Brusina has written about twelve hundred pages upon the Mollusca of South-East Europe in his various memoirs, nearly fifty in number. He also published a voluminous catalogue of the Adriatic fauna from manuscripts and unpublished figures by Stephano Chiereghini.

ANNUAL ADDRESS BY THE PRESIDENT,

B. B. Woodward, F.L.S., F.G.S., etc.

(*Delivered* 12*th February*, 1909.)

DARWINISM AND MALACOLOGY.

Members of the Malacological Society,—

Among the several celebrations held of late years in honour of the world's great men, there are certain that more particularly interest us as Naturalists, for while concentrating our attention on one branch of Nature, we do not, if we be true to ourselves, neglect its wider aspects.

The bicentenary of the birth of Linnæus, and that of the birth of Buffon, both fell in 1907. The jubilee of the announcement by Darwin & Wallace of their independent discovery of the Origin of Species by means of Natural Selection was held in July of last year. To-night we celebrate the centenary of the birth of the distinguished philosopher-naturalist, Darwin himself.

To Linnæus (1707–78), "the great lawgiver of systematic zoology," as Huxley terms him (*32*, p. 104), we owe the introduction of method into the study of the three Kingdoms of Nature. He enunciated the true principles for defining genera and species, and this, with his adoption of the simple binomial method of nomenclature, resulted in an orderly and systematic arrangement that enabled the ever-increasing number of plants and animals to be sorted and provisionally placed till their true affinities were ascertained.

His necessarily arbitrary classifications have given way to more natural arrangements in all the three Kingdoms, but the underlying method has remained and enabled continuous progress to be made down to the present time.

Linnæus is commonly regarded as having considered species to be fixed entities in contradistinction to Classes and Orders, which were invented for the convenience of the classifier, and this undoubtedly was his earlier position in regard to the subject. Thus in his "Fundamenta Botanica" (*48*, 1736, p. 19, § 162) he wrote "Naturæ opus semper est Species et Genus," to which in his "Philosophia Botanica" (*49*, 1751, p. 101, § 162) he added "Species constantissimæ sunt, cum earum generatio est vera continuatio." Later in life, however, he obviously had his doubts on the subject, being confronted with the difficulty of satisfactorily accounting for hybrids in plants, for in his thesis "Fundamentum Fructificationis" in 1762 (*50*, p. 16, § 10) the following remarkable passage occurs:—"Suspicio est quam diu fovi, neque jam pro veritate indubia venditare audeo, sed per modum hypotheseos propono: quod scilicet omnes species ejusdem generis ab initio unam constituerint speciem, sed postea per generationes hybridas propagatæ sint, adeo ut omnes congeneres ex una matre progenitæ sint, harum vero ex diverso patre diversæ species factæ." [1]

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[1] For more detailed remarks on Linnæus and his opinions consult Geoffroy Saint Hilaire (*25*, pp. 373–83) and Osborn (*52*, pp. 128–30).

Linné's celebrated contemporary, Buffon (1707–88), to whom the world owes a great debt for being the first to really popularize Natural History by his monumental work, was, according to Geoffroy Saint-Hilaire (*25*, pp. 383–96), the first to preach the variability of species. At the same time, as the last-named writer shows, he has been quoted by both parties in the old struggle over the question of the fixity or non-fixity of species. In his earlier volumes on Animals he constantly reiterates the statement that they are fixed, but later he admits varieties, which he attributes to degeneration. (Cf. Osborn, *52*, pp. 130–9; Kellogg, *44*, p. 216.)

The true key to Buffon is, however, that indicated by Clodd (*15*, p. 101). Students of Buffon have neglected to take into account his environment. In his first volumes, and notably in his "Théorie de la Terre," he gave expression to views which were not acceptable to the theologians of the day, and these expressions of opinion the Sorbonne, or Faculty of Theology in Paris, compelled him to retract in 1751. Their list of his heresies, with his recantation of them, were published in the forefront of the first volume on Animals (*14*, tom. iv, 1753). In consequence of this submission, Buffon dared not proclaim what he obviously felt to be the truth in the matter, and so, while ostensibly supporting the fixity of species, he by repeatedly drawing attention, almost *ad nauseam*, to the great similarity between related forms, endeavours to lead his readers to the opposite conclusion. No one who carefully reads his chapters on the ass (*14*, tom. iv, p. 377, where *à propos* of its kinship to the horse he passes the whole question in review), on the pig (*14*, tom. v, 1755, p. 99), the dog (*14*, tom. v, p. 194), or the rat (*14*, tom. vii, 1758, p. 278) can fail to see that his remarks are conceived in a spirit of irony. Perhaps the following quotation from the chapter on the goat (*14*, tom. v, p. 59) will give the best illustration of this:—"Quoique les espèces dans les Animaux soient toutes séparées par un intervalle que la Nature ne peut franchir, quelques-unes semblent se rapprocher par un si grand nombre de rapports, qu'il ne reste, pour ainsi dire, entre elles que l'espace nécessaire pour tirer la ligne de séparation."

Geoffroy Saint-Hilaire, unfortunately, only quotes the first part of the sentence, omitting of course the "quoique," thus spoiling the effect of the whole, and he has been followed blindly by all subsequent commentators.

Lamarck (1744–1829), to whom tardy statuary honours are shortly to be paid, at first followed in his teachings on the lines of his master, Buffon, and this continued up to and including the time of his "Recherches sur les causes des principaux faits physiques" (*45*), which was written in 1776 and presented to the Academy in 1780, but not published till 1794. When, however, in 1802, his "Recherches sur l'organisation des corps vivants" (*46*) appeared, his opinions were seen to have undergone an apparent complete change, which culminated in his "Philosophie Zoologique" of 1809 (*47*).

In response to Huxley's comment that "it would be interesting to know what brought about the change of opinion" thus manifested (*33*, p. 748*b*, note), Osborn suggests that it "was probably due to the change of his studies from Botany to Zoology" (*52*, p. 155). A possibly more potent factor, however, appears to have been overlooked; it was once more a question of environment. The Revolution had taken place in those intervening years; the power of the priesthood was broken; and Lamarck was free to boldly advocate, as he did, the transmutation of species.

This transmutation he explained primarily on the theory of changing needs (environment we might say) leading either to the greater use of parts or organs not previously brought so much into play and thus to their development, or, on the other hand, to their disuse and consequent atrophy; in either case the resultant effect reacted on the organism, which became in course of time and generations so modified as to eventuate in a new species. At the same time he advocated the progressive development of Animals and Plants in geological time, and so was the father of Evolution as we understand it.[1]

His theories met with no hearty response at the time, chiefly because the scientific world of the day was not sufficiently advanced to receive the new teaching, which met with Cuvier's strong opposition; but also because the final and convincing argument was lacking and only supplied subsequently in the theory of "Natural Selection" promulgated by Darwin & Wallace (*21*).[2]

We are still, perhaps, too close to the time of Darwin to fully appreciate the magnitude of his work. 'Darwinism,' as it came to be termed, is even now interpreted by the proverbial 'Man in the Street' as explaining man's descent from a monkey, or as I once heard it expressed in front of Darwin's statue in the Natural History Museum, "He discovered the Missing Link, don't you know."

Probably to Darwin's theory more than to any other of the great discoveries in Science has the old aphorism been applicable that first people said "It is not true," then that "It is contrary to Religion," and finally that "Everybody knew it before." Certainly of late years the final stage has been predominant, and many would-be belittlers have arisen and pointed to the lack of originality in the various items of his work.

That such was the case was fully acknowledged by Darwin himself, and he notes that even the Theory of Natural Selection had been anticipated, and the fact lost sight of (*20*, pp. xv and xvi). Thus Dr. W. C. Wells (*61*) in 1813, and Patrick Matthew (*51*, Appendix, pp. 384–7) in 1831, very exactly postulated the view of the Origin of Species propounded by Darwin & Wallace in 1858.

What Darwin did in his "Origin" was to give practical shape to the theory of Evolution by supplying the key to the fitting

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[1] For more detailed information on Lamarck and his opinions reference should be had to Geoffroy Saint-Hilaire (*25*, tom. ii, pp. 404–11), Kellogg (*44*, p. 263), Osborn (*52*, pp. 156–81), Packard (*54*), and Clodd (*15*, pp. 105–7).

[2] Dr. Jackson, the General Secretary of the Linnean Society, informs me that the historic meeting on 1st July, 1858, was held in the Society's rooms in old Burlington House, now used by the Royal Academy of Arts, the Linnean Society having removed thither from Banks' House in Soho Square in 1857.

together of the puzzle of Life. "He discovered the Missing Link" in a sense other than that cited. "The Origin," wrote Huxley (*22*, vol. ii, p. 197), "provided us with the working hypothesis we sought." The highest tribute to the successful way in which Darwin elaborated and drove home the Theory is that paid by its co-originator, the veteran Alfred Wallace, who, while he realized the value and scope of the Theory, modestly says (*60, fide 15*, p. 131), "I have felt all my life, and I still feel, the most sincere satisfaction that Mr. Darwin had been at work long before me, and that it was not left for me to attempt to write the *Origin of Species*. I have long since measured my own strength, and know full well that it would be quite unequal to that task."

Darwin naturally relied mainly on "Natural Selection" to explain the "Origin of Species," and subsequent observers have not been slow to perceive, or backward to demonstrate, that other agencies are also concerned in the production of species, notably the action of 'environment.' What many cavillers have overlooked, however, is that Darwin himself, at the close of the Introduction to the first edition of the "Origin," says, "I am convinced that Natural Selection has been the main but not the exclusive means of modification" (*19*, p. 6), while in the sixth edition (*20*, p. 421) he concludes that species have been modified "chiefly through the natural selection of numerous, successive, slight, favourable variations; aided in an important manner by the inherited effects of the use and disuse of parts; and in an unimportant manner, that is in relation to adaptive structures, whether past or present, by the direct action of external conditions, and by variations which seem to us in our ignorance to arise spontaneously. It appears that I formerly underrated the frequency and value of these latter forms of variation, as leading to permanent modifications of structure independently of natural selection." He returns to the point in a letter to Moritz Wagner in 1876, when he writes (*22*, vol. iii, p. 159), "In my opinion the greatest error which I have committed has been not allowing sufficient weight to the direct action of the environment, i.e. food, climate, etc., independently of natural selection . . . When I wrote the 'Origin,' and for some years afterwards, I could find little good evidence of the direct action of the environment; now there is a large body of evidence."

The present, however, is neither the time nor the place to enter into a lengthy disquisition on Darwin and his work; this has already been done by those competent for the task, while an excellent discussion of Darwinism as it appears to-day has lately been published by Kellogg (*44*).

The following brief general statement appears to me to best epitomize our present knowledge on the subject, and may be permitted on account of what follows.

Every organism possesses an inherent capacity to vary in a greater or less degree in certain directions more or less peculiar to itself.

The influences of environment, using that word in its widest possible sense to include all influences exterior to the organism itself, and possibly to a lesser degree other agencies, by their action on the organism call forth such variation.

Natural Selection then comes into play, and working on the varieties which the environmental conditions have provoked and continue to stimulate, determines, through the survival of the fittest, which of these varieties shall develop into new species.

The process is a consistent whole, and it is waste of time and logic to argue whether the actual origin of the species is to be counted from the time of intervention of natural selection, or reckoned from the point when incipient variation first showed itself. All organisms have undergone and are still undergoing this process of evolution, of which we know not the beginning and cannot forecast the end.

Of all the divisions of the Animal Kingdom the Mollusca probably furnish the best means of tracing out these workings of evolution, for unlike the higher organisms, whose parts only teach the condition of the individual at the moment, the shell of the mollusc properly dissected will yield evidence of its whole life-history. This being true of fossil equally with recent forms, they offer a fine field for investigation. So, too, in a lesser degree, do the Brachiopods and Corals. It may not, therefore, be out of place on the present occasion to summarize what has so far been done in this branch of research, and to indicate what further opportunities for investigation are open.

Hyatt was one of the first to seize on the evolutionary idea and apply it to his particular study, the fossil Cephalopoda. He demonstrated that each Ammonite (and less conspicuously each Nautiloid), when broken up and examined, could be shown to pass through a series of stages changing its form with growth ('ontogenesis'). So great sometimes is the difference between the earlier and later stages that it has not uncommonly happened for two stages of growth in the same Ammonite to have received distinct specific names. For these stages he proposed terms *(39)* which, as subsequently modified in accordance with suggestions made by Mr. S. S. Buckman & Dr. Bather (*13*), have obtained wide currency inasmuch as they are applicable to all forms of animal life (*41*, *42*).

For the sake of those to whom these terms may not yet be familiar, it is permissible to recapitulate them here; they are—

1.	Embryonic.	
2.	Nepionic . .	Larval, or young.
3.	Neanic . .	Immature, or adolescent.
4.	Ephebic . .	Mature, or adult.
5.	Gerontic . .	Senile, or old.

When these terms are applied to the race instead of the individual the root 'phylo' is prefixed.

Hyatt's next interesting point ('phylogenesis') was that the earlier stages in each individual resembled the adult stages of forms which immediately preceded them in geological time, and of which they were the modified descendants (*34*). Thus in some Ammonites the young shell is smooth, and the margins of the simple septa show but slightly sinuous sutures where they join the shell-wall—in effect they bear a close resemblance to the ancestral Goniatites. With growth the septa and their sutures show successively greater and greater complexity till the well-known foliaceous appearance is presented. The exterior of the shell will also show gradations in its sculpture: the smooth surface of the young Ammonite will develop ribs which, as growth proceeds, become more and more complex, while to the ribs spines may be added. In other forms again the sculpturing of the adolescent, or of the adult shell, gradually disappears with age, the test reverting to a smooth condition.

The individual, therefore, presents in itself a history of its descent, and so to a certain extent of its race. To a certain extent, because Hyatt further found and was the first to point out that there was a tendency, not merely sometimes, as Darwin supposed (*20*, p. 10), but constantly, for the higher forms to reproduce the characters of their predecessors at earlier and earlier stages in their development. "The young of higher species are thus constantly accelerating their development and reducing to a more and more embryonic condition, or passing entirely over, the stages of growth corresponding to the adult periods of preceding or lower species" (*34*, p. 203).

This he denominated the 'Law of Acceleration,' or 'Tachygenesis' (*34*, *40–2*). These phenomena of Ontogenesis, Phylogenesis, and Tachygenesis were also independently discovered by Würtenberger (*62*) and Buckman (*8*, *12*).

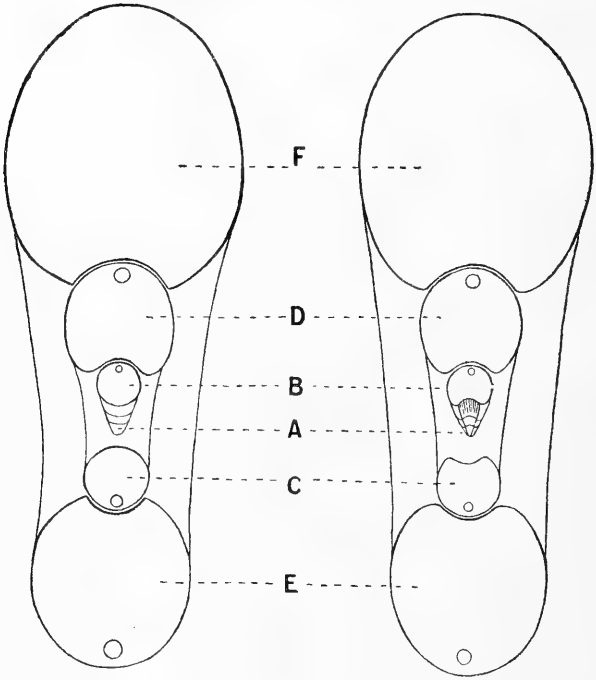
How these principles apply in the phylogeny of the Ammonites will best be shown by the following quotation from a paper by Professor J. F. Blake (*5*, pp. 280–1):—"If we want to know the nearest ancestor of a form A, we must find a form B which reproduces in the adult the early whorls of A; in the same way C, the immediate ancestor of B, must reproduce its [B's] early whorls; and so the series grows. It may, however, often happen, on account of the acceleration, or even abbreviation by curtailment, of development, that the early whorls of the latest, A, do not show us the stages so far back in the history, even on a diminished scale, as the early, or even the later, whorls of C; and so it might be proved, step by step, that a form which, neither in its adult stages nor in any earlier stage agreed with a second, might yet be of the same lineage. In this way a well-proved lineage may pass from so-called species to species, from so-called genus to genus, and from so-called family to family."

Moreover, this process of development takes place not merely in a direct line, but along lines branching, as it were, from some original primitive form.

The genetic relationships among the Ammonoidea have been the subject of many memoirs. The principal writers, beside Hyatt (*34–42*), have been S. S. Buckman (*8–11*), Haug (*30*), Karpinsky (*43a*), Waagen (*59*), Würtenberger (*62–3*), and to their writings the student must turn.

One other contribution to the study of evolution as exhibited in the Cephalopoda claims attention, viz. Hyatt's contention that the group affords proof of the inheritance of an acquired characteristic.

The evidence adduced, in a memoir (*42*) that all should read, may be summarized as follows:—In the Nautilus shell the dorsal or inner side of each whorl is channelled and into this groove ('contact furrow') the preceding whorl fits. Now in the early nautiloids the young shells, which are not closely coiled, show no sign whatever of such furrow, but with the growth of the shell, and the increased tendency to closer coiling, this groove develops as the succeeding



I. II.

Diagrammatic Sections of Nautiloid Shells.

I. Of an early type, in which the initial whorls (A, B, C), not being in contact, show a sectional outline devoid of indentation, while the later ones (D, E, F) show a 'contact furrow.'

II. Of a late type, in which the initial whorls (A, B, C), still not in contact, exhibit an 'impressed zone,' the precursor of the 'contact furrow' in the later ones (D, E, F).

whorls come in contact, and it not only becomes more and more pronounced in the different forms which follow on in time, but tends by the law of acceleration to develop earlier and earlier in the life-history of the individual, till it is shown, as in the modern Nautilus, as an 'impressed zone' in the very earliest stages, before a single complete whorl has been formed, when its existence serves no purpose, and it simply foreshadows a need to come. Hyatt regards the development of this contact furrow and its beginning, the impressed zone, as an 'acquired characteristic,' it being one that originally had no existence in the phylogeny of the race, but was developed later. Whether the teachers of recent morphology will accept this definition is another matter, for unlike palæontologists they expect more immediate results.

While so much has been done in unravelling the evolution of the Tetrabranchiate Cephalopoda, more still awaits solution, especially among the earlier forms, and the Dibranchia are practically untouched.[1]

Following in the footsteps of Hyatt, under whom he in part studied, R. T. Jackson began similar researches among the Pelecypoda, and dealt with the Aviculidæ (i.e. Pteriidæ) and their allies (*43*).

His work, unhappily, does not carry the same conviction with it as Hyatt's. For this the subject is to blame. The prodissoconchs of Pelecypods seem to afford fewer characteristic features than the protoconchs of Cephalopods, while the later stages exhibit no such marked intrinsic features as do the septa of Ammonoids and Nautiloids. Moreover, the author's genealogical table shows that his conclusions, when dealing with genera having modern representatives, do not coincide with the teachings of investigations founded on the animals and their embryology.

Another attempt to deal with the Pelecypoda from the evolutionary point of view was unfortunately brought to naught, for the intervention of death cut short the projected work of Félix Bernard (*3*), which gave promise of ably carrying through the task of tracing out the ontogeny and morphology of the Pelecypod shell so far as the Tertiary and Recent forms were concerned. As was to be expected from his previous investigations (*2*), the development of the hinge took a prominent place in these researches. The work is a fragment, but we are fortunate in possessing even that from so able a pen.

With the exception of these two writers, Jackson and Bernard, no one seems to have taken up the study of the Pelecypods from the detailed evolutionary point of view, and there is therefore a wide and important field of research awaiting due investigation.

What opportunities for evolutionary research the Gastropoda offer has of late been shown by the series of valuable papers by A. W. Grabau (*26–9*), that deserve the careful attention of all Malacologists.[2] His examples are chiefly drawn from families high up in the phylogeny of the race (*Fusus*, *Murex*, *Sycotypus*, *Fulgur*), and so do not afford scope for any really wide generalizations; nevertheless, they teach much, as the following résumé of his conclusions will show.

For purposes of study the Gastropod shell presents an advantage over

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[1] In the foregoing observations on the Cephalopoda I have had the advantage of Mr. G. C. Crick's kind assistance and advice, and I gladly take this opportunity of returning to him my sincerest thanks.

[2] The classical work by Neumayr (*51a*) on the evolution of the species of *Vivipara* in the Neogene beds of Slavonia, with Hilgendorf's (*30a–c*) and Hyatt's (*38a, b*) papers on the phylogeny of the forms of *Planorbis multiformis* from the Miocene of Steinheim, being limited in their scope, need not detain us, valuable as they are.

that of the Cephalopod in that the greater part of the whorls are exposed, whereas in the latter the older are mostly concealed by the newer whorls.

The form of the Gastropod shell is multiple, but the types are few. Primitive types always begin with a protoconch having rounded whorls, free from all ornamentation. When the whorls remain rounded throughout the life of the species no regular ornamentation is as a rule produced. Generally, however, a change from the primitive rounded outline to an angular one takes place by the formation of a peripheral keel. The subsequent shape of the shell will then depend upon the position of this keel, whether high up or low down on the whorl, and the extent to which the succeeding whorls overlap each other. Occasionally more than one carina is developed. Keeled shells usually exhibit several forms of surface ornamentation, such as ribs, spiral liræ, nodules, and spines. Of these the ribs are usually the first to appear, but many instances will readily occur to conchologists in which the spiral lines have precedence and are even found on the protoconch itself. The cause of these adornments is uncertain, but Grabau, bettering Dall's suggestion for the columellar plaits of *Voluta* (*17*, pp. 58–61 ; *18*), attributes the formation of the spiral liræ to the wrinkling of the mantle as the animal withdraws into its shell; he apparently forgets that the new shell is formed when the animal is extended. Moreover, plications formed simply by the folding of a flexible surface would be apt, like the lines on the palms of our hands, to show considerable individual variation, a condition not exhibited in shells where the regularity of the spiral liræ is usually constant for the species.

The evolution of the spines and their development in the life of a single individual, as in *Murex brevifrons* (*26*, pp. 934–5) is very happily traced by Grabau, but it is difficult to follow him when, especially in the Melanias, he claims for them a regular phylogenetic sequence (*28*, p. 639). One wonders what he would make of the ornamentation displayed by *Tanalia aculeata* (Gmelin), of which H. F. Blanford collected specimens from the same spot in a given stream exhibiting very considerable range of graduated variation, from coarsely granulated to smooth forms (*6*). Beecher in his admirable memoir (*1*, p. 353) argues that spines, or, rather, a spinose condition, occurs just after the culmination of a group, and is to be taken as the visible evidence of the beginning of the decline of the vitality of the group. Packard (*53*, pp. 505–6) inclines to attribute the development of spines, in some cases at all events, to a response to a change of environment, and says: "It is not improbable that the appearance of such highly or grotesquely ornamented forms as certain later Brachiopods, Trilobites, and Ammonites was the result of a change in their environment." In the case of our common *Cardium echinatum*, Linn., it may be remarked, the size and number of the spines vary with the nature of the sea-bottom, being fewer and smaller in proportion as the silt in which they bury is firmer.

Many Gastropods, after passing through the juvenile stage of a plain protoconch and developing the characteristic ornamentation of their tribe or species in the adult (aggregational development), will in their old age lose their ornamentation by stages that reverse the order in which it developed and finally revert to a smooth-whorled condition (degradational development), just as Hyatt found to be the case in Ammonites.

All these successive stages follow the sequence outlined above in regular order, and to this Grabau applies the term "Orthogenetic Variation." To quote his own words: "Orthogenetic Variation may be defined as progressive variation along definite or determinate lines, whether such variation is along the line of increasing or decreasing complexity, i.e. aggregational or degradational" (*28*, p. 607).

The law of tachygenesis is well shown in Gastropoda when a series of forms are traced through successive geological epochs, as Grabau has done for *Fulgur*, *Sycotypus* (*27*), and *Fusus* (*29*).

That the study of orthogenetic development in the different families of Mollusca, and more careful attention to the character of the protoconch,[1] due allowance being made for differences in individuals living under diverse conditions (the Heterostylism of Boettger (7)), may lead to the sorting out of forms, hitherto classed together owing to similarity of form in the adult, is more than probable. It may also lead to the phylogenetic association of groups hitherto considered to be unrelated.[2] It is not, however, possible to follow Grabau when, led away by enthusiasm for his special study, he maintains that similarity of lingual dentition should be subordinate to shell characters (*27*, p. 537). Nor can assent be given when he classes patelloid shells with uncoiled and, according to him, degenerate forms like those of *Vermetus*, *Cyclosurus*, and many another from Lower Cambrian times to the present day (*26*, pp. 938–9; *28*, p. 623). The patelloid shell is not the result of uncoiling, but of a total alteration in growth to suit it to the animal's mode of living. To label *Patella* and other cognate forms phylogerontic is to misapply that much abused and overworked term. One might equally describe *Dentalium* as phylogerontic!

In this matter it would seem as if the disciple had, as disciples are apt to do, gone further than the master, for Hyatt points out (*42*, p. 588): "There is an obvious correlation between coiling of the shell and the habit of crawling. Thus all univalve crawling mollusca have this general tendency. Among Gasteropoda this is well known, and those shells which degenerate and tend to lose the spiral mode of growth and become irregularly straightened out in these older stages of growth, are forms which become attached or lead sedentary lives, i.e. *Vermetus* attached late in life and *Magilus* buried in coral. The most significant case, however, is that of *Fissurella*, which has a coiled

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[1] "I believe it is not too much to say that the protoconchs of all the species within a given genus should agree as to their essential characteristics, and that no species can be considered congeneric in which the protoconchs show a radical difference" (Grabau, *26*, p. 922).

[2] Grabau puts *Buccinum* and *Fulgur* with *Fasciolaria*, and *Melongena* and *Hemifusus* with *Fusus* (*27*, p. 537), considers *Levifusus* closely related to *Pleurotoma* (*27*, p. 526), and hints that *Pterocera* is polyphyletic (*26*, p. 930, note).

shell in the nepionic stage and becomes similar to *Patella*, a depressed, straight cone in the neanic and ephebic stages, the habitat being like that of *Patella* and the approximate forms of *Haliotis* and others, comparatively sedentary upon littoral rock ledges." Jackson, too (*43*, p. 294), who had the benefit of Hyatt's direct teaching, refers the uncoiled stage of *Vermetus* to the ephebic or adult period, and therefore by no means considers it gerontic.

So far, then, as the Gastropoda are concerned, we are but on the threshold of inquiry, and there is need of much further work among other groups and especially the older fossil forms.

The chief object in thus drawing attention to such progress as has been made in the study of molluscan phylogeny and in emphasizing the fact that so much more of very great interest remains to be done, is the hope that some members of this Society may be persuaded to take up this branch of investigation, hitherto comparatively neglected in England. Opportunity, of course, will not come to all, but for willing workers other less comprehensive fields of research connected with the question are equally open. As an example may be instanced the excellent work done quite lately by Mr. E. S. Russell in studying the Limpet.

In his memoir (*55*), after narrating the results of experiments on the well-known homing propensities of this mollusc, that demonstrate large Limpets to be more fixed in their positions than small ones, Mr. Russell turns to the influences of environment on the size and character of the shell. He finds that the shells of those Limpets which live near high-water mark are at every stage of their growth higher spired and a little broader, though narrower in proportion to their height, than low-water shells. Also the proportion of large shells is greater at high-water than at low-water sites. When those inhabiting exposed are contrasted with shells in sheltered spots in a given definite locality, the former are found to be proportionately narrower than the latter. Observation showed that of the two types of shell, the rough and the smooth, the first-named were attached to rough, the others to polished stones, and were simply the result of the growing shell-margin moulding itself to the surface of attachment, so that the two types are the outcome of a single environmental character.

Similar observations are now required with respect to other intertidal molluscs.[1] The effect of environment on molluscs is as yet but very imperfectly understood. Beudant's experiments (*4*) on the

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[1] At a meeting of the Challenger Society held on January 27th of this year, Mr. W. M. Tattersall gave some exceedingly interesting details concerning the breeding habits and development of the British species of *Littorina*. It appears that the eggs of *L. littorea* are deposited in small capsules shaped like a Panama hat, and are not attached, which accounts for their not having been recorded hitherto. The species is exposed only at low spring tides, and the embryo is freed as a trochosphere, later attaining the veliger stage ; the embryo of *L. obtusata*, which is exposed at ordinary low water, is freed as a veliger ; *L. rudis* and *L. neritoides*, on the other hand, which live at the high-water line, are viviparous. A remarkable instance this of adaptation to suit environmental conditions. (Cf. *Athenæum*, February 13th, 1909, pp. 203–4.)

capacity of freshwater molluscs to survive in salt water, and vice versa, require repetition and extension; so, too, do both Semper's (*56–8*) and Varigny's (*58a*) experimental dwarfing of *Limnæa.*

The influence of different foods on even the commonest of our garden snails, easily as they may be kept under observation, is practically unknown—nay, the ordinary food of many is not fully understood, and Gain (*23*, *24*) seems the only person who has conducted practical experiments on the subject. The habitat and mode of life of many terrestrial mollusca, even the commonest, call for further scrutiny: of this type of œcological investigation the Rev. A. H. Cooke's paper (*16*), lately contributed to our Proceedings, is a good example.

All these things should claim our attention, for, to quote Kellogg (*44*, p. 387): "Our work is to learn. To observe, to experiment, to tabulate, to induce, to deduce. Biology was never a clearer or more inviting field for fascinating, joyful, hopeful work. To question life by new methods, from new angles, on closer terms, under more precise conditions of control; this is the requirement and opportunity of the biologist of to-day. May his generation hear some whisper from the Sphinx!" But, as Huxley so wisely expressed it (*31*, p. 390): "Those who wish to attain to some clear and definite solution of the great problems which Mr. Darwin was the first person to set before us in later times must base themselves upon the facts which are stated in his great work, and, still more, must pursue their inquiries by the methods of which he was so brilliant an exemplar throughout the whole of his life. You must have his sagacity, his untiring search after the knowledge of fact, his readiness always to give up a preconceived opinion to that which was demonstrably true, before you can hope to carry his doctrines to their ultimate issue; and whether the particular form in which he has put them before us may be such as is finally destined to survive or not is more, I venture to think, than anybody is capable at this present of saying. But this one thing is perfectly certain—that it is only by pursuing his methods, by that wonderful single-mindedness, devotion to truth, readiness to sacrifice all things for the advance of definite knowledge, that we can hope to come any nearer than we are at present to the truths which he struggled to attain."

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DESCRIPTION OF A NEW SPECIES OF *OLIVA* FROM THE ANDAMAN ISLANDS.

By F. G. Bridgman.

Read 12th March, 1909.

Oliva Andamanensis, n.sp.

Shell cylindrical with the outlines a little curved, yellowish, copiously covered with angular clouded purplish-brown markings, which often coalesce, forming a kind of reticulation. This is sometimes (but not always) suddenly interrupted towards the labrum, leaving a plain yellowish tract or space entirely or almost without markings. The acute sutural margin of the body-whorl is marked with spots or short lines of a purer and darker brown colour, which also are visible upon the upper whorls when not hidden by a callous deposit which invariably covers the spire. This is shortly conical, yellowish, and without markings, excepting the sutural spots or lines already referred to. The apex is usually of a lilac tint. Whorls 7,

the three apical a little convex, the three following obliquely flattened, the last marked off by a narrow channelled suture; labrum a little thickened, generally pale or purple-whitish at the edge; aperture rather narrow, purplish; upper half of basal fasciole yellow, lower half marked with short brown lines forming an oblique band; columella with a defined white callus bearing about 15–18 transverse liræ. These are much more evident in some specimens than in others, and four of them are produced over the end of the whorl, the uppermost forming the margin of the callus, which is almost white or faintly tinted with pale red anteriorly.

Length 21, diam. 10 mm.

Hab.—Andaman Islands.

In many respects this shell is closely allied to certain varieties of *Oliva carneola*, Lam., and *O. todosina*, Duclos, and in fact is separated almost exclusively by difference of colour and locality.

The typical forms of *carneola* and *todosina* exhibit transverse banding, a feature which has not yet been observed in the present species from the Andaman Islands.

NOTES ON THE GENERA *CYPRÆA* AND *TRIVIA*.

By H. O. N. Shaw, F.Z.S.

Read 12*th March*, 1909.

PLATES XII AND XIII.

After systematically working at the genera *Cypræa* and *Trivia*, and paying particular attention to synonymy, dates of publication of the species, references and figures cited in the original descriptions, etc., I have been induced to publish the results obtained with regard to certain species with the hope that they may be of use to workers on these genera.

In the first place, I noticed that several species in both genera stand at the present time with specific names which have been employed previously to their present use by various authors to designate what they believed at the time to be new species, but which have proved to be synonyms or only varieties of earlier species. Gmelin is the chief offender in this respect, as he described a considerable number of species from figures of early writers, giving very brief and inadequate descriptions, and often describing the same shell in different states of growth.

I had always understood that if a specific name had been used once, even though in error, and therefore became a synonym, it could never be employed again, or, to use a well-known expression, "Once a synonym, always a synonym."[1] On inquiry from various eminent conchologists and nomenclaturists, I find they are all of the same opinion, and state that species bearing a name that has been used before in the same genus must be renamed. Those species which require renaming, with the names I propose for them, will be found in this paper.

The following is the general idea of the rules now usually recognized on which I have made the changes:—

1. A specific name used once, even though a *nomen nudum* or synonym, cannot be used again in the same genus.

2. A name given to a species, believed by the author to be new, and which has proved to be only a variety of a prior species, can retain the original name (being reduced to varietal rank), even though the same name had been used previously either for a good species or for what now is a synonym in the same genus.

3. Two or more species in the same genus can have the same varietal name; e.g., *minor*, *major*, *alba*, *pyriformis*, *oblonga*, etc.

4. A name used to designate a fossil shell, even though now a synonym, cannot be used for a recent shell of the same genus, and vice versa; but a name used to designate a fossil can also be used as a varietal name of a recent form, or the reverse, and any number of varietal names may be standing at the same time in the same fossil and recent genus.

Before attempting these notes, besides the various monographs and works referred to, I have carefully studied Sènor Hidalgo's excellent

[1] Dall, Trans. Wagner Free Inst., 1895, vol. iii, pt. iii, pp. 561–5.

monograph[1] on *Cypræa*, which certainly of its kind is the best published, and to him all those who specialize in the genus are greatly indebted for the trouble and care he has taken in its preparation, and for his exhaustive synonymy. The reasons for differing from his views in certain cases and the conclusions arrived at will appear later on.

While writing this paper Mr. C. D. Sherborn conclusively proved to me that the "Descriptive Catalogue of Shells by John Edward Gray," 1832, was never published, but existed only in a few proof-sheets. It must therefore be regarded in the same light as manuscript and no longer quoted as a publication. The species described in it for the first time must therefore take as their author the next writer who adopted them.

It is most probable, indeed almost certain, that this Catalogue has never been seen except by the officers of the Natural History Museum, where the extant proofs are preserved, and perhaps by one or two who, like myself, have been working there. The reason that it has always been quoted in the various monographs on *Cypræa*, by Reeve, Sowerby, Weinkauff, Roberts, Kiener, Melvill, Hidalgo, etc., is that Sowerby refers to it in his "Conchological Illustrations" (Gray having probably given him a copy), where he quotes the species with Gray as the author and gives references to the Catalogue, which evidently have merely been copied by later writers.

I now give a list of the species of recent *Cypræa* and *Trivia* described by Gray in this Catalogue, quoting the writer who first adopted them, who, as stated above, must be regarded as the author. The place where this author first mentions them should also be considered the place of publication. Where referred to in this paper, I have quoted the proper author, entirely eliminating the "Descriptive Catalogue."

Species first described in the Descriptive Catalogue by Gray, with the references given by him.	*Author of the species, with reference to where first described and published.*
p. 7, No. 48*, *Cypræa Adamsonii*, Gray, Illust., f. 7.	Sowerby, Conch. Illust., p. 11, No. 107, f. 7.
p. 9, No. 68*, *Cypræa hirundo*, Linn., var. *Owenii*, Gray, Illust., f. 12**.	Sowerby, op. cit., p. 6, No. 64, f. 12**. (Now admitted to hold specific rank.)
p. 10, No. 84, *xanthodon*, Gray, Illust., f. 18.	Sowerby, op. cit., p. 9, No. 88, f. 18.
p. 11, No. 94*a*, *Walkeri*, Gray, Illust., f. 22*.	Sowerby, op. cit., p. 7, No. 70, f. 22*.
p. 14, No. 119, *Trivia sanguinea*, Gray, Illust., f. 32.	Sowerby, op. cit., p. 12, No. 115, f. 32.
p. 14, No. 121, *Trivia globosa*, Gray, Illust., f. 34.	Sowerby, op. cit., p. 12, No. 117, f. 34.
p. 15, No. 125*, *Trivia fusca*, Gray, Illust., f. 37.	Sowerby, op. cit., p. 13, No. 120, f. 37.
p. 15, No. 127*, *Trivia nivea*, Gray, Rumph., t. 39, f. P.	Sowerby, op. cit., p. 13, No. 122, f. 38*.
p. 16, No. 134, *Trivia suffusa*, Gray, Illust., f. 41.	Sowerby, op. cit., p. 13, No. 126, f. 41.
p. 16, No. 136, *Trivia Solandri*, Gray, Illust., f. 43.	Sowerby, op. cit., p. 14, No. 128, f. 43.

[1] "Monografía de las especies vivientes del género *Cypræa*," 1906–7.

Besides describing the above species in the "Descriptive Catalogue," Gray also split up the genus *Cypræa*, making the genera *Luponia* and *Trivia* and the subgenera *Aricia* and *Naria*. All with the exception of *Trivia*, which is now shown to be a good genus, are simply sections of *Cypræa*. Their authors, and the place where first adopted, are as follows: *Luponia* and *Trivia*, Sowerby, "Conchological Manual," 1839, pp. 60, 108; *Aricia*, H. & A. Adams, "The Genera of Recent Mollusca," 1854, vol. i, pp. 265, 266; *Naria*, Gray, "Guide to the Systematic Distribution of Mollusca in the British Museum," 1857, pt. i, p. 72. It will be observed that the dates of various species in the "Conchological Illustrations" quoted in this paper, differ from those which have hitherto been considered correct. The dates now cited may, however, be regarded as accurate, as proved by certain information lately acquired (*vide* my paper on the "Conchological Illustrations," which will be published in Part VI of this volume).

I now give some notes on the differences between *Cypræa* and *Trivia*, and the reasons for considering them distinct genera.

In 1839 Sowerby, on conchological grounds, created the genus *Trivia* for that section of *Cypræa* which is characterized by a lighter shell, with ridges or costæ running transversely from the base over the sides and dorsal surface, ending in most cases in a groove or sulcus, sometimes broad and shallow, or narrow and deep, running longitudinally along the centre of the shell. In some species there is no sulcus, and the striæ gradually become less and less until they disappear on the middle of the dorsum, while in others they interlace so that the striæ from one side end in the grooves between those of the other.

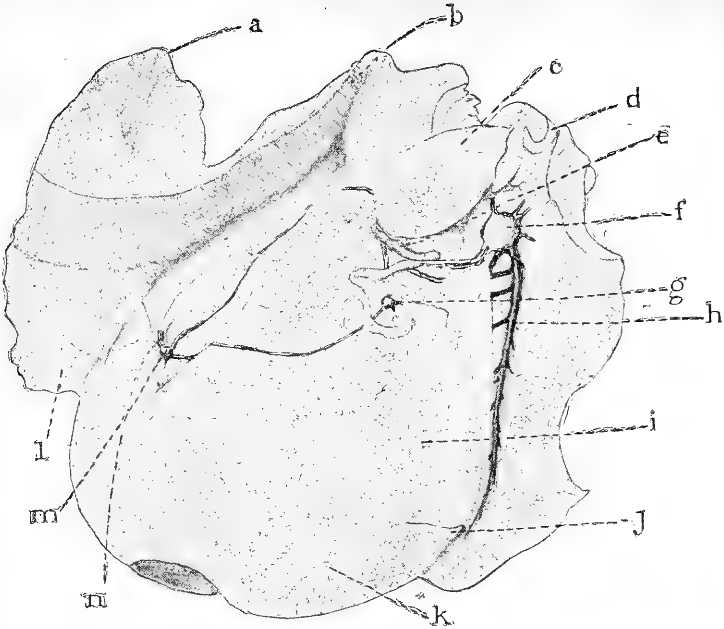
Some writers have considered *Trivia* as a genus, others as a subgenus, while a third class maintain that it is simply a section of *Cypræa*.

When about to revise the nomenclature of the latter genus, this matter was of great importance, because if they were distinct genera they might have the same specific name standing in each, and the nomenclature of one would not interfere with that of the other. On the other hand, if *Trivia* was only a subgenus or section, a good many names would have to be altered as having been used in the one group, although perhaps now only being synonyms of earlier names, but in the other group there were shells bearing these same designations which would have had to be changed.

If *Trivia* was made a genus on purely conchological differences, there was no reason why *Luponia*, *Naria*, *Cypræovula*, *Aricia*, *Gaskoinia*, etc., should not also be considered as genera, as they differ conchologically from the typical *C. mappa*, Linn., almost as much as *Trivia*.

After consulting Mr. E. A. Smith on this subject, it was decided that if any real anatomical difference existed between *Cypræa* and *Trivia* it would be justifiable to regard them as distinct genera, weight also being given for this decision by the difference of the shells.

Mr. H. G. Farmer, New College, Oxford, to whom I am greatly indebted for all the trouble and time he has expended over the matter,



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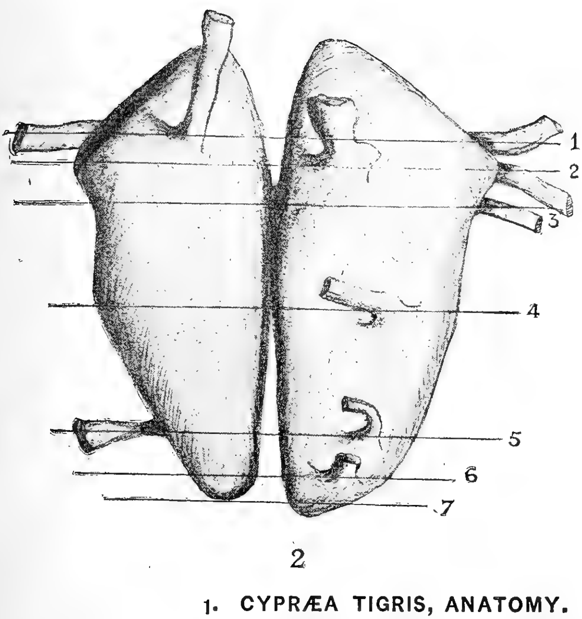

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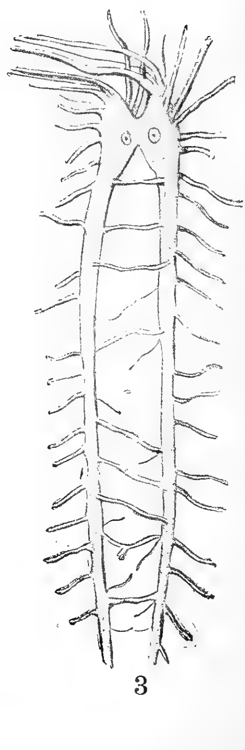


3

1. CYPRÆA TIGRIS, ANATOMY.
2. TRIVIA ARCTICA, PEDAL GANGLIA.
3. CYPRÆA ARABICA, PEDAL GANGLIA.

very kindly undertook to work out the anatomy of specimens of *Cypræa tigris* and *Trivia arctica*.

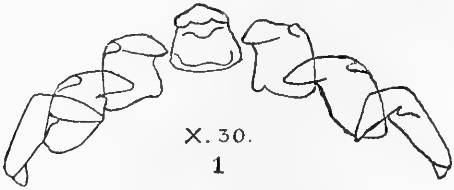
The difference between *Cypræa* and *Trivia* lies first of all in the nervous system of the foot.

In *Cypræa*, as originally described by Bouvier,[1] the pedal centres are in the form of a long pair of cords (Pl. XII, Fig. 3), swollen at their anterior extremities and composed of a central core of nerve fibres, ensheathed by nerve ganglion cells throughout their extent. These two longitudinal pedal cords are connected by a number of transverse commissures, of which the most anterior, connecting the swollen anterior extremities, is the largest and most important. This scalariform system of transverse commissures is, as Bouvier points out, a primitive feature, recalling the condition found in *Patella* and *Paludina* [*Vivipara*].

In *Trivia* the pedal centres are much concentrated when compared with those of *Cypræa*. Whereas in the latter the length of the pedal centres relatively to that of the foot is as 3 to 4, in *Trivia* it is as 1 to 14.

The part corresponding to the swollen anterior ends of the cords in *Cypræa*, with the anterior transverse commissure connecting them, remains; but the posterior elongated cords are very much abbreviated, and, indeed, are so small as to be only recognizable in sections. In dissection they look like a stout pair of nerves given off from the posterior ends of a pair of rounded pedal ganglia. Sections (Pl. XIII, Figs. 1–7), however, show that these apparent nerves are, like the pedal cords of *Cypræa*, ensheathed by ganglion cells to their hindermost ends, and that the nerves supplying the foot are given off from their sides. There are, however, no transverse commissures beyond the one already mentioned, and therefore no trace of the scalariform system observed in *Cypræa*. *Trivia* therefore is more specialized in the nervous system than *Cypræa*.

In the second place, the radulæ are distinct; in that of *Cypræa tigris* (Fig. 1) the median tooth has a large central cusp with a small one on each side; the marginal teeth have an elongated and hook-shaped central cusp with a small one of similar shape at its base, but



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they are not much longer in proportion than the median, and the ends of the marginal teeth do not extend so as to meet in the middle of each transverse row of the radula ribbon. The lateral teeth have one central cusp and a small pointed one on each side.

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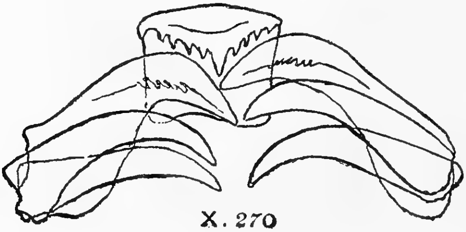
[1] Bibl. de l'école des Hautes Etudes, 1887, vol. xxxv, p. 216.

In *Trivia* (Fig. 2) the median tooth has a small pointed central cusp, with four or five small and slightly curved ones on each side of it, while the marginals have no small cusps, but are of such a length that they almost meet in front of the median tooth, and the laterals have 3–5 small cusps situated on each side of the central one.



X. 270

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With a view to ascertaining whether the differences in the nervous system and dentition mentioned above were sufficient to justify generic separation, I submitted the question to Professor G. C. Bourne, whom I wish to thank for his kindness in this and other matters connected with this paper. He maintains that the difference in the nervous system alone is sufficient for separation, and this, together with that of the dentition, leaves no doubt that they should be considered as separate genera. The justification for this conclusion will, it is hoped, be obvious when the differences of nerve systems, radulæ, and shells are taken into consideration.

Much discussion has arisen as to whether Bolten's "Museum Boltenianum," 1798, Humphrey's "Museum Calonnianum," 1797, Meuschen's "Index Musei Gronoviani," 1778, and the "Museum Geversianum," 1787, also of Meuschen, ought to be accepted. After getting the opinion of several of the chief authorities on conchology and nomenclature, and after having studied the works themselves and various criticisms, and the reasons for and against accepting them, I have come to the conclusion that the opinion held by Mr. E. A. Smith and Professor W. H. Dall is correct, and I therefore propose adopting it.

1. Bolten must be accepted, as he quoted the names and figures with pages, plates, and volume of previous authors, and was strictly binomial, although he gave no diagnoses of the various species.

2. The "Museum Calonnianum" ought to be entirely ignored; it is simply a sale catalogue, Humphrey's name did not appear on it, and there are no references.

3. Both of Meuschen's publications ought also to be debarred from zoological literature, as he did not use a strictly binomial, but in places a trinomial, system, and his generic names, of which I quote four, viz., *Cassides*, *Globosæ*, *Coni*, and *Porcellanæ*, would not now be allowed as generic appellations. For these reasons it is undesirable to accept his works.

Owing to the reasons already stated for not admitting Meuschen, his two species, accepted by Hidalgo on grounds of priority, should return to the names by which they have always been known. The two species are—

C. fragiloides, Meusch., becomes, as formerly, *C. cinerea*, Gmelin.

C. amarata, Meusch., in the same way stands as *C. scurra*, Gmelin.

With regard to species described by non-binomial authors, it is now generally accepted that the first binomial writer who published the name should be considered the author; this is far better than employing such terms as (Chemnitz) auctorum, as used by some monographers.

I give below the species described by non-binomial writers, and hitherto accepted, with their proper authors, the typical form in all cases remaining the same—

Cypræa scurra, Chemnitz. Author, Gmelin.

C. histrio, Meuschen. Author, Gmelin.

C. onyx, L., var. *adusta*, Chemnitz. Author, Lamarck.

C. zonata, Chemnitz. First accepted by Gmelin, but he changed the name into '*zonaria*.' This name will have to stand, as the references given by him refer to *C. zonata*, Chemnitz.

The practice of some writers of quoting Solander as the author of various species clearly cannot be endorsed, as the Solander catalogue is only manuscript. The writers, therefore, who first published any of the names contained in it must be acknowledged as the authors, although, like Dillwyn, Gray, and others, they quote the species as of Solander.

NOTES ON VARIOUS SPECIES.

Cypræa arabica, Linn., var. intermedia, Gray.[1]

Hidalgo (p. 369) very properly points out that Gray's name must become a synonym in part of *C. Gillei*, Jousseaume.[2] Gray's description covers var. *eglantina*, Duclos,[3] as well as var. *intermedia*.

In 1847 Redfield[4] quoted var. *intermedia*, Gray, but confused it with *C. arabica*, Linn. Jousseaume, believing that *C. Gillei* was a new species, and evidently not knowing that it was the *C. arabica*, L., var. *intermedia*, auct. (*non* Gray), described it as such. Since he was the first to give it a name different from Gray's his name must stand for this variety.

Cypræa Boivinii, Kiener.[5]

After closely examining the figure and description of this species in Kiener's monograph, and some very typical shells in the British Museum, I do not agree with Hidalgo in making it a variety of *C. Listeri*, Gray,[6] instead of *C. gangrænosa*, Dillwyn,[7] as has always been maintained.

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[1] Zool. Journ., 1825, vol. i, p. 77.
[2] Le Naturaliste, 1893, p. 171.
[3] Mag. de Zool., 1833, pl. xxviii.
[4] Ann. Lyc. Nat. Hist. New York, vol. iv, p. 488, pl. xvi, fig. 2.
[5] Coq. Viv., 1845, vol. i, p. 66, pl. xviii, fig. 2.
[6] Zool. Journ., 1825, vol. i, p. 507.
[7] Descr. Cat. of Shells, 1817, vol. i, p. 465.

This I think will be evident after comparing *C. Boivinii* with *C. Listeri* and *C. gangrænosa*, as it agrees much better with the latter in colour and marking, possessing the characteristic brown maculations at each end of the shell, which is one of the constant features of *C. gangrænosa*, besides being much closer to it in shape and dentition. The pale violet-tinged base, which induced Hidalgo to make it a variety of *Listeri*, is noticeable in some colour varieties of *C. gangrænosa*, but nevertheless there is no doubt that *C. Boivinii* is simply a large and pale form of *C. gangrænosa*, as recognized by all previous writers. It may not be out of place to point out that *C. Reentsii*, Dunker,[1] which is only a variety of *C. gangrænosa*, is quite a different shell from *C. Boivinii*, with which it has been confused. When compared with the latter it is seen to be much smaller, of a bluish colour, with the extremities maculated with brown, the base bluish purple, and the dorsal surface transversely lined with brown.

Cypræa clara, Gaskoin.[2]

After comparing specimens of this so-called species with *C. cinerea*, Gmelin,[3] I have come to the conclusion that they merely belong to a variety of it. In *C. clara* the teeth are slightly finer, the base is of a whiter colour, and the form is slightly more elongate. In *C. cinerea* there is generally more colour between the teeth, though this is not always present; also, the black markings along the margins of the shell, though generally conspicuous, are by no means constant.

Both these forms come from Central America, and also from the West Indies, being restricted to these regions. I have examined a number of these shells, and although in certain cases have been able to separate them, in others it has been impossible, as they merge into each other. I therefore do not hesitate in considering *C. clara* merely a variety of *C. cinerea*, and cannot understand why Gaskoin compared it to *C. isabella*.

Cypræa cruenta, Gmelin.[4]

Hidalgo (p. 174) states that the *C. cruenta*, Gmelin, is not the *C. cruenta*, auctorum. The former, he says, equals *C. errones*, Linn., var., and the *cruenta*, auctorum, is the same as *C. Chinensis*, Gmelin.[5] Gmelin's description is very inadequate, and the figure in Argenville which he quotes is very poor, so that it is doubtful whether it represents *C. cruenta*, auctorum, or not. Gmelin's description of *C. cruenta* and his reference to Gualtier (Test. T. 15, f. E) make one inclined to agree with Hidalgo that this species is a variety of *C. errones*, Linn. Under the circumstances I think it would be wise to adopt the name of *C. variolaria*, Lamarck,[6] about which there is no

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1 Zeitsch. f. Malak, 1852, p. 189, and Novitat. Conch., 1858, pl. ix, figs. 3, 4.
2 Proc. Zool. Soc., 1851, p. 13.
3 Syst. Nat., 13th ed., vol. vi, p. 3402.
4 Op. cit., p. 3420.
5 Op. cit., p. 3421.
6 Ann. du Mus., 1810, vol. xvi, p. 91.

doubt, and I entirely agree with M. Deshayes' remarks in connexion with that species.[1]

CYPRÆA DUBIA, Gray.[2]

After searching through all subsequent writers and monographers I have been unable to find a single reference to this species. Mr. E. A. Smith and myself carefully examined the Gray Collection, now in the British Museum, and failed to discover any shell bearing this name. It certainly is not the *C. dubia* of Gmelin,[3] which is the *C. exanthema* of Linnæus. The Zool. Miscellany seems to have been unknown or ignored by a considerable number of writers, and probably on this account we find no reference to this species in any work. From the description alone it is impossible to say what Gray's species was, and it must therefore be classed among the "Unidentifiable." *Cypræa bicallosa*, *Trivia exigua*, *C. Friendii*, and *C. similis* were also first described in the same paper, pp. 35–6, though it is generally stated that *T. exigua* and *C. bicallosa* first appeared in the "Descriptive Catalogue," which was a year later.

CYPRÆA FLAVEOLA, Linn.

Hidalgo (pp. 174, 245) states that the *flaveola* of the tenth edition and of the Mus. Ulricæ is a different species to that of the twelfth edition, and maintains that the former is only a colour variety of *C. helvola*, which being so, the *flaveola* of the twelfth edition (which is the *flaveola*, auctorum) cannot retain the appellation given it by Linnæus, as it is later than the tenth edition and the Mus. Ulricæ, where this name was first used, and according to Hidalgo erroneously. He therefore has substituted for the species of the twelfth edition the *C. acicularis*, Gmelin, which he regards as a synonym.

The result of these changes is as follows:—

C. flaveola, tenth edition and Mus. Ulr. = *C. helvola*, Linn., var.
C. acicularis, Gmelin = *C. flaveola*, twelfth edition.
The *C. flaveola*, Linn., therefore entirely disappears.

Mr. E. A. Smith and I have gone into this question, and have come to the following decision, which does not agree with that arrived at by Hidalgo, but which in my opinion seems conclusive. In the first place, I do not admit that the *flaveola* of the tenth edition and of the Mus. Ulricæ is a colour variety of *C. helvola*. The difference lies in the Mus. Ulricæ. The twelfth edition is a copy of the tenth with a slight addition. It is more than probable that the shell described in the Mus. Ulricæ was different from that of the tenth and twelfth editions of the Systema. Yet it is evident that the author supposed them to be the same, since in the twelfth edition we have a reference to the Mus. Ulricæ, in which he again refers to the tenth edition.

The difference does not seem to lie in the fact that in the twelfth edition mention is made of the marginal spots, while there is none in

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[1] Anim. sans Vert., 2nd ed., vol. x, p. 511.
[2] Zool. Misc., 1831, vol. i, p. 36.
[3] Syst. Nat., p. 3405.

the tenth edition and the Mus. Ulricæ; it is very probable that in both the latter cases the spots were there, but were not mentioned. Where, however, we do find a difference is, as Hanley[1] points out, the "Nocitur colore supra et subtus flavo" of the Mus. Ulricæ, as compared with the white base of *C. flaveola*, auctorum.

I have examined the specimen now in the British Museum figured in Reeve, to which Hanley refers as being typical of the shell in the Linnæan cabinet; and after comparing it with the descriptions, entirely agree with Hanley that this is the true *flaveola*, Linn., and I do not see why, because a few of the words in the description of the Mus. Ulricæ do not quite agree with the other two descriptions, we should refuse to adopt the *flaveola*, Linn., considering what Hanley has said, and when its identity with the two editions of the Systema is unmistakable. *C. flaveola*, Linn., should therefore be retained in the sense in which it has always been recognized.

With regard to the *C. acicularis* of Gmelin, it is obvious from his description that this shell is a synonym, not of *C. flaveola*, Linn., but of *spurca*, Linn. The figure cited in Martini, and the latter's description, together with the fact that he says he has received it from the "Spanish Sea," all prove this point, and I fail to see how Hidalgo could have made it a synonym of *C. flaveola*. I may perhaps point out that the *labiolineata*, Sow. (as of Gaskoin), is only a variety of *C. flaveola*, Linn., and not of *C. gangrænosa*, Dillwyn, as stated by Sowerby in the Thesaurus and by other writers. It is the same shell as *C. labrolineata*, Gaskoin, and *C. Helenæ*, Roberts. Of this I am certain, as I have examined in the British Museum what is probably one of the co-types of Gaskoin's species, in which, when compared with *C. flaveola*, the teeth are seen to be finer, and to have a fine brown line running down the centre of each from the margins to the aperture. The shell also is of a slightly paler colour.

The conclusions arrived at concerning the species under discussion are as follows:—

1. *C. flaveola*, Linn., Syst. Nat., 10th ed., Mus. Lud. Ulr., 12th ed. (*partim*).
2. *C. spurca*, Linn., Syst. Nat., 10th ed., p. 724.
   = *acicularis*, Gmelin, Syst. Nat., 13th ed., vol. vi, p. 3421.
3. *C. flaveola*, Linn., var. *labrolineata*, Gask., Proc. Zool. Soc., 1848, p. 97.
   = *Helenæ*, Roberts, Amer. Journ. Conch., 1868, vol. iv, p. 250, pl. xv, figs. 7–10.
   = *labiolineata*, Sow. (as of Gask.), Thes. Conch., vol. iv, p. 38, fig. 231.

Cypræa fuscomaculata, Pease.

This species was first described in the Proceedings of the Zoological Society, 1865, p. 515, and a second description of it appeared in the American Journal of Conchology, 1868, vol. iv, p. 95, pl. xi, figs. 10

[1] Ipsa Linn. Conch., 1855, p. 193.

and 11, which, except in being slightly fuller, is precisely similar, and in parts word for word the same. Hidalgo asserts that the second description is of a different species, and has named it *C. Dautzenbergi*. After comparing the two descriptions it is obvious that they relate to one and the same species; *C. Dautzenbergi*, Hidalgo, therefore becomes a synonym of *C. fuscomaculata*, Pease.

With regard to the *C. fusco-maculata* (Gray, MSS.) described by Sowerby in the Thesaurus, vol. iv, figs. 372, 373, Mr. Smith very kindly went into this matter with me.

After comparing the two specimens in the British Museum (which are the two figured by Sowerby) with the descriptions and figures of *C. fuscomaculata*, Pease, I have no hesitation in pronouncing them to be identical with the latter species. This appears to be the first time that this has been noticed, as all writers and monographers on this genus have considered them to be distinct species. *Fuscomaculata* having been preoccupied by Pease, Roberts changed the *fusco-maculata* (Gray, MSS.), Sow., to *Adelinæ*, by which name the latter shell has generally been known.

One naturally wonders why two identical shells were both named *fuscomaculata* by different authors, and I think the solution given to me by Mr. Smith is the right one. It is more than probable that two of his own specimens, perhaps even co-types, were give by Pease to Cuming, which were put in the latter's collection (before it was acquired by the British Museum) labelled *C. fuscomaculata*, without any author. When the Thesaurus was written, Sowerby saw there two shells labelled *fuscomaculata*, and seeing there was no author quoted, concluded it was a manuscript name of Dr. Gray which had not been published (and it would not have been the first time this has happened), and therefore published them in his monograph with the result stated above. The fact that there is no mention of a *Cypræa fuscomaculata* ever having been described by Gray in any of his works, and that the two specimens are the only ones in the Museum (we could find none in the Gray Collection), gives weight to this theory.

Of course all this to a certain extent is mere speculation, but what we do know is, first, that the *fuscomaculata*, Pease, was unknown to Sowerby at the time, since there is no reference to it in his work, and secondly, that the *Adelinæ* of Roberts = *fuscomaculata* (Gray, MSS.), Sow., is identical with the *fuscomaculata*, Pease. It may be as well to notice that the figures in the Thesaurus are by no means good illustrations of the shells they represent.

The result derived, therefore, is as follows:—

Cypræa fuscomaculata, Pease, Proc. Zool. Soc., 1865, p. 515.
= *fuscomaculata*, Pease, Amer. Journ. Conch., vol. iv, p. 95.
= *fusco-maculata* (Gray, MSS.), Sow., Thes. Conch., 1870, vol. iv, p. 28, figs. 372, 373.
= *Adelinæ*, Roberts, Man. Conch., 1885, vol. vii, p. 168.
= *Dautzenbergi*, Hidalgo, Monograph Cyp., 1907, p. 362.

I may mention that the two shells in the British Museum are exactly the same size as the one figured by Pease, viz., 13 mm. long, 7 in diam.

Cypræa Gaskoinii, Rve.,[1] and C. Peasei, Sow.[2]

These two forms have generally been considered distinct, but after examining the type of *C. Gaskoinii* in the Natural History Museum and comparing it with a series of *C. Peasei*, Mr. E. A. Smith and I have come to the conclusion that they are identical. There is no difference in the dentition, aperture, marginal spots, or colour pattern, as mentioned by Sowerby, and the shape is exactly similar. The only difference appears to be that in a few cases *C. Peasei* is more pellucid and transparent, but this feature also varies considerably. With a series of shells it is impossible to separate the two, and I therefore feel justified in considering *C. Peasei* simply a synonym of *C. Gaskoinii*, and not entitled even to varietal rank. Moreover, both come from the same locality, and I fail to see the slightest reason for keeping them apart. *C. Gaskoinii*, on the other hand, is a good species, and quite distinct from its nearest congeners, *C. cribraria*, Linn., etc.

Cypræa hirundo, Linn.[3]

Hidalgo (p. 177) has adopted for the type of this species the one quoted on p. 576 of the Mus. Ulricæ, although he unites it with the *C. hirundo* of the Systema, and maintains that *hirundo* (Mus. Ulricæ) equals *neglecta*, Sowerby, and designates *hirundo*, auctorum (which is the typical shell), as *Kieneri*, Hidalgo. The following it is hoped will clear up the misunderstanding.

Linnæus evidently confused two species under this name. The first, in the tenth edition of the Systema, is the one that has always been accepted as the type, and Hanley (Ipsa Linnæi Conchylia, p. 190) says: "and the fact that the *Cypræa hirundo* of authors [Reeve, Conch. Icon., fig. 104] is present in the Linnean cabinet, where it solely answers to the definition of the species, is not without value in confirming the established opinion."

The species in the Mus. Ulricæ is the *C. neglecta*, Sow.,[4] the chief differences between the two shells being that in *C. hirundo* the teeth are coarser, further apart, and do not extend over the base; while in *C. neglecta* they are finer, closer, and extend over the basal surface. This agrees with "dentibus transversis, extensis rugis per basin exteriorem" of the Mus. Ulricæ. I maintain that if the *hirundo*, Linn., is the *neglecta*, Sow., Hanley would have mentioned the fact, considering both these species are on the same plate in Reeve's Conch. Icon., and I therefore do not see how the species of the Mus. Ulricæ can be taken as the type, ignoring that of the Syst. Nat. which was described six years earlier, and quite a different shell, and I hold the typical *hirundo*, Linn., to be the one quoted in the Syst. Nat., while the species of the Mus. Ulricæ equals the *neglecta*, Sow., which is now generally admitted as

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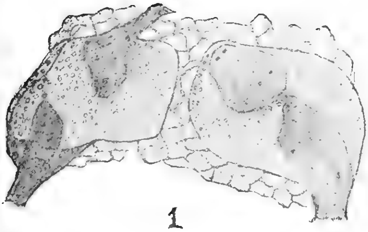
[1] Proc. Zool. Soc., 1846, p. 23.
[2] Thes. Conch., vol. iv, p. 33, figs. 167, 168.
[3] Syst. Nat., 10th ed., p. 722.
[4] Conch. Illust., p. 6, pl. xiii, fig. 12*.



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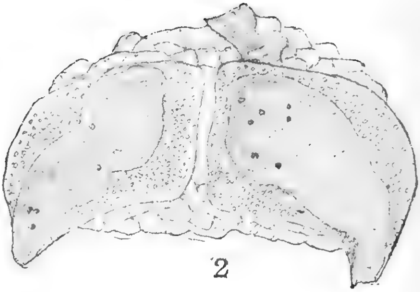

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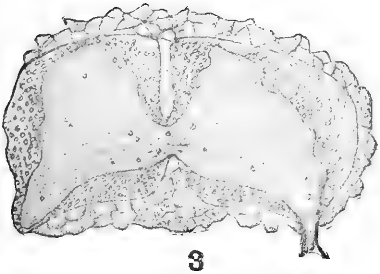

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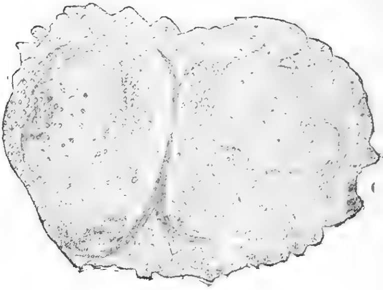

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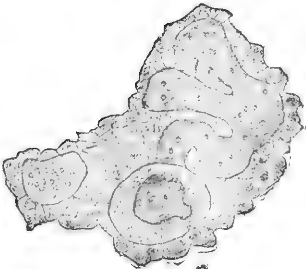

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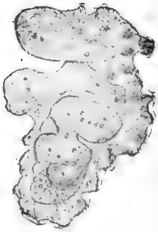

7

TRANSVERSE SECTIONS OF THE PEDAL GANGLIA OF TRIVIA ARCTICA.

a variety of *hirundo*. *C. Kieneri*, Hidalgo, therefore becomes a synonym of *C. hirundo*, Linn.

I may add that I consider the *C. coffea*, Sow.,[1] a distinct species and not a variety of *C. hirundo*, as stated by various monographers. This opinion is based on the difference of shape, colour-marking, and particularly on the teeth being finer and extending over the posterior extremity.

Cypræa Prestoni, n.n. for C. interrupta, Gray.[2]

The name of this species has to be changed, Bolten[3] having previously used the same term. The *C. interrupta*, Bolten, is a *nomen nudum*, there being no description or figure given or even cited. Although Bolten's name is useless, Gray's designation, having been used before, cannot stand, and therefore I have much pleasure in naming this shell *C. Prestoni* after my friend Mr. H. B. Preston.

Cypræa Hidalgoi, n.n. for C. leucostoma, Gaskoin.[4]

The specific name *leucostoma* had been used by Gmelin[5] to designate a species which Roberts says equals *C. lynx*, Linn. Dillwyn considered it a synonym of *C. Vanelli*, Linn., which is *C. lynx*, Linn., juv., and according to Hidalgo it is the *C. picta*, Gray (?). As this species has no synonyms, I propose to rename it *C. Hidalgoi*, after the author of the recent excellent monograph of this genus.

Cypræa Loebbeckeana, Weinkauff.[6]

This shell has generally been considered a variety of *C. carneola*, Linn., without the purple-coloured teeth which are characteristic of that species. In the Thesaurus (fig. 322) Sowerby illustrates a shell which is supposed to be the same, a *C. Loebbeckeana*. It is true that the teeth of the specimen illustrated are white, but it is also distinctly three-banded and of a cylindrical shape, and is clearly only a variety of *C. carneola*. *C. Loebbeckeana*, on the other hand, is pyriform, of a uniform pale yellow colour, without any bands, with a white base, and a ridge on the outer edge of the columella. The teeth on the columella lips are long and fine, and are interrupted below the ridge, leaving a gap. In my opinion this shell is not a variety of *C. carneola*, but a good species. Hidalgo makes the shell under consideration a variety of *C. vitellus*. Through the kindness of Mr. E. A. Smith I have been able to examine some pale yellow varieties of *C. vitellus* in the British Museum, but failed to see the slightest resemblance to *C. Loebbeckeana*.

Weinkauff, in his note on this species, says he has inspected 800 specimens of *C. carneola*, but could not link up *Loebbeckeana* with them.

Until we have further proof and more specimens of this shell are

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1 Thes. Conch., vol. iv, p. 10, pl. xxxii, figs. 359, 360.
2 Zool. Journ., 1824, vol. i, p. 376.
3 Mus. Bolt., 1798, p. 27.
4 Proc. Zool. Soc., 1843, p. 25.
5 Syst. Nat., 13th ed., vol. vi, p. 3413.
6 Conch. Cab. (*Cypræa*), p. 82, pl. xxiv, figs. 2, 3.

known, it would be best to consider this a distinct species, since after careful search I have been unable to unite it to any other. It certainly is not a variety of *C. carneola*, Linn.

CYPRÆA MILIARIS, Gmelin.[1]

The figure in Lister (Hist. Conch., pl. 700, fig. 47), quoted by Gmelin, represents *C. erosa* of Linnæus; the other figure referred to (pl. 701, fig. 48) probably equals *C. ocellata* of Linnæus. The figure referred to in Martini (Conch. Cab., vol. i, pl. xxx, fig. 323) corresponds to the *C. miliaris*, auct. As this species is well established, and the figure and description in Martini agree perfectly with the shell which has always been known as *miliaris*, it is undesirable to make any change, but perhaps it may be well to draw attention to the fact that both of Lister's figures must be eliminated and the species restricted to the figure in Martini. The same applies to *C. guttata* of Gmelin.[2] Gray has sometimes been quoted as the author, but erroneously, since he himself refers it to Gmelin. This species must be restricted to the latter's reference to Martini (Conch. Cab., vol. i, pl. xxv, figs. 252, 253).

The figure quoted from Lister (pl. 676, fig. 23) equals the young state of *C. vitellus* of Linnæus, while the one in Gualtier (Test., pl. xvi, fig. 1) probably represents the same shell. These two references must therefore be eliminated.

CYPRÆA GAMBIENSIS, n.n. for C. NEBULOSA, Kiener.[3]

This name was preoccupied by Gmelin[4] for a species which, according to Dillwyn and Roberts, equals *C. stercoraria*, Linn., while Hidalgo refers it to *C. eglantina*, Duclos. Personally, after examining the figure in Lister's Conchology, referred to by Gmelin, I am inclined to agree with Dillwyn and Roberts, and now rename this species *C. Gambiensis* from the locality which is usually associated with it.

CYPRÆA NOTATA, Gill.[5]

Hidalgo (pp. 176, 443) has united this species with *C. macula*, Angas,[6] asserting that they are identical. The latter, having been described nine years later, becomes a synonym of Gill's species. I venture to point out that this is not the case. *C. macula* is only a variety of *C. fimbriata*, Gmelin,[7] being more pyriform, and having generally a larger brown maculation on the dorsal surface than in the typical form. After examining a number of specimens at the British Museum and elsewhere, I am convinced that this form is only a variety of *C. fimbriata*, as it is always possible to link them

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[1] Syst. Nat., 13th ed., vol. vi, p. 3420.
[2] Op. cit., p. 3402.
[3] Coq. Viv., 1845, p. 63, pl. xxxii, fig. 3.
[4] Syst. Nat., 13th ed., vol. vi, p. 3413.
[5] Ann. Lyc. Nat. Hist. New York, 1858, vol. vi, p. 255, pl. ix, figs. 1–3.
[6] Proc. Zool. Soc., 1867, p. 206, not *maculata* as quoted by some authors.
[7] Syst. Nat., p. 3420.

together, and is not worthy of specific rank. A. Adams is not the author of this shell, as has always been supposed; he never described a *Cypræa*, and *macula* was a manuscript name published for the first time by Angas, who must be considered the author.

When compared with *C. macula*, *C. notata* is more elongate and narrower, is not pyriform, the back is curved in a different manner, the extremities are produced, the external margins are more thickened, the base is nearly flat, the columellar teeth are finer, closer, and more numerous, and the marginal tooth is larger and stouter. On the outer lip are considerably more teeth, there being twenty-two, as compared to fifteen or seventeen in *C. macula*, which in the latter are coarser than in *C. notata*. In *C. macula* there are no "blurred longitudinal straw-coloured lines," their place being taken by faint brown dots; nor are there any distinct yellow bands along the sides separating the colour of the back from that of the margins.

With all the differences enumerated above, and bearing in mind the elongated rostrate form of *C. notata* and its difference of dentition, I fail to see how these two species can be considered identical. To my mind *C. notata*, Gill, is a distinct and good species, while *C. macula*, Angas, is only a variety of *C. fimbriata*, Gmelin. This species was described by Angas as *C. macula*, and not as *C. maculata*, as quoted by many writers. It should therefore be known by the original appellation.

Cypræa pantherina (Solander's MSS.), Dillwyn.[1]

Hidalgo (p. 178) makes this species a synonym of *C. vinosa*, Gmelin,[2] 1791, which species might or might not be the same as *C. pantherina*, Dill. The two figures referred to by Gmelin are practically useless; the figure in the Mus. Kirch. (1709) is simply a copy of the one in the Recreatio (1684). I therefore do not think it is advisable to change this well-known name to *C. vinosa*, Gmelin, which is a very doubtful species. However, Perry,[3] under the name of *Cypræa obtusa*, gives a very good figure of a colour variety of *C. pantherina* (var. *theriaca*, Melvill). I therefore see no reason why Perry's name should not be accepted, as in this case there is no doubt about the species, and he is six years prior to Dillwyn. As, however, there is a varietal difference in colour between *C. obtusa*, Perry, and *C. pantherina*, Dill., I propose to keep *C. pantherina* as a colour variety of *C. obtusa*, so that in this way the well-known and more common form will still retain its name but be reduced to varietal rank.

Cypræa physis, Brocchi.[4]

Hidalgo (p. 245) gives a note to the effect that the fossil shell is different from the recent. The recent form was first named *C. achatidea* by Sowerby in 1837, and in 1844 Kiener[5] called it *C. Grayi*. Deshayes ("Anim. sans Vert.," 2nd ed., vol. x, p. 551),

[1] Descr. Cat., 1817, p. 449.
[2] Syst. Nat., vol. vi, p. 3421.
[3] Conch., 1811, pl. xix, fig. 3.
[4] Conch. foss. Subapp., 1814, vol. ii, p. 284, pl. ii, fig. 3.
[5] Coq. Viv., p. 20, pl. xxvi, fig. 3.

believing they were identical, united *C. physis* and *C. achatidea*, sinking the latter as a synonym. Since then, till recently, Deshayes was believed to have been right, and the recent shell has been known as *C. physis*. However, on examining and comparing the fossil and recent forms, it will be seen that they are not absolutely similar. In the first place, the fossil is a more solid and ponderous shell, in most cases considerably larger; indeed, Brocchi's figure is almost twice the size of an average recent specimen. Moreover, in the fossil the teeth are stronger, the shell is more deeply umbilicated, the aperture is narrower and more curved, and at the anterior end is less gaping; the external lip is more solid and rounded on the inner edge. The colour also in *C. physis* from the original description is "ad latera alba, vel toto ex fusco lutea," while in the recent shell the sides and margins are of a reddish-brown colour. There is no doubt that the fossil and recent forms are very close; still, there are differences, as shown above. I therefore think that the recent shell ought to return to its original name of *C. achatidea* and be kept separate from the fossil, a practice which is now adopted by most Continental conchologists.

C. achatidea was first published in the Conch. Illust. (*Cypræa*), 1837, pl. cxxxi, fig. 179, and index, p. 3. No description of the species is given, only a figure, and in the index we find *C. achatidea*, Gray. Dr. Gray never described a *C. achatidea*, so it follows that Sowerby must have adopted a manuscript name of Gray's, and published it for the first time in his work. Sowerby, therefore, and not Gray, is the author of *C. achatidea*. *C. Grayi*, Kiener, is a synonym.

The same applies to *C. Reevei*, Sow.[1] Sowerby gives Gray as the author, but the latter did not describe a *C. Reevei*; it again follows that Sowerby adopted a manuscript name, and therefore must be considered the author. Likewise the *Trivia costis-punctata*[2] was only manuscript in Gaskoin's cabinet till first published by Sowerby.

Cypræa punctulata, Gray.[3]

This specific name was used by Gmelin,[4] and according to Hidalgo must stand in place of *C. tabescens*, Dillwyn.[5] The reason for not accepting the *punctulata* of Gmelin, as Hidalgo suggests, will be seen elsewhere, but anyhow the *punctulata*, Gray, cannot stand. The name *Robertsi*, suggested for it by Hidalgo, must be accepted.

Cypræa fuscorubra, n.n. for C. similis, Gray.[6]

After examining the type of this species and the *C. castanea* of Higgins[7] in the British Museum, I am bound to agree with Roberts

[1] Conch. Illust., pp. 2, 3, pl. viii, fig. 52.
[2] Sowerby, Thes. Conch., vol. iv, p. 42, pl. 326, figs. 452, 453.
[3] Zool. Journ., 1824, vol. i, p. 387.
[4] Syst. Nat., vol. vi, p. 3404.
[5] Descr. Cat. Shells, 1817, vol. i, p. 463.
[6] Zool. Misc., 1831, p. 36.
[7] Proc. Zool. Soc., 1868, p. 178, pl. xiv, fig. 1.

and Weinkauff that Higgins' shell is merely a specimen in fine condition of the *C. similis* of Gray. Mr. Smith very kindly went into this matter with me, and after looking up the original descriptions, etc., entirely confirms my opinion; I therefore feel justified in reducing these two to one species. Unfortunately, neither of the above names can stand. *Similis* was used by Gmelin to designate a shell which is a synonym of *C. erosa*, Linn., and *castanea* was used first by Bolten for a species which is a synonym of *C. Mauritiana*, Linn., and secondly by Anderson[1] for a form which is unidentifiable. I therefore rename this shell *fuscorubra* on account of its dorsal coloration.

CYPRÆA SCOTTII, Gaskoin.[2]

This species was first described by Gray in the Zoological Miscellany, 1831, vol. i, p. 35, as *C. Friendii*. A note by the editor on p. 330 of vol. v of the Zoological Journal, which is as follows, seems to show that Gray knew that this shell was about to be described by Gaskoin:—"*Cypræa Friendii*, Gray, Zool. Miscell. named and published by that author after he knew that the shell was here named, described, figured, and ready for publication.—Ed." With that unfriendly spirit that existed at this time among certain conchologists, it seems that, in order to claim the species as his own, Gray anticipated Gaskoin by a short period. Anyhow, in spite of these facts, as *C. Friendii* is prior to *C. Scottii*, the former must undoubtedly stand.

CYPRÆA SOWERBYI, Kiener.[3]

This specific name was used first by Anton[4] for a species which equals *C. carneola*, Linn., var. The shell named by Kiener was for a long time confused with *C. zonaria*, Gmelin,[5] until a note by Reeve (Conch. Icon., sp. 40) finally settled the matter. The only synonym of this species is *C. ferruginosa*, Kiener,[6] which is the young state of *C. Sowerbyi*. Unfortunately, this name had already been used by Gmelin for a species which is a synonym of *C. erosa*, Linn.

Dr. Dall therefore proposed to rename the present species *C. Annettæ*.[7]

CYPRÆA STAPHYLÆA, Linn., var. LIMACINA, Lam.[8]

C. limacina, Lam., is considered by Hidalgo (pp. 400, 519) as a good species and distinct from *C. staphylæa*. I do not, however, agree with this opinion, but consider Lamarck's species simply a large and smooth variety of *C. staphylæa*, in which the teeth do not extend more than half-way over the base, while the granulation on the dorsal surface is replaced in some cases by large white spots, which are sometimes slightly raised, or by a few scattered and distinct nodules, whilst in others the dorsal surface is of a smooth shining

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[1] Archiv für Naturg., 1837, vol. ii, p. 271.
[2] Zool. Journ., 1831, vol. v, p. 330, pl. xiv, figs. 1–3.
[3] Coq. Viv., p. 38, pl. vii, fig. 3.
[4] Verzeichniss Conch., 1839, p. 97.
[5] Syst. Nat., vol. vi, p. 3414.
[6] Op. cit., p. 37, pl. lvi, fig. 3.
[7] Nautilus, 1909, vol. xxii, p. 125.
[8] Ann. du Mus., 1810, vol. xvi, p. 101.

brown, entirely destitute of granulations, with a few white spots on the margins. With a series of specimens it is possible to link up the two extremes, thus clearly proving that *C. limacina* is only a variety. With regard to the *C. interstincta*, Wood,[1] which Melvill[2] considers as a variety and distinct from *limacina* (both of which he regards as varieties of *C. staphylæa*), after examining Wood's figure, which is unaccompanied by a description, I have been unable to see where it differs from *limacina*, and maintain that it is simply another name for the same shell.

Kiener, in his monograph of this genus, pl. xxxv, fig. 1, depicts the typical *limacina* (Col. Lam. et Mus.), while figs. 1*a*, 1*b*, and pl. xv, fig. 1, are good illustrations of some of the varieties.

CYPRÆA TABESCENS, Dillwyn.[3]

In his monograph of this genus, pp. 178 and 484, Hidalgo changed the name of this species from *tabescens* to *punctulata*, Gmelin.[4] Gmelin founded his species on two figures, of which one represents a young shell, and both are unrecognizable and not in any detail the same as the shell known as *tabescens*. Gmelin's description is absolutely inadequate, and I fail to see how Hidalgo could possibly have made this change. *Cypræa punctulata*, Gmelin, must therefore remain, as it always has been, one of the unrecognizable species described by that author.

While looking up these points I had occasion to refer to the original descriptions of *Cypræa tabescens*, Dill., *teres*, Gmelin, and *subteres*, Weinkff. With regard to *teres*, Gmelin,[5] there is not the slightest doubt, the description being good, and the figure referred to representing the typical form of this shell, and agreeing with the description.

Cypræa tabescens, Dill., has generally been considered a good species, and distinct from *C. teres*, Gmelin, but on comparing the descriptions and figures cited, this will be found not to be the case. The shell figured in Martini, Conch. Cab., vol. i, pl. xxviii, figs. 294, 295, quoted by Dillwyn, is *C. cylindrica*, Born,[6] while Martini, vol. i, pl. xxviii, figs. 296, 297, represents the *C. teres*, Gmelin. The greater part of the rest of the other figures quoted by him have reference to one or other of these two species. It therefore appears that *C. tabescens* was founded chiefly on *C. teres*, Gmelin, and partly on *C. cylindrica*, Born. It follows that *tabescens* cannot be retained as a good species, as it is simply a synonym in part of *C. teres*, Gmelin.

CYPRÆA SUBTERES, Weinkauff.[7]

This is decidedly not a synonym of *C. teres*, as most monographers and writers have asserted. It is only necessary to compare the two

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[1] Index Test. Suppl., 1828, pl. iii, fig. 9.
[2] Mem. Proc. Manchester Soc. (4), 1888, vol. i, p. 232.
[3] Descr. Cat., p. 463.
[4] Syst. Nat., vol. vi, p. 3404.
[5] Op. cit., p. 3405.
[6] Index Mus. Vind., 1778, p. 169.
[7] Conch. Cab., p. 27, pl. viii, fig. 4; pl. xiii, figs. 1, 4.

species to at once see the difference. When compared with *C. teres* it is more elongated, cylindrical, rostrated, differs considerably in the size and number of the teeth, and the colour and marking are also different, being of a pink or mauve tinge, while *teres* is pale green or fulvous.

The following figures which were supposed to represent *C. teres* do not do so, but depict this species: Sow., Conch. Illust., fig. 56; Rve., Conch. Icon., pl. xviii, figs. 93*a*, *b*; Sow., Thes. Conch., vol. iv, pl. xxvii, figs. 259, 260.

Cypræa ursellus, Gmelin.[1]

The *C. ursellus* of Gmelin and the *C. ursellus*, auctorum, are different species. Hidalgo rightly points out (pp. 179, 426) that the *C. ursellus* of Gmelin, Dillwyn, and Lamarck is simply a worn specimen of *C. hirundo* of Linn. This fact is clearly shown by Gmelin's references to Rumphius, Gualtier, and Martini, all of whose figures in shape and marking represent the *C. hirundo* of Linn. The *C. ursellus*, auct., is exceedingly well figured in Kiener's monograph of this genus (pl. xxxiii, figs. 4, 4*a*), and is totally different from Gmelin's species. This being the case, *C. ursellus*, auct., has been renamed by Hidalgo *C. Melvilli*.

After referring to the original figures and descriptions, and examining and comparing the shells, I have come to the following conclusions.

Cypræa Artufelli, Jouss.

This form is only a variety of *C. clandestina*, Linn., agreeing well with specimens of the latter, and is not entitled to specific rank.

Cypræa Annæ, Roberts.

This species is a flat and broad variety of *C. staphylæa*, Linn. Roberts made it a variety of *C. semiplota*, Mighels, which is only a small *staphylæa*.

Cypræa atomaria, Gmelin, and C. stercusmuscarum, Lam.

These are not even varieties, but simply synonyms of *C. punctata*, Linn.

Cypræa albuginosa, Gray.

C. albuginosa, Gray: Zool. Journ., 1825, vol. i, p. 510, pls. vii, xii, fig. 2.

At the bottom of Gray's description appears the following:—"This beautiful shell was first mentioned in the useful elementary work above quoted (Mawe), but was not described; knowing that my shell is the one intended I have adopted the name." The only reference to this species in Mawe's work, "The Linnean System of Conchology," 1823, is on p. 97: "*albuginosa . . . California . . . Birds eye Cowery." Mawe's name is practically a *nomen nudum*; therefore Gray, who first adopted it, and not Mawe must be considered the author. (* = new species.)

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[1] Syst. Nat., vol. vi, p. 3411.

Cypræa arabica, Linn.

C. arabica, Linn.: Syst. Nat., 10th ed., p. 718.
var. *eglantina*, Duclos: Mag. de Zool., 1833, p. 28, pl. xxviii.
var. *Gillei*, Jouss.: Le Naturaliste, 1893, p. 171, fig.
var. *histrio*, Gmelin: Syst. Nat., vol. vi, p. 3403.
var. *reticulata*, Martyn: Universal Conchologist, 1784, vol. i, pl. xv.

The above so-called species, on account of their variation and because they run into the typical form, should be considered simply varieties of *C. arabica*, and not admitted as good species.

Cypræa angustata, Gmel.

C. angustata, Gmelin: Syst. Nat., vol. vi, p. 3421.
var. *bicolor*, Gaskoin: Proc. Zool. Soc., 1848, p. 92.
var. *Comptonii*, Gray: Juke's Voyage, 1847, vol. ii, p. 356, pl. i, fig. 3.
var. *declivis*, Sow.: Thes. Conch., vol. iv, p. 31, pl. xxviii, fig. 287; pl. xxx, figs. 328*, 329*.
var. *piperata*, Gray: Zool. Journ., 1825, vol. i, p. 498.

The note respecting *C. arabica* and its varieties applies also to the above four so-called species, which for the same reasons I consider simply varieties of *C. angustata*, Gmelin.

C. pulicaria, Rve. (Proc. Zool. Soc., 1846, p. 23), on account of its narrower and more elongate form and finer teeth, should be regarded as a good species and not a variety of *C. angustata*.

Cypræa tigris, Linn., var. Rossiteri, Dautzenberg.[1]

This variety, with a yellow dorsal surface and sparsely spotted with brown, was first described by Melvill as *C. tigris*, Linn., var. *flavonitens*.[2]

Cypræa erythræensis (Beck MSS.), Sowerby.

This is a manuscript name of Beck's adopted for the first time by Sowerby (Conch. Illust. Index, No. 161, fig. 161), who must be considered the author and not Beck, as quoted by several monographers.

Cypræa Surinamensis, Perry.

C. Surinamensis, Perry: Conchology, pl. xx, fig. 4.

From Perry's description and figure it is impossible to definitely say what shell he intended to represent, though most writers have been inclined to believe that it was the *C. Gambiensis*, mihi (*C. nebulosa*, Kiener). It is, however, as already stated, impossible to be certain, and *C. Surinamensis* must therefore remain unidentifiable. The locality given for his species by Perry, Surinam, if correct, which is doubtful, does not tend to strengthen the idea that his species is the *C. Gambiensis*, mihi (*nebulosa*, Kiener), which comes from the Gambia coast.

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[1] Journ. de Conch., 1902, p. 341.
[2] Mem. Proc. Manchester Soc. (4), 1888, vol. i, p. 212.

CYPRÆA SUBVIRIDIS, Reeve.

C. subviridis, Lake: Proc. Zool. Soc., 1835, p. 68.

At the above reference Mr. Lake and not Reeve appears as the author of this species. A note by Reeve, however (Conch. Icon., *Cypræa*, sp. 48), shows that he was the author and that Lake was a typographical error.

CYPRÆA SUBCYLINDRICA, Sow.

C. subcylindrica, Sow.: Thes. Conch., vol. iv, p. 9, pl. xxvii, figs. 269, 270.

This shell is broader and more oval than *C. cylindrica*, Born (Index Mus. Cæsar. Vindob., p. 169, pl. viii, fig. 10), with the teeth not extending so far over the base; it is, however, undoubtedly only a variety of the latter.

CYPRÆA WILHELMINA, Kenyon.

C. Wilhelmina, Kenyon: Proc. Linn. Soc. N.S.W., 1897, vol. xxii, p. 145.

Never having seen the shell, and from the inadequate description, no figure being given, it is impossible to say what this species is.

CYPRÆA MARGINATA, Gaskoin.

C. marginata, Gaskoin: Proc. Zool. Soc., 1848, p. 91.

After examining the unique shell in the British Museum, I am inclined to believe that it is only a young deformed specimen of *C. thersites*, Gaskoin, the margins being flattened and laterally produced so as to form a crenulated ridge on each side of the base. Apart from the above, it agrees well in shape, colour, dentition, etc., with *C. thersites*.

CYPRÆA PETITIANA, Crosse & Fischer.

C. Petitiana, Crosse & Fischer: Journ. de Conch., 1872, vol. xx, p. 213.

I have only seen one example of this shell in the Natural History Museum, which certainly seems very close to *C. pyrum*, Gmelin, to which I am inclined to unite it as a variety. Before any definite conclusion can be arrived at, it is necessary that a larger series of specimens should be studied.

CYPRÆA MACANDREWI, Sow.

C. Macandrei, Sow.: Thes. Conch., vol. iv, p. 52, pl. xxxvii, figs. 537, 538 (*Macandreæi*).

I have never had the advantage of seeing this shell, but from the figures and description it seems doubtful whether there is any real difference between it and *C. Beckii*, Gaskoin (Proc. Zool. Soc., 1835, p. 203), and I am of Weinkauff's opinion (Conch. Cab., p. 120) that it is probably only a variety of that species.

CYPRÆA MICRODON, Gray, C. CHRYSALIS, Kiener, C. MINORIDENS, Melvill.

I entirely agree with Mr. Melvill on the changes and explanations given by him in the Journal of Conchology, vol. x, pp. 117–19, viz., *C. microdon*, Gray (= *chrysalis*, Kien.), *C. minoridens*, Melv. (= *microdon*, auct.), and I consider them good species and distinct from *C. fimbriata*, Gmelin.

CYPRÆA RASHLEIGHANA, Melvill.

C. Rashleighana, Melvill: Journ. of Conch., 1887, vol. v, p. 288, pl. ii, fig. 26.

This shell, judging by the specimens I have seen, is a good species, and is figured in the Conch. Icon., pl. xiv, fig. 66*a*.

TRIVIA CANDIDULA, Gaskoin.

T. candidula, Gaskoin: Proc. Zool. Soc., 1835, p. 200.

On p. 201 (loc. cit.) Gaskoin mentions that this shell was also described about the same time by Duclos as *C. olorina*, and by Beck as *C. approximans*. After careful search I have failed to discover that the two latter names were ever published, though they are both given as synonyms of *candidula*, Gask., by Roberts, Reeve, Sowerby, Weinkauff, and Hidalgo, all of whom merely give as reference Proc. Zool. Soc., 1835, p. 201.

TRIVIA CORINNEÆ, n.n. for T. AFFINIS, Marrat.[1]

This name being preoccupied for a fossil by Dujardin (Mém. Soc. Géol. France, 1837, vol. ii, p. 304, pl. xix, fig. 12), I propose to substitute that of *Trivia Corinneæ*. The species appears to be closely related to *T. pacifica*, Gray, but is slightly more elongate and has no dorsal sulcus.

TRIVIA INSECTA, Mighels.

T. insecta, Mighels: Proc. Bost. Soc., 1845, vol. ii, p. 24.
= *hordacea*, Kiener: Coq. Viv., 1845, p. 149, pl. liv, fig. 5.

TRIVIA NAPOLINA, Kiener.

T. napolina (Duclos MSS.), Kiener: Coq. Viv., p. 144, pl. liii, fig. 3.
= *obscura*, Gask.: Proc. Zool. Soc., 1848, p. 94.

TRIVIA ORYZA, Lamarck.

T. oryza, Lam.: Ann. du Mus., 1810, vol. xvi, p. 104.
= *Sandwichensis*, Sow.: Thes. Conch., vol. iv, p. 57.
= *intermedia*, Kiener: Coq. Viv., p. 145, pl. liv, fig. 1.
= *scabriuscula*, Gray: Zool. Journ., vol. iii, p. 364.

With regard to *T. oryza*, Lam., and *T. scabriuscula*, Gray, they agree in size, sculpture, shape, colour, and in the extremities being produced, and in fact *scabriuscula* is only a synonym of *T. oryza*, Lam., to which it has been united by Mr. E. A. Smith in the British Museum Collection.

TRIVIA GLOBOSA, Sowerby.

T. globosa, Sow.: Conch. Illust., 1832, p. 12, No. 117, fig. 34.
= *pilula*, Kiener: Coq. Viv., p. 151, pl. liv, fig. 2.
= *sphærula*, Mighels: Proc. Bost. Soc., 1845, vol. ii, p. 24.

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[1] Ann. Mag. Nat. Hist., 1867, vol. xx, p. 215.

Trivia nivea, Sowerby.

T. nivea, Sow.: Conch. Illust., 1832, p. 13, No. 122, fig. 38*.
= *scabriuscula*, Kiener (*non* Gray): Coq. Viv., p. 133, pl. xliii, fig. 3.

Trivia suffusa, Sowerby.

T. suffusa, Sow.: Conch. Illust., 1832, p. 13, No. 126, fig. 41.
= *T. Armandina* (Duclos MSS.), Kiener: Coq. Viv., p. 140, pl. xlvi, fig. 2.

Trivia Californica, Gray.

This species was first described by Gray as *T. Californiana*.[1] In 1832 Sowerby[2] refers to the same species under the name *Californica*, which has been used ever since by subsequent monographers, and like Hidalgo, I think that the original appellation should be employed.

Trivia Europæa, Montagu.[3]

After reading Pulteney's description of *Trivia arctica*,[4] it will at once be perceived that this shell is the *T. Europæa* of Montagu, and I entirely agree with Hidalgo (p. 263) in reducing *Europæa* to a variety, but would point out that the figure he quotes (pl. xxii, fig. 6, in the Dorset catalogue) does not represent *arctica* but *pediculus*, Linn., as it was intended to do.

Pulteney's description, which is as follows, was published in 1799, while Montagu's did not appear till 1808.

Trivia arctica.—"Shell differs from the foregoing [*T. pediculus*] in being smaller and in wanting the longitudinal furrow on the back, and in being without spots. I have found it at Poole and Weymouth." As will be seen, he chose for his type the unspotted shell, while Montagu's type is the one with the brown spots on the dorsal surface. The latter in his description says, "The *Cypræa Europæa* with spots, and that without spots termed *arctica*, may be considered as perfectly formed varieties." In order, therefore, in some way to keep the well-known name, I propose to call Montagu's species *T. arctica*, Pult., var. *Europæa*, Mont.

I may perhaps add that the variety *minor* described by Marshall[5] is simply a small *T. arctica* (*ex typo*), and not the same as var. *minor* of Monterosato.[6] The latter is the *T. Mollerati*, Locard,[7] which, although considered by some as a species, seems to be simply a small globose form of *T. arctica* with the costæ slightly more pronounced. At most *T. Mollerati* is only a variety of *T. arctica*, and certainly not a good species, and is the same as *T. globulosa* (Monterosato MSS.), Locard, Coquil. mar. Corse, 1900, p. 32.

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1 Zool. Journ., 1828, vol. iii, p. 365.
2 Conch. Illust., p. 13, No. 127, fig. 42.
3 Test. Brit. Suppl., 1808, p. 88.
4 Cat. Dorset, 1799, p. 39.
5 Journ. of Conch., 1893, vol. vii, p. 263.
6 Enum. e Sinon. delle Conch. Mediterranee, 1878, p. 49.
7 L'Échange, 1894, p. 131.

Trivia globosa, Sowerby.[1]

After having carefully compared the description, figure, and specimens of this species with those of *T. pilula*, Kiener,[2] I fail to see why Hidalgo has separated them. *T. pilula* has generally been accepted as a synonym of *T. globosa*, and I cannot see the slightest ground for keeping them apart. With regard to geographical distribution, *T. globosa* is supposed to be a West Indian form, though Gray in the "Descriptive Catalogue" gave China as the locality of his type. *T. pilula* is reported from the Persian Gulf, Siam, Japan, Philippines, New Caledonia, Sandwich Islands, and New South Wales. Even if *globosa* was incorrectly cited from China and is strictly a West Indian shell (which I think very improbable), there is not the slightest conchological reason for separation.

Trivia Edgari, n.n. for T. grando, Gaskoin.[3]

Potiez[4] first employed the specific name *grando* to designate a fossil species. His description, however, is so short and inadequate that it is useless for the purpose of identification, and this being so, one cannot unite with it the *T. grando* of Gaskoin as some writers have suggested. Gaskoin's species must therefore be re-designated, and in proposing the name of *Trivia Edgari* I have much pleasure in associating with it Mr. E. A. Smith's christian name, the term *Smithi* having already been used for a fossil form.

Trivia multilirata, Sowerby.

T. multilirata, Sow.: Thes. Conch., vol. iv, No. 178*, figs. 427, 428, 521, 522.

This species is considered by Hidalgo (pp. 424–5) a synonym of *T. Mediterranea*, Risso (Hist. Nat. Eur. Mérid., 1826, vol. iv, p. 239), whilst Monterosato (Journ. de Conch., 1899, vol. xlvii, p. 401) holds that *T. Mediterranea* = *T. lathyrus*, Blainville (= *T. pulex*, Gray). Risso's description is applicable in certain respects to both *T. multilirata* and *T. lathyrus*, Blainville (= *T. pulex*, Gray), the colour and numerous costæ agreeing best with *T. multilirata*, whereas "peritremate albido" and the length (7 mm.) corresponds more nearly to *T. lathyrus*. Under these circumstances, as it is doubtful what *Mediterranea* really was, I think it would be advisable to adopt the *multilirata*, Sow., about which there is no question. The synonymy of this species would therefore be—

T. multilirata, Sow.
- = *T. crebricostata*, Sow.: op. cit., p. 51.
- = *T. formosa*, Reeve (*non* Gask.): Conch. Icon., sp. 132.
- = *T. Mediterranea*, Risso (?): Hist. Nat. Eur. Mérid., vol. iv, p. 239.

The *T. formosa*, Gask. (Proc. Zool. Soc., 1835, p. 198), although it

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[1] Conch. Illust., p. 12, No. 117, fig. 34.
[2] Coq. Viv., p. 151, pl. liv, fig. 2.
[3] Proc. Zool. Soc., 1848, p. 96.
[4] Galerie des Moll., 1838, vol. i, p. 481.

has been compared with the above, is quite a different shell, being attenuated anteriorly, with finer and closer costæ, a different style of coloration, and occurs only in South Africa.

TRIVIA ONISCUS, Lam.[1]

This species must retain the name *aperta* given to it by Swainson,[2] since Bolten had already used the term *oniscus* (Mus. Bolt., p. 24) for a species which is the same as *Trivia pediculus*, Linn. The Bligh Sale Catalogue was published a year before the appearance of Mawe's "Linnæan System of Conchology," where that author described the same shell and under the same name as that used by Swainson.

TRIVIA PULEX, Gray.[3]

Lathyrus (Dufresne MSS.), Blainville,[4] was the first name given to this species of *Trivia*. It was published two years prior to *pulex*, and is quoted by Gray in his synonymy of that species. Blainville's reference to the Isle of France is erroneous, as it is a Mediterranean species extending to the Azores and along the north-west coast of Africa. In his "Faune française," 1830, p. 248, Blainville again refers to this species, giving a fuller description, accompanied by two good figures (pl. 9A, figs. 3, 3*a*), and citing the original description of 1826. There can be no doubt that *T. lathyrus* is the same species as *T. pulex*, Gray, and as it has priority that name must be adopted. The *Trivia lathyrus*, Kiener,[5] is not Blainville's species, but only a synonym of *T. sanguinea*, Sowerby.[6]

TRIVIA SULCATA, Gaskoin.[7]

Dillwyn had already used the name *sulcata* to designate a species of *Trivia* which included *T. pediculus*, Linn. (part), *T. oryza*, Lam., and *T. lathyrus*, Blainville (*T. pulex*, Gray). Dillwyn's species on this account could not stand, neither can Gaskoin's, as he employed the same preoccupied name. Roberts, however (Amer. Journ. Conch., vol. v, p. 206), proposed the name *T. Gaskoinii* for the *T. sulcata* of Gaskoin.

DESCRIPTION OF FOUR NEW VARIETIES.

1. CYPRÆA HELVOLA, Linn., var. CALLISTA.

Shell of an oval form, sides hardly thickened; teeth on the columella the same as in the typical form, while on the anterior end of the outer lip the last six are produced over the base and margin, and disappear between the pitting of the latter; the last four on the posterior end of the outer lip being likewise produced, but not so strongly accentuated as the former. The base and teeth are of a palish golden brown,

[1] Ann. du Mus., 1810, vol. xvi, p. 103.
[2] Bligh Sale Cat., 1822, p. 21, No. 317; appendix, p. 18.
[3] Zool. Journ., 1828, vol. iii, p. 368.
[4] Dict. des Sciences Nat., 1826, vol. xliii, p. 25.
[5] Coq. Viv., p. 146, pl. xxii, fig. 4.
[6] Conch. Illust., p. 12, No. 115, fig. 32.
[7] Proc. Zool. Soc., 1848, p. 95.

lighter towards the margins; both extremities are of a pure shining white, the posterior one having a white blotch extending from the spire almost to the outer margin. The dorsal surface is of a very pale brown, profusely sprinkled with small, deep brown spots intermingled with minute ones of a pure white, the pittings and sides above them on each side of the shell being of a beautiful purplish tint. Long. 29, diam. 18 mm.

Hab.—Tahiti.

I have only seen two specimens of this variety; that here described in my possession, the other, slightly smaller and from the same locality, now in the collection of M. Dautzenberg.

2. Cypræa moneta, Linn., var. aurea.

Shell of typical form, teeth slightly finer, dorsal surface entirely suffused with a deep golden orange extending over the margins, where it disappears on the base; base white. Long. 25, diam. 18 mm.

Hab.—Tahiti.

3. Cypræa arabica, Linn., var. prasina.

Shell of the usual form and dentition, but entirely suffused with green, covering the dorsal surface and margins and extending over the base nearly to the aperture. This peculiar green coloration is probably caused by a disease of the mantle.

Hab.—Sandwich Islands, Labuan, New Caledonia, etc.; occurring with the typical form.

This is a well-known variety, mentioned by several writers, but appears never to have received a varietal name.

4. Trivia ovulata, Lam., var. rubra.

Shell differing from the typical white form in having the interior and the whole of the dorsal surface of a deep rose colour. The outer lip and base are white. This is a common variety of the above species, and specimens are frequently only slightly tinged with rose colour.

Hab.—Jefferys Bay.

Good figures of this variety appear in Sowerby's Thesaurus, figs. 409–11.

T. ovulata was originally described by Lamarck in the Ann. du Mus. as *C.* '*ovulata.*' In the Anim. sans Vert., 2nd ed., vol. x, p. 533, probably from a typographical error, it appears as '*ovula.*' Reeve (Conch. Icon., sp. 112) gives the following note: "*Cypræa* '*ovulata*' was the first name given to this shell by Lamarck, but finding probably that it had been already used by Gmelin in reference to the *C. cervus* he dropped the last syllable for the sake of distinction, though both terms are sufficiently corrupt." If Reeve had referred to Gmelin's species, he would have found that it was *oculata* and not *ovulata*. It is therefore obvious that the species in question must be known by its original appellation, *ovulata*, and not *ovula*, as favoured by some writers and monographers.

In concluding this paper the writer hopes that the notes on the various species of *Cypræa* and *Trivia* will be of some use and interest to those conchologists who make an especial study of this group of molluscs. At first there is sure to be objection to the changing of specific names (in most cases well-known species) which has been suggested, but it is believed, when the reasons for the various changes have been carefully considered, that these alterations will be admitted as justifiable.

To the following who have kindly helped me in various ways I wish to tender my thanks:—Mr. B. B. Woodward, Mr. C. D. Sherborn, Professor G. C. Bourne, Mr. H. G. Farmer, Professor W. H. Dall, the Librarians of the Radcliffe Library, Oxford, Marquis de Monterosato, and Mr. R. Bullen Newton. My especial thanks are due to Mr. E. A. Smith for the trouble he has taken in working out various points with me, and for his kindness in allowing me to examine the types and other specimens of *Cypræa* and *Trivia* in the British Museum.

EXPLANATION OF PLATES XII, XIII.

Plate XII.

Fig. 1. *Cypræa tigris*. (By H. G. Farmer.) Sub-intestinal and visceral ganglia somewhat reduced, and pedal ganglion slightly enlarged. *a*. osphradium; *b*. ctenidium; *c*. proboscis sac; *d*. tentacle; *e*. radula; *f*. pedal ganglion; *g*. sub-intestinal ganglion; *h*. right pedal cord; *i*. gonopore; *j*. anus; *k*. recto-genital mass; *l*. mucous gland; *m*. visceral ganglion; *n*. renal pore.

Fig. 2. *Trivia arctica*. (By H. O. N. Shaw.) Pedal ganglia, showing some of the nerves given off. The lines 1–7 indicate the transverse sections so numbered on Pl. XIII.

Fig. 3. Pedal ganglia of *Cypræa arabica* (after Bouvier).

Plate XIII.

Figs. 1–7. Transverse sections of the pedal ganglia of *Trivia arctica*, as shown by the lines in Fig. 2 on Pl. XII. (By H. O. N. Shaw.)

NOTE ON THE SPECIES OF *CYCLOPHORUS* FOUND AT HONG-KONG.

By Staff-Surgeon Kenneth H. Jones, R.N.

Read 12th March, 1909.

During a period of service extending over three years recently spent at Hong-Kong, I collected several hundreds of a species of *Cyclophorus*, which, as far as I can ascertain, is the only one of the genus to be found there.

Mr. J. H. Ponsonby has also been unable to find more than one species in the island. The following are the most important references to the occurrence of *Cyclophorus* at Hong-Kong:—

Kobelt (Tierreich, Cyclophoridæ, pp. 138, 142) states that *C. punctatus*, Grat., and *C. exaltatus*, Pfr., are found at Hong-Kong.

Möllendorff (Jahrb. deutsch. Malak. Ges., 1882, p. 266, pl. ix, fig. 3) quotes *C. exaltatus*, Pfr., from Hong-Kong (from Happy Valley, Sheko, and Little Hong-Kong).

Dr. E. von Martens (Preuss. Exped. Ost. Asien, p. 39, pl. xix, fig. 8) gives *C. exaltatus*, Pfr., from Hong-Kong, and mentions that it was taken there by Mr. Fortune and also by himself.

C. exaltatus, Pfr., was described from a shell in the Mus. Cuming, locality unknown, and Reeve (Conch. Icon., *Cyclophorus*, species 24) considers it to be "a small *C. volvulus*." *C. punctatus*, Grat., does not occur at Hong-Kong, but is common at Canton, and I have also taken it at Hoi Ha, on the mainland, about 40 miles to the east of Hong-Kong. No doubt, if the country is ever properly worked, it will be found elsewhere. *C. exaltatus*, Pfr., is described as having the last whorl "obtuse angulatus," but in all the specimens of the Hong-Kong species that portion of the shell presents a well-marked keel, which can be readily seen and felt. On examination of actual specimens of *C. exaltatus*, Pfr., collected by Mr. Fortune in China, it is found that the periphery of the last whorl is almost, if not quite, rounded, certainly presenting nothing resembling the carination so obvious in the Hong-Kong species.

It was noticed by von Martens that the specimens of *Cyclophorus* which he collected in Hong-Kong were angulated and not rounded on the last whorl.

Möllendorff states that *C. exaltatus*, Pfr., is about as much keeled as *C. punctatus*, Grat., but the latter certainly presents nothing at all resembling carination.

The probability is that Mr. Fortune collected his specimens of *C. exaltatus*, Pfr., either in the Northern or Central Provinces of the Chinese Empire, hundreds of miles from Hong-Kong, but that by some error the last-named locality has been ascribed to them. Indeed, Möllendorff writes that "as only one species of *Cyclophorus* is found in Hong-Kong, he does not doubt, any more than von Martens did, that it is *C. exaltatus*, Pfr., always assuming that that species really was taken by Mr. Fortune in the island."

It is quite obvious that the *Cyclophorus* of Hong-Kong is not *C. exaltatus*, Pfr., and the question arises naturally, what is it? There are in the Natural History Museum two specimens of *C. subcarinatus*, Mölldf., from Lofoushan, a place 40 miles E.N.E. of Canton, which agree in every particular of shape and sculpture with the Hong-Kong species, and with a certain large proportion of them in coloration also.

Further, the description given by Möllendorff of *C. subcarinatus* exactly fits the Hong-Kong species as regards the existence of the keel on the periphery of the last whorl and the flattening of the base below it. There exists another species, *C. elegans*, Mölldf., from Shui Hing, a locality about 50 miles N.N.W. of Canton, which, from the figure given of it, bears a considerable resemblance to the Hong-Kong species, but as I have not been able to examine actual specimens I think it better to say no more of it for the present.

Möllendorff thought that on further investigation it might be possible to unite *C. punctatus*, Grat., *C. exaltatus*, Pfr., and *C. subcarinatus* as one; to me, judging by the material at present available, they appear quite distinct.

There is next to be faced the question of the distribution of *C. subcarinatus*, which is recorded from the island of Hainan as well as from Lofoushan, and now, in my opinion, shown to occur at Hong-Kong as well.

It is to be remembered that the region under consideration has scarcely been touched by conchologists, of whom a few have collected in scattered localities often at great distances from one another, so that it is quite likely when the molluscan fauna of South-Eastern China is better known, it will be found that *C. subcarinatus* is a common enough species, with a large area of distribution, in suitable localities. In conclusion, I can only say that I think *C. subcarinatus*, Mölldf., and the Hong-Kong species are not capable of separation.

Since writing the above I have ascertained that Mr. Fortune, a botanical collector employed by the Horticultural Society of London, spent nearly three years in China, from early in 1843 to the end of 1845.

The bulk of his time was occupied by collecting in the Chusans, Chekiang, and Fokien, although he did visit Canton and was several times at Hong-Kong. He does not mention collecting any mollusca, but expressly states that all his plants were sent home from Hong-Kong, which fortifies me in my belief that in this way an error of locality has crept in with regard to the specimens of *Cyclophorus* which he sent to this country.

ON *POMATIAS HARMERI*, N.SP., FROM THE PLIOCENE (RED CRAG) OF LITTLE OAKLEY, ESSEX.

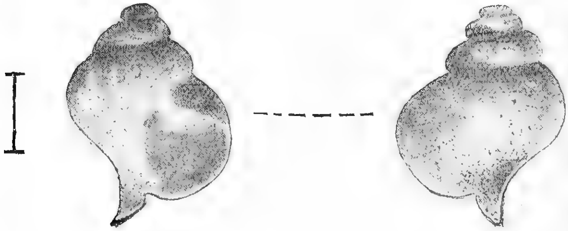
By A. S. KENNARD, F.G.S.

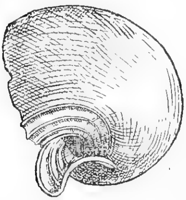
Read 16*th April*, 1909.

POMATIAS HARMERI, n.sp.

Shell conical, somewhat solid, with numerous close-set spiral ridges, periphery rounded; whorls 4½, rapidly enlarging, very tumid; spire produced, apex obtuse and smooth; suture very deep; mouth circular, slightly angulated above; umbilicus narrow; operculum unknown. Height 10, breadth 8 mm.

This interesting shell was found by Mr. F. W. Harmer, F.G.S., in the Red Crag of Little Oakley, Essex, which he considers the upper part of the Waltonian. He has kindly placed it in my hands for description, and I have great pleasure in associating it with his name as a slight recognition of his lifelong work in the Pliocene and Pleistocene beds of East Anglia.





At first sight it bears a considerable resemblance to *Pomatias elegans*, but on carefully comparing the sculpture differences are at once seen. The sculpture of *Pomatias elegans* is reticulate, the spiral ridges being connected by numerous striæ. This reticulate sculpture is to be found in nearly all the European species of *Pomatias*. In *P. Harmeri* the spiral ridges are rather coarser than in *elegans*, and the striæ are absent. It must be pointed out that the example of

P. Harmeri is somewhat worn, and that in this condition the reticulation, if it existed, should be much more apparent. The umbilical region, however, has suffered no detrition, and the absence of reticulation is noteworthy. Since it has lost at least half a whorl, it is rather difficult to compare the relative proportions, but it would appear to be distinctly broader in proportion than *P. elegans*.

Eleven species of *Pomatias* (*Cyclostoma*) are cited by Westerlund from the Palæarctic region, and after a careful comparison with all these forms I have failed to identify it, while there is no known extinct form which compares with it. It greatly extends the age of the genus in England, which hitherto has not been found in any deposit older than late Pleistocene, Barrington (Cambridge), Ightham (Kent), and the Happaway Cavern (Devonshire) being the records for that period, though it is known from many Holocene beds. It may be objected that it is unwise to name a rolled and worn shell of which only one example is known, yet it appears to me better to give it a new name rather than list it as *Pomatias elegans*, var. ?, from which species it distinctly differs.

ON SOME FOSSIL PEARL-GROWTHS.

By J. Wilfrid Jackson, F.G.S. (Manchester Museum).

Read 16th April, 1909.

PLATE XIV.

After reading Mr. R. Bullen Newton's highly interesting article on "Fossil Pearl-growths" (*antea*, pp. 128–39), I at once commenced to hunt up specimens of fossil pearls in the collections at the Manchester Museum, and am pleased to be able to add other examples to Mr. Newton's list. An account of these may not be without interest to readers, and may stimulate further search for these objects. The following are the examples which have, so far, come under my notice. For the sake of uniformity Mr. Newton's excellent method of description is adopted.

Family MYTILIDÆ.

Mytilus edulis, Linnæus. Pl. XIV, Figs. A, B.

In the late Mr. R. D. Darbishire's large series of shells from the Raised Beach of Uddevalla, there is quite a number of odd valves of the above species, each containing one or more examples of attached pearls. Some of the valves contain many of these bodies, as will be seen by the larger example figured on Pl. XIV, Fig. A. Several small isolated pearls, of irregular shapes and varying in size, are also included in the same collection.

Geological age.—Post-Pliocene (Raised Beach).

Locality.—Uddevalla, Sweden.

Collection.—Manchester Museum (R. D. Darbishire Coll.) [L. 3120].

Family AVICULIDÆ.

Inoceramus (?). Pl. XIV, Fig. C.

Amongst a large collection of Cambridge Greensand fossils presented by the Rev. A. Dixon in 1901, I recently came across a rather fine example of a pearl. Its greatest diameter is 9 mm., and various growth layers can be seen in places where the outer crust has been fractured. The colour of the pearl is a dirty steel-grey. Like the Crag examples, no doubt this specimen was of derivative origin.

Geological age. — Cretaceous (Albian). Found in the so-called Cambridge Greensand.

Locality.—Cambridge.

Collection.—Manchester Museum (Rev. A. Dixon Coll.) [L. 8702].

Inoceramus. Pl. XIV, Fig. D.

The Manchester Museum possesses three examples of pearls from the Crag deposits of Suffolk, presented by Mr. R. Cairns. In general characters they agree with the British Museum specimens referred to in Mr. Newton's paper (see pp. 136, 137). One, however, is still attached to a small portion of the shell.

Geological age. — Cretaceous (Senonian). Found in the Crag deposits as probably derivative fossils from the Chalk.

Locality.—Near Orford Castle, Suffolk.

Collection.—Manchester Museum (R. Cairns Coll.) [L. 1550].

Family OSTREIDÆ.

Ostrea edulis, Linnæus. Pl. XIV, Fig. E.

Attached to a valve of this species amongst a collection of Coralline Crag fossils in the Manchester Museum is an almost spherical pearl (see above plate). Like the shell itself, the pearl, which is about 4 mm. in diameter, has lost a good deal of its beautiful nacreous nature, and appears almost porcellanous. Beyond the fact that it was originally in the old Manchester Museum and came from Ramsholt, no particular history is attached to it.

Geological age.—Pliocene (Coralline Crag).

Locality.—Ramsholt, Suffolk.

Collection.—Manchester Museum [L. 4696].

Ostrea tenera, J. Sowerby.

Ostrea tenera, J. Sowerby: Min. Conch., 1819, vol. iii, p. 95, pl. cclii, figs. 2, 3.

Whilst cleaning up and working out the material from between the valves of a specimen of the above species in the Caroline Birley Collection, I came across a small spherical body, not quite 2 mm. in diameter, bearing a strong resemblance to a pearl. It is dirty brown in colour, but exhibits the characteristic nacreous lustre.

Geological age.—Lower Eocene (Woolwich Beds).

Locality.—Croydon Gasworks.

Collection.—Manchester Museum (Caroline Birley Coll.) [L. 8703].

Gryphæa dilatata, J. Sowerby.

Gryphæa dilatata, J. Sowerby: Min. Conch., 1816, vol. ii, p. 113, pl. cxlix.

Attached to the upper valve of a specimen of the above species are three small pearl-growths, close together, and situated very near the hinge. They are dark-coloured, and partake of the same nature as the shell itself.

Geological age.—Jurassic (Oxford Clay).

Locality.—Cowley, Oxford.

Collection.—Manchester Museum (Manning Coll.) [L. 6360].

Family LIMIDÆ.

Lima scabra, Born.

Lima scabra, Born: Index Mus. Cæsar. Vindobon., 1778, p. 110.

Amongst a small collection of Tertiary fossils collected by Sir William Rawson in the Bahamas are two odd valves of this species, and in the interior of one of these are a number of attached pearl-growths. The shell is thick and coarsely grown, slightly deformed, and shows traces of disease in the interior, especially in the region of the large adductor impression and along the pallial line. It is on these impressions that the pearls, which are small and somewhat lustreless, are situated.

Geological age.—Late Tertiary.

Locality.—Bahamas.

Collection.—Manchester Museum (Sir William Rawson Coll.) [L. 4700].

EXPLANATION OF PLATE XIV.

Mytilus edulis, Linnæus. Post-Pliocene (Raised Beach): Uddevalla, Sweden.

FIG. A. Valves showing attached pearls of various shapes and sizes.
,, B. Series of free pearls from same species.

Inoceramus (?). Albian (found in the so-called Cambridge Greensand): Cambridge.

FIG. C. Isolated pearl exhibiting growth layers on fractured surface.

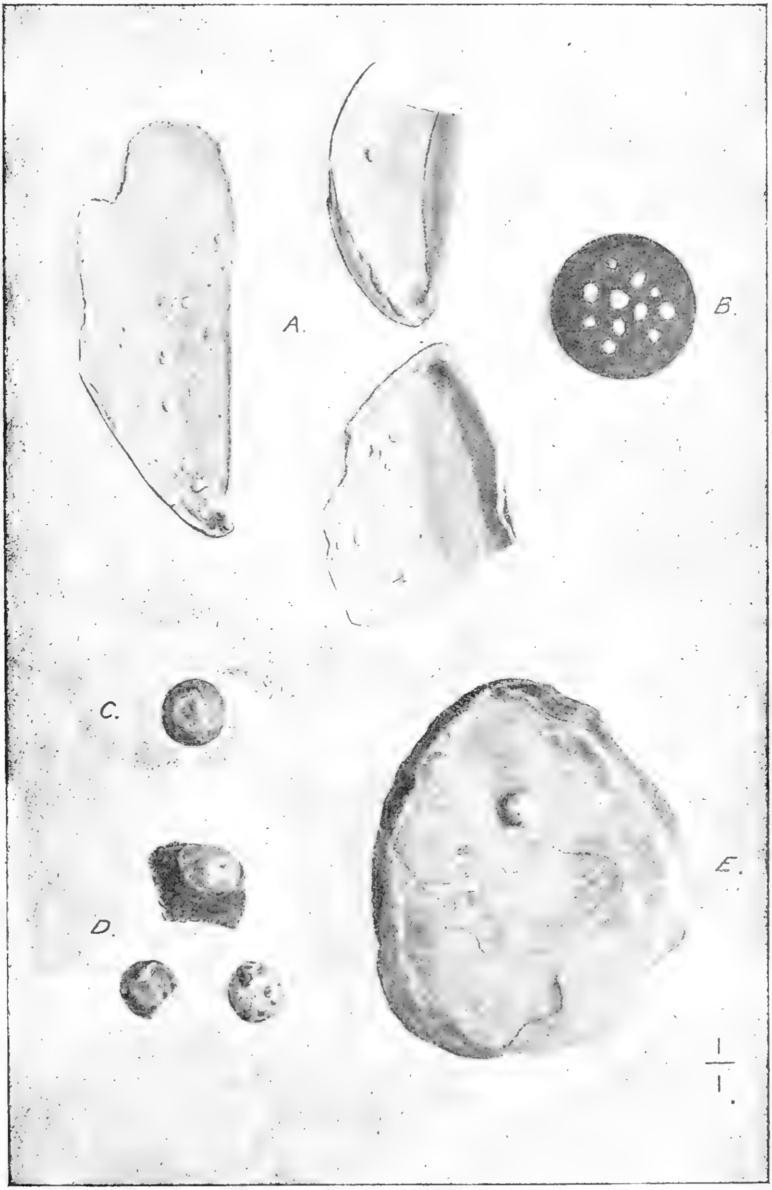
Inoceramus. Senonian (found in the Crag deposits): near Orford Castle, Suffolk.

FIG. D. Three examples of pearls, one of which still retains a small portion of the original shell.

Ostrea edulis, Linnæus. Pliocene (Coralline Crag): Ramsholt, Suffolk.

FIG. E. Upper valve of above species containing attached pearl.

All the figures are natural size.



FOSSIL PEARL-GROWTHS.

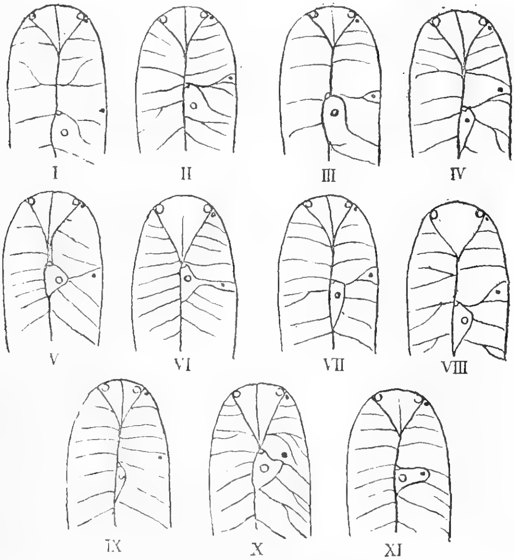
THE NEW ZEALAND ATHORACOPHORIDÆ, WITH DESCRIPTIONS OF TWO NEW FORMS.

By Henry Suter.

Read 16th April, 1909.

Since publishing a revision of this family[1] much more material has come to hand. Of great interest are the slugs collected by the late Captain Hutton, and recently by Professor W. B. Benham, F.R.S., during the scientific expedition to our sub-antarctic islands. I am thus enabled to correct a number of mistakes made in my revision, assisted also by the paper published by L. H. Plate[2] in 1898, "Beiträge zur Anatomie und Systematik der Janelliden." All the different forms, except *A. Schauinslandi*, are now in my collection.

To show the peculiarities of head-shield, mantle-area, position of the grooves, respiratory, renal, and anal orifices, the eleven diagrams which here follow have been drawn.



Genus ATHORACOPHORUS, Gould, 1852.

Janella, Gray, 1850 ; *non* Grateloup, 1838. *Neojanella,* Cockerell, 1891.

Subgen. 1. Athoracophorus, s.str.

Mantle-area not bounded on all sides by grooves ; tentacles long, cylindrical ; renal orifice inside the mantle-area.

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[1] These Proceedings, 1897, vol. ii, p. 245.
[2] Zool. Jahrb. (Anat.), vol. xi, pp. 193–280.

1. A. BITENTACULATUS (Quoy & Gaimard), 1832.

Limax bitentaculatus, Q. & G.: Voy. Astrolabe, Zool., vol. ii, p. 149, pl. xiii, figs. 1–3.
Janella maculata, Collinge: P.Z.S., 1894, p. 527.
Neojanella dubia, Cockerell: P.Z.S., 1891, p. 217.

I have examined more specimens of *A. dubius*, Cokll., and found the central tooth of the radula always symmetrical on the posterior part of the radula, and sometimes, but not always, oblique or asymmetrical on the anterior part. As pointed out by Plate, the slight differences in the generative organs are not sufficient to separate this form from that which we consider to be *A. bitentaculatus*. Cockerell's species is from the south side of Cook Strait, and we are no doubt fully justified in assuming that it represents the typical *A. bitentaculatus*, which was found in Tasman Bay.

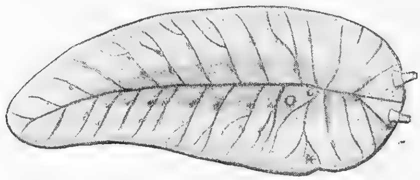
Var. *antipodum* (Gray), 1853.

Janella antipodarum, Gray: Ann. Mag. Nat. Hist., 1853, vol. xii, p. 414.

Differs from the species only in the absence of spots. Plate has shown that the animal dissected by Collinge (*A. bitentaculatus*) was sexually immature.

2. Nov. subsp. *rufovenosus*. Figs. 1–3.

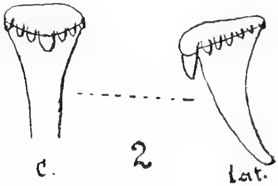
Animal limaciform, moderately large, broad, with more or less rounded tail when at rest; long, slender, semi-cylindric, with pointed tail when crawling; semi-transparent, with an opaque and darker central area when alive. Colour yellowish, with numerous small white papillæ, median and side-grooves reddish-brown, with four longitudinal rows of brown spots close to the side-grooves; mantle-area and its neighbourhood orange; sole yellowish-white.



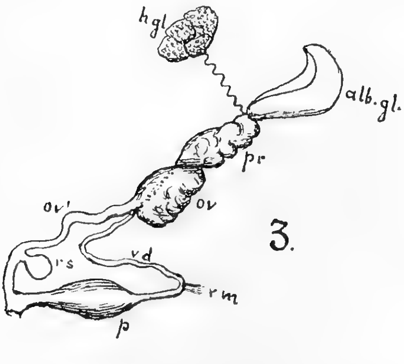
1.

Spirit specimens are light yellow, the grooves more or less brown, and the spots are sometimes indistinct. Head with two distinct oval oral lobes; tentacles cylindrical; head-shield extending to about midway between head and mantle-area, with a median groove. Notum densely covered with small papillæ, median and side-grooves well pronounced, the latter occasionally bifurcating, their number being about fourteen on each side, ten of which are post-pallial. Mantle-area open on the right side, the respiratory orifice not far from the median groove, the renal opening in front of it. Anus on the right side, close to the perinotum, in a triangle formed by the pre- and post-anal grooves. Generative orifice on the outer side of the right tentacle. Hyponotum broad, the perinotum thread-like. Sole aulacopod through contraction in alcohol. Shell rudiments consisting of about a dozen calcareous white grains of various sizes and shapes, the largest about $1\frac{3}{4}$ mm.

Measurements of a large spirit specimen: length over back from head to tip of tail, 37 mm.; width of back to perinotum, 9 mm.; sole—length 33, breadth 4 mm.; breadth of hyponotum, 2·5 mm.; distance of anus from right tentacle, 7 mm.; from pulmonary orifice, 4 mm.; pulmonary orifice from head, 10 mm.; generative pore from pulmonary orifice, 9 mm.



Jaw elasmognathic. Radula with very numerous teeth, the central tooth (Fig. 2, *c.*) with a larger median and six lateral denticles, three on each side. Lateral teeth (Fig. 2, *lat.*) with an inner large and six outer smaller denticles.



Reproductive organs (Fig. 3). The hermaphrodite gland is of moderate size, brownish, the albumen gland rather large, smooth, yellowish-white; there are no accessory glands below it; the prostate above and the oviduct below are of nearly equal size, the latter is prolonged into a somewhat convoluted free oviduct with a proximal receptaculum seminis. The sheath of the male organ is not long, oval, narrowed distally, with the retractor muscle at the bend where the vas deferens begins. The intromittant organ has papillæ inside.

Type in my collection.

Hab.—North Island: Tuakau (type); vicinity of Auckland; Waitakerei Range; Stratford.

Very often found in leaf-sheaths of Nikau palms.

Remarks.—This subspecies was formerly included in *A. bitentaculatus*, and is the form mentioned by me as being semi-transparent and having an orange mantle-area. It is also distinguished from the species by the brown grooves, the rows of brown spots close to the side-grooves, the mantle-area limited in front and behind by a groove and open on the side, and the presence of a pre-anal groove.

Subgen. 2. CONOPHORA, Hutton, 1879.

Konophora, Hutton: Trans. N. Zeal. Inst., 1879, vol. xi, p. 332.

Slugs with the mantle-area open on the right side, the renal orifice in front of it, separated by a more or less distinct groove; tentacles short, conical.

3. A. MARMOREUS (Hutton).

Konophora marmorea, Hutt.: Trans. N. Zeal. Inst., 1879, vol. xi, p. 332; vol. xiv, p. 158, pl. v, figs. 1, 2.

Hab.—Dunedin (type); Ashburton; Resolution Island.

Subgen. 3. PSEUDANEITEA, Cockerell.

Pseudaneitea, Ckll.: P.Z.S., 1891, p. 217. Type, *A. papillatus*, Hutt.

Slugs of New Zealand and its sub-antarctic islands, resembling *Athoracophorus*, s.str., but showing a decided tendency towards the formation of a mantle-area like that of *Aneitea*.

These slugs are not always small. Notum usually finely granulate, with larger raised tubercles or papillæ between the lateral grooves. Mantle-area distinct, triangular or rarely quadrangular, enclosing the respiratory and renal orifices. Anus near the perinotum.

4. A. DENDYI, Suter.

A. Dendyi, Sut.: Proc. Mal. Soc., 1897, vol. ii, p. 253, figs. 12–17 in text.

There is no spermoviduct. In fig. xiv on p. 254 *pr.* is the bulbose gland (Knollendrüse of Plate), not the prostate, and *ov.* is the glomerate gland (Knäueldrüse of Plate), not the oviduct. The receptaculum seminis is distal.

5. A. HUTTONI, Suter, n.sp.

This new species will be described and figured in the report on the scientific expedition to the sub-antarctic islands.

Hab.—Snares Islands (Captain Hutton and Dr. Colquhoun); Campbell Island (Des Barres and Chambers).

6. A. MARTENSI, n.nov.

A. marmoratus (v. Mts.), Simroth: Nova Acta Leop.-Carol. Deutsch. Akad. Naturf., 1889, vol. liv, p. 71, pl. iv, figs. 3–10; *non A. marmoreus*, Hutt., 1879.

As may be seen from the diagrams, this species is quite distinct from Hutton's *marmoreus*. The name bestowed on the species by the late von Martens cannot stand, and I now propose the above name.

Hab.—Auckland Islands (Dr. Krone, Captains Hutton, Bollons, and Professor Benham); Macquarie Island (Dr. Colquhoun).

7. A. PAPILLATUS (Hutton), 1879.

Janella papillata, Hutt.: Trans. N. Zeal. Inst., 1879, vol. xi, p. 332.

A. verrucosus (v. Mts.), Simroth: Suter, Proc. Mal. Soc., vol. ii, p. 251; *non* Simroth.

There is no spermoviduct and no prostate, only the accessory bulbose and glomerate glands. Receptaculum seminis proximal.

This species is very variable in colour, either uniformly olive or dark coloured with the papillæ of lighter colour, or yellowish with rows of large brown spots. *A. verrucosus* is a very distinct species.

Hab.—North Island: Heretaunga and Forty Mile Bush. South Island: Pelorus Valley, Nelson, Greymouth, Little River, Riccarton Bush, Governor's Bay, Hooker Valley, Ashburton, and Invercargill. Chatham Islands (*fide* Hutton).

8. A. SCHAUINSLANDI (Plate), 1897.

Janella Schauinslandi, Plate: Sitz. Ber. Naturf. Fr. Berlin, 1897, p. 141; Zool. Jahrb., Anat., vol. xi, pp. 193–269, pls. xii–xvi.

Very near *A. papillatus*, but the head-shield without a median groove; the side-grooves less numerous, about fifteen against twenty; the lateral fields of notum with two to four papillæ only, but about six in *A. papillatus*; the central tooth of the radula with three denticles, and the receptaculum seminis distal.

Hab.—Stephens Island, Cook Strait (Professor Schauinsland).

9. A. SIMROTHI, Suter, 1896.

A. Simrothi, Sut.: Proc. Mal. Soc., 1896, vol. ii, p. 34, pl. iv, figs. 3, 4; p. 253.

No other specimen has turned up, and the anatomy still remains unknown. Plate suggested that it might be a young specimen of *papillatus* or *Schauinslandi*, but I cannot share this view. The large, oval, crowded papillæ distinguish it at once from all the other hitherto known species of the genus.

Subgen. 4. AMPHICONOPHORA, Suter, 1897.

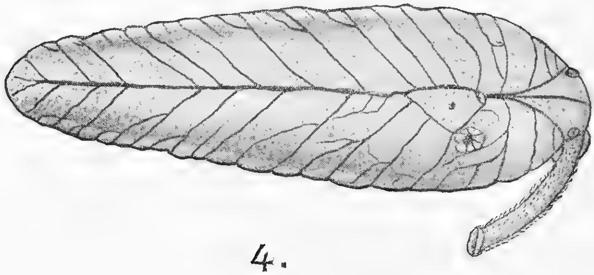
Amphikonophora, Suter: Proc. Mal. Soc., 1897, vol. ii, p. 256. Type, *A. giganteus*, Suter.

New Zealand slugs with dorsal, median, and lateral grooves; mantle-area distinct, triangular, with the renal orifice inside its anterior angle, the pulmonary opening sub-central. Anus near the mantle-area, sometimes inside it.

10. A. GIGANTEUS, n.sp. Figs. 4–7.

A. marmoratus (v. Mts.), Simroth: Suter, Proc. Mal. Soc., 1897, vol. ii, p. 256, fig. xviii in text; *non* Simroth.

Animal (spirit specimen) large, limaciform, broad in front and very gradually tapering toward the broadly rounded tail; back flatly convex, with deep grooves and numerous small papillæ; head-shield with median groove; anus on right side of mantle-area. Colour uniformly yellowish-white, the larger papillæ whitish. Head broad, oval, the two tentacles retracted, mouth with two upper labial lobes which nearly meet in the middle, surmounted by a median triangular lobe. Notum with a deep median groove and inequidistant oblique lateral grooves, about fifteen on each side, eight of which are post-pallial, most of them bifurcating toward the margin; the whole surface covered with small granules, amongst which are numerous slightly larger papillæ in most of the side-fields behind the mantle-area. Head-shield triangular with a median groove, the posterior part reaching



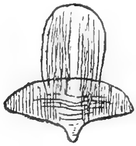
4.

to the mantle-area, which is triangular, its length nearly twice its breadth, enclosed by grooves on all sides; the respiratory orifice subcentral; the renal aperture in the anterior angle. Anal opening close to the mantle-area, just in front of the outer angle, with a curved pre-anal groove. The generative orifice on the outer side of the right tentacle; the figure shows the exserted male organ thickly beset with small, sharp papillæ. The hyponotum is indistinct, the perinotum consisting of tubercular oval swellings of the margin of the notum. Sole aulacopod through contraction in alcohol, the side-fields with numerous transverse grooves, central part smooth; in front the sole is separated from the head by a deep groove. Shell rudimentary, consisting of very numerous and small calcareous grains, no larger ones amongst them.

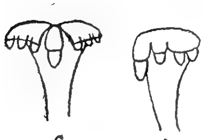
Measurements of type-specimen: Length over back from head to tip of tail, 92 mm.; width of back to perinotum, 32 mm.; sole—length 71, breadth 19 mm.; breadth of hyponotum, 4 mm.; distance of anus from right tentacle, 16 mm.; from pulmonary orifice, 5 mm.; pulmonary orifice from head, 22 mm. This slug, when alive and crawling, had a length of 130 mm.

Jaw (Fig. 5) elasmognathic, with a sharp median projection. Radula large, with numerous teeth. Central tooth (Fig. 6, *c.*) with three cusps, the median small and with one cutting point, the lateral ones triangular with two or three denticles on each. Lateral teeth (Fig. 6, *lat.*) with four denticles, the inner one largest.

Generative organs (Fig. 7). The hermaphrodite gland is not large, globular; the albumen gland is yellowish, tongue-shaped, compact; the prostate is composed of globular and oval dark-grey convolutions; oviduct long, yellow, the vas deferens adhering to it; there are no



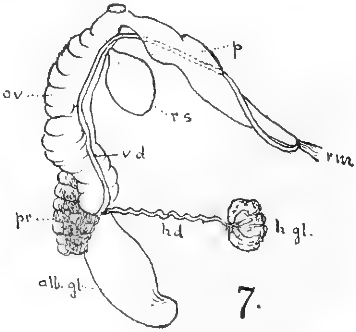
5.



6

accessory glands. Vagina very short. Sheath of male organ long, thick, tapering very gradually to the posterior end, where the vas deferens enters and the retractor muscle is fixed; verge with numerous small, pointed papillæ.

Type in my collection.



7.

Hab.—South Island: Collingwood, in a birch-tree (type); Chausille Ridge, South Westland, one specimen at an elevation of 5,500 feet; this specimen was sent to the Canterbury Museum, Christchurch, by the Rev. H. E. Newton, of Ross.

Remarks.—This is the largest species of *Athoracophorus* known. The stomach of the specimen I dissected contained a large amount of greyish-black wood fibres.

11. A. verrucosus (v. Mts.), Simroth.

A. verrucosus (v. Mts.), Simroth: Nova Acta Leop.-Carol. Deutsch. Akad. Naturf., 1889, vol. liv, p. 77, pl. iv, figs. 11–14.
Var. *nigricans* (v. Mts.), Simroth: t.c., p. 77.
Var. *fasciatus* (v. Mts.), Simroth, em. (*fuscatus*): t.c., p. 79.

I examined the radula of one specimen, and could find no trace of a rhachidian tooth. The lateral teeth have nine denticles, the inner one being the largest.

Hab.—Auckland Islands (Dr. Krone and Professor Benham).

The following table will, together with the diagrams given (p. 321), facilitate the separation of the species.

PILLATUS.	
g to middle n head and - area. Me- oove	I
enclosed by	I
post-pallial ; furcate	1
	I
papillæ and 6 larger ones e-field	2
perinotum	I
nside mantle-	1
s	3
	'
bulbose and ate gland	1
	1
	1

	1. Bitentaculatus.	2. Subsp. rufovenosus.	3. Marmoreus.	4. Dendyi.	5. Huttoni.	6. Martensi.	7. Papillatus.	8. Schauinslandi.	9. Simrothi.	10. Giganteus.	11. Verrucosus.
Head-shield . . .	Extending not quite to middle between head and mantle. Median groove	Extending to middle between head and mantle. Median groove	Extending to near the middle between head and mantle. Shallow median groove	Extending to middle between head and mantle. Median groove	Extending to middle between head and mantle. Median groove	Extending to mantle-area. Shallow median groove	Extending to middle between head and mantle-area. Median groove	Extending to middle between head and mantle-area. No median groove	Extending to middle between head and mantle-area. Median groove	Extending to mantle-area; shallow median groove	Extending to middle between head and mantle-area. Median groove
Mantle-area . . .	With groove in front only	With anterior and posterior groove, open on outer side	Closed in front, open post-laterally	Perfectly closed by grooves	Perfectly closed by grooves	Triangular, but open towards anus	Perfectly enclosed by grooves	Perfectly enclosed by grooves	Perfectly enclosed by grooves	Perfectly enclosed by grooves	Transverse, perfectly enclosed by grooves
Lateral grooves . .	15, 8 post-pallial, simple	About 14, of which 10 are post-pallial; some bifurcate	12, 6–7 post-pallial, some bifurcating	15, 8 post-pallial, bi- and trifurcate	18–21, 9 post-pallial; a few bifurcate	18–20, 9–10 post-pallial; shallow	20, 12 post-pallial; some bifurcate	15, 7 post-pallial; some bifurcate	15, 8–9 post-pallial, some bifurcating	15, 8 post-pallial, mostly bifurcate	20, 10 post-pallial
Pre-anal groove . .	Wanting	Pre- and post-anal	Present	Present	Present	Present	Present	Present	?	Present	—
Sculpture of notum .	Granular	Dense small papillæ	Granular, with 2–3 small papillæ in a side-field	Minutely granular; 2 rows of large papillæ in front, 4 behind mantle-area	Large papillæ, 5 in a post-pallial side-field	Wrinkled	Small papillæ and about 6 larger ones in a side-field	2–4 papillæ in a side-field	3–4 large oval papillæ in a side-field	Granular, with numerous small papillæ	Small, pointed, dense papillæ
Anus	Close to perinotum	Close to perinotum	Close to perinotum	2 mm. from perinotum	Near perinotum	5 mm. from perinotum	Close to perinotum	Near perinotum	Near perinotum	Close to mantle-area	Inside mantle-area, on right outer side
Renal orifice . . .	In front, inside mantle-area	In front, inside mantle-area	Separated by groove from mantle	Inside mantle-area, in front	Inside mantle-area, in front	In front, inside mantle-area	In front, inside mantle-area	Inside mantle-area, in front	Inside mantle-area, in front	In front, inside mantle-area	In front, inside mantle area
Central tooth . . .	5–7 denticles	7 denticles	7 denticles	Asymmetric denticle	3 denticles	2 cusps and 2–4 denticles	7 denticles	3 denticles	?	3 cusps, 5 or 7 denticles	None
Spermoviduct . . .	Present	Present	Wanting	Wanting	Present	Wanting	Wanting	Wanting	?	Present	Present
Accessory glands . .	None	None	Present, bulbose and glomerate gland	Present, bulbose and glomerate gland	None	Prostate and glomerate gland	Present, bulbose and glomerate gland	Present, bulbose and glomerate gland	?	Wanting	Wanting
Receptaculum seminis .	Proximal	Proximal	Proximal	Distal	Proximal	Distal	Proximal	Distal	?	Proximal	Proximal
Male organ	Papillæ	Papillæ	?	Papillæ	Papillæ	Papillæ	Papillæ	Papillæ	?	Papillæ	Papillæ, in 6 rows

ORDINARY MEETING.

FRIDAY, 14TH MAY, 1909.

B. B. WOODWARD, F.L.S., President, in the Chair.

Mr. T. H. Dale, of Potchefstroom, Transvaal, was elected a member of the Society.

The following communications were read:—

1. "Descriptions of the Animals of two Land Shells from Perak, Skeat Expedition in the Malay Peninsula, 1899–1900." By Lieut.-Colonel H. H. Godwin-Austen, F.R.S.
2. "List of Mollusca from Christmas Island, Indian Ocean." By E. A. Smith, I.S.O.
3. "Further Notes on the Holocene and Recent Non-Marine Shells of Perranzabuloe, Cornwall." By Rev. R. Ashington Bullen, B.A., F.G.S.
4. "On Non-Marine Mollusca from an early Neolithic Interment at Cuxton, Kent." By A. S. Kennard, F.G.S.

The President exhibited specimens of *Pisidium supinum* from Aylestone, Leicester, and Kelsall, Cheshire, the property of Mr. C. Oldham; also, on behalf of Mr. J. E. Cooper, specimens of *Pisidium amnicum* and *supinum*; and, on behalf of Mr. J. R. Le B. Tomlin, *Ancylus fluviatilis* from a tarn in co. Kerry, 2,500 feet above sea-level.

The Rev. R. Ashington Bullen exhibited a collection of living land shells from Monte Carlo, collected by Miss D. W. A. Bate, and a *Helix* with fragments of a hibernaculum from Mallorca.

The Secretary exhibited a collection of twenty-three species of *Opisthostoma*.

ORDINARY MEETING.

FRIDAY, 11TH JUNE, 1909.

B. B. WOODWARD, F.L.S., President, in the Chair.

The following communications were read:—

1. "Descriptions of new Trochoid Shells from North Queensland." By H. B. Preston, F.Z.S.
2. "Notes on certain types of *Ampullaria* in the Paris and Geneva Museums." By G. B. Sowerby, F.L.S.
3. "On the Radulæ of the British Helicids." Part III. By Rev. E. W. Bowell, M.A.

Mr. A. S. Kennard exhibited Molluscan remains from the Lower Keuper, Bromsgrove, collected by Mr. L. J. Wills, supposed to be a cast of a *Modiola*.

NOTES.

On the Occurrence of *Pisidium supinum* in the Living State in England. (*Read* 14*th May*, 1909.)—In their paper read before this Society in December last Mr. J. E. Cooper and Mr. A. Loydell announced the re-discovery of *Pisidium supinum* living in the Thames at Hampton Wick and Twickenham, and in a tributary stream at Bedfont. Last meeting specimens collected in the Thames at Richmond by Mr. H. Overton were exhibited by me, and now I am able to show specimens from the collection of Mr. Charles Oldham from widely different localities, viz., Aylestone, near Leicester, where they were found in the canal close to the River Soar, and Kelsall, Cheshire, where they occurred in a pond. Mr. J. E. Cooper informs me that the species has also been identified by Mr. J. W. Taylor from a place near Lincoln. Mr. Oldham's specimens show slight variations in the hinge as compared with the Thames specimens, as might be expected from their quieter habitats. The Kelsall examples have a less massive hinge, while in those from Aylestone, although the hinge-plate is wider at the umbo than in the Thames forms, it is yet not quite so stout.

B. B. Woodward.

ON "THE CONCHOLOGICAL ILLUSTRATIONS," BY GEORGE BRETTINGHAM SOWERBY, JUN., LONDON, 1832–41, AND THE "DESCRIPTIVE CATALOGUE OF SHELLS," BY JOHN EDWARD GRAY, 1832.

By C. Davies Sherborn, Hon. F.Z.S.

Read 12th March, 1909.

At the request of Mr. Edgar Smith I have put together here my notes on these two works.

About 1830 G. B. Sowerby, sen., and J. E. Gray agreed to bring out a joint publication under the title "The / Conchological / Illustrations, / or / Coloured Figures / of all the hitherto unfigured / recent shells, / by G. B. Sowerby, Junr. / with the corresponding text of a / Descriptive Catalogue / of / Shells, / by / John Edward Gray, Esq., F.R.S., &c. /"

Four proofs exist of pp. 1–22 (Cypræidæ) and three proofs of pp. 1, 2 (Strombidæ), and one proof of the original title page of Gray's work (dated London, 1832) in the Gray Tracts, British Museum (Nat. Hist.), viz., Tracts on Mollusca, 8vo, vol. viii (4), xi (14), xxi (12), and Tracts on Mollusca by English writers, i (10). The signature of the Cypræidæ reads "Gray's Descrip. Cat. Shells, Part I.—June 1832," and that of the Strombidæ the same, omitting the words "Part I."

It is evident that this joint scheme was at once upset, for in part 1 of "The Conchological Illustrations, or Coloured Figures of all the hitherto unfigured recent shells, by G. B. Sowerby, Junr." (London, 1832), the following note is printed on the back of the title page: "The intention of giving the text of a Descriptive Catalogue of Shells by John Edward Gray, Esq., F.R.S., &c., in company with these Conchological Illustrations having been abandoned, the names of the species figured in each part will now be given with it, and as complete a catalogue as can be made will be added in the course of publishing each genus. Such Catalogue will consist of the names of all the species that can be ascertained, together with the locality and a reference to a figure when any is known: and when there is no good previous figure known, one will be given. A reference to the author whose name is adopted will be added, together with concise descriptions of the new species. The Conchological Illustrations will thus form a very complete addition to Wood's Catalogue of Shells" (Gray, Tracts of Natural History, i (8); Radcliffe Library, Oxford, *fide* H. O. N. Shaw). The original circular for Sowerby's work (Gray, Tracts of Natural History, i (8)) is still preserved, and states: "Price 1*s.* 6*d.* Part I, to be continued weekly, of Conchological Illustrations . . . It was at first intended to have published this work in monthly parts . . . it has, however, been deemed advisable . . . to publish it in weekly parts . . . the first part will contain 14 figures of seven species of Cowries and the Cowries will be continued in some of the following parts." The weekly issue soon broke down, and is no guide to the dates.

Gray's original circular (Gray's Tracts on Mollusca, viii (4)) states that of his "Descriptive Catalogue of Shells" part 1 will be published on 1st of July (1832), and "contemporaneously with this work will appear Coloured figures of the hitherto unfigured shells described in Mr. Gray's Descriptive Catalogue, by George B. Sowerby, junr."

The reason of the breach between Sowerby and Gray may be inferred from a letter inserted in this circular, dated 15th September, 1832, in which G. B. Sowerby says: "I am glad you have sent me some copies of your three first half sheets [i.e. 24 pp.], but I must see you again on the subject, for it is so incorrectly printed that I cannot resolve to publish it."

The issue of "The Conchological Illustrations," therefore, would seem to have begun about October, 1832, and each part was to have had a list of contents printed on small paper, which in the 1841 "Directions to Binder" were ordered to be cancelled, as they were reprinted in "Part 200."

Such, then, is the history of these two works, one of which, Gray's "Descriptive Catalogue of Shells," exists only as proof-sheets, and was never published; the other, "The Conchological Illustrations," being issued in 200 parts between 1832 and 1841.

Owing to the peculiar method of issue of "The Conchological Illustrations" it is extremely difficult to provide a complete collation, as most copies have been bound up in accordance with instructions and the clues [lists of contents] destroyed. But the Radcliffe Library copy has been bound in sequence of numbers as issued, and Mr. H. O. N. Shaw has kindly contributed to your journal his researches in the following communication.

ON THE DATES OF ISSUE OF SOWERBY'S "CONCHOLOGICAL ILLUSTRATIONS," FROM THE COPY PRESERVED IN THE RADCLIFFE LIBRARY, OXFORD.

By H. O. N. Shaw, F.Z.S.

Read 12th March, 1909.

The copy of this work in the above Library is incomplete, containing only the first 160 parts out of the total 200. It is probably owing to this fact that the lists printed on small paper have been bound up with the parts to which they belong, as the binders did not see the "Instructions" (issued in part 200) where they were told to omit these said lists. Out of the original 160 parts that I have seen, only 106 are dated, but from these in many cases it is possible to fill in some of the lacunæ by observing the dates of the parts before and after.

The first few parts were published weekly; part 5 is not dated, but part 4 was issued on October 19th, 1832, and part 6 on November 2nd, 1832; it is therefore highly probable that part 5 was issued on October 26th. In many cases, of course, this is not possible after the weekly issue broke down, as parts were then issued at periods of from two weeks to two months after the preceding one, and in these cases all that can be said, from the knowledge we now possess, is that part . . . was issued between . . . and . . . , the dates of the nearest parts before and after.

It is to be hoped that owners of copies of this work who have any of the missing dates will publish them, and thus complete the work we have undertaken.

Part.	Date of Issue.	Genus.	Figures contained in Part.	Remarks printed on the small List accompanying the Parts.
1	"Sept. 28, 1832"?	*Cypræa*	1, 3–8*	
2	"Oct. 5th, 1832"?	,,	1, 9–13	
3	Oct. 12th, 1832	,,	2, 12*–19	
4	Oct. 19th, 1832	,,	2, 12**, 20–5	
5	"Oct. 26th, 1832"?	,,	2*, 16*, 22*, 26–8, 44	
6	Nov. 2nd, 1832	,,	29–38, 44, 49	
7	Nov. 9th, 1832	,,	2*, 38*, 39*, 41–8, 50	"N.B. A part of the Catalogue of the Cypræadæ is given with this" (probably pp. 1–8 ?).
8		,,	40, 51–61	The rest, pp. 9–18, probably with part 8 ?
9	Nov. 30th, 1832	*Cancellaria*	1–9	
10	Dec. 7th, 1832	,,	10–18	
11	Dec. 21st, 1832	,,	19–27	
12	Dec. 28th, 1832	,,	28–35	
13	Jan. 4th, 1833	,,	36–44	

Part.	Date of Issue.	Genus.	Figures contained in Part.	Remarks printed on the small List accompanying the Parts.
14	Jan. 11th, 1833	*Nucula*	1–3	"And the Catalogue of the genus *Cancellaria* is given, from which, Mr. Sowerby regrets to observe, one species, namely the *C. bulbulus*, has been inadvertently omitted."
15	Jan. 18th, 1833	,,	4–17	
16		,,	18–24*	And Catalogue.
17		*Amphidesma*	1–4	
18		,,	5–7	
19		,,	8–10*	And Catalogue.
20		*Eburna*	1–5	In the Catalogue nine species are quoted; only five are figured, which with the original list were all issued in part 20.
21	March 8th, 1833	*Bulinus*	1–3	
22	March 15th, 1833	,,	4–8	
23	March 22nd, 1833	,,	9–13	"By an unfortunate oversight a species of *Partula* has found admittance to this plate. We can only promise to rectify this error by repeating the *Partula* in its proper place."
24	March 29th, 1833	*Conus*	1–7	
25	April 12th, 1833	,,	8–14	
26	April 19th, 1833	*Bulinus*	14–17	
27	May 3rd, 1833	,,	18–22*	
28	May 10th, 1833	*Conus*	15–21	
29	May 17th, 1833	,,	22–9	
30		*Bulinus*	23–32	
31		,,	33–9	
32		*Conus*	30–3	
33		,,	34–41	
34	July 12th, 1833	*Bulinus*	39–48	"Those marked with a (*) are from Mr. Cuming's collection."
35	July 19th, 1833	,,	49–58	,, ,,
36		*Conus*	42–9	
37		,,	50–8	
38		*Chiton*	1–8	
39		,,	9–14	
40		,,	15–21	
41		,,	22–30	
42		,,	31–7	
43		,,	38–43	
44		,,	44–8	
45		,,	49–55	
46		*Cardium*	1–4	
47		,,	5–10	
48	Jan., 1834	,,	11–15	
49	Jan., 1834	,,	16–21	
50	Feb., 1834	,,	22–5	
51	Feb., 1834	,,	26–31	
52		*Eulima*	all	Issued together with Catalogue.
53		,,		

Part.	Date of Issue.	Genus.	Figures contained in Part.	Remarks printed on the small List accompanying the Parts.
54	April 15th, 1834	*Conus*	59–67	
55	April 15th, 1834	,,	68–75	
56	April 30th, 1834	,,	76–91	Issued together.
57	April 30th, 1834	,,		
58	May 30th, 1834	*Murex*	1–7	
59	May 30th, 1834	,,	8–14	
60	June 15th, 1834	,,	15–21	
61	June 15th, 1834	,,	22–9	
62	June 30th, 1834	,,	30–40	,, ,,
63	June 30th, 1834	,,		
64		,,	41–51	,, ,,
65		,,		
66	Oct. 1st, 1834	,,	52–8	,, ,,
67	Oct. 1st, 1834	,,		
68		*Fissurella*	1–14	"Note, as very few species of this Genus are WELL figured, it has been thought advisable to give in these Conchological Illustrations, representations of ALL that we know at present." Issued together.
69		,,		
70	Dec. 21st, 1831	,,	15–27	Issued together (misprint for 1834).
71	Dec. 21st, 1831	,,		
72	Jan., 1835	,,	28–39*	Issued together.
73	Jan., 1835	,,		
74	Jan., 1835	,,	40–51	,, ,,
75	Jan., 1835	,,		
76		,,	52–63	,, ,,
77		,,		
78	May 25th, 1835	,,	64–9	"A complete Catalogue of the Fissurellæ will be given in the 80th part, with figures of the remaining species."
79	May 25th, 1835	*Monoceros*	1–4	
80	June 30th, 1835	*Fissurella*	70–7	And Catalogue, pp. 1–8.
81	June 30th, 1835	*Monoceros*	5–7	
82	July 25th, 1835	,,	8–16	Issued together with Catalogue.
83	July 25th, 1835	,,		
84	Sept. 15th, 1835	*Ranella*	1–8	Issued together.
85	Sept. 15th, 1835	,,		
86	Sept. 29th, 1835	*Neritina*	1–8*e*	Issued together. "8a–e. *brevispinosa*, several stages of growth and varieties with and without spines."
87	Sept. 29th, 1835	,,		
88		*Ranella*	9–15	Issued together.
89		,,		
90	Jan. 1st, 1836	*Neritina*	9–18	,, ,,
91	Jan. 1st, 1836	,,		
92	Jan., 1836	*Ranella*	16–22	,, ,,
93	Jan., 1836	,,		
94	March 30th, 1836	*Neritina*	19–27	,, ,,
95	March 30th, 1836	,,		
96	May 2nd, 1836	,,	28–38	,, ,,
97	May 2nd, 1836	,,		

Part.	Date of Issue.	Genus.	Figures contained in Part.	Remarks printed on the small List accompanying the Parts.
98	May 15th, 1836	*Neritina*	39–51	Issued together.
99	May 15th, 1836	,,		
100	June 30th, 1836	,,	52–60	
101	July 30th, 1836	*Cypræa*	63–71	Issued together. "69" (*C. Childreni*) "accidentally omitted in the Catalogue of recent species of Cypræadæ."
102	July 30th, 1836	,,		
103	Aug. 31st, 1836	,,	72–9	Issued together.
104	Aug. 31st, 1836	,,		
105	Oct. 31st, 1836	,,	80–7	,, ,,
106	Oct. 31st, 1836	,,		
107	Oct. 31st, 1836	,,	88–95	,, ,,
108	Oct. 31st, 1836	,,		
109	Nov. 30th, 1836	,,	96–104	,, ,,
110	Nov. 30th, 1836	,,		
111	Dec. 31st, 1836	,,	105–12	,, ,,
112	Dec. 31st, 1836	,,		
113	Jan. 15th, 1837	,,	113–22	,, ,,
114	Jan. 15th, 1837	,,		
115	March 1st, 1837	,,	123–32	,, ,,
116	March 1st, 1837	,,		
117	March 31st, 1837	,,	133–40	Issued together. (Plates and list printed 123–30, corrected in the reprinted Catalogue.)
118	March 31st, 1837	,,		
119	May 1st, 1837	,,	141–8	Issued together. (Plates and list printed 131–8, corrected in the reprinted Catalogue.)
120	May 1st, 1837	,,		
121	May 31st, 1837	,,	149–55	Issued together.
122	May 31st, 1837	,,		
123	June 30th, 1837	,,	156–62	,, ,,
124	June 30th, 1837	,,		
125	July 15th, 1837	,,	163–8	,, ,,
126	July 15th, 1837	,,		
127	Sept. 1st, 1837	,,	169–74	,, ,,
128	Sept. 1st, 1837	,,		
129	Oct. 31st, 1837	,,	175–7	,, ,,
130	Oct. 31st, 1837	,,		
131	Nov. 15th, 1837	,,	178–81	With the Index to the Cypræadæ, pp. i–vii.
132		*Margarita*	all	Probably all three parts with the Catalogue were issued together; as there are no small lists with these parts.
133		,,		
134		,,		
135		*Chilina*	all	Issued together with Catalogue.
136		,,		
137		*Bulinus*	59–66	Issued together.
138		,,		
139		,,	67–78	,, ,,
140		,,		
141		,,	79–87	,, ,,
142		,,		
143		,,	88–97	,, ,,
144		,,		

Part.	Date of Issue.	Genus.	Figures contained in Part.	Remarks printed on the small List accompanying the Parts.
145	Oct. 31st, 1838	*Bulinus*	98–103	Issued together.
146	Oct. 31st, 1838	,,		
147	Dec., 1838	*Conus*	92–102	,, ,,
148	Dec., 1838	,,		
149		*Cardium*	32–9	,, ,,
150		,,		
151		*Conus*	103–11	,, ,,
152		,,		
153	April 15th, 1839	,,	112–19	,, ,,
154	April 15th, 1839	,,		
155	May 15th, 1839	,,	120–7	,, ,,
156	May 15th, 1839	,,		
157	June, 1839	,,	128–37	,, ,,
158	June, 1839	,,		
159		*Chiton*	56–67	,, ,,
160		,,		

(End of Radcliffe copy.)

Parts 161–76 are on the genus *Chiton*.
Parts 177–84 are on the genus *Cardium*.
Parts 185–6 are on the genus *Bulinus*.
Parts 187–99 are on the genus *Murex*.

Part 200, containing the genus *Typhis*, with the catalogue of same, and the new title page, dated 1841 (with the table of contents), were issued in this last part, together with the reprinted catalogues of the genera *Amphidesma*, *Bulinus*, *Cancellaria*, *Chilina*, *Eburna*, *Eulima*, *Monoceros*, *Neritina*, and *Nucula*, as the original texts of the above had been printed on smaller paper than the rest of the work.

The dates of the catalogues given in the table (in the cases where they were afterwards reprinted) are those of the original edition.

The following notes are printed on the first pages of the original catalogues of the genera *Nucula* and *Cancellaria*, and do not appear in the reprinted ones.

Nucula.

"These are small bivalves, exceedingly variable in form, but all well characterized by an internal ligament and by a series of minute, sharp-pointed teeth, on each side of the ligament, in each valve. Very few of them agree in form with that one, which from its resemblance to a little nut, has given rise to their genetic appellation. They do not appear to have excited the attention of Naturalists in any great degree, for Lamarck has only mentioned six recent species. He appears, moreover, to have been very imperfectly acquainted with the characters of the genus; for he speaks of them as forming by their nacreous interior and by the situation of the ligament of their valves, an evident transition to the Trigoniæ. In fact, though several of the

Nuculæ, at least of such as have nearly the same form as his *N. margaritacea*, are pearly within, the number of such is really very few; and the ligament in the Trigoniæ is entirely external, whereas in all the Nuculæ it is almost wholly internal. Besides the six species mentioned by Lamarck, three are given by Montagu, three by Say in his American Conchology, one in my own work on the Genera of Shells, one in Wood's Suppt. and one in the Zool. Journ. To these 15 I now had [*sic*] 9 from my own collection, and 10 collected by Mr. Cuming."

Differences between the original and the reprinted catalogues—

Original.	*Reprint.*
No. 7. Mont. Test. Brit., Sup., p. 55, t. 27, f. 7.	Mont. Test. Brit., Sup., p. 55, t. 27.
No. 10. *fluviatilis* nobis, Schroëtter, Flussconch: Sowerby, Gen. of Shells.	*fluviatilis* nobis: Sow., Gen. of Shells.
No. 26. *margaritacea*, Lam.: Sowerby, Gen. of Shells, No. 17, f. 7, British.	*margaritacea*, Lam.: Sow., Gen. of Shells, f. 7, British.

Cancellariæ.

"The scientific Public and Conchologists are already aware that it is intended to introduce in this work figures and descriptions of all the new species which have been collected by Mr. H. Cuming. They will be brought in under the various Genera to which they belong; and several have already appeared among the Cypræadæ. I take this opportunity of drawing the attention of Naturalists to this subject, in this place, because it will be seen that half the number of species of the beautiful Genus *Cancellaria* at present known have been discovered and first brought to England by that Gentleman, to whose indefatigable industry we are indebted for the knowledge of at least 500 species of various Genera, among which are several new Genera and a great variety of the most interesting and remarkable species. The care and precision with which Mr. Cuming has preserved all the particulars relative to localities and habitations of the various subjects collected by him, entitle him to our warmest admiration and praise, and I shall gladly avail myself of the advantages afforded to me by this circumstance, not only in stating the localities and habitats of such Shells as have been first discovered by Mr. Cuming, but of such others as we were previously acquainted with, though we know not those particulars. The descriptions of all the species discovered by Mr. Cuming either have appeared or will appear in the 'Proceedings of the Committee of Science of the Zoological Society,' to which we shall refer, by the initials Z.P.

"The list here given of the species of the Genus *Cancellaria* will be found to be much more copious than that in Lam. Hist. nat. des Anim. sans vert. where only nine species that really belong to the Genus are given,* eight of these are in this list, and to these I have added one in my work on the Genera of Recent and Fossil Shells, two in the catalogue of the Tankerville Collection, and sixteen in the present Conchological Illustrations: the remaining twenty-one have been discovered by Mr. Cuming, and are figured from his collection."

Differences between the original and the reprinted catalogues—

Original.	*Reprint.*
No. 9. *Canc. indentata* nobis: Conch. Illust., f. 9, jun.; f. 10, adult; Z.P., 1832, p. 54. Shell oblong, cancellated, brown; spire rather short, acuminated; volutions six, cross-ribbed, ribs nodulose at their junctions; aperture ovato-oblong, oblique, effuse near the anterior extremity, canal in front rather lengthened; peritreme indented; columella with three plaits, the lower plait very small, distinct in the young specimen, the two lower plaits united and forming a large callosity in the adult; umbilicus small, with a distinct margin: length 1·3, breadth 0·7. Of this species Mr. Cuming found two young specimens on the shore at Panama; a full-grown individual is in my collection.	*Canc. indentata* nobis: Conch. Illust., f. 9, test. jun.; f. 10, adult; Z.P., 1832, p. 54. Panama.
No. 12. Z.P., 1832, Octr.	Z.P., 1832.
No. 13. A single specimen was dredged by Mr. Cuming in sandy mud at Panama.	Sandy mud at Panama. Mr. Cuming.
No. 48. *Delphinula trigonostoma*, Lam., vii, pt. ii, p. 231. *Lamarck's *C. senticosa*, *C. citharella*, and *C. Zierrogeliana* do not belong to this genus; the first is a *Phos*, the second an *Oniscia*, and the last a *Mitra*. His *C. scalariformis* is entirely unknown to me. (As a footnote to p. 2 of the Catalogue.)	*Delphinula trigonostoma*, Lam. vi, pt. ii, p. 231. Obs. Lamarck's *C. senticosa*, *C. citharella*, and *C. Zierrogeliana* do not belong to this genus; the first is a *Phos*, the second an *Oniscia*, and the last a *Mitra*. His *C. scalariformis* is unknown to the author. (As an Observation, on the "Corrected list of Figures," p. 8 of the Catalogue.)

The differences between the original and the reprinted catalogues are in most cases of little or no importance, but where they do exist it has been thought advisable to notice them.

Besides the differences in the catalogues of the two genera just mentioned, the remaining reprints differ in the following way from the originals:—

Amphidesma. In the original Catalogue there is no "List of Figures," and sp. No. 11 reads "Chemn. xi, f. 1941, 1942," while in the reprint it is "Chemn. xi, f. 1931, 1932."

Cancellaria. In the original Catalogue there is no "Corrected List of Figures."
Chilina. ,, ,, ,, ,, "List of Figures."
Eburna. ,, ,, ,, ,, "List of Figures."
Eulima. ,, ,, ,, ,, "Corrected List of Figures."
Monoceros. ,, ,, ,, ,, "Corrected List of Figures."
Nucula. ,, ,, ,, ,, "List of Figures."
Bulinus } *Neritina* } I have not seen the original catalogues as they appear to have been published after part 160.

The following notes appear on the small list published with each part:—

Cypræa, Parts 121, 122. "OBS. All the species contained in these two parts, except *testudinaria*, are new (see Gaskoin, in Zoological

Proceedings, 1836). They are not included in the Catalogue published in the early part of this work. N.B. G. B. S. Jun. is sorry to observe that the numerical figures in the plates and lists of parts 117 and 118[1] are incorrect. Instead of figs. 123 to 130, they should be fig. 133 to 140. Persons possessing incorrect copies, may have them exchanged by applying to G. B. S. Jun. for the purpose."

Cypræa, Parts 129, 130 (referring to fig. 177). "Another view to be given in the next part. G. B. S. Jun. regrets exceedingly that having no present means of access to the only Specimens of the two latter Species (*C. leucodon* and *C. guttata*) he has been under the necessity of copying the figures from the Zoological Journal."

Cypræa, Part 8. "Mr. Sowerby is exceedingly sorry to observe that the *Cypræa Childreni* has been inadvertently omitted from the catalogue of the Cypræadæ; it should be placed near to *C. globulus*."

Conus, Parts 147, 148. "G. B. S. Jun. takes this opportunity of stating his intention to proceed with a complete illustration of the Genus *Conus*, with a catalogue."

Dates of issue of the Catalogues as far as known.

Amphidesma. Original Cat., pp. 1–2, with part 19, 1833. Reprint, pp. 7–8, with part 200, 1841.

Bulinus. Original list, pp. 1–4, with part 186? Reprint, pp. 5–8, with part 200, 1841.

Cancellaria. Original Cat., pp. 1–10, with part 14, 1833. Reprint, pp. 1–8, with part 200, 1841.

Cardium. Cat., pp. 1–8, with part 184? 1840?

Chilina. Cat., p. 1, with parts 135–6, 1838. Reprint, pp. 1–2, with part 200, 1841.

Chiton. Cat., pp. 1–7, with part 168?

—— Cat., pp. 1–8, before part 176? 1840?

—— List, pp. 9–10, with part 176? June, 1840?

Conus. List, pp. 1–4, in 1841.

Cypræadæ. Cat., pp. 1–8, with part 7, 1832.

—— Cat., pp. 9–18, including *Erato*, pp. 14–16, and *Ovulum*, pp. 16–18, with part 8? 1832.

—— Index, pp. 1–7, with part 131, 1837.

Eburna. Original Cat., p. 1, with part 20, 1833. Reprint, pp. 1–2, with part 200, 1841.

Eulima. Original Cat., pp. 1–2, with parts 52–3, 1834. Reprint, pp. 1–2, with part 200, 1841.

Fissurella. Cat., pp. 1–8, with part 80, 1835.[2]

Margarita. Cat., p. 1, probably with parts 132–4, 1837? as these parts contain no small lists.

Monoceros. Original Cat., p. 1, with parts 82–3, 1835. Reprint, pp. 3–4, with part 200, 1841.

Murex. Cat., pp. 1–9, and Index, pp. 1–2, with part 199, 1841.

Neritina. Cat., pp. 1–4, and List, pp. 5–6, after part 160. Reprint Cat. and List, pp. 1–6, with part 200, 1841.

Nucula. Original Cat., pp. 1–5, with part 16, 1833. Reprint, pp. 3–6, with part 200, 1841.

Ranella. Index, pp. 7–8, after part 160, 1841?

Typhis. Cat., pp. 1–2, with part 200, 1841.

The dates of issue of the catalogues and lists of *Bulinus*, *Cardium*, *Chiton*, *Conus*, *Murex*, *Neritina*, *Ranella* are uncertain. It is evident that they did not appear till after July, 1839 (part 160), as none of them are contained in the Radcliffe copy.

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[1] Also 119, 120, printed figs. 131–8 should be figs. 141–8.

[2] I have been unable to find when the "List of Figures" (pp. 1–2) was issued. It must have been after part 160, as it is not contained in parts 1–160.

ON THE SHELL-MOUND AT SIDON.

By the Rev. A. H. Cooke, M.A., F.Z.S.

Read 12th March, 1909.

I had heard reports of the existence of a shell-mound at Sidon, and suspected that it would prove to be a rubbish-heap of *Murices* used in the manufacture of that Tyrian purple dye for which both Tyre and Sidon were so celebrated in antiquity. Accordingly, when, last January, I found myself at Sidon, I was soon in search of the shell-mound, and found it without the least difficulty. It stands immediately to the south of the present town, a few yards outside the walls, and forms part of a low cliff which abuts on the shore. The cliff is composed of more or less disturbed earth, which in places completely covers the mound, but a narrow lateral footpath leads along the face of the cliff and intersects the mound at about its middle point, so that a sort of section of the mound facing the sea is left uncovered.

It is not easy to estimate the exact area of the mound in which the shells are, but I paced about twenty steps along the cliff path with shells visible all the time; perhaps about 60 feet by 20 would be a fair estimate, but I have no idea how far inland the shells extended, as an Arab burial-ground occupied the upper part of the cliff.

The shells were exclusively those of *Murex trunculus*, Linn., and I saw no other shell whatever in the heap, except a solitary specimen of *Euthria cornea*, Linn. There were countless thousands of the *Murex*, and the interesting point about them was that they had evidently all been broken at exactly the same place, in order to extract the dye. If a specimen is held with the spire uppermost and the mouth towards the observer, and slightly inclining to his right, a large hole is observed in the ultimate and penultimate whorls, laying bare, but not fracturing, the axis of the spire. I imagine this hole to have been made by some punch or stamp; occasionally it misses its mark, and one or more of the upper whorls are fractured also. Underneath this portion of the shell would be the purple-secreting gland, which lies on the interior of the mantle between the intestine and the branchia, in the neighbourhood of the anal gland.

According to Aristotle (Hist. An. V., xv, 9, 10), the ancients used to pound up (κόπτειν) the smaller specimens, shells and all, because of the difficulty of removing the shell without breaking the gland, in which case the dye was lost. In large specimens, however, they removed the shell and separated out the gland. They are particular, he continues, to pound them up alive, for if they die they spit out the purple. The old plan of catching them, he says, was with a bait only, the result of which was that when the line was hauled in many were lost by dropping off the bait, and this they were sure to do if they were gorged. The plan prevalent in Aristotle's own day was to hang a basket on the line underneath the bait, and then if the *Murex* (which he always calls πορφύρα) fell off it tumbled into the basket and was caught.

Pliny the elder (Hist. Nat., ix, 61) says that the *Murex* was caught in small open-work baskets, in which is placed a bait consisting of half-dead *mituli* (query *Tapes geographicus*). These gape when restored to the sea, and when the greedy *Murex* inserts its 'sting' they revive, close their valves, and imprison the *Murex*.

There are similar shell-mounds outside Tarentum, which was a very noted locality for the production of the purple dye. As in the case of Sidon, the mounds are outside the city area, as no doubt the manufacture was not very savoury. Traces of similar works have been noticed in Crete, in Cythera, in Laconia, and, finally, in the Island of Leuce off Crete, by R. C. Bosanquet, who dates them back to 1600 B.C. (Rep. Brit. Assoc., 1903, p. 817). At Tyre, which I also visited, there are at the foot of the cliff remains of certain narrow oblong chambers lined with very hard cement, which are supposed by some to have been employed in the manufacture of the dye. Canon Tristram ("Land of Israel," ed. 1865, p. 51) saw at Tyre 'kitchen middens' of *Murex*, thrown up in the course of excavation. I was not fortunate enough to come across these, and it is remarkable that he notes that they were all of one species, *Murex brandaris*, Linn., while there were only a few broken specimens of *M. trunculus*. My experience at Sidon was exactly the reverse.

ON THE HABITAT, ETC., OF CERTAIN SPECIES OF *CLAUSILIA* FROM THE COAST OF SYRIA.

By the Rev. A. H. Cooke, M.A., F.Z.S.

Read 12th March, 1909.

A recent visit to the Syrian coast enabled me to continue certain observations on the habitat, etc., of *Clausilia*, which I began in Dalmatia and Bosnia last April. I had the opportunity of observing *Clausilia* along about 60 miles of the Syrian coast, from a point about 10 miles north of Beirût, as far south as Tyre. In the neighbourhood of the coast itself the land is fairly flat and unpromising, but in many places the foothills of the Lebanon abut on the sea, and here *Clausilia* abounds, the rock being limestone.

The best place for observation is the Nahr el Kelb, or Dog River, about 7 miles north of Beirût, where a small river runs into the sea between precipitous limestone cliffs. At my first visit I could almost believe myself back at the beautiful outlet of the Cetina at Almissa. Not only was the scenery strikingly similar, but on the limestone slabs at the foot of the cliffs the bluey-white shells of *Cl. Boissieri*, Charp., conspicuous and abundant, corresponded exactly to those of *Almissana*, Küst. The species was not, it is true, so remarkably confined to the moist slabs as was *Almissana*, being found on the bare cliff face as well, but wherever there was a trickle of water from above there was plenty of *Boissieri* feeding on the microscopic algæ. It is a singularly shade-loving species, and appears to occur only on the southern or shady bank of the river, never in closely associated groups, although so numerous, but dotted singly over the cliff face.

Associated with *Boissieri*, but much fewer in number, was *Cl. strangulata*, Fér. This is a species which, exactly like *albocincta*, Pfr., of Prenj, loves to feed on the surface of clay, and wherever a clay band occurs in the limestone of the Nahr el Kelb it is certain to be found, its beautifully laced shell often daubed and disfigured by the mud. Green food is near it, but its tastes apparently do not lie in that direction.

On looking over my specimens of these two species a few shells occur which I am quite unable to assign definitely to one species or the other, and yet I am sure they do not belong to a third. Considering how numerous in individuals both species are, innocent errors must occasionally occur, and it seems probable that in these apparent hybrids we have the descendants of these mixed marriages.

Living close by *Boissieri* and *strangulata* at the Nahr el Kelb, and with *strangulata* alone at the lighthouse at Beirût, is a third species, *mœsta*, Fér., whose habits are so singular that I would almost wager that ten collectors out of twenty would fail to discover it at all. It may be described as almost an underground species. The discovery of one or two worn specimens at the foot of the same cliff on the face of which *Boissieri* and *strangulata* were abundant and conspicuous led me to search more closely, and I found that *mœsta* lives under heaps of stones, not attempting to climb a single inch up the cliff, but preferring to hide itself, sometimes as much as a foot deep, beneath piles of débris. Here it feeds on decaying vegetation, and I came across dozens of living individuals simply by clearing away the heaps of stones.

Quite by chance another fine species, *Medlycotti*, Trist., was lighted on. Driving from Sidon to Beirût, we stopped at a wayside inn for refreshment. The place looked most unpromising—ploughed fields in every direction. At the last moment I saw some rocks sticking up two or three fields off, and on the shady side of these, feeding singly on the moss and greenish slime on the surface of the limestone, *Cl. Medlycotti* occurred in some abundance. Tristram's original locality was further south, the hills behind Sarepta. But some miles nearer Sidon, in the bay where, as local tradition relates, the whale vomited up Jonah, a most beautiful and well-marked variety occurred, very slender, with a much produced spire, and narrow and more flattened lamellæ. This form was found feeding on a large black, moist lichen, which grew in the hollows of shady rocks, and I never found it anywhere else. If, as seems probable, the variety is new, I should like to associate it with the name of the prophet, and call it *Cl. Medlycotti*, Trist., var. *Jonasi*.

Beirût is a large town of about 120,000 inhabitants, and it fairly surprised me to find a *Clausilia* tolerably abundant on street walls in the centre of Beirût. This species is variously named in Dr. Norman's collection, now in the British Museum, as *Delesserti*, Bgt., *brunnea*, Zgl., *vesicalis*, Friv., and *fauciata*, Parr. It lodges in the interstices of stone walls which face north and west, feeding on moss, and I found it fairly plentiful in exactly similar situations at Sidon, but no trace of it on the rocks in the open.

I will only conclude by saying that I feel confident that close observation of the habits and mode of life of many land shells, in relation to their food and choice of habitat, will be found productive of interesting and possibly valuable results.

NOTES ON THE FAMILY AMPULLARIIDÆ, WITH LIST OF SPECIES, VARIETIES, AND SYNONYMS, ALSO DESCRIPTIONS OF FOUR NEW SPECIES.

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

Read 16th April, 1909.

A careful study and comparison of the very numerous shells of this family to which I have had access has resulted in the amalgamation of a large number of supposed species. Many of the forms to which specific names have been given merge into others by almost imperceptible gradations, so that it is scarcely possible to define their limits. Some of the characters which have been regarded as forming important distinctions are found to be quite unreliable, such, for instance, as the malleation of the surface. In several cases that have come under my notice in specimens unquestionably belonging to the same species, some are strongly malleated, others only slightly so, and others are perfectly smooth. The umbilicus is also an unreliable character; *Ampullaria impervia* (Philippi), for instance, is more often umbilicated than not. In the following list I have placed provisionally as separate species some forms which would very likely unite with others, were a sufficient series under view to show the connexion, and in some cases the actual shells are unknown to me, so it is best to assume that a species is good until it can be proved bad. This work is therefore of necessity incomplete.

The present paper treats only of the species of the Western Hemisphere—*Ampullaria* (sensu stricto), *Ceratodes*, and *Pomella*. In a subsequent contribution I hope to treat of the Eastern forms—*Pila*, *Lanistes*, etc., and to take the opportunity of making any needful additions to or alterations in my present list.

Genus AMPULLARIA, Lamarck.

Ampullaria, Lam., 1799, Prodrome, p. 76 (*ex parte*).
Ampullaria, Lam., Système, Animaux sans Vertèbres.
Ampullarius, Montfort, Conch. Syst., 1810, vol. ii, p. 242.
Pomacea, Perry, Conch. Expl., 1811, pl. xxviii.
Marisa, Gray, Phil. Mag., 1824, vol. lxiii, p. 276.
Pomus, H. & A. Adams, Genera Rec. Moll., 1854, vol. i, p. 346.

Type.—*Ampullaria urceus*, Müller.

Note.—Lamarck's diagnosis of the genus describes the operculum as 'corné' (horny). This does not apply to the species usually regarded as the type, viz. *A. ampullacea* (*Helix ampullacea*, Linn.), but only to the species of the Western Hemisphere, all of which have horny opercula, while those of all the Eastern forms are more or less testaceous, with the exception of the sinistral African species distinguished under the generic names of *Lanistes* and *Meladomus*.

Species of AMPULLARIA (*sensu stricto*).

1. Ampullaria Amazonica, Reeve.

Conch. Icon., sp. 55.

Hab.—River Amazon.

This is allied to *haustrum* and *gigas*, but its suture, though depressed, is not deeply channelled, as in those species.

2. Ampullaria Aulanieri, Hupé.

Voy. de Castelnau, 1847.

Hab.—Peru.

3. Ampullaria auriformis, Reeve.

Conch. Icon., sp. 133.

Hab.—Honduras (Reeve).

This may possibly be a variety of *A. Hopetonensis*, but the effusion of the base of the aperture is remarkable.

4. Ampullaria avellana, n.sp., p. 360.

5. Ampullaria Baeri, Dautzenberg.

Journ. de Conch., 1901, vol. xlix, p. 312, pl. ix, figs. 12, 13.

Hab.—Rio Mixiollo, Prov. Huallaga, Peru.

6. Ampullaria Bridgesi, Reeve.

Conch. Icon., sp. 50.

Hab.—Rio Grande, Bolivia.

7. Ampullaria bulla, Reeve.

Conch. Icon., sp. 104.

Hab.—Mexico.

8. Ampullaria buxea, Reeve.

Conch. Icon., sp. 112.

Hab.—Jamaica.

9. Ampullaria canaliculata, Lamarck.

Anim. sans Vert., 1819, 1st ed., vol. vi, p. 178.

Hab.—Rivers of Guadeloupe (Lamarck).

I have not been able to identify this shell. The figure in Delessert's "Receuil," pl. xxxi, fig. 3, is *A. gigas*, Spix, and cannot be Lamarck's type of *canaliculata*, which is described as only 25×22 lines. The shell figured in Reeve's "Conchologia Iconica" for the species is an Eastern form, *A. speciosa*, Phil., while specimens of *A. haustrum* and *immersa*, Reeve, and *insularum*, D'Orbigny, have done duty for it in various collections.[1]

10. Ampullaria Castelloi, Sowerby.

Proc. Malac. Soc., 1894, vol. i, p. 48, pl. iv, fig. 22.

Hab.—River Meta, S.E. Bogota.

This species presents considerable variation. The columella of the type is bright red, but in other specimens it is nearly white.

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[1] Since reading this paper I have identified this species. See note, p. 363.

The umbilicus of some specimens is completely closed, in others partly open. In view of the inconstancy of this latter character it is hardly practicable to maintain Dall's section *Limnopomus*, to which this species seems to belong.

11. Ampullaria Catamarcensis, Sowerby.

Proc. Zool. Soc., 1874, p. 600, pl. lxxii, fig. 4.

Hab.—Catamarca, Andes of Peru.

12. Ampullaria cerasum, Hanley.

Conch. Miscellany; Reeve, Conch. Icon., fig. 99.
A. aurostoma, Reeve (Lea MSS.), Conch. Icon., fig. 131.

Hab.—Mexico.

13. Ampullaria cingulata, Philippi.

Conch. Cab. Amp., p. 19, pl. v, fig. 3.

Hab.— ? (Berlin Museum).

A doubtful species which may possibly be young of *A. gigas*.

14. Ampullaria citreum, Reeve.

Conch. Icon., sp. 117.

Hab.— ?

15. Ampullaria columellaris, Gould.

Gould, "Otia," p. 51.
A. Sprucei, Reeve, Conch. Icon. Amp., fig. 134.

Hab.—Tarapoto, east side of the Andes (Spruce); Rio Chunchurras, Peru (Da Costa); Amazon River.

This is the type of Dall's section *Limnopomus*, Journ. Conch., vol. xi, pp. 53, 54. See above note on *A. Castelloi*.

16. Ampullaria conoidea, Martens.

Biologia Central. Amer., 1899, p. 423, pl. xxiv, figs. 10, 11.

Hab.—Costa Rica.

17. Ampullaria cornucopia, Reeve.

Conch. Icon. Amp., fig. 4.

Hab.—Columbia (Reeve).

18. Ampullaria Costaricana, Martens.

Biologia Central. Amer., 1899, pp. 418, 644, pl. xxiv, figs. 14–17.

Hab.—Costa Rica.

19. Ampullaria Cousini, Jousseaume.

Bull. Soc. Zool. Fr., 1877, vol. xii, p. 185, pl. iii, fig. 3.

Hab.—Ecuador.

20. Ampullaria crassa, Swainson.

Zool. Illust., ser. i, vol. iii, p. 101; Reeve, Conch. Icon. Amp., fig. 5.
A. Browni, Jay: Ann. Lyc. Nat. Hist. New York, 1846, vol. iv.
A. Olivieri, Deshayes.
Helicina exumbilicata, Spix.

Hab.—Brazil, Guyana, etc.

This is smaller and comparatively broader than *A. columellaris*, to which it is allied.

21. Ampullaria Crosseana, Hidalgo.

Journ. de Conch., 1871, vol. xix, p. 206; vol. xx, p. 242, pl. vii, fig. 1.

Hab.—River Amazon.

This is allied to *A. gigas*, Spix, of which it may prove to be a variety without colour-bands.

22. Ampullaria Cumingi, King.

Zool. Journ., vol. v, p. 344; Reeve, Conch. Icon. Amp., sp. 81.
A. peristomata, D'Orbigny: Mag. Zool., 1835, p. 33.
A. miltocheilus, Reeve: Conch. Icon. Amp., sp. 120.
A. Quitensis, V. d. Busch: Proc. Zool. Soc., 1859, p. 168.

Hab.—Prov. of Chiapes, Mexico (Ghiesbreght); Panama; Quito.

23. Ampullaria cyclostoma, Spix.

Test. Fluv. Brasil., 1827, p. 4, pl. iv, fig. 5.
A. Spixii, D'Orb.: Moll. Voy. Amér. Mérid., 1839, p. 376, pl. lii, figs. 7, 8.
A. elegans, D'Orb.: Mag. de Zool., 1835.
A. pulchella, Anton: Verz. Conch., 1839, p. 50.

Hab.—Rio Parana, La Plata, Bolivia, etc.

Var. elegans, D'Orbigny.

A. elegans, D'Orb.: Mag. de Zool., 1835.

Hab.—La Plata.

Var. Roissyi, D'Orbigny.

A. Roissyi, D'Orb.: Moll. Voy. Amér. Mérid., p. 377, pl. lii, figs. 1–3.

Reeve places *A. cyclostoma*, Spix, with *A. Platæ*, Maton, which is quite different.

24. Ampullaria Da Costæ, n.sp., p. 359.

25. Ampullaria decussata, Moricand.

Mém. Soc. Phys. Genève, vol. viii, p. 445, pl. ii, figs. 26, 27; Reeve, Conch. Icon., sp. 127.
A. intropicta, Reeve: Conch. Icon., sp. 89.

Hab.—Brazil.

26. Ampullaria dolioides, Reeve.

Conch. Icon., sp. 75.

Hab.—La Plata, etc.

27. [1] Ampullaria D'Orbignyana, Philippi.

Conch. Cab., p. 65, pl. xxi, fig. 4.
A. canaliculata, var., D'Orb.: Voy. Amér. Mérid., pl. iv, fig. 4.

Hab.—La Plata.

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[1] This is *A. canaliculata*, Lamk.; see note, p. 363.

28. AMPULLARIA ELECTRINA, Reeve.

Conch. Icon., sp. 95.

Hab.—?

29. AMPULLARIA EROGATA, Crosse & Fischer.

Journ. de Conch., 1890, vol. xxxviii, p. 113.

Hab.—Guatemala.

30. AMPULLARIA ERRONEA, Nevill.

Cat. Moll., 1877, fasc. E; Hand-list of Moll. Ind. Mus. Calcutta, 1884, pt. ii, p. 12.

A. aperta, Reeve: Conch. Icon., figs. 90, 91 (*non* Philippi).

Hab.—South America (Nevill).

Philippi's *A. aperta* is an Indian species.

31. [1] AMPULLARIA ERYTHROSTOMA, Reeve.

Conch. Icon., sp. 59.

A. hæmastoma, Reeve: Conch. Icon., sp. 34.

Hab.—Peru.

The habitat given by Reeve, "Zanzibar," is certainly erroneous.

32. AMPULLARIA EUMICRA, Crosse & Fischer.

Journ. de Conch., 1890, vol. xxxviii, p. 113.

Hab.—Mexico.

33. AMPULLARIA EXIGUA, Philippi.

Conch. Cab., p. 46, pl. xiii, fig. 4.

Hab.—?

This may be a variety of *A. crassa*, Swainson.

34. AMPULLARIA EXIMIA, Dunker.

Zeitsch. f. Malak., 1853, vol. x, p. 93.

A. cassidiformis, Reeve: Conch. Icon., sp. 56.

Hab.—Mazatlan, Lake Maricaibo, Venezuela.

35. AMPULLARIA EXPANSA, Miller.

Mal. Blätt. (2), 1879, p. 150, pl. xv, figs. 5, 6.

Hab.—Ecuador.

36. AMPULLARIA FIGULINA, Spix.

Helix figulina, Spix: Test. Fluv. Brasil., pl. iv, fig. 4.

Hab.—?

This may possibly be an extreme form of *A. Hopetonensis*.

37. AMPULLARIA GHIESBREGHTI, Reeve.

Conch. Icon., sp. 123.

Hab.—Prov. of Chiapes, Mexico.

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[1] Upon comparing this with Lamarck's type of *A. Guyanensis* at Geneva I find it identical; see note, p. 363.

38. Ampullaria gigas, Spix.

Test. Fluv. Brasil., 1827, p. 1, pl. i, fig. 1; Reeve, Conch. Icon., sp. 3.
A. gigantea, Tristram: Proc. Zool. Soc., 1863, p. 414.
A. canaliculata, Delessert (*non* Lamarck), Recueil Coq., pl. xxxi, figs. 31*a–b*.

Hab.—Brazil.

39. Ampullaria glauca, Linn.

Helix glauca, Linn.: Mus. Ulric., 1764, p. 667.
A. glauca, Linn.: Philippi, Conch. Cab., pl. xii, fig. 4: Reeve, Conch. Icon., sp. 85.
Helix oculus-communis, Gmelin.

Hab.—Demerara, Trinidad, etc.

This is an extremely variable species, to many forms of which specific names have been attached. The following I regard as varieties.

Var. effusa, Müller.

Nerita effusa, Müller.
Bulimus effusus, Bruguière.
A. effusa, Swainson.
A. crocostoma, Phil.: Conch. Cab., pl. xii, fig. 3.

Var. Geveanensis, Deshayes.

A. Geveanensis, Desh.: Lamarck's Hist. Nat. Anim. sans Vert., 1838, vol. viii, p. 541.
A. Geveana, Phil.: Conch. Cab., pl. vii, fig. 7.
A. villata, Martens.

Hab.—Cayenne.

Var. prunulum, Reeve.

A. prunulum, Reeve: Conch. Icon., sp. 82.

Hab.—New Granada (Reeve).

Var. luteostoma, Swainson.

A. luteostoma, Swainson: Zool. Illust., vol. iii, pl. clvii.; Reeve, Conch. Icon., sp. 84.
A. dubia, Guilding: Zool. Journ., vol. iii, p. 359.

Hab.—Venezuela.

Var. pachystoma, Philippi.

A. pachystoma, Phil.: Conch. Cab., p. 44, pl. xii, fig. 5.

Var. balteata, Philippi.

A. balteata, Phil.: Conch. Cab., p. 21, pl. v, fig. 7.
A. Guadeloupensis, Martens: Mal. Blätt., 1857, vol. iv, p. 199.

Var. Cubensis, Reeve.

A. Cubensis, Reeve: Conch. Icon., sp. 83.

Hab.—Cuba.

Var. ORONOCENSIS, Reeve.

A. Oronocensis, Reeve: Conch. Icon., sp. 45.
Hab.—River Oronoco.

Var. CUPRINA, Reeve.

A. cuprina, Reeve: Conch. Icon., sp. 1.
Hab.—? (Reeve).

40. AMPULLARIA GOSSEI, Reeve.

Conch. Icon., sp. 93.
Hab.—Jamaica.

41. AMPULLARIA GRANULOSA, Sowerby.

Proc. Malac. Soc., 1894, vol. i, p. 48, pl. iv, fig. 22.
Hab.—Cayenne (Eudel).

42. [1] AMPULLARIA GUYANENSIS, Lamarck.

Anim. s. Vert., 1819, vol. vi, p. 176.
Hab.—Guyana.

This name has erroneously been placed in the synonymy of *A. glauca*, with which it has no affinity. It is more nearly related to *A. urceus*.

43. AMPULLARIA HAUSTRUM, Reeve.

Conch. Icon., sp. 23.
Hab.—River Maranon, Brazil (Reeve).

Var. IMMERSA, Reeve.

A. immersa, Reeve: Conch. Icon., sp. 52.
Hab.—Rio Grande, Bolivia.

44. AMPULLARIA HEPATARIA, Reeve.

Conch. Icon., sp. 77.
Hab.—?

Nevill unites this with *A. globosa*, Swainson, but it surely belongs to the Western Hemisphere, and may possibly prove to be one of the numerous forms of *A. Hopetonensis*.

45. AMPULLARIA HOPETONENSIS, Lea.

Trans. Phil. Soc., 1839, vol. v, pl. xix, fig. 84.
A. depressa, Say: Exped. St. Peter's River, 1824, vol. ii, p. 264 (*non* Lamarck, 1822).
Hab.—Georgia, Florida, Hopetown, etc.

The name is rather unfortunate for this very variable and widely distributed species, but the law of priority compels its adoption.

The following I regard as synonyms and varieties, though others may still continue to regard some of them as distinct species. In

[1] *A. erythrostoma* and *hæmastoma* of Reeve are synonyms; see note, p. 363.

comparing a large series of these shells, it is to be observed that the great differences in form and aspect produced by the elation or depression of the spire, the expansion of the outer lip, as well as the smoothness or malleation of the surface, etc., are characters subject to such variation in degree that I find it impossible to define the limits of each form.

Var. AUSTRALIS, D'Orbigny.

A. australis, D'Orb.: Voy. Amér. Mérid., p. 375, pl. li, figs. 3, 4.
Hab.—Buenos Ayres.

Var. BELIZENSIS, Crosse & Fischer.

A. Belizensis, C. & F.: Journ. de Conch., 1890, p. 110.
Hab.—Belize, Mexico.

Var. DYSONI, Hanley.

A. Dysoni, Hanley: Conch. Misc., No. i, pl. ii, fig. 1.
A. paludosa, Say: N. H. Diss., 1840, p. 260.
A. venetus, Reeve: Conch. Icon., sp. 17.
A. Hondurasensis, Reeve: Conch. Icon., sp. 15.
Hab.—Honduras.

Var. FLAGELLATA, Say.

A. flagellata, Say: Conch. U.S., 1856, p. 147.
A. Lamarcki, Phil.: Conch. Cab., p. 67, pl. xxi, fig. 5.
A. flatilis, Reeve: Conch. Icon., sp. 31.
A. Guatemalensis, Morelet?
Hab.—Mexico, etc.

Var. FUMATA, Reeve.

A. fumata, Reeve: Conch. Icon., sp. 124.
Hab.—Prov. of Chiapes, Mexico.

Var. LEMNISCATA, Crosse & Fischer.

A. lemniscata, C. & F.: Journ. de Conch., 1890, p. 112.
Hab.—Belize, Mexico.

Var. LIVESCENS, Reeve.

A. livescens, Reeve: Conch. Icon., sp. 21.
Hab.—?

Var. MALLEATA, Jonas.

A. malleata, Jonas: Beitr., p. 22, pl. x, fig. 11.
Hab.—Mexico.

Var. MARTENSIANA, Nevill.

A. Martensiana, Nevill: Hand-list Moll. Ind. Mus. Calcutta, 1884, p. 10.
Hab.—South America (Nevill).

Var. OCCLUSA, Crosse & Fischer.

A. occlusa, C. & F.: Journ. de Conch., 1890, p. 111.
Hab.—Tanesco, Guatemala.

Var. PHÆOSTOMA, Philippi.

A. phæostoma, Phil.: Conch. Cab., p. 45, pl. xiii, fig. 2.

Var. PORPHYROSTOMA, Reeve.

A. porphyrostoma, Reeve: Conch. Icon., sp. 30.
Hab.—New Granada.

Var. PYRUM, Philippi.

A. pyrum, Phil.: Conch. Cab., p. 18, pl. v, fig. 2.

Var. REFLEXA, Swainson.

A. reflexa, Swainson: Zool. Illust., vol. iii, p. 173.
Hab.—Cuba.

Var. RETUSA, V. Olfers.

A. retusa (V. Olfers), Phil.: Conch. Cab., p. 18, pl. v, fig. 1.

Var. YUCATANENSIS, Crosse & Fischer.

A. Yucatanensis, C. & F.: Journ. de Conch., 1890, p. 110.
Hab.—Yucatan.

46. AMPULLARIA IMPERVIA, Philippi.

Zeitsch. f. Malak., 1852, vol. ix, p. 21.
Hab.—Bolivia, etc.

Var. NUBILA, Reeve.

A. nubila, Reeve: Conch. Icon., 1856, sp. 65.
Hab.—River Salamonis, Amazons.

This species is generally known as *A. nubila*, which, although it is generally less elately conical, cannot be separated from Philippi's species. Philippi's type is imperforate, but most of the specimens are more or less umbilicated.

47. AMPULLARIA INNEXA, Crosse & Fischer.

Journ. de Conch., 1890, vol. xxxviii, p. 111.
Hab.—Monte de Mistan, Mexico.

48. AMPULLARIA INSULARUM, D'Orbigny.

Voy. Amér. Mérid., Moll., 1839, p. 374, pl. li, figs. 1, 2; Reeve, Conch. Icon., figs. 42, 43.
A. vermiformis, Reeve: Conch. Icon., sp. 54.
A. fasciata, Reeve; Conch. Icon., sp. 41.
A. australis, D'Orb.: Voy. Amér. Mérid.
A. Georgi, J. W. Williams: Ann. Mag. Nat. Hist., 1889, vol. iv, p. 47.
Hab.—Parana, Rio Grande, Bolivia, Paraguay, etc.

I cannot agree with Nevill in uniting this with *A. gigas*. The shell is stouter in substance, more oblique in form, and has a roughly striated surface. Reeve's type of *A. vermiformis* is still more oblique, but it cannot be separated from *A. insularum*.

49. AMPULLARIA INTERRUPTA, n.sp., p. 361.

50. Ampullaria labiosa, Koch.

Conch. Cab., p. 58, pl. xviii, fig. 5.

This has been quoted as Indian, which seems to be a mistake. From Philippi's figure it appears to be allied to *A. Hopetonensis*; and there is a specimen, believed to be *A. labiosa*, in the British Museum which has a thin, horny operculum, proving it a Western form.

51. Ampullaria Lattrei, Reeve.

Conch. Icon., sp. 22.

Hab.—Coban, Guatemala.

52. Ampullaria levior, n.sp., p. 361.

53. Ampullaria lineata, Spix.

Helix lineata, Spix: Test. Fluv. Brasil., 1827, pl. v, fig. 2.
A. fasciata, Swainson: Zool. Illust., 1822, ser. i, vol. ii, pl. ciii (not of Lamarck, 1819, nor Roissy, 1805).
A. fasciata, var., Swainson: Zool. Illust., ser. ii, vol. ii, pl. lxiv.
A. Swainsoni, Phil.: Conch. Cab., p. 53, pl. xvi, fig. 5.
A. Swainsoni, Reeve: Conch. Icon., sp. 128.
A. Linnæi, Phil.: Conch. Cab., 1852, p. 62, pl. xx, fig. 6.
A. Chemnitzi, Phil.: Conch. Cab., p. 39, pl. x, fig. 5.

Hab.—Brazil, British Guyana, etc.

It appears that the name *fasciata* cannot be retained in the genus, as it was used by Roissy and Lamarck for *Ampullaria ampullacea* (Linn.).

54. Ampullaria lymnæformis, Reeve.

Conch. Icon., sp. 39.

Hab.—River Maranon (Reeve).

55. Ampullaria Martinezi, Hidalgo.

Journ. de Conch., 1866, vol. xiv, p. 345, pl. xiv, fig. 5.

Hab.—Ecuador.

I have some doubt as to whether this is distinct from *A. columellaris*; it has a much shorter spire and a more tapering form.

56. Ampullaria Metcalfei, Reeve.

Conch. Icon., sp. 119.

Hab.—?

57. Ampullaria Miamensis, Pilsbry.

Proc. Acad. Nat. Sci. Philadelphia, 1899, p. 365.

Hab.—Florida.

58. Ampullaria modesta, V. d. Busch.

Proc. Zool. Soc., 1859, p. 168.

Hab.—Quito.

59. Ampullaria monacha, Crosse & Fischer.

Journ. de Conch., 1890, vol. xxxviii, p. 112.

Hab.—Santa Efigenia, Mexico.

60. Ampullaria nigrilabris, Philippi.

Conch. Cab., p. 65, pl. xxi, fig. 2.

Hab.—Rio Janeiro.

This shell is rather like *A. sordida*, Swainson, from which it differs principally in being decussately striated.

61. Ampullaria nobilis, Reeve.

Conch. Icon., sp. 8.

Hab.—East Peru.

62. Ampullaria notabilis, Reeve.

Conch. Icon., sp. 63.

Hab.—Peru.

63. Ampullaria Novægranadæ, V. d. Busch.

Proc. Zool. Soc., 1859, p. 169.

Hab.—New Granada.

64. Ampullaria oblonga, Swainson.

Zool. Illust., vol. ii, p. 136; Reeve, Conch. Icon., sp. 70.

Hab.—Caripe, Venezuela.

65. Ampullaria olivacea (Spix).

Test. Fluv. Brasil., 1827, pl. iii, fig. 1; Reeve, Conch. Icon., sp. 38.

Var. quercina, Spix.

A. quercina, Spix: Test. Fluv. Brasil., pl. iii, fig. 2.

Hab.—Brazil.

66. Ampullaria oviformis, Deshayes.

Encyc. Méth. Vers., vol. ii, p. 34.

Hab.—Cayenne.

67. Ampullaria papyracea, Spix.

Test. Fluv. Brasil., p. 3, pl. iv, figs. 1, 2; Reeve, Conch. Icon., sp. 44.

Hab.—Meobamba (Reeve).

68. Ampullaria Pealeana, Lea.

Trans. Amer. Phil. Soc., 1838, new ser., vol. vi; Philippi, Conch. Cab., p. 62, pl. xxvii, fig. 7.

Hab.—Turbaco, Columbia.

69. Ampullaria Pernambucensis, Reeve.

Conch. Icon., sp. 103.

Hab.—Pernambuco.

70. Ampullaria pertusa, Sowerby.

Proc. Malac. Soc., 1894, vol. i, p. 94, pl. iv, fig. 23.

Hab.—Merida, Venezuela.

71. Ampullaria Petiti, Crosse.

Journ. de Conch., 1890, vol. xxxix, p. 214, pl. iv, fig. 2.

Hab.—Amazon River.

This is perhaps a variety of *A. impervia*, Phil., than which the type is much larger, with a more conical spire. It is very much thickened towards the base.

72. Ampullaria physis, Hupé.

Hab.—Amazon River.

73. Ampullaria physoides, Reeve.

Conch. Icon., sp. 107.

Hab.—Pernambuco.

74. Ampullaria picta, Reeve.

Conch. Icon., sp. 117.

Hab.—Mazatlan.

75. Ampullaria Pinei, Dall.

Nautilus, vol. xii, p. 75.

Hab.—Florida.

76. Ampullaria Platæ, Maton.

Trans. Linn. Soc., 1809, vol. x, pl. xxiv, figs. 16, 17.
Asolene Platæ, D'Orb.: Voy. Amér. Mérid., p. 364.
A. naticoides, D'Orb.

Hab.—La Plata.

77. Ampullaria producta, Reeve.

Conch. Icon., sp. 68.

Hab.—Amazon River.

78. Ampullaria pulchra, Gray.

Griffith Ed. Cuvier, pl. i, fig. 6.
A. Hanleyi, Reeve: Conch. Icon., sp. 113.

Hab.—South America.

79. Ampullaria puncticulata, Swainson.

Zool. Illust., 1822, vol. iii, p. 143; Reeve, Conch. Icon., sp. 19.
A. vexillum, Reeve: Conch. Icon., sp. 20.

Hab.—Cayenne.

80. Ampullaria Puntaplaya, Cousin.

Bull. Soc. Zool. France, 1887, vol. xii, p. 278.

Hab.—Ecuador.

81. Ampullaria purpurascens, Guppy.

Ann. Mag. Nat. Hist., 1864, vol. xiv, p. 243.

Hab.—Trinidad.

82. Ampullaria quinquidensis, Miller.

Mal. Blätt. (2), vol. i, p. 150, pl. viii, figs. 1, 2.
Hab.—Ecuador.

83. Ampullaria Reyeri, Cousin.

Bull. Soc. Zool. France, 1887, vol. xii, p. 279, pl. iv, fig. 7.
Hab.—Ecuador.

84. Ampullaria robusta, Philippi.

Conch. Cab., p. 50, pl. xv, figs. 4, 5.
Hab.—?
This may be a variety of *A. columellaris*, but it is perforate and the aperture is rather more oblique.

85. Ampullaria rotundata, Say.

Descript., etc., New Harmony, p. 21.
Hab.—St. John's River, Florida.
Unfigured and unknown to me, and most likely a form of *Hopetonensis*.

86. Ampullaria rufilineata, Reeve.

Conch. Icon., sp. 7.
Hab.—?

87. Ampullaria scalaris, D'Orbigny.

Voy. Amér. Mérid., Moll., p. 374, pl. 1, figs. 1–3.
Hab.—Bolivia.

88. Ampullaria Schrammi, Crosse.

Journ. de Conch., 1876, vol. xxiv, p. 102.
Hab.—Oyapock River, French Guyana.

89. Ampullaria semitecta, Mousson.

Mal. Blätt., 1873, vol. xxi, p. 18; Pfeiffer, Novit. Conch., vol. iv, p. 137.
Hab.—Bogota.

90. Ampullaria simplex, Reeve.

Conch. Icon., sp. 98.
Hab.—?

91. Ampullaria sinamarina, Bruguière.

Deshayes in Lamk., Anim. s. Vert., 2nd ed., vol. viii, p. 548.
Hab.—Upper Corentyne River, British Guyana.
Shell resembling a *Paludomus*, closely transversely striated.

92. Ampullaria sordida, Swainson.

Zool. Illust., 1822, vol. iii, pl. cxliii; Philippi, Conch. Cab., p. 38, pl. x, fig. 3; Reeve, Conch. Icon., sp. 72.
A. intermedia, Fér.: Voy. de l'Uranie, pl. lxviii, figs. 1, 2.
A. autumnalis, Reeve: Conch. Icon., sp. 16.
A. melanocheila, Reeve: Conch. Icon., sp. 24.
Hab.—Rio de la Plata, Bolivia, etc.

93. AMPULLARIA STORERIA, Jay.

Catal., 1839, pl. i, fig. 5.
Hab.—Amazons.

94. AMPULLARIA STREBELI, Martens.

Biol. Cent. Americana, p. 415, pl. xxii, fig. 2.
Hab.—East Mexico.

95. AMPULLARIA SWAINSONI, Philippi.

Conch. Cab., p. 53, pl. xvi, fig. 5.
A. fasciata, Swainson: Zool. Illust., 1822, ser. II, vol. ii, pl. lxiv (not of Roissy, 1805, nor Lamarck, 1819).
Hab.—La Plata.

96. AMPULLARIA TAMSIANA, Philippi.

Zeitsch. f. Malak., 1852, vol. ix, p. 27; Conch. Cab., p. 51, pl. xvi, figs. 1, 2.
Hab.—Puerto Cabello.

97. AMPULLARIA TENUISSIMA, Jousseaume.

Le Naturaliste, 1894, p. 120.
Hab.—La Coca, Ecuador.

98. AMPULLARIA TESTUDINEA, Reeve.

Conch. Icon., sp. 114.
Hab.—Amazons.

99. AMPULLARIA TROCHULUS, Reeve.

Conch. Icon., sp. 66.
Hab.—?

100. AMPULLARIA URCEUS (Müller).

Nerita urceus, Müller: Hist. Ver., 1774, p. 174.
A. rugosa, Lamarck.
Pomus urceus, H. & A. Adams: Gen. Rec. Moll., vol. i, p. 346.
A. leucostoma, Swainson.
A. dolium, Phil.: Conch. Cab., p. 40, pl. xi, fig. 1.
A. urceus, Reeve: Conch. Icon., sp. 18.
Hab.—Trinidad, New Granada (Morelet), Mississippi (Dall).

101. AMPULLARIA VIOLACEA, Valenc.

Humboldt & Bonpl., Obs. Zool., 1833, vol. ii, p. 259; Martens, Zool. Blätt., vol. xii, p. 52.
Hab.—Veracruz.

102. AMPULLARIA YATESI, Reeve.

Conch. Icon., sp. 28.
Hab.—River Maranon (Reeve).

103. AMPULLARIA ZONATA (Spix).

Test. Fluv. Brasil., p. 1, pl. i, figs. 1, 2; Philippi, Conch. Cab., p. 9, pl. ii, fig. 1; Reeve, Conch. Icon., figs. 53, 155.

Hab.—Columbia, Brazil, etc.

Var. ARCHIMEDIS, Spix.

A. Archimedis, Spix: Philippi, Conch. Cab., p. 9, pl. xx, fig. 1.
A. pyrum, Phil.: Conch. Cab., p. 18, pl. v, fig. 2.

Var. MARGINATRA, Jonas.

A. marginatra, Jonas: Zeitschr. f. Malak., 1845, p. 69; Philippi, Conch. Cab., p. 63.

Sub-genus CERATODES, Guilding.

Ceratodes, Guilding: Zool. Journ., 1828, vol. iii, p. 540.
Marisa, H. & A. Adams (*non* Gray).

104. AMPULLARIA CORNUARIETIS (Linn.).

Helix cornuarietis, Linn.: Syst. Nat., 1758, 10th ed.
Planorbis cornuarietis, Lamk.: Système, p. 93.
A. Knorri, Philippi: Conch. Cab., p. 37, pl. xviii, fig. 3.
A. rotula, Mousson.
A. Chiquitensis, D'Orb.: Voy. Amér. Mérid., p. 367, pl. xlviii, fig. 10.

Hab.—Parana, Trinidad, Venezuela, New Granada, etc.

105. AMPULLARIA PLANORBULA, Philippi.

Conch. Cab., p. 26, pl. vii, fig. 3.

Hab.—Para.

Sub-genus POMELLA, Gray.

Pomella, Gray: Proc. Zool. Soc., 1847, p. 148.

106. AMPULLARIA MEGASTOMA, Sowerby.

Tank. Cat. App., 1825, p. 10.
A. neritoides, D'Orb.: Voy. Amér. Mérid., p. 368, pl. xlix, figs. 1, 2.

Hab.—Uruguay.

This fine species stands quite alone, distinguished principally by the great size of its aperture.

DESCRIPTION OF THE NEW SPECIES.[1]

AMPULLARIA DA COSTÆ, n.sp.

Testa mediocriter umbilicata, ovato-turbinata, tenuis, nitens, fuscescens, fusco fasciata, postice purpureo tincta; spira convexe turbinata; anfractus 5, rotunde convexi, obscure subobliquе plicato-striati, sutura angustissima sejuncti; anfractus ultimus $\frac{3}{4}$ longitudinis

[1] The types of these species are now in the British Museum.

testæ æquans, rotunde convexus, basim versus paulo attenuatus; apertura ovalis, intus fusco-purpurea; peristoma tenue. Long. 50, lat. 40; apertura, long. 32, lat. 19 mm.

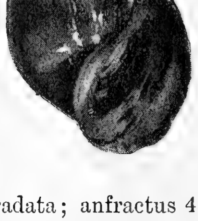
Hab.—Costa Rica.

A shell of simple symmetrical form, its greatest width being about the middle, with the anterior and posterior ends nearly equal. The whorls are smoothly rounded, without sutural depression, but separated by an exceedingly narrow suture. The prevailing colour is brown, but tinged here and there with purple, particularly about the spire. The interior of the aperture is deep brownish purple.

The type-specimen came from the collection of the late S. I. Da Costa.

AMPULLARIA AVELLANA, n.sp.

Testa ovalis, mediocriter umbilicata, tenuiuscula, longitudinaliter striato-plicata, fusco-olivacea, lineis fuscis plus minusve obscuris



fasciata; spira breviter gradata; anfractus 4, penultimus rotundatus; ultimus $\frac{5}{6}$ longitudinis testæ æquans, ovatus, convexiusculus, ad suturam depressus; apertura ovalis; peristoma tenue. Long. 25, lat. 20; apertura, long. 18, lat. 11 mm.

Hab.—Lagunella, Venezuela.

A small oval shell, with a moderate, rather narrow umbilicus, depressed, but not channelled at the suture, the top of the body-whorl forming an obtuse rounded angle. The sides are rather less roundly convex than most of the species of this group. The surface is rather irregularly striated, of an olive-tinted brown colour, with numerous rather faint transverse brown lines, which become more distinct towards the aperture.

AMPULLARIA INTERRUPTA, n.sp.

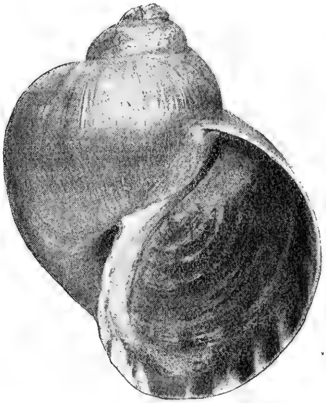
Testa imperforata, solidula, ovata, viridis, varicibus planulatis, vix elatis, luteo strigatis, fusco maculatis ornata, longitudinaliter irregulariter plicata, subtilissime corrugatim striata; spira conica, elatiuscula; anfractus 6, convexi, sutura angusta sejuncti; ultimus $\frac{3}{4}$ longitudinis testæ æquans, supra rotundatus, infra levissime attenuatus; apertura ovata, antice latiuscula, postice angustior, fauce fusca; labrum intus cæruleo fasciatum, ad marginem fusco tessellatum; columella crassa, alba, leviter sinistrorsum effusa. Operculum corneum, nigro-fuscum. Long. 28, lat. 22; apertura, long. 18, lat. 12 mm.

Hab.—Laguna Urao, Venezuela (Da Costa).

This small species is allied to *A. columellaris*, D'Orb., and *Castelloi*, Sow., belonging to Dall's section *Limnopomus*. It is chiefly distinguished by its prettily coloured varices, which are scarcely raised, but rendered conspicuous by dark-brown spots bordered with yellow. The shell is otherwise green; its surface is apparently smooth, but beneath the lens it is seen to be very finely corrugately striated.

AMPULLARIA LEVIOR, n.sp.

Testa mediocriter umbilicata, conico-ovata, tenuis, pallide fulva, griseo-fusco multifasciata, hic illic malleata, longitudinaliter striato-plicata, transversim obscurissime striata et crenato-lirata; spira conica, elatiuscula; anfractus 5, rotunde convexi; ultimus $\frac{3}{4}$ longitudinis testæ æquans, inflatus, leviter obliquus; apertura patula, intus fusco fasciata; labrum acutum. Operculum corneum, fuscum, concentrice conspicue plicatum. Long. 43, lat. 35 mm.; apertura, long. 31, lat. 20 mm.



Hab.—Amazon River.

A shell of light substance and colour, with an unusually expanded aperture. It somewhat resembles *A. dolioides*, Reeve, but has not the sutural depression characteristic of that species.

NOTES ON CERTAIN TYPES OF *AMPULLARIA* IN THE PARIS AND GENEVA MUSEUMS.

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

Read 11*th June*, 1909.

Since reading my paper on the Western forms of the genus *Ampullaria*, I have visited the Paris and Geneva Museums, and through the kindness of Dr. Louis Germain, Professor Bedot, and M. de Lessert have been able to identify from the actual types some of the species concerning which I was previously in doubt.

In the Geneva Museum I found the collections of Delessert, Bourguignat, Brot, Moricand, and most of Lamarck's Gastropoda. Among the latter I was pleased to be able to fix definitely the following species, which has long been misrepresented by various authors, and which, in my last paper, I confessed myself unable to identify.

Ampullaria canaliculata, Lamarck.

This shell measures $2\frac{1}{10}$ inches long by $1\frac{9}{10}$ inches wide; its spire is small and conical, from a front view showing about $3\frac{1}{2}$ whorls above the high obtusely rounded shoulder; it is deeply and rather broadly channelled at the suture. The body-whorl is rather square and nearly vertical, not oblique as in most allied species. The substance of the shell is thicker than that of *A. gigas*; its surface is lustrous, posterior smooth, anterior plicately striated. Philippi's *A. D'Orbignyana* is the same, only the spire is more immersed. *A. haustrum*, *Amazonica*, and *immersa* of Reeve (which I regard as one species) may possibly merge into this, but at present it seems to me sufficiently distinct. *A. insularum*, D'Orbigny (= *vermiformis*, Reeve), is another allied species, but much more oblique, more solid, and with a rougher surface.

Ampullaria Guyanensis, Lamarck.

I now find that Reeve's *A. erythrostoma* is identical with it, and *A. hæmastoma* of the same author is a stunted form of the same.

From Bourguignat's collection I made a number of notes concerning his African species, but I propose to embody these in my next paper dealing with *Pila* and *Lanistes*. In the Paris Museum I found several of Crosse & Fischer's types previously unknown to me, the principal result of which is to add the following to the already very considerable synonymy of *A. Hopetonensis*, viz., *A. Belizensis* and *lemniscata*, C. & F., both from Belize, Mexico, and *A. occlusa*, C. & F., from Tanesco, Guatemala. On seeing the type of *A. Petiti*, Crosse, I now think it distinct from *A. impervia*, Phil. It is a much larger shell, with a very elately conical spire, and the peristome very thick, particularly at the base; its colouring also is different, being destitute of the peculiar cloud-like blotches characteristic of *A. impervia*, and particularly of its variety *nubila*.

While in Paris I also visited the rich collection of Mr. Dautzenberg, and found there material confirming my previously expressed opinions on several species with which my acquaintance was limited. Mr. Dautzenberg has a specimen of *A. Tamsiana,* Phil., much larger than any I have previously seen; it measures 47×46 mm. The specimens of African species in Mr. Dautzenberg's collection I found helpful and instructive, but of these I will treat in my next paper.

DESCRIPTIONS OF THE ANIMALS OF TWO LAND SHELLS FROM PERAK. "SKEAT EXPEDITION IN THE MALAY PENINSULA, 1899–1900."

By Lieut.-Colonel H. H. Godwin-Austen, F.R.S.

Read 14*th May*, 1909.

Plate XV.

1. Leptodontarion Perakensis, n.sp. Pl. XV, Figs. 1–1*d*.

Hab.—Talum, Perak; "Skeat Expedition," in Brit. Mus. Collection.

Shell very globose, thin, and membranaceous; spire low, apex rounded; peristome somewhat sinuate; suture moderately impressed; no sculpture, smooth, shiny; colour ochraceous green; whorls 3½; aperture and columellar margin not seen. Only one specimen received, and to examine the animal the shell was broken to extract it. Major diam. 6·3 mm.; diam. of shell figured 5·5 mm. (Figs. 1, 1*a*). Animal (Figs. 1*b*, 1*c*, 1*d*) pale-coloured throughout, without markings of any kind. The right shell lobe in figure (1*c*) is shown rolled up by contraction in the spirit; it is long, fairly wide, of even breadth at first, then narrowing, and in life would cover the portion of the shell below and on side of the periphery. The young specimen from the Cambridge Museum, a good deal contracted by the spirit, shows the right shell lobe unfolded (Fig. 1*b*). There is a very small left shell lobe. The right dorsal lobe is large and triangular, the left dorsal lobe in two distinct lappets. The foot is pointed and has a long overhanging lobe. The peripodial grooves are well marked, sole indistinctly divided. Length of the animal about 16 mm.

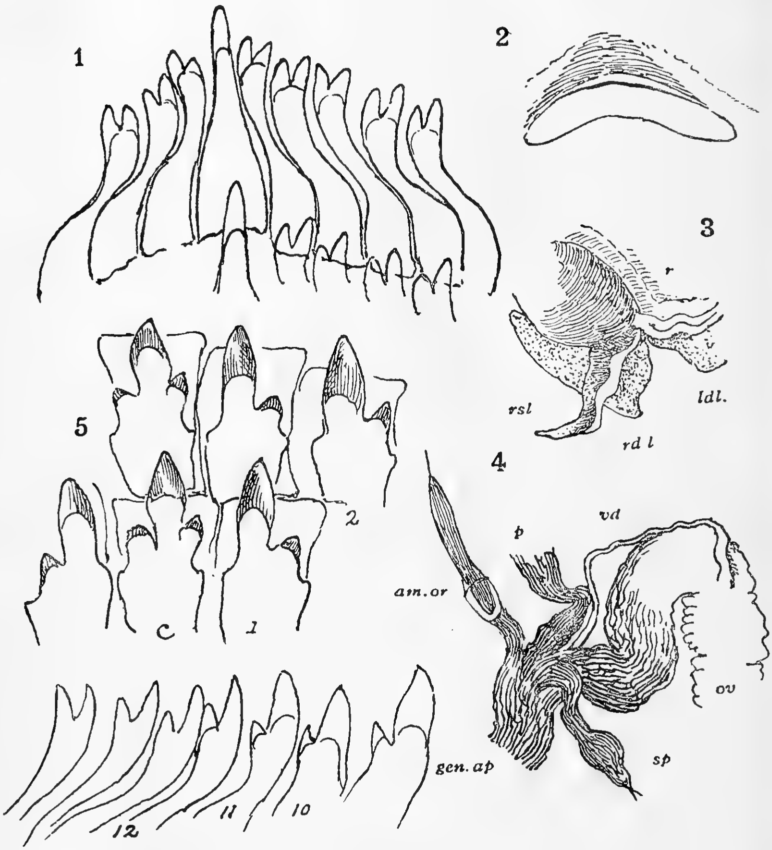
The jaw (Fig. 2, line block) is nearly straight, narrow, the cutting-edge slightly concave; it is thin and transparent, arched above, merging into the muscular tissue.

The radula (Fig. 1, line block) consists of numerous rows of similar curved teeth having a great number in a row, on long narrow plates. The centre tooth is unicuspid, very long and pointed, the base gradually widening out. All the admedians are nearly evenly bicuspid, the outer cusp being very slightly the longer.

The genitalia (Fig. 4, line block) were not got out quite perfect. An amatorial organ with a blunt point is present, also a short ovoid spermatheca with club-like free end; the penis was broken off.

This species has most interesting similarity to *Leptodontarion Hiraseanus* from Formosa, both in the jaw and radula and outward form, even to the globose shape of the shell, but *Hiraseanus* is even more globose. The generative organs differ in the presence of the amatorial organ and in other details. Its relationship is therefore closer with the Indian species, *L. minuta* of Assam, as might be expected, than with the Formosan form.

This mollusc, one of seven, had been presented to the Natural History Museum by Messrs. Annandale and Robinson in May, 1904, for the "Skeat Expedition." It bore the name—determined apparently by Mr. Collinge—of *Helicarion permolle*, Stoliczka. This was a species I had long wished to dissect, and Mr. Edgar Smith was kind enough to allow me to take a specimen for this purpose.



1. *Leptodontarion Perakensis*. Central teeth of the radula very much enlarged. From Natural History Museum specimen.
2. Jaw. × 30.
3. Mantle-zone, showing right shell lobe, etc.
4. Part of the genitalia.
5. *Sitala* (?) *Gunongensis*, n.sp. Central and admedian teeth of the radula.

Helicarion permolle from Penang Hill is described in the Journal of the Asiatic Society of Bengal, 1873, vol. xlii, pt. ii, p. 18, pl. i, fig. 11 (shell); pl. ii, figs. 21–3 (radula and generative organs). It will be seen that all these characters differ considerably from those of the Perak mollusc, which belongs, in fact, to a different sub-family, the Durgellinæ. The character of the anatomy of *H. permolle* approaches that of *Sitala*. Stoliczka says of the shell "ad basin striis spiralibus sub-obsoletis notata," and also "the rather strongly *elevated spire* and membranaceous transparent structure of the shell separate this species from the numerous allied forms of the Philippines." The italics are mine, *vide* figs. 11–11*d* (Pl. XV, Fig. 3).

H. permolle, Stol., is included by Mr. Collinge in his paper on the mollusca collected by the "Skeat Expedition" in the Malay Peninsula (Journ. Malacology, 1902, vol. iv, p. 73); hab., Gunong Inas, 3000 feet, State of Perak. It was not figured or described. Mr. Collinge says, "This is certainly the mollusc described by Stoliczka, for both externally and internally it agrees with his descriptions and figures." Some mixing of species in submitting them to the British Museum must have occurred. The animal named *H. permolle*, which I now describe, cannot possibly be the same Mr. Collinge examined and catalogued. Compare the radula figured by Stoliczka of *H. permolle*, with the central and admedian teeth on quadrate plates, and that of the specimen I received from Mr. E. A. Smith, with its very numerous and similar teeth on very narrow plates, showing generic differences. The shell and genitalia also differ in the two species.

Further, in order to clear up the doubt hanging over the distribution of the Penang shell *H. permolle*, with the kind assistance of Dr. S. F. Harmer and Mr. C. L. Boulenger I have been able to examine the specimens under that name in the Cambridge Museum. The tube contained the right number of specimens, but they represented three species.

(*a*) One specimen similar to those in the Natural History Museum (*Leptodontarion*). (Pl. XV, Fig. 1*b*, animal and shell.)

(*b*) Three specimens which I feel sure from the form of the shell represent *H. permolle*, yet when compared with Stoliczka's figures on pl. i, figs. 11–11*b*, cannot be that shell, although there are many resemblances indicated in Stoliczka's description of the animal. They possibly belong to the same genus. I now put them both provisionally in *Sitala*. This genus now holds in the Indian region ("Fauna British India" (Mollusca), 1908, p. 225) some twenty-six species, and of the majority nothing is known of their anatomy. In course of time, as our knowledge increases, it is quite evident they will require to be separated into new generic divisions.

(*c*) A shell which much resembles the young of *Macrochlamys* (?) *Townsendiana*, G.-A. & Nev.

2. Sitala (?) Gunongensis, n.sp. (shell and animal). Pl. XV, Figs. 2–2*c*.

Hab.—Gunong Inas, Perak State; "Skeat Expedition."

Shell globosely conoid, not umbilicated, with well-defined wavy longitudinal striation, strong on base; colour pale burnt sienna, milky-white on apical whorls; spire low, sides flat; apex blunt; suture shallow; whorls 4, the last inflated, regularly increasing; aperture lunate; peristome thin; columellar margin nearly perpendicular, rounded, and reflected. Major diam. 5·7 mm.

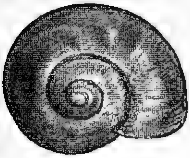
Animal.—Foot well divided; the peripodial margin would appear in life to be paler than the part above, a small overhanging lobe. There is a small pointed right shell lobe, also a well-developed left shell lobe (Figs. 2*b*, 2*c*). The animal was in a very hardened state; plain water had scarcely any effect in softening it, so I used at last a little caustic potash. This, of course, destroyed the internal organs, but I secured the radula; the jaw unfortunately was not found. This radula has the formula 60 . 2 . 10 . 1 . 10 . 2 . 60, or 72 . 1 . 72; total in row, 145. The centrals and admedians are on elongate quadrate plates, the main point or mesocone being long and spindle-shaped; below the side cusp there is a conspicuous sharp shoulder; the marginals are very evenly bicuspid, becoming gradually very minute towards the outer edge; some of these minute teeth are tricuspid; there is no serration, as seen in the teeth of the radula of *Lamprocystis*.

EXPLANATION OF PLATE XV.

FIG.

1, 1*a*. *Leptodontarion Perakensis*, n.sp. Shell. × 4·5.
1*b*. Ditto. Cambridge specimen, with animal.
1*c*. Ditto. Animal, right side, Natural History Museum specimen. × 4·5. *ot*, oral tentacle.
1*d*. Ditto. Animal, left side. Ditto. × 4·5.
2, 2*a*. *Sitala* (?) *Gunongensis*, n.sp. Shell. × 4·5.
2*b*. Ditto. Animal, shell removed, from right side. × 4·5.
2*c*. Ditto. Ditto, from left side. × 4·5.
3. *Helicarion permolle*, Stol. From figs. in J.A.S.B., 1873, pl. i, fig. 11. Enlarged and natural size.

1a



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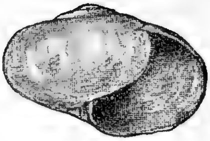

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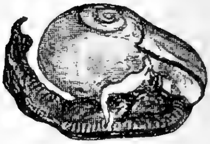
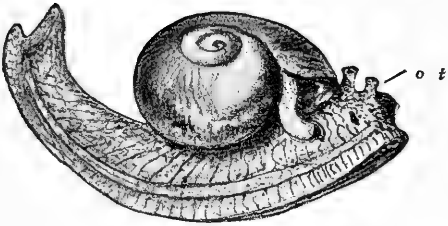


1c



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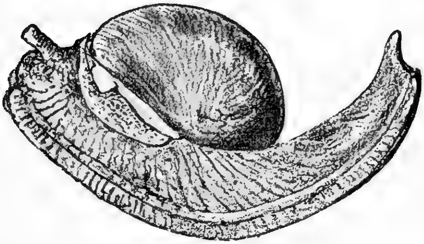
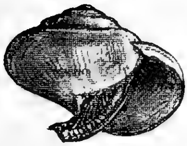
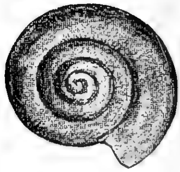


2



2a



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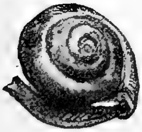

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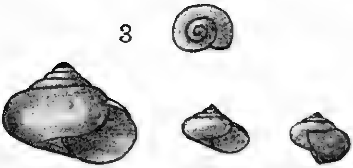

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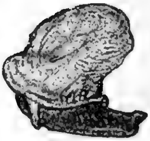

H. H. G.-A. del.

Perak Mollusca.

LIST OF MOLLUSCA FROM CHRISTMAS ISLAND, INDIAN OCEAN.

By E. A. Smith, I.S.O.

Read 14th May, 1909.

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The few species here enumerated were collected by Dr. C. W. Andrews, and have been presented to the British Museum by Sir John Murray, K.C.B. Three appear to be new to science.

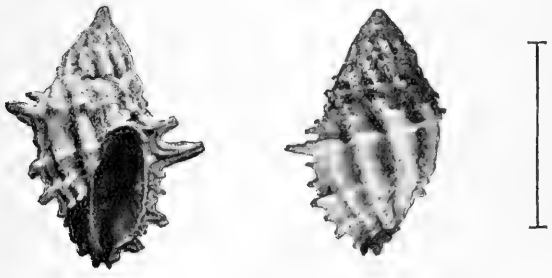
1. List of Species.

1. *Glyphis Singaporensis* (Rve.).
2. *Haliotis*, sp. juv.
3. *Plesiotrochus Fischeri*, n.sp.
4. *Truncatella valida*, Pfr.
5. *Amalthea australis* (Lamk.).
6. *Mitrularia diaphana* (Rve.).
7. *Cypræa poraria*, Linn.
8. *Cerithium zebra*, var.
9. *Triphora triticea*, Pease.
10. *Planaxis longispira*, Smith.
11. *Peristernia nassatula* (Lamk.).
12. *Mitra*, sp. juv.
13. *M. retusa*, Lamk.
14. *Tritonidea undosa* (Linn.).
15. *Nassa papillosa* (Linn.).
16. *Columbella varians*, var.
17. *Sistrum Andrewsi*, n.sp.
18. *S. morus* (Lamk.).
19. *Coralliophila neritoidea*, jun.
20. *Conus hebræus*, Linn., and var. *vermiculatus*, Lamk.
21. *Smaragdinella viridis* (Rang).
22. *Siphonaria ferruginea*, Rve.
23. *Arca maculata*, Sowb.
24. *Septifer bilocularis* (Linn.).
25. *S. excisus* (Wiegm.).
26. *Libitina oblonga* (Linn.).
27. *Tridacna*, sp. juv.
28. *Teredo* sp.
29. *Xylotrya* sp.
30. ,, ,,
31. *Octopus granulatus*, Lam. (?).
32. *Ennea (Huttonella) bicolor* (Hutton).
33. *Kaliella cruda*, n.sp.
34. *Opeas subula*, Pfr.

2. Description of the New Species.

Sistrum Andrewsi, n.sp.

Testa fusiformi-ovata, rimata, pallide violacea, spinosa; anfractus circiter 8, oblique planiusculi, longitudinaliter costati et spiraliter lirati, liris supra costas spinosis; anfr. ultimus seriebus spinarum



4–5 cæteris magis conspicuis ornatus, circa rimam porca squamosa rubicunda instructus; apertura angusta, antice contracta, canaliculata, saturate roseo-purpurea; labrum intus incrassatum, tuberculis 4–5 armatum; columella callo roseo-purpureo induta, in medio prominens, antice tuberculis 2–3 inconspicuis interdum instructa. Long. 25, diam. 12 mm.; apertura cum canali, 14 mm. longa, 4·75 lata.

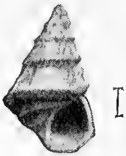
Operculum fuscum, breviter unguiformis, nucleo extremitatem versus acuminatam, autem haud apicali. Lineæ incrementi extra tenues, nucleum versus confusæ. Superficies inferior densatione lævi margini excurvo parallela, instructa. Reliquiæ superficei rugosæ, porcis transversis paucis subvalidis instructæ.

This species has in some respects the general features of *S. spinosum*, H. & A. Adams.[1] It differs, however, in the number of rows of spines on the body-whorl. The spines are hollow and pale, and not dark-coloured, the anterior canal is more contracted, and the colour of the aperture is more intensely rosy purple.

The spines of the second series from the suture are the longest and consequently most conspicuous. There is one series above these and usually three below, besides the squamate ridge around the rimation, which is of a rosy-red colour, quite different from the general pale-violet ground-colour of the shell. The spiral liræ covering the entire surface are more or less developed into short prickles upon the costæ. The latter are usually nine in number upon the body-whorl.

Plesiotrochus Fischeri, n.sp.

Testa parva, trochiformis, in medio carinata, angustissime rimata, alba; spira conica, pagodiformis; anfractus 7 declives, plani, infra fortiter carinati, undique spiraliter striati, ultimus ad peripheriam acute angulatus, infra concentrice striatus, porcis duobus rotundatis instructus, una mediana, altera paulo majori circa rimam sita; apertura irregulariter quadrangularis, alba, antice brevissime canaliculata; columella arcuata, callo albo, lævi, reflexo induta, antice obscure subtruncata; labrum tenue, in medio parum productum. Long. 4, diam. 2·5 mm.; apertura, 1·5 longa, 1·25 lata.



This species resembles *P. Souverbianus*, Fischer, the type of the genus, in form, although perhaps a little higher in proportion to the width. It differs, however, in being minutely rimate, and in the swollen ridge around the perforation. Upon the body-whorl between the peripheral keel and the median ridge are three fine liræ, of which that close to the keel is the thickest. Between the median ridge and the umbilical ridge is a single fine lira.

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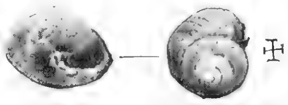
[1] Reeve, Conch. Icon., vol. iii, *Ricinula*, fig. 12*b*.

Kaliella cruda, n.sp.

Testa parva, anguste perforata, breviter conica, in medio angulata, tenuis, pellucida, nitida; spira breviter conica, ad apicem obtusa; anfractus $4\frac{1}{2}$ superiores duo convexi, sequentes minus convexiusculi, penult. et ultimus liris 4–5 spiralibus tenuissimis supra ornati, striisque incrementi, tenuibus sculpti, ultimus infra peripheriam acute angulatam convexiusculus, concentrice microscopice striatus; apertura obliqua, angulato-lunaris; peristomium simplex, acutum, margine basali arcuato, columellari superne breviter reflexo. Diam. 3, alt. 2·25 mm.



Hab.—Ross Hill.

These shells may not be mature, but Mr. Andrews informs me that he saw no larger specimens.

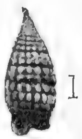
3. Notes on various Species.

Triphora triticea, Pease.

Triphoris triticea, Pease: Proc. Zool. Soc., 1860, p. 433.

Hab.—Sandwich Islands.

To Pease's brief description I add the following further details. Shell minute, fusiformly ovate, tapering at the apex, which is pale brown, the ground-colour of the rest of the shell being dark purplish red, upon which the tubercles are dusky white; whorls 11–12, apical one pale, smooth, globose, three following with two spiral ridges crossed by fine longitudinals forming a kind of cancellation, the points of intersection becoming finely granose upon the three next volutions and more coarsely tuberculated upon the rest of the shell;



the tubercles are ranged in two rows on each whorl, and falling fairly regularly one under another also form longitudinal series; the last whorl has five rows of tubercles, the uppermost the largest, the next with smaller tubercles, and the rest still more finely granose; aperture very small, dark-coloured within; labrum a little thickened and expanded, pale, minutely yet distinctly sinuated at the suture; anterior canal short, oblique, closed. Length 3·5, diam. 1·25 mm.

The suture between the whorls appears to be invisible, but by following the two spiral ridges of the upper whorls down the shell it is seen that the lower whorls have each two rows of tubercles.

PLANAXIS LONGISPIRA, Smith.

Planaxis longispira, Smith: Ann. Mag. Nat. Hist., 1872, vol. ix, p. 45; Sowerby in Reeve's Conch. Icon., vol. xx, pl. iv, fig. 32.

Hab.—Chinese seas (Hanley Coll.).

Three specimens from Christmas Island in fresh condition show that the spire is not always smooth as originally described. Apparently the types from the Hanley collection, which are now in the Museum, were rather worn, and did not show the spiral striation, which is present, at all events, upon the upper whorls. One of the three shells obtained by Mr. Andrews is of the same elongated form as the type, but the others are somewhat shorter. Of the latter, one has three fine red lines upon that body-whorl, whereas the other and the elongated specimen also have but a single line just above the periphery, which passes up the spire.

LIBITINA OBLONGA (Linn.).

Chama oblonga, Linn.: Gmelin, Syst. Nat., vol. vi, p. 3302.

Cypricardia Guinaica, Chemn.: Reeve, Conch. Icon., vol. i, pl. ii, fig. 13.

The single specimen from Christmas Island agrees with *Cypricardia Guinaica* as determined by Reeve. This shell also seems to be the *Chama oblonga* of Linnæus as defined by Gmelin, Chemnitz, Lamarck, and Hanley. The specimens figured by Reeve as *Cy. oblonga* (Conch. Icon., figs. 4*a*, 4*a*) belong to a different form.

TEREDO and XYLOTRYA spp.

Two or three species of *Xylotrya*, judging from the pallets, were obtained from piles in Flying Fish Cove. Unfortunately the pallets were separated from the soft parts, and only one shell was obtained attached to an animal, and this was without pallets. Under these circumstances it does not seem advisable to name these species. A species of *Teredo* (animal and pallets only) was found in the same balks of timber. The pallets of one specimen of *Xylotrya* are about 4 inches in length.

ENNEA (HUTTONELLA) BICOLOR (Hutton).

This species occurs in many localities, and doubtless this has led to its being described five times under different names. It is *Pupa Largillierti*, Philippi; *Pupa mellita*, Gould; *Pupa Ceylanica*, Pfeiffer; and *Pupa cafæicola*, Craven.

It has been recorded from many localities in India, also from Burmah, Rangoon, Arakan, Cochin-China, Singapore, Pulo Pinang, Andaman and Nicobar Islands, Ceylon, Réunion, Seychelles, Mauritius, Nossi Bé, Timor, Amboina, Madura, and Sarawak. It also occurs in the West Indies, at Trinidad, St. Croix, St. Thomas, St. Lucia, and Granada, where it has probably been introduced by human agency.

FURTHER NOTES ON THE HOLOCENE NON-MARINE SHELLS OF PERRANZABULOE, CORNWALL.

By Rev. R. Ashington Bullen, B.A., F.G.S.

Read 14th May, 1909.

In continuation of my observations on the blown sand deposits of Perranzabuloe last November, I was able to pay a further visit to Cornwall last January.

These sands are divided into three districts—(1) the Reen Sands near Perranporth, (2) the Gear Sands towards the central area, and (3) the Penhale Sands to the north, near Cubert. The fluviatile (lacustrine) deposit occurs on the Gear Sands, from which the farmers are accustomed to draw their supplies of shell-sand for fertilizing purposes, evidently a well-recognized work, as there is a toll-house where they pay the dues to the owner of the sands for this privilege. This is interesting to us, since it is in the lacustrine area and its neighbourhood that the greater part of the sand-carting is done. Add to this the constant destruction of the now dessicated lacustrine area by the wind, as detailed in my last paper, and the wonder is, not that there is so little of this deposit left, but that there is any at all. I have found no further species to record. The finding of Limnæas at a higher level (about 8 feet) in the same superficial marly sand shows that the lake area was basin-shaped, and not merely a shallow flattish area.

After consultation with Mr. A. Santer Kennard, F.G.S., I find that the doubtful Limnæas may be ranged under *L. pereger* and *L. truncatula*, with the exception of a Limnæa which is probably a new species, being identical with a form occurring in Ireland which has been miscalled *L. auricularia*, var. *acuta*. The Succineas also are to be classed under *S. elegans*; a possible *oblonga* must be crossed out and omitted from the list.

Mr. Penrose accompanied me to the place, and promised to see whether the collection of the Royal Institution of Cornwall, which is under his charge as Curator, contained anything that would throw light on the question, but I have heard nothing further on the matter.

Mr. Kennard considers this find as of great importance. His remarks are as follows:—"I have been over your shells carefully, and a more remarkable lot of Limnæas I have never seen. I have compared them with my own collection, and that is a large one of fossil and recent *Limnæa pereger*, and there are many that I cannot match. One thing that strikes one is the great variation in *pereger*; some are dwarfed, others are large, nearly all are *very* thick. Some are fairly typical, but these gradually pass into the narrow, slender, compressed form. These latter are something like what is called on the Continent *L. succinea*, Nilsson, only the characters of that form are more pronounced in the Cornish shells. Now thick shells are found either in rapid waters or greatly disturbed waters, so that if there were a lake then its surface would be agitated. I have cleaned out your shells and I find that in nearly all of them there was a marly matrix still remaining, not the material that one would find in a swamp or morass, but in a lake with a CHARA vegetation. A lake, moreover, to deposit such material must be of some depth, say 12 feet at least. Were it less than that marl would not form, it would be a carbonaceous mud. Since so many of the *L. pereger* are decidedly not normal there must have been abnormal conditions there. This raises the question in my mind whether the new Limnæas may not after all only be *auricularia*, which owing to unfavourable conditions were stunted during the latter period of their life, and so unable to properly develop the last whorl. I still think that these are the same as the Irish shells, a new form, but I have stated the alternative."

These remarks agree with the observed conditions, for the lacustrine area consists of a deposit of a marly nature, of a thickness of 2 or 3 inches, on the top of blown sand about 30 inches thick, the fresh-water shells occurring only in the upper 2 or 3 inches.

The lacustrine area of the Gear Sands is confined to the eastern side of the highest sand dunes. I could find no extension of it towards the Penhale Sands. Probably the underlying rocks render that impossible. At Penhale Sands there is a swampy area at a much lower level than the lacustrine area aforesaid, surrounded by lofty sand dunes. I should think the lower level here is not more than 80 or 90 feet O.D., compared with 200 feet for the lacustrine area. Above the swampy part, which, however, was dry when I was there in January last, and on the north of it, there are three terraces, apparently natural. On the upper terrace I found a valve of *Pecten varius*, bored by *Cliona perforans*, and on the two lower terraces valves and broken fragments of *Mytilus edulis* were abundant. I also found a fragment of another bivalve and a few *Patella vulgata* and a *Purpura lapillus*. The broken *Mytilus edulis*, etc., may be the debris of a kitchen midden, but some at least may have reached their present position by being rolled up the slopes of sand by the wild Atlantic gales, seeing that the slope to the seashore is in some places continuous from the beach upward and the blown sand completely masks the cliffs, if indeed they exist at these particular spots. In the swampy sand at about 125 feet O.D. a very few *Limnæa pereger* occurred.

In conclusion I have to thank my friend Mr. A. Santer Kennard for the kind trouble which he has taken to work out the puzzling lacustrine specimens.

ON NON-MARINE MOLLUSCA FROM AN EARLY NEOLITHIC INTERMENT AT CUXTON, KENT.

By A. S. Kennard, F.G.S.

Read 14th May, 1909.

In 1907 an early Neolithic interment was discovered whilst quarrying for chalk in the large chalk-pit belonging to Messrs. Trechmann, Weeks, & Co. Through the kindness of Mr. G. E. Dibley, F.G.S., I was informed of this by Mr. J. G. Wilson, the manager of the works, to whom I am greatly indebted for kind help in examining the interment and in obtaining the material. The grave had been made by a slight excavation in the overlying scarp drift. The body had been placed in the excavation and then covered with a large quantity of flints, obviously picked from the surface of the ground. This layer of flints was from 12 to 18 inches thick. On this a layer of chalk had been spread, and probably, though this is not certain, the surface soil had then been replaced. During the succeeding centuries there had been a certain amount of soil creep from the hill above, so that there was about 3 feet of soil above the chalk layer. On examining the layer of stones I was surprised to find large numbers of shells, which I carefully collected, and I also took away a quantity of the finer material between the stones for washing. It should be noted that in many cases the interstices between the stones were free from earth, and a deposit of carbonate of lime, derived from percolating water, had been deposited on the surfaces of the flint. No less than thirty-one species were obtained, viz.:—

Limax arborum, 6 examples.
Agriolimax agrestis, 8 examples.
Arion sp., abundant.
Vitrea Scharffi, common.
V. cellaria, common.
V. crystallina, common.
V. nitidula, 5 examples.
V. pura, 5 examples.
V. radiatula, 1 example.
Vallonia pulchella, 1 example.
V. excentrica, common.
V. costata, common.
Acanthinula aculeata, 4 examples.
Helicella cartusiana, 12 examples.
H. itala, common.
Hygromia hispida, 10 examples.
Pyramidula rotundata, common.
Helix nemoralis, 5 examples.
Helicigona lapicida, 4 examples.
H. arbustorum, 1 example.
Cochlicopa lubrica, 5 examples.
Clausilia laminata, 5 examples.
C. bidentata, 5 examples.
Jaminia muscorum, common.
J. cylindracea, 4 examples.
Vertigo pygmæa, 14 examples.
V. minutissima, 4 examples.
Cœcilianella acicula, common.
Carychium minimum, 14 examples.
Pomatias elegans, abundant.
Acicula lineata, 2 examples.

Several ova of a large species of land mollusca were also found.

The occurrence of *Helicella cartusiana* is noteworthy, since it furnishes additional proof of its former abundance in West Kent. It is now known in a fossil state in West Kent, from Otford, Exedown, Greenhithe, Northfleet, and Cuxton.

Vertigo minutissima and *Jaminia cylindracea* are rarely found in a fossil state, whilst *Acicula lineata* is extremely rare as a fossil in

Kent. There are four species extremely abundant in the neighbourhood at the present time which are absent—*Helix aspersa*, *Helicella cantiana*, *H. caperata*, and *H. virgata.*

It is extremely difficult to account for the presence of such a large number of mollusca in this situation. After careful consideration I think the explanation is this. The grave was not covered in immediately. The body was covered with stones and then some little time elapsed before the chalk was placed on top, and the heap of stones became a place of refuge for the shells in the immediate vicinity.

The carnivorous Cæcilianellas, Vitreas, and Arions would naturally be attracted, and it is noteworthy that all these are very common. When the layer of chalk was spread over the grave the shells were trapped, there to await for centuries the pick of the quarryman.

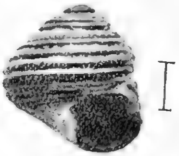
DESCRIPTIONS OF NEW TROCHOID SHELLS FROM NORTH QUEENSLAND.

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

Read 11*th June*, 1909.

Leptothyra crassilirata, n.sp.

Shell somewhat globosely turbinate, solid, dark purplish-red; whorls 4½, sculptured throughout with coarse, rather broad liræ; sutures impressed; columella descending in a very oblique curve; peristome acute; aperture subcircular; operculum unknown. Alt. 7·25, diam. maj. 7·5 mm.; aperture, alt. 4, diam. 3 mm.

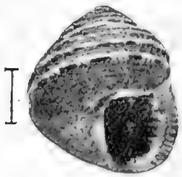


Hab.—North Queensland.

As the present shell has all the appearance of that of a *Leptothyra*, I have placed it provisionally in that genus, notwithstanding the fact that the operculum is unknown. In many respects it resembles *L. sanguinea*, Linn., but is easily separable from that species by the much coarser basal sculpture.

Gibbula Dacostana, n.sp.

Shell perforate, turbinate, moderately solid, blackish bronze, tesselated with cream colour, and flecked and spotted, especially on the base, with the same colour, alternating with rusty red; whorls 5½, rather coarsely spirally lirate, the interstices between the liræ bearing two fine spiral striæ; sutures impressed; umbilicus narrow, deep,



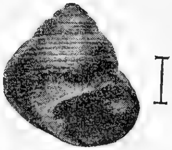
the umbilical region being somewhat lighter in colour than the rest of the shell; columella curved; peristome iridescent bluish green, minutely dentate throughout, the margins joined by a thickish pearly callus; aperture subquadrate; operculum horny, multispiral. Alt. 8, diam. maj. 8 mm.; aperture, alt. 4·25, diam. 3·25 mm.

Hab.—North Queensland.

I have great pleasure in dedicating this species to the memory of my friend, the late Mr. S. I. Da Costa, from whose collection it originally came.

Gibbula tenuilirata, n.sp.

Shell turbinate, chocolate, tesselated and sparsely spotted with cream colour; whorls 5, sculptured with many fine, closely-set liræ, and minute, oblique, transverse striæ, presenting under a lens a lightly cancellate appearance; sutures impressed; umbilicus moderately narrow; columella descending obliquely and somewhat sinuously,

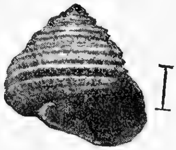


slightly outwardly expanded above over the umbilicus; peristome acute, the margins joined by a whitish callus; aperture subcircular; interior of shell white. Alt. 7, diam. maj. 7 mm.; aperture, alt. 4, diam. 3 mm.

Hab.—North Queensland.

Minolia cinerea, n.sp.

Shell roundly turbinate, shining, grey, painted above with closely-set transverse bands of greyish-brown; whorls $6\frac{1}{2}$, flattened above, sculptured with a number of beaded carinæ, increasing to four on the last whorl, the space above these occupied by two spiral beaded riblets, a third also occurring between the first and second carinæ; sutures impressed; base of shell sculptured with two spiral grooves and a number of very fine spiral striæ, painted with a zone of fine,



closely-set cinereous flammules, within which is a second zone almost uniformly of the same colour; umbilicus whitish, wide, deep, bearing several small, indistinct, spiral, crenate riblets, the outer margin surrounded by a coarsely crenulate carina; columella somewhat angularly arched above, descending obliquely and terminating rather abruptly; peristome acute; aperture subquadrate. Alt. 6·75, diam. maj. 6·5 mm.; aperture, alt. 3, diam. 2 mm.

Hab.—North Queensland.

It is very difficult to give anything like an adequate description of the complicated sculpture and colouring of this interesting form, and I do not know of any species to which it may be profitably compared.

ON THE RADULÆ OF THE BRITISH HELICIDS. (Part III.)

By Rev. E. W. Bowell, M.A.

Read 11th June, 1909.

The radulæ to be described in the present paper are those of *virgata*, *cantiana*, *revelata*, *sericea*, *hispida*, *rufescens*, *caperata*, *Itala*, *barbara*, and *granulata*. Generic names will not be mentioned for the present; and to avoid confusion the species will be mentioned in the above order, which is the result of a classification of the peculiarities of the radulæ.

On p. 126 of Volume VIII of these "Proceedings" I stated that *barbara* differed from the other small Helices of this group in the possession of bifid marginal mesocones. Closer examination of better mounted specimens has shown that this character also is found in *caperata*, *Itala*, and *granulata*; this will be noted in the accompanying illustrations. This correction is of great importance, since it appears probable that the species possessing this character are nearer to the larger Helices than to those in which it is not present. By the term 'larger Helices' I mean the species described in Part II of these notes, purposely using an unscientific phrase, because the limits of this group are very vague to me at present. The study of this particular point has emphasised an opinion towards which I have inclined for a long time, namely, that size has counted for too much in our systems of classification. I was led to look out for large species which might be supposed to be magnified races derived from known smaller species; and also for small species which appear to be the starved representatives of larger ancestors. Instances of this kind of thing are not rare amongst insects, but probably there is no part of the animal kingdom where they are more frequent than in that to which our studies are devoted. On examining these pairs of forms we do not find that they are ever the exact counterparts of each other; and the same is true of large and small races occurring in the same species. Increase of size or diminution of size involve in every case a redistribution of symmetry, because the constituent cells of the organism do not share the increase or diminution. In the case of some organs it matters more, and in the case of other organs it matters less, that the general scale of the organism should be increased or diminished. The radula appears to be an organ that does not readily vary in size with the general scale of the organism. It has already been pointed out that in our British Helicidæ the size of the radula is not proportionate to the size of the animal, though the proportion it bears is closer than in some other groups. This is true also of the individual unci. But the individual unci of *Zonites Algirus* are not larger than those of *Vitrea lucida*, consequently there must be, and there are, many more of them. And since the number of unci is multiplied, their form is altered; they are simplified so that the admedians resemble Helicid admedians in general appearance. If we

Measurements.—Results of examination of selected typical specimens are here given in tabulated form. The numbers indicate micromillimetres.

	A.			B.			C.			D.			F.			G.			H.			I.		
Heliomanes virgata .	31	34	19	26	28	18	23	25	23	12	14	15	21	21	12	15	18	12	7	8	6	4	4	3
Theba cantiana . .	38	46	22	35	33	20	27	35	27	15	20	20	25	21	16	16	17	15	9	11	9	3	4	5
Fruticicola revelata .	17	18	9	14	13	7	15	15	12	7	7	7	18	18	11	13	12	10	6	7	5	3	3	2
Fruticicola sericea .	25	26	17	20	20	15	16	19	21	9	11	16	15	14	14	10	13	14	5	6	5	2	3	3
Fruticicola hispida .	25	27	14	18	17	13	17	20	24	9	11	16	15	14	13	10	14	11	5	5	4	3	3	3
Fruticicola rufescens	34	36	11	24	23	8	23	25	24	11	11	16	15	14	11	10	11	10	7	7	4	2	3	3
Candidula caperata .	28	32	11	20	24	6	20	23	20	12	14	13	18	18	12	15	15	14	9	8	7	2	3	2
Helicella Itala . .	28	31	17	17	18	15	19	23	21	11	13	14	18	17	17	15	16	16	6	7	8	4	4	5
Cochlicella barbara .	23	25	9	15	19	8	14	20	12	6	9	9	15	14	11	11	14	10	6	7	4	3	3	(5)
Fruticicola granulata	28	28	11	20	21	10	18	22	16	8	9	10	17	16	15	12	15	13	6	9	7	2	4	(4)

Under each letter the first column gives the measurement in the case of the centrals, the second in the case of the admedians, the third in the case of the externals.

A = Length of basal plate.
B = From edge of lacinia to apex, in middle line.
C = From apex to tip of mesocone.
D = From apex to tip of ectocone.

F = Width of basal plate across laciniæ.
G = Width of basal plate across ectoconic region.
H = Maximum width of mesocone.
I = Maximum width of ectocone.

examine the rest of the anatomy of *Z. Algirus*, we find that it is quite of the true *Vitrea* type, except for such modifications as are evidently the result of its hypertrophic growth. All our Helicidæ, with the exception of the Vallonias, present the character of many admedians, but especially is this the case with the larger specimens and larger individuals; and this holds good with regard to the *Succineæ* also. The fact assumes a special importance when we observe that it is an example of change in size inducing definite type of morphological change, and doing so for a mechanical reason which it is not hard to understand. As the causes of change in size may be traced back to the action of cosmic forces, acting rhythmically during the whole of the biological period, this definite change of symmetry which results from change of size may be supposed to form an important factor in evolution.

Let us next ask ourselves what is the significance of the marginals. It is possible to tell at a glance in most cases whether we are dealing with a Limacid, or a *Succinea*, or a Helicid, by looking at the marginals; and, as has already been mentioned, there are two Helicid types, one with bifid mesocone (like the Helices), and the other with simple mesocone (like the Arions). What is the relationship between these two forms? The latter is illustrated in the first six of the species described in this paper.

Measurements, additional characters, and diagnostic notes are here given according to the plan adopted in Part II.

ADDITIONAL CHARACTERS.

[The first description in each case is that of the centrals, the second of the admedians, and the third of the externals.]

(*a*) Shape of basal plate.

virgata. Rounded oblong, larger below; not markedly alate; upright oblong, upper margin irregular.
cantiana. With indentations above and below; alate; subtetragonal.
revelata. Roughly hexagonal; modified central; depressed oblong.
sericea. Upright oblong; as central; squared.
hispida. As *sericea*, but more curved. (See note below.)
rufescens. As *hispida*, but generally more elongated.
caperata. As *virgata*, but externals small, irregular.
Itala. Roughly hexagonal; rounded oblong; irregular triangulate.
barbara. Key-shaped, doubly notched below; first oblongate, then alate; depressed oblong.
granulata. Rounded oblong, larger below; rhomboid; depressed oblong.

(*b*) Character of lower corners of basal plate.

virgata. Rounded; inclined; squared.
cantiana. As *virgata*, but with characters intensified.
revelata. All considerably shortened.
sericea. Angles not prominent.
hispida. Approaching *virgata* type.

rufescens. As *cantiana,* except central (see plate); externals truncate.
caperata. As *virgata*; externals minute.
Itala. As *virgata,* but externals sometimes acute.
barbara. Various, as plate; not irregular.
granulata. Rounded; rounded; rectangular.

(*c*) Shape of lower edge of basal plate.
virgata. Slight incurvations.
cantiana. Notched; irregularly notched; straightened.
revelata. All slightly incurved.
sericea. All slightly incurved; transitionals more incurved.
hispida. Very slight incurvation.
rufescens. Straight; incurved; straight.
caperata. Double curve; curved; irregular.
Itala. Incurved; various; irregular.
barbara. Double outward curve; various; slightly incurved.
granulata. Incurved; straightened; straightened.

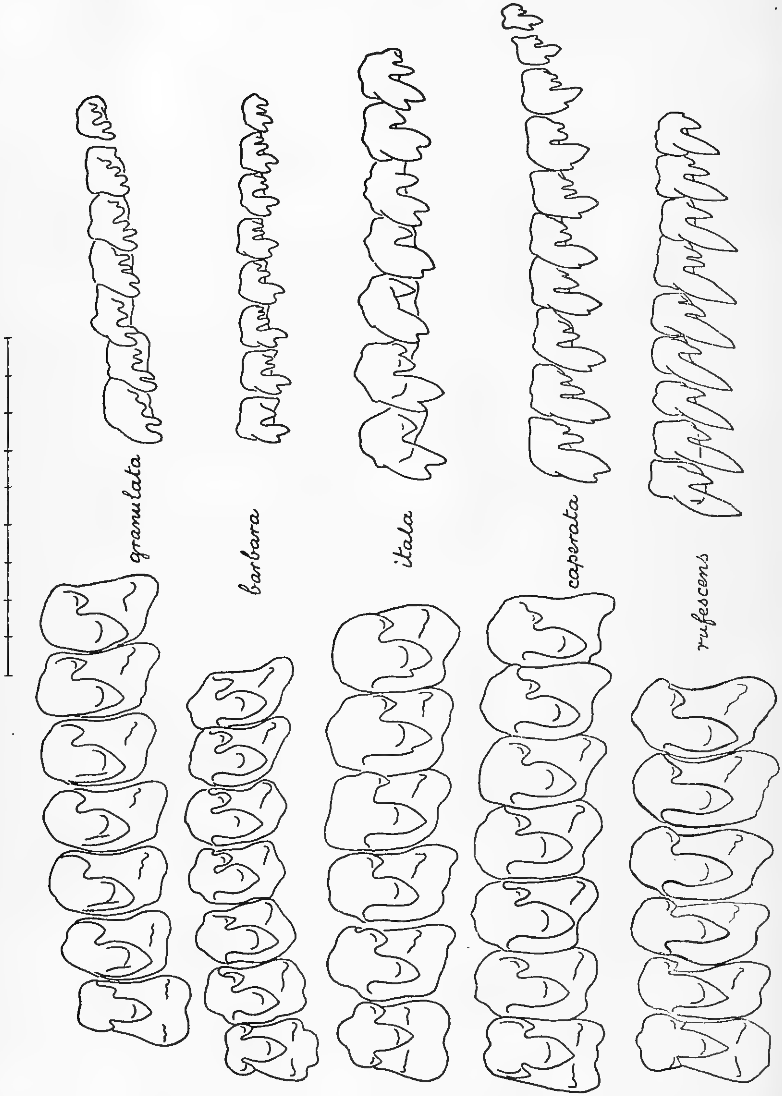
(*d*) Shape of apex.
See plate. The pointed form, as in *Itala,* is found in transitionals of several species, especially *sericea* and *hispida.* Incurvation or acumination in central is partly a matter of thickness or thinness of growth.

(*f*) Number and character of cones visible.
virgata. 3; 2; 2.
cantiana. 3; 2; 2; accessories evanescent.
revelata. 3; 2; 2.
sericea and *hispida.* 3; 2; 2.
rufescens. 3 (ectocones minute); 2; 2 or 3.
caperata. 3; 2; 4 (3 if bifid mesocone be secondary).
Itala. As *caperata,* but second accessory external often missing.
barbara. 3; 2; 3 to 5.
granulata. 3; 2; 4 or 5.

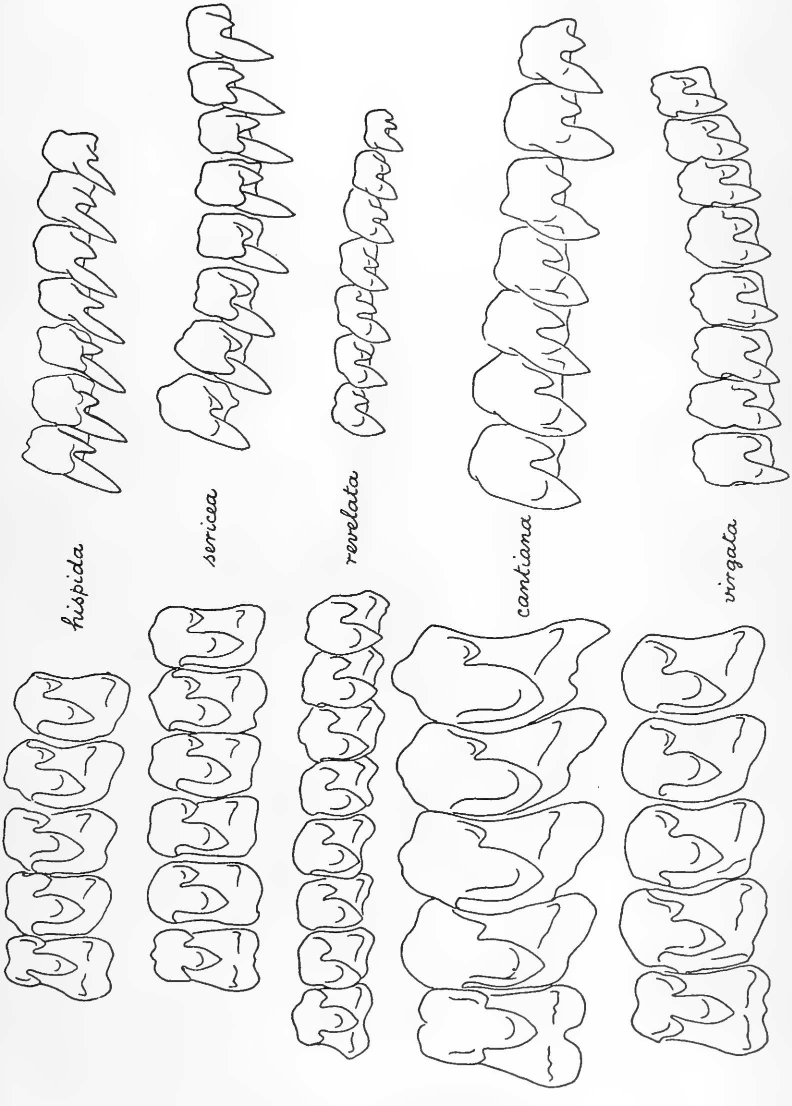
Diagnostic Notes.

In *cantiana* the admedians approach those of *hortensis* and *nemoralis* in respect of rotundity. The shape of the basal plates distinguishes *cantiana* from *virgata. Revelata* shows remarkably shortened and squared unci and plates; in *sericea* and *hispida* both are lengthened. The pointed apex shown in *sericea* is characteristic, but not so marked in immature specimens; it is due to a general strengthening and thickening of the backbone of the mesocone, if we may so speak. The 'knife-blades' (external mesocones) of these two species differ in slenderness, and further variations are found in other forms belonging to the same group. Those of *rufescens* are uniformly narrower. The base of the cusps in this species is larger, and it will be observed that where enlargement occurs it seems first to appear in this region; compare the figures of *pomatia* and its allies. The bifid mesocones of externals mark the remaining four species here described; in *Itala* this character invades the admedians also to some extent, and this is occasionally to be seen in *caperata* also. *Barbara* is distinguished from *Itala* by many differences, but the shape of the external apices seems one of the most interesting. *Granulata* seems nearer to *fusca* than other members of this group.

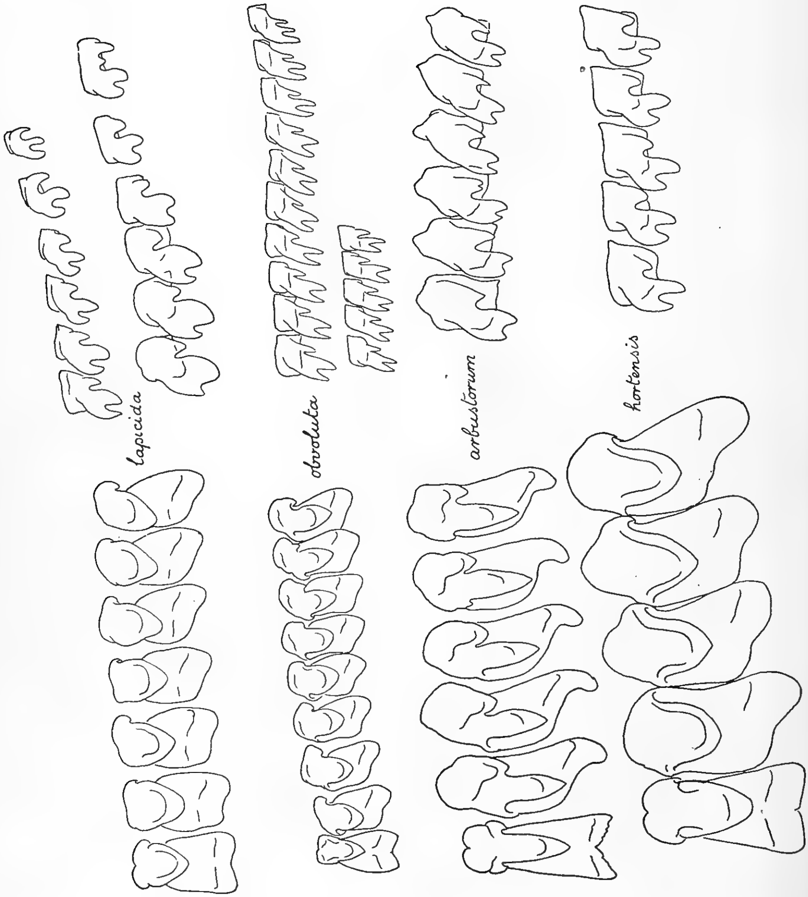
The accompanying figures (pp. 384–7) are all drawn to the same scale; the scale will be found next to the figure of *granulata*. It has been thought desirable to add figures of the larger Helicids also, and all of these have been redrawn under the same conditions and to the same scale. The magnification of the original drawings is 1,200 diameters.



Radulæ of British Helicids.



RADULÆ OF BRITISH HELICIDS.



RADULÆ OF BRITISH HELICIDS.

RADULÆ OF BRITISH HELICIDS.

INDEX TO VOL. VIII.

A † is prefixed to the names of fossil species.

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