PROCEEDINGS

OF THE

MALACOLOGICAL SOCIETY OF LONDON.

VOL. X.

1912—1913.

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OF LONDON.

EDITED BY

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

Under the direction of the Publication Committee.

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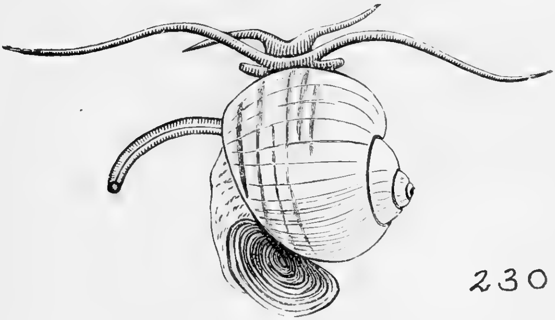

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LONDON:
DULAU & CO., Ltd.,
37 Soho Square, W.

BERLIN:
R. FRIEDLÄNDER & SOHN,
11 Karlstrasse, N.W.

1913.

DATES OF PUBLICATION, VOL. X.

Part I	. . . .	March 8th, 1912.
,, II	. . . .	June 29th, 1912.
,, III	. . . .	October 30th, 1912.
,, IV	. . . .	March 28th, 1913.
,, V	. . . .	June 25th, 1913.
,, VI	. . . .	September 22nd, 1913.

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Proceedings :—

LIST OF ILLUSTRATIONS IN VOL. X.

Vol. X. Part I. MARCH, 1912. Price 7s. 6d. net.

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See page iv of this wrapper.

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PROCEEDINGS

OF THE

MALACOLOGICAL SOCIETY OF LONDON.

ORDINARY MEETING.

Friday, 10th November, 1911.

R. Bullen Newton, F.G.S., President, in the Chair.

Mr. Guy Coburn Robson, B.A., was elected a member of the Society.

The following communications were read:—

1. "On the Anatomy of Species of *Cultellus* and *Azor*." By H. H. Bloomer, F.L.S.

2. "Description of new Terrestrial Mollusca from North-West China." By H. B. Preston, F.Z.S.

3. "Note on *Viquesnelia lenticularis*, Desh., from the Miocene (Sarmatian) of Turkey." By G. K. Gude, F.Z.S.

Mr. A. S. Kennard exhibited a specimen of *Eulota fruticum* collected in Kent by the Rev. E. W. Bowell. It was surmised that the species might possibly have survived from the Pleistocene Age, and has been either overlooked by conchologists or mistaken for *Helicella Cantiana*. On the other hand, it was admitted that on the strength of a single stray specimen the species could not be recognized as a member of the British recent fauna.

Mr. Kennard and Mr. B. B. Woodward both exhibited specimens of *Planorbis Strœmi* from Oxford.

The Rev. R. Ashington Bullen exhibited some shells of *Eulota similaris* collected by him in the Bermudas, some of which showed a strongly thickened lip; also a scalariform specimen of the same species.

ORDINARY MEETING.

Friday, 8th December, 1911.

R. Bullen Newton, F.G.S., President, in the Chair.

Messrs. Cæsar R. Boettger, John Shirley, B.Sc., F. R. Tindall Lucas, Harry Overton, A. W. Stelfox, and Julius Heller were elected members of the Society.

The following communications were read :—

1. "Note on the genus *Aricia* of Gray." By H. O. N. Shaw, F.Z.S.

2. "Description of *Sistrum Oparense*, n.sp., from the South Pacific." By J. Cosmo Melvill, M.A., D.Sc.

3. "Notes on the Shells of *Tridacna*, and description of a new species." By G. B. Sowerby, F.L.S.

4. "On a case of presumed Viviparity in *Limicolaria*." By G. C. Robson, B.A.

5. "Descriptions of New Helicoid Shells from Cape Colony." By H. B. Preston, F.Z.S.

Mr. B. B. Woodward exhibited fragments of limestone eroded by *Helicella caperata* taken by Mr. C. Davies Sherborn at Tregeagle Cove, Pendower Beach, Cornwall.

Mr. E. A. Smith exhibited a very large specimen of *Anodonta cygnea* from Lancashire, and on behalf of Mr. K. Hurlstone Jones specimens of *Pisidium Lilljeborgii* from Loch Urie, Isle of Arran, and of *Pisidium Steenbuchi* from Glengarriff, co. Cork.

ORDINARY MEETING.

Friday, 12th January, 1912.

R. Bullen Newton, F.G.S., President, in the Chair.

Dr. Henry Woodward and Mr. G. C. Robson were elected Auditors.

Dr. L. Soos and Mr. P. Hesse were elected members of the Society.

The following communications were read :—

1. "Note on the genus *Panope*, Ménard." By Dr. W. H. Dall.

2. "The Nomenclature of the Veneridæ: a reply to Dr. W. H. Dall." By A. J. Jukes-Browne, F.R.S., F.G.S.

3. "The occurrence of *Helicella Heripensis* (Mabille) in Great Britain" and "Notes on some British Non-marine Mollusca". By A. W. Stelfox.

4. "Characters of two undescribed Land Shells from the Republic of Colombia and a new genus of Helicoids"; "Explanation of the figures occurring in Westerlund's 'Sibiriens Land- och Sötvatten-Mollusker', 1877"; "On two preoccupied specific names in Gastropoda." By G. K. Gude, F.Z.S.

5. "On the occurrence of *Pupisoma* in South Africa." By H. C. Burnup.

6. "Note on *Aphanitoma Locardi*, Bavay, and *Mitra biconica*, Sykes." By E. R. Sykes, B.A.

Mr. B. B. Woodward exhibited the types, obtained on loan from the Stockholm Museum, of the following: *Pisidium Baicalense*, var. *P. subtilistriatum*, Lindholm, both of which he found upon examination to pertain to *P. amnicum*; also other *Pisidia* from the region of Lake Baikal. He exhibited on behalf of Mr. H. C. Napier *Pseudanodonta elongata* from the River Cherwell.

Mr. A. S. Kennard exhibited, on behalf of the Rev. R. Ashington Bullen, a living specimen of *Helicella cespitum*, from Sicily, taken nine months previously and kept without food during the whole of that period. He also showed a specimen labelled *Pseudanodonta Rothomagensis*, Locard, from the River Teme, near Worcester.

Mr. G. K. Gude exhibited the two species of *Pupisoma* in illustration of Mr. Burnup's paper, and an extensive series of species of *Isomeria* and *Labyrinthus*, together with *Ambages vexans*, Dohrn, *A. ænigma*, Dohrn, and *A. Sharmani*, n.sp., all in connexion with the proposed new genus *Ambages*, while Mr. E. A. Smith contributed the types of *A. assimilans*, Smith.

NOTES.

NOTE ON THE OCCURRENCE OF *PISIDIUM LILLJEBORGII* IN THE ISLE OF ARRAN. (*Read 8th December*, 1911.)—In September, 1911, in Loch Urie, at an elevation of 1,300 feet above Lamlash Bay in the Isle of Arran, many specimens of *Pisidium Lilljeborgii* were obtained, and some of these were of very large size. *Pisidium Lilljeborgii* in the above loch is associated with *P. Casertanum* and *P. pusillum.* The specimens were identified by Mr. B. B. Woodward. K. H. JONES.

NOTE ON A LARGE SPECIMEN OF *ANODONTA CYGNEA*. (*Read 8th December*, 1911.)—The average length of adult shells of this species recorded in works on British Mollusca is about 5–6 inches, but examples $7\frac{1}{2}$ and 9 inches long are mentioned in Mr. Lionel Adams' work, *The Collector's Manual of British Land and Freshwater Shells*, 2nd ed., p. 151. The largest of these were taken by Mr. W. H. Heathcote near Preston. The example which I now exhibit, recently acquired by the British Museum, was, I am informed by Mr. J. R. Charnley, also taken near Preston by his friend, W. H. Heathcote. Its measurements are: length $8\frac{3}{4}$ inches, height $4\frac{9}{16}$, diam. $3\frac{1}{8}$, girth $11\frac{7}{8}$. In the year 1899 Mr. E. R. Sykes presented to the Museum a specimen from Claughton in Lancashire, $7\frac{5}{8}$ inches in length, and a specimen in the Cuming Collection, which has been in the Museum forty-five years, is $8\frac{1}{2}$ inches long. Unfortunately no locality was attached to this shell. E. A. SMITH.

NOTE ON *APHANITOMA LOCARDI*, BAVAY, AND *MITRA BICONICA*, SYKES. (*Read 12th January*, 1912.)—In the last part of the "Proceedings" (p. 334), I described a new species under the name of *Mitra biconica.* Mons. Bavay very kindly wrote to me pointing out the exceeding similarity of this species to his *Aphanitoma Locardi*[1]; and, having compared my species with his figure and description, I feel no doubt that they are the same. Whether the form belongs to the Mitridæ or Pleurotomidæ, remains to be finally settled; but it may well prove to belong to *Aphanitoma*, which genus, hitherto supposed extinct, I had overlooked.
E. R. SYKES.

FRAGMENTS OF LIMESTONE ERODED BY *HELICELLA CAPERTA*. (*Read 8th December*, 1911.)—Specimens were shown that had been picked up on a field above Tregeagle Cove, Pendower Beach (between Veryan and Nare Head), South Cornwall, by Mr. C. Davies Sherborn, when on a recent visit to that locality. The limestone was not indigenous, but had been brought there and spread as 'dressing' for the soil. The pieces had been sought out by the snails to obtain the lime-salts for their shells, and at the time of their discovery some of the little pits they had eroded were occupied by the excavators.

The big burrows formed by the larger helicoids have been well known for many years and were correctly described by Dr. Buckland in 1841, but at a later period were assigned by other observers to various agents, including *Pholas*, till Mr. J. Rofe in 1870 (*Geol. Mag.*, pp. 4–10) gave an admirable little summary of the whole history and fully re-established Buckland's conclusions. The fact that in districts where there is scarcity of lime in the soil, snails will resort to limestone outcrops, or, as in the Channel Islands, attack the shells of their comrades, seems to show that the animals do not rely on their plant-food solely for their lime-salts, but must get some direct from the soil. B. B. WOODWARD.

[1] Bull. Mus. Hist. Nat. Paris, vol. xii, p. 548, 1906.

ON THE ANATOMY OF SPECIES OF *CULTELLUS* AND *AZOR*.

By H. H. Bloomer, F.L.S.

Read 10th November, 1911.

PLATE I.

I desire to express my thanks to Mr. Edgar A. Smith, I.S.O., of the British Museum, for kindly permitting me to examine the following:—

Cultellus cultellus (Linn.).

The specimen examined from the Indian Ocean measures 61 mm. antero-posteriorly by 17 mm. dorso-ventrally. Along the dorsal edge it is straight, except at the anterior end, where it bends upwards. The other edges are curved.

The mantle-lobes are united in front of the anterior adductor muscle and project anteriorly. The pedal aperture occupies nearly the anterior half of the ventral surface, then the pallial edges coalesce. Posteriorly the other openings are only the siphonal ones, there being no fourth aperture. The lobes bordering the pedal aperture carry a minute tentacular fringe on the middle longitudinal fold, the same being a little more evident at the anterior end. The inner longitudinal fold or velum on the ventral surface of the animal is shallow, but becomes deeper anteriorly. The whole of the external surface of the mantle is mottled with small brown markings, which to an extent correspond to, and account for, the mottled appearance of the periostracum covering the shell, the more distinctive feature of this species.

The siphon is nearly all in one piece, the free portions being very short. The siphonal chambers are short, but deep, and their apertures are bordered by a long tentacular fringe, the outer tentacles being much longer than the inner ones. The fringe continues dorsally and ventrally, though in a considerably lesser degree, and gradually disappears. Fig. 1 (*Ex.S.*, *In.S.*) shows the free portions of the siphon to point dorso-posteriorly, but this is probably due to the greater contraction of the muscles controlling the exhalent part.

The foot (Fig. 1, *F.*) is apparently large and muscular, with the distal part pointing anteriorly. Its exact length, however, cannot be determined, as a portion of it is missing.

Musculature. *Pallial Muscles.*—The anterior adductor muscle (Fig. 1, *A.A.*) is a broad muscle, with the anterior part turning sharply upwards, and increasing in depth as it proceeds posteriorly. It is joined at the anterior end with the mantle-lobes, and at the posterior one with the protractor pedis anterior muscles. Compared with the same muscle in *Solen pellucidus* it is neither so broad nor so deep, and at the posterior end the bend ventrally is not so pronounced.

The posterior adductor muscle (Fig. 1, *P.A.*) is large, being both wide and deep, and is much larger than that of *S. pellucidus*. It is flattened dorsally and curved ventrally. Anteriorly it is connected with the retractor pedis posterior muscle, and posteriorly with the mantle-lobes.

The muscular band of the pallial edge does not vary much in depth, but is somewhat shallower at the posterior end, and the transverse muscle-fibres have the usual radial direction. The latter become more developed near the posterior part of the pedal aperture and increase in thickness towards the siphon. The longitudinal muscle-fibres, forming the circumpallial muscles, also increase in number from the same region. The siphon is muscular and compact.

Pedal Muscles.—The protractor pedis anterior muscles (Fig. 1, *P.P.*) are long and connected with the anterior adductor muscle, whilst proximally their fibres lie close to the pedal integument.

The retractor pedis anterior muscles (Fig. 1, *P.R.A.*) are long, flat, very wide, and bifurcated; each bifurcation is divided, the anterior into two and the posterior one into three parts. They extend over the greater part of the anterior adductor muscle with their distal ends inserted into the shell. Proximally they pass inside the longitudinal muscles of the foot in a fan-shaped direction.

The retractor pedis posterior muscle (Fig. 1, *P.R.P.*) is long, but not bifurcated. It is attached to the posterior adductor muscle, and laterally is also inserted into the shell. Proximally its fibres pass longitudinally along the foot.

Alimentary Canal.—The mouth (Fig. 1, *M.*) is on the ventral surface to the rear of the anterior adductor. The œsophagus, which is short, proceeds dorsally with a slight curve, where it joins the œsophageal division of the stomach. This division is separated from the cardiac one, which lies dorsally to it, by a lateral process of the gastric wall from its left side, and extends about half the length of the stomach. The pyloric division is the largest one, and on the postero-ventral side is continued as the cæcum of the crystalline style (Fig. 1, *C.C.*); the latter passes with a curve near to the ventral edge of the foot. The intestine (Fig. 1, *In.*) also leaves the pyloric division in front of the cæcum, but a little to the left. It then passes near to the distal end of the cæcum. There it makes a number of folds, then proceeds below the cæcum, turns dorsally, passing close to the posterior pedal wall to the dorsal part, where it turns posteriorly, going over the posterior adductor muscle into the exhalent siphonal chamber, and ends in a conspicuous anus.

The *branchiæ* along the gill axis are separate from each other. The lamellæ are heterorhabdic and plicate. There are about seventeen filaments to a plica in the inner, and fourteen in the outer demi-branch. The frontal ridge of the principal filaments is sharp.

Nervous System.—The cerebro-pleural ganglia are situated just in front of the mouth, one on each side, and each ganglion gives off anteriorly a nerve which passes to the lateral posterior edge of the anterior adductor muscle; this divides and innervates the muscle and the mantle.

The viscero-parietal ganglia are situated at the antero-ventral edge of the posterior adductor muscle, and each ganglion gives off posteriorly a nerve, the branchial nerve, which passes directly to the gill, and another nerve which goes obliquely across the muscle, innervating it, the siphon, and the mantle.

Solecurtus (Azor) antiquatus (Pult.).

The one specimen examined from the English Channel is imperfectly preserved, and is much swollen laterally. The measurements, from the shell, are 47 mm. antero-posteriorly by 21 mm. dorso-ventrally. There is a slight lateral constriction towards the centre of the ventral surface. The mantle is muscular and strongly formed.

The pedal aperture extends from the anterior adductor muscle about half-way along the ventral surface of the mantle. The inner longitudinal fold or velum is short and not so well developed as the middle longitudinal fold which prominently projects ventrally. The union of the two velar processes, terminating the pedal aperture, encloses the posterior portion of the mantle-cavity, and is also continuous with the ventral wall of the siphon. Similarly, the mantle covering the dorsal surface of the posterior adductor muscle is continuous with the dorsal siphonal wall.

Ventrally to the posterior adductor muscle (Fig. 2, *P.A.*) lies the musculus cruciformis, and near it commences the fusion of the proximal portion of the siphon with the mantle; still, from that position the mantle-lobes extend some distance posteriorly.

The siphon is very muscular, with its proximal part (Fig. 2, *Ex.S.*, *In.S.*) extending a considerable distance rearwardly beyond the fusion of its lateral walls with the mantle. Internally from the junction of the tubes with the proximal portion is on each side a process of the lateral wall (Fig. 2, *S.R.*), which runs just above the siphonal retractor muscle to the posterior adductor muscle. To the free edge of this process is attached the basal portion of the gills, thus completing the division of the inhalent from the exhalent chamber. The siphonal tubes are likewise large and long. The edge of the mantle carries a minute tentacular fringe; it is, however, a little more distinct near the anterior adductor muscle, whilst there is no sign of it on the siphon or at the free end of the tubes.

Musculature. *Pallial Muscles.*—The muscles of the mantle (Fig. 2, *M.L.*) consist of the radial fibres and the circumpallial or longitudinal ones nearer the edge, but the latter are more numerous in the part supporting the velum. The anterior adductor muscle (Fig. 2, *A.A.*) spreads out somewhat towards each end, where it is moderately deep and wide, but is much longer ventrally than dorsally owing to the convexity of the shell. The posterior adductor muscle (Fig. 2, *P.A.*) is large and, like the anterior one, spreads out towards each end, and is also longer ventrally than dorsally. The musculus cruciformis (Fig. 2, *M.C.*) is situated on the inner surface of the mantle ventrally to the posterior adductor muscle, and its two branches on each side gradually diverge, the one going anteriorly and the other posteriorly. Both are then inserted into the shell. The siphon is characterized by the rearward prolongation of its proximal portion (Fig. 2, *Ex.S.*, *In.S.*), the same being all in one piece. On each side the muscle-fibres of its walls are drawn together into a round and powerful muscle (Fig. 2, *S.R.M.*), which afterwards penetrates the mantle and, spreading out into a large ovoid-shaped disc, becomes attached to the shell. The siphonal tubes (Fig. 2, *Ex.S.'*, *In.S.'*) are also muscular and externally are transversely ribbed, whilst internally they present evidences of slight longitudinal ribbing.

Pedal Muscles.—The retractor pedis anterior muscles are inserted into the shell on the dorsal surface.

The protractor pedis anterior muscles are attached to the shell and to the anterior adductor muscle close to the lateral edge.

The retractor pedis posterior muscle (Fig. 2, *P.R.P.*) is short and thick, with its bifurcations resting upon the antero-dorsal edge of the posterior adductor muscle.

The attachment to the shell of the pedis elevator and branchial retractor muscles cannot be traced with certainty.

Alimentary Canal.—The mouth (Fig. 2, *M.*) is wide with the lips lying in an anterior direction. The œsophagus passes with a curve to the stomach (Fig. 2, *St.*); the latter is long, but internally its shape is not plainly discernible. It appears to be divided into three parts, the œsophageal and cardiac ones being long and shallow, and separated from each other, on the left side, by a lateral process of the gastric wall, whilst the pyloric division is much larger, and on the ventral surface is continued as the cæcum of the crystalline style (Fig. 2, *C.C.*) which extends to near the ventral part of the foot. The intestine (Fig. 2, *In.*) has the aspect of being only a groove on the left side of the cæcum, but becomes quite separate at the distal end of the cæcum, where it turns rearwardly, and passes dorsally to near the posterior part of the stomach; there it makes a number of folds and goes posteriorly, as the rectum, over the posterior adductor muscle to the anus (Fig. 2, *A.*), situated at the postero-ventral edge of the latter muscle.

It is not possible to make out the nervous system except the position of the viscero-parietal ganglia, situated at the antero-ventral edge of the posterior adductor muscle.

Solecurtus (Azor) coarctatus (Gmel.).[1]

The specimen described from Japan in 15 fathoms differs considerably from *A. antiquatus* from the English Channel.

The Japanese shell, measured antero-posteriorly, is shorter than the English species, the difference being chiefly in the part posterior to the umbonal region, whilst the posterior edge is a little more angular. Measured dorso-ventrally it is deeper than the English species. From the umbonal region of both specimens, and passing in a slightly postero-ventral direction, is on each side a constriction of the shell. This is, however, more pronounced in *A. coarctatus*.

The animal itself is in a far better state of preservation than the one previously described, though more contracted. The muscles of the mantle border are well developed and much deeper at the anterior part. The chief difference, however, is in the proximal portion of the siphon, which is very prolonged in the English species, but the

[1] See Smith, *Challenger Lamellibranchiata*, 1885, p. 79.

anterior part is folded upon itself in a somewhat similar manner as in *Solecurtus strigillatus*.

The anterior adductor muscle (Fig. 3, *A.A.*) is similar, but smaller. The posterior adductor (Fig. 3, *P.A.*) is deeper, angular on the antero-dorsal surface, and is situated more ventrally. The siphonal tubes (Fig. 3, *Ex.S.'*, *In.S.'*) are more compact, though very muscular.

In transverse section the arrangement of the muscles of the inhalent siphonal tube appears to be very similar to that of *Solecurtus strigillatus* and *Tagelus gibbus*; it is also akin to that of *Psammobia vespertina*, as described and illustrated by Rawitz in *Der Mantelrand der Acephalen*, and by myself *On the Anatomy of the British Species of Psammobia*, whilst in the distribution of the nerves there is still a closer resemblance. A tentacular fringe is present all round the ventral portion of the mantle from the anterior adductor to the posterior adductor muscle, but it is more pronounced at the anterior and posterior ends. What, however, is the chief characteristic, in fact a striking feature of the animal, is the mass of tentacular processes, which covers the entire external surface of the siphonal tubes. This is in great contrast to the British and Mediterranean species of *A. antiquatus*, which are quite bare. The bifurcations of the retractor pedis posterior muscle (Fig. 3, *P.R.P.*) are longer, and their terminal parts are situated on the dorsal, instead of the dorso-anterior, surface of the posterior adductor muscle.

The alimentary canal also varies. The œsophagus is a little shorter, the stomach more compact, being shorter and deeper, and the intestine makes a larger number of folds before turning posteriorly.

From the foregoing description of the British specimen of *A. antiquatus*, the type of the subgenus *Azor*, it will be observed that it differs considerably from the genus *Psammosolen*, Risso, type *S. strigillatus* (Linné),[1] and more so from the genus *Solecurtus*, Blainville, type *Solen legumen* (Linné),[1] consequently *Azor* should be raised to the position of a genus; further, the Japanese is quite distinct from the English species and bears out the justification of treating it as a separate species, but whether it agrees in its structure with the animal of the Nicobar shell described by Chemnitz, the type of *coarctatus*, I have as yet been unable to determine, as I have not succeeded in obtaining a specimen from that locality. At the same time I shall not be surprised to learn later that the Japanese specimen, owing to the peculiarity of the mantle fringe and the siphonal tentacular processes, is only local, and consequently will have to be made a distinct species.

In the work of Dr. Dall just referred to he states "The Solenidæ form a compact group after the elimination of the soleniform Psammobiidæ such as *Novaculina* and *Tagelus*", but to this exclusion must be added the genera *Azor* and *Psammosolen* (in the latter as far as *S. strigillatus*, *S. candidus*, and *S. Philippinarum* are concerned).

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[1] Dr. W. H. Dall, "Tertiary Fauna of Florida": Trans. Wagner Inst. Phil., vol. iii, pt. ii, p. 951, 1900.

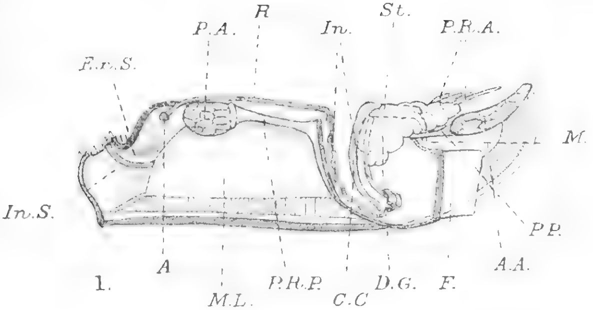
EXPLANATION OF PLATE I.

FIG. 1. *Cultellus cultellus.* View from the right side, showing internal structure, etc. Nat. size.

,, 2. *Azor antiquatus.* View from the right side, showing internal structure, etc. Nat. size.

,, 3. *Azor coarctatus.* View from the right side, showing internal structure, etc. Nat. size.

A. anus; *A.A.* anterior adductor muscle; *C.C.* cæcum of the crystalline style; *D.G.* digestive gland; *Ex.S.* proximal portion of the exhalent siphonal chamber; *Ex.S.'* exhalent siphonal tube; *F.* foot; *In.* intestine; *In.S.* proximal portion of the inhalent siphonal chamber; *In.S.'* inhalent siphonal tube; *M.* mouth; *M.C.* musculus cruciformis; *M.L.* mantle-lobe; *P.A.* posterior adductor muscle; *P.P.* protractor pedis anterior muscle; *P.R.A.* retractor pedis anterior muscle; *P.R.P.* retractor pedis posterior muscle; *R.* rectum; *S.R.* ridge dividing the inhalent from the exhalent chamber of the proximal portion of the siphon, and to which is attached the basal part of the gill; *S.R.M.* siphonal retractor muscle; *St.* stomach.



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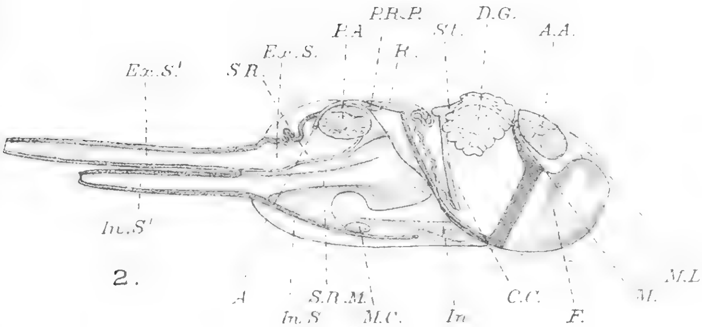

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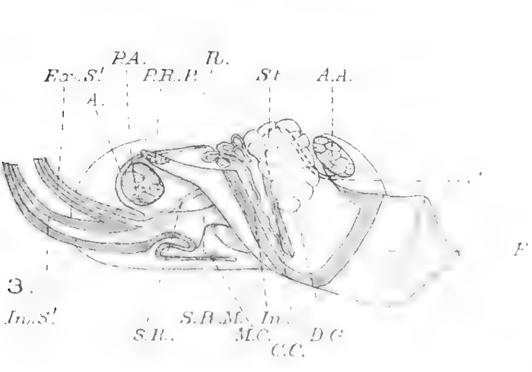

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H.H. Bloomer del. ad nat. Huth, Lith. London.

ANATOMY OF SPECIES CULTELLUS AND AZOR.

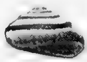
DESCRIPTIONS OF NEW TERRESTRIAL MOLLUSCA FROM NORTH-WEST CHINA.

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

Read 10th November, 1911.

Eulota (Cathaica) Orestias, n.sp.

Shell rather small, perforate, depressedly turbinate, whitish above, painted with a supersutural band of reddish chestnut, which appears as a superperipheral band on the last whorl; base of shell ornamented with two or three zones of pale brown, which are transparent, and between which the ground-colour is of a rather yellowish white; whorls $5\frac{1}{2}$, the apical whorls pale flesh-coloured and smooth, the remainder somewhat coarsely plicate and sculptured with very fine,



wavy, spiral striæ, which become more noticeable on the base of the shell; suture impressed; umbilicus rather narrow, deep; columella thin, outwardly expanded, descending in an abrupt curve; labrum simple, except at the base, where it is slightly internally thickened; aperture broadly and irregularly sub-lunate. Alt. 6·5 mm.; diam. maj. 10·25, min. 9 mm. Aperture: alt. 3·25, diam. 3·75 mm.

Hab.—Mountains of S.E. Kan-su, at an altitude of from 2,000 to 5,000 feet.

Eulota (Plectotropis) Wardi, n.sp.

Shell very depressedly orbicular with slightly convex base, acutely carinated at the periphery, rather thin, light bronze colour, somewhat shining; whorls $5\frac{3}{4}$, the last abruptly descending in front, sculptured with closely set, arcuate costulæ, becoming much finer on the base, which is also sculptured with slightly distant, fine, revolving striæ; suture impressed, margined above with a narrow whitish callus which

forms the carina on the last whorl; umbilicus very wide, open, moderately deep; labrum thickened, especially at the base, narrowly expanded, reflexed, continuous; aperture obliquely sub-quadrate, somewhat nasute in front. Alt. 5·5 mm.; diam. maj. 18·5, min. 16 mm. Aperture: alt. 4·5, diam. 7 mm.

Hab.—Limestone region, S.E. Kan-su, at an altitude of 3,000 feet.

A marvellously beautiful species, which I have much pleasure in dedicating to the discoverer.

BULIMINUS CASTANEO-BALTEATUS, n.sp.

Shell imperforate, subulately fusiform, with sub-mamillary apex; the apical whorls reddish chestnut, the later whorls bluish grey painted with irregular, oblique, transverse bands of the same colour; whorls 8, not very convex, the last ascending in front, marked with very oblique irregular growth-lines; suture impressed, scarcely crenellate, very narrowly banded with white below; umbilical area

depressed; labrum white, broadly expanded, not reflexed, the margins joined by a callus which thickens almost into a tubercle just before its junction with the right margin, aperture ovate; interior of shell reddish chestnut. Alt. 21·5 mm.; diam. maj. 12, min. 8·75 mm. Aperture: alt. 7·5, diam. 5 mm.

Hab.—Limestone region, S.E. Kan-su, at an altitude of 3,000 feet.

BULIMINUS ORDINARIUS, n.sp.

Shell perforate, fusiform, rather thin, somewhat polished, brown; whorls 7, moderately convex, the last two broad in proportion to the remainder, the last ascending in front, malleated and marked with very oblique, slightly arcuate growth-lines, and small interrupted spiral scratches; suture well impressed, very narrowly margined below; umbilicus rather broad above, rapidly narrowing to a mere

chink; labrum white, expanded, the margins converging and joined by a thin callus which thickens almost into a nodule where it reaches the right margin; aperture ovate; interior of shell pale brown. Alt. 17·5 mm.; diam. maj. 7·25, min. 5·75 mm. Aperture: alt. 5, diam. 3 mm.

Hab.—Mountains of S.E. Kan-su, at an altitude of from 2,000 to 5,000 feet.

BULIMINUS OSCITANS, n.sp.

Shell thin, fusiform, scarcely perforate, slightly shining, dark livid flesh-colour, irregularly transversely banded with pale reddish chestnut, the last whorl painted with a very narrow, whitish spiral streak at the periphery; whorls $6\frac{1}{2}$, the apical whorls small, the last two very broad, the last ascending in front, rather flat, marked with lines of growth; suture impressed, narrowly margined below; columella descending obliquely; labrum white, thin, expanded, hardly reflexed,

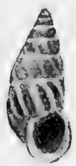
the margins joined by an almost imperceptible callus; aperture very large for the size of the shell, broadly inversely auriform; interior of shell reddish, polished, shining. Alt. 22·75 mm.; diam. maj. 10·5, min. 7·5 mm. Aperture: alt. 9, diam. 5 mm.

Hab.—Limestone region, S.E. Kan-su, at an altitude of 3,000 feet.

Easily distinguished from other forms from this region by the exceptionally large aperture.

Buliminus Wardi, n.sp.

Shell fusiform, with rather acuminate apex, rimate, dark flesh-colour, obliquely transversely banded, and occasionally blotched with white; whorls 7, moderately convex, the later whorls rather rapidly increasing, marked with fine growth-striæ; suture well impressed,

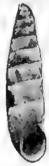


narrowly margined with white below; perforation reduced to a mere chink; labrum white, expanded, not reflexed, the margins joined by a light callus; aperture irregularly ovate. Alt. 15·5 mm.; diam. maj. 6·75, min. 5·5 mm. Aperture: alt. 4, diam. 3 mm.

Hab.—Mountains of S.E. Kan-su, at an altitude of from 2,000 to 5,000 feet.

Buliminus (Serinus) sobrinus, n.sp.

Shell cylindrically fusiform, pale flesh-colour, mottled and banded here and there with a darker shade of the same colour; whorls 11, somewhat convex, regularly and rather slowly increasing, malleated, occasionally almost sub-costulate, the last ascending in front, and somewhat dilated below, just behind the aperture; suture impressed, margined below; umbilical area forming a shallow, elongate depression; columella rather obliquely descending; labrum narrowly expanded, not reflexed, a very light, scarcely perceptible callus uniting the margins; aperture inversely auriform. Alt. 16·25 mm., diam. maj. 3·75 mm. Aperture: alt. 3, diam. 2 mm.



Hab.—Mountains of S.E. Kan-su, at an altitude of from 2,000 to 5,000 feet.

Closely allied to *B. Szechenyi*, Hilber, also from Kan-su, but with a broader and more ovate aperture, more convex whorls, and deeper suture.

Buliminus (Napæus) Cookei, n.sp.

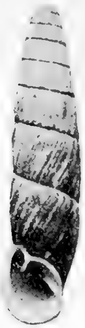
Shell sinistral, rimate, fusiform, smooth but for growth-lines, scarcely shining, pale yellowish brown; whorls 7½, rather flat, the earlier whorls small, the last two rapidly increasing; sutures somewhat lightly impressed; umbilicus appearing as an extremely narrow

fissure; labrum white, expanded, the margins converging and united by such a thick callus as to be practically continuous; aperture rectangularly ovate. Alt. 18 mm.; diam. maj. 7, min. 6 mm. Aperture: alt. 4, diam. 3 mm.

Hab.—Mountains of S.E. Kan-su, at an altitude of from 2,000 to 5,000 feet.

Clausilia Cookei, n.sp.

Shell large, moderately solid, cylindrical, with very obtuse apex, pale brownish straw-colour, somewhat shining; whorls 10, flat, the two last very broad, marked with fine, very closely set, oblique, transverse striæ; suture impressed, slightly crenellate; labrum white, continuous, broadly expanded and reflexed below, exserted and narrowly reflexed above; aperture broadly, inversely auriform, armed with a high, erect, white lamella on the parietal wall suddenly decreasing in height, and curving round in the interior of the shell to form a junction with the columella plait, which is moderately broad and very oblique, and below which is situated a small, twisted, basal plication; a thin, elongate, revolving lamella is also visible on the outer wall, but situated well within the shell. Alt. 42 mm.; diam. maj. 10, min. 8·75 mm. Aperture: alt. 8, diam. 5·5 mm.



Hab.—From the Loess Plain of the Wei River, S. Shen-si, at an altitude of 1,200 feet.

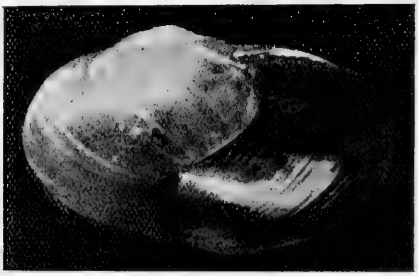
DESCRIPTIONS OF NEW HELICOID SHELLS FROM CAPE COLONY.

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

Read 8th December, 1911.

Helicarion Coxi, n.sp.

Shell small, vitreous, very thin, transparent, shining, semi-orbicular, not very depressed, very pale greenish; whorls $2\frac{1}{2}$, rapidly increasing, the last large, inflated, smooth; suture impressed, rather narrowly margined below; base of shell inflated; columella descending

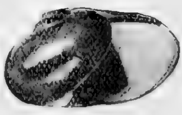


in a gentle curve; labrum simple, acute, projecting in front, receding below; aperture dilated below, broadly sub-lunate. Alt. 3·5 mm.; diam. maj. 6·5, min. 5 mm. Aperture: alt. 4, diam. 3 mm.

Hab.—Knysna Forest, Cape Colony.

Helicarion Knysnaensis, n.sp.

Shell thin, semi-transparent, shining, pale greenish yellow, depressedly turbinate; whorls $3\frac{1}{2}$, rapidly increasing, the last large but not dilated in front, smooth; suture impressed, narrowly margined below; base of shell rather inflated and malleatedly wrinkled;



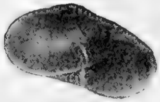
columella descending in an oblique curve; labrum projecting in front, receding behind; aperture depressedly and broadly sub-lunate. Alt. 9 mm.; diam. maj. 13·73, min. 11·25 mm. Aperture: alt. 7·75, diam. 7 mm.

Hab.—Knysna Forest, Cape Colony.

The wrinkles on the base of the shell are only visible with the aid of a microscope.

NATALINA LILIACEA, n.sp.

Shell moderately thin, very depressedly turbinate, yellowish brown above, shading to straw-colour round the umbilical area, somewhat shining; whorls $3\frac{1}{2}$, rapidly increasing, sculptured with closely set, coarse, transverse, arcuate striæ which become obsolete on the base of the shell; base of shell somewhat flattened; suture impressed; umbilicus rather wide, deep; columella descending

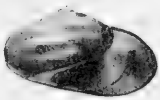


obliquely, angled below; labrum pinkish, thickened but scarcely reflexed, projecting in front, receding below, a light but well-defined yellowish callus uniting it with the columella; aperture irregularly ovate; interior of shell lilac-coloured. Alt. 16·5 mm.; diam. maj. 20, min. 15 mm. Aperture: alt. 9, diam. 10 mm.

Hab.—Knysna Forest, Cape Colony.

ZINGIS PERLEVIS, n.sp.

Shell thin, depressedly suborbicular, pale yellowish flesh-colour, shining; whorls 4, the first three regularly increasing, the last large, quite smooth; sutures impressed, narrowly margined below; perforation extremely narrow, almost concealed by the narrow reflexion of

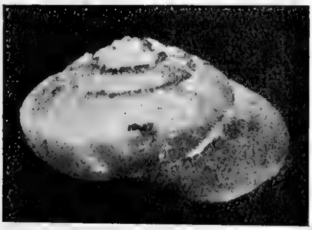


the columella; columella reflexed above, descending in a gentle curve; labrum thin, membranaceous; aperture broadly sub-lunate. Alt. 6·5 mm.; diam. maj. 12, min. 10 mm. Aperture: alt. 6, diam. 6 mm.

Hab.—Knysna Forest, Cape Colony.

TRACHYCYSTIS KNYSNAENSIS, n.sp.

Shell small, perforate, depressedly turbinate, brownish flesh-colour; whorls $4\frac{1}{2}$, regularly increasing, the last obtusely carinate at the

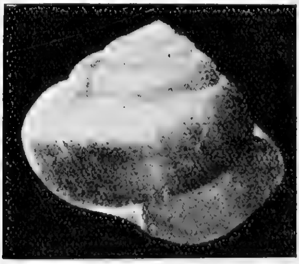


periphery, sculptured with closely set, somewhat wavy, spiral striæ, crossed by coarse, arcuate, transverse, membranaceous riblets, occasionally terminating in a short bristle; suture impressed; umbilicus narrow, deep; columella outwardly expanded above, descending in an oblique curve, extending into a light, whitish callus which joins the upper margin of the labrum; labrum simple, acute; aperture obliquely sub-lunate. Alt. 2·5 mm.; diam. maj. 4·5, min. 4 mm. Aperture: alt. 1·75, diam. 1·75 mm.

Hab.—Knysna Forest, Cape Colony.

TRACHYCYSTIS MICROSTRIATA, n.sp.

Shell imperforate, turbinate, thin, semi-transparent, very pale yellowish brown; whorls $4\frac{1}{2}$, somewhat shouldered above, regularly increasing, the last convex, sculptured throughout with very fine, closely set, arcuate, transverse striæ, crossed by extremely fine, spiral striæ, these latter being visible only under the microscope; suture

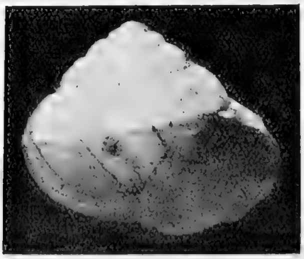


impressed, very narrowly margined above; columella white, almost vertically descending above, then angled and very obliquely descending below; labrum simple; aperture broadly sub-lunate. Alt. 3 mm.; diam. maj. 4·5, min. 4 mm. Aperture: alt. 2·5, diam. 1·75 mm.

Hab.—Knysna Forest, Cape Colony.

TRACHYCYSTIS COXI, n.sp.

Shell closely allied to *Trachycystis microstriata*, but of a pale flesh-colour, marked with dark, radiate, transverse bands; the upper whorls are rather flattened, not shouldered above, and the sculpture differs



entirely in the present species, the transverse striæ being much finer and the spirals very much coarser than in *T. microstriata*. Alt. 3·25 mm.; diam. maj. 4·5, min. 3·5 mm. Aperture: alt. 2, diam. 1·75 mm.

Hab.—Knysna Forest, Cape Colony.

NOTE ON *VIQUESNELIA* OF DESHAYES FROM THE MIOCENE (SARMATIAN) OF TURKEY.

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

Read 10th November, 1911.

The genus *Viquesnelia* was established by Deshayes in 1857,[1] being based on some simple testaceous rudiments found in great abundance in nummulitic beds in Rumelia. These he considered to be the internal shell of a limacoid Gastropod, which he named *Viquesnelia lenticularis*.[2] A note was appended to this article by P. Fischer, who referred a mollusc from Mahé, Seychelles, and labelled *Clypeicella Dussumieri*, Val., in the Paris Museum, to the same genus. Another species discovered by Morelet & Drouet in the Azores was also placed in this genus, and described by the former under the designation *Viquesnelia Atlantica*.[3] Neither of these, however, bears any resemblance to the type of *Viquesnelia*, as was pointed out subsequently by Fischer,[4] who rejects the hypothesis that the Azorean mollusc is the living representative of the genus, adding that no evidence exists that these structures should be the internal shells of limacoids rather than opercula.

Morelet's species possesses a shell resembling *Ancylus* and is now placed in the genus *Plutonia*, while Gray in 1855 [5] created the genus *Mariaella* for the reception of the Seychelles species.

D'Archiac [6] had already previously restricted the genus to the type and only species originally indicated by Deshayes.

While recently working at some Turkish Tertiary Mollusca at the British Museum I had occasion to examine the specimens forming part of the set of fossils collected by A. F. Dabell, Esq., in the district surrounding the Dardanelles, and presented by him to the National Collection.

The specimens of the so-called *Viquesnelia lenticularis* had been obtained with other fossils from the Sarmatian Beds of the Tekfur Dagh district, to the north of the Dardanelles. On examining these I was at once struck with their resemblance to a molluscan operculum. The outer or upper surface is slightly concave, has a short spiral nucleus, situate considerably below the centre, consisting of about $1\frac{1}{2}$ whorls. The spiral character then seems to disappear and the lines of growth apparently become sub-ovate or auriculate, the excentricity becoming emphasized by the closer crowding together of the lines of growth at the lower and outer (right) sides. A shallow groove proceeds upwards from the nucleus, running more or less parallel with the right margin and traversing the

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[1] Journ. de Conchyl., vol. v, p. 289.
[2] Tom. cit., p. 287, pl. vii, figs. 14–17.
[3] *Hist. Nat. des Açores*, 1860, p. 139, pl. i, fig. 1.
[4] Man. de Conchyl., 1883, p. 457.
[5] Cat. Pulm. Coll. Brit. Mus., pt. i, p. 62.
[6] Viquesnel, *Voyage dans la Turquie*, vol. ii, p. 457, 1868.

lines of growth towards the acute oblique apex, while in some specimens another shallow groove proceeds parallel with the left margin. Some radiating impressed lines are also observable in some specimens. The inner or lower surface is convex and more or less finely rugose or papillate, but no spiral or other lines of growth are to be seen. It is surrounded by a raised rim, which is grooved at its periphery. In texture it is evidently horny, as upon being tested by Mr. Newton with acid no reaction took place, as would have been the case had it been calcareous. These organisms appear very abundant, as according to Fischer as many as 500 may be found in a space of 7 or 8 square cm. Although as a rule they are thus found congregated in the matrix without any shells being present, I have found stray specimens associated with various freshwater shells, such as *Planorbis*, *Viviparus*, and bivalves. The presence of one of these structures in a piece of rock containing the shell of a species of *Viviparus* or allied genus led me to compare it with some of the Slavonian operculates, and I found that they accurately fitted the aperture of *Tylopoma Pilari*. It may, consequently, be reasonably inferred that these structures are the operculum of a species of *Tylopoma* or of some allied genus, on the following grounds: (1) They bear no resemblance to the internal shell of any known mollusc. (2) They have combined characters of the operculum of various opisthobranchiate molluscs, i.e. they share the amorphous inner surface of the operculum of *Bithynia* and the excentric lines of growth of the outer surface of that of *Pomatias*. (3) They differ from the operculum of *Viviparus*, which has concentric rings on both surfaces and lacks the grooved rim. The fact that it has never been found *in situ* in the aperture of a shell does not, in my opinion, militate against this assumption, since amongst the numerous specimens of *Viviparus* and allied genera from the Slavonian, Dalmatian, Croatian, and Roumanian beds which have passed through my hands I have never come across a single specimen with the operculum *in situ*. This, I think, may be accounted for by the fact that when these creatures died and the soft parts perished the operculum would probably sink to the bottom and the shell float away. Perhaps some day a specimen may come to light with the operculum *in situ*, when all doubts on the subject will vanish.

CHARACTERS OF TWO UNDESCRIBED LAND SHELLS FROM THE REPUBLIC OF COLOMBIA AND A NEW GENUS OF HELICOIDS.

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

Read 12th January, 1912.

The shells forming the subject of the present communication were collected in the United States of Colombia at an altitude of 5,600 feet near Alejandria, a place 50 miles from Medellin, by Mr. T. P. Sharman, a mining engineer, who is also a good naturalist and sportsman. They were forwarded by him to Major A. J. Peile, who sent them to me for identification, and as they appeared to be new to science he obligingly placed them at my disposal for description.

The first species belongs to a small group of Helicidæ, of which hitherto only three species were known, two of which Professor Pilsbry assigned to *Isomeria*, namely, *Pleurodonta vexans*, Dohrn, and *P. ænigma*, Dohrn,[1] while the third species, *L. assimilans*, Smith,[2] was referred by Mr. E. A. Smith to *Labyrinthus*. The former two species were regarded by Pilsbry "as an independent line of evolution from typical *Isomeria*, rather than as an intermediate or ancestral form between *Isomeria* and *Labyrinthus*". Previously, however, he had regarded the group intermediate between these two sections.[3] Since this group does not, in my opinion, assimilate with either section named, I adopt his earlier view and therefore dissociate it from *Isomeria*, and propose to create for its reception the genus *Ambages*,[4] taking *P. vexans* as the type. It differs from *Isomeria* in having the teeth more strongly developed, and from *Labyrinthus* in the sub-globose depressed form.

Ambages Sharmani, n.gen. et n.sp.

Shell umbilicate, depressed orbicular, closely striated, the striæ broken up into rather coarse granules; light brown. Spire sub-convex, suture impressed, apex obtuse. Whorls $4\frac{3}{4}$, increasing regularly, slightly convex above, tumid below, penultimate whorl angulated, last whorl rounded at the periphery, suddenly and shortly deflexed at the mouth, slightly constricted behind the peristome, and bi-scrobiculate behind the basal margin. Aperture oblique, rhomboid; peristome white, expanded and reflexed, continuous; outer margin semicircular, basal margin slightly incurved, columellar margin projecting over the umbilicus, parietal margin nearly straight. Aperture provided with four folds, namely, two equal, short, transverse, entering, convergent folds—one on the basal and one on the outer margin; a third fold, close to the latter, but less elevated,

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[1] Man. Conch., vol. ix, p. 94, 1894.
[2] Journ. Malac., vol. vi, p. 27, pl. iv, figs. 6–8, 1897.
[3] Man. Conch., vol. v, p. 157, 1889.
[4] *Ambages*, 'obscurity.'

occurs on the outer margin, nearly parallel with the peristome, its upper termination bent slightly forward; on the parietal wall is a low bifurcated entering fold, its lower arm terminating close to the peristome, descending abruptly, its upper arm shorter, descending gradually. Diam. maj. 21, min. 18·5 mm.; alt. 10 mm.

Hab.—Alejandria, Republic of Colombia.

Type in the British Museum, presented by Major A. J. Peile, R.A.

The new species is nearest to *P. vexans*, but is smaller and more distinctly and coarsely granulated, almost beaded. It differs further in having a white peristome, in having the upper fold parallel with, instead of transverse to, the peristome, in the fold on the basal margin being oblique, in the junction of the basal and outer margins being more acute, in the straight parietal margin, and finally in the bifurcate entering parietal fold. The aperture in shape resembles more that of *Labyrinthus triplicata*, Mart.

NEOCYCLOTUS PEILEI, n.sp.

Shell somewhat narrowly umbilicated, depressed turbinate, more or less striated transversely, the striæ being intersected by other striæ descending obliquely forward, thus forming coarse granules

arranged in quincunx, except in a few scattered places where a portion of either set of striæ is continuous, in some instances even forming zigzag lines, while near the peristome the oblique striæ tend to disappear and the granules become obsolete. Whorls 5, convex, increasing rather slowly at first, the last increasing rapidly, and dilated towards the mouth; the earlier whorls pale brown, becoming gradually darker, the last dark brown with blackish streaks at the lines of growth, descending slowly in front. Aperture circular, scarcely oblique; peristome simple, acute, slightly sinuate at the junction of the upper and columellar margins; operculum slightly concave. Diam. maj. 39·5, min. 30 mm.; alt. 30 mm.

Type in the British Museum, presented by Major Peile.

Its nearest ally appears to be *Neocyclotus Belli*, Beddome,[1] but that species is considerably larger, and lacks the coarse granules so conspicuous a feature in the present species.

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[1] These Proceedings, vol. viii, p. 20, 1908.

EXPLANATION OF THE FIGURES OCCURRING IN WESTERLUND'S "SIBIRIENS LAND- OCH SÖTVATTEN-MOLLUSKER", 1877.

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

Read 12th January, 1912.

My attention was recently drawn to the fact that the treatise by Westerlund entitled "Sibiriens Land- och Sötvatten-Mollusker" forming article No. 12 of Bandet xiv of Kongl. Svenska Vetensk. Akad. Handl., 1877, contained no explanation of the figures on the plate accompanying this article. It at once occurred to me that, when several years ago I acquired a copy, I noted the omission and that no reference was made in the text to these figures. I requested the author to supply the missing information, and, writing under date of 16th September, 1900, he complied with my request, stating that the explanation had been accidentally omitted.

Under the circumstances it may be worth while to publish this information for the benefit of those possessing copies.

The Mollusca there illustrated are—

FIG.

1. *Helix* (*Eulota*) *fruticum*, Müller.
2. *H.* (*Eulota*) *Nordenskioldi*, Westerlund.
3. *H.* (*Trichia*) *Stuxbergi*, Westerlund.
4. *Pupa Theeli*, Westerlund.
5. *Succinea turgida*, Linné.
6. *S. putris*, var. *acuta*, Pfr.
7. *S. Altaica*, Martens.
8. *Limnæa attenuata*, Say.
9. *L. lagotis*, var. *patula*, Westerlund.
10. *L. pereger*, var. *producta*, Westerlund.
11. *L. pereger*, var. *torquilla*, Westerlund.
12. *Physa hypnorum*, var. *polaris*, Westerlund.
13. *P. Sibirica*, Westerlund.
14. *Planorbis infralineatus*, Westerlund.
15. *Valvata aliena*, Westerlund.
16. *V. Sibirica*, Middendorf.
17. *Sphærium levinodis*, Westerlund.
18. *S. nitidum* (Clessin), Westerlund.
19. *Calyculina lacustris*, var. *septentrionalis* (Clessin), Westerlund.
20. *Pisidium Nordenskioldi* (Clessin), Westerlund.
21. *P. Sibiricum* (Clessin), Westerlund.
22. *P. mucronatum* (Clessin), Westerlund.
23. *P. boreale* (Clessin), Westerlund.

ON TWO PREOCCUPIED SPECIFIC NAMES IN GASTROPODA

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

Read 12th January, 1912.

A NEW species of *Happia*, from Sao Paulo, South Brazil, was described by Professor Pilsbry in Proc. Acad. Nat. Sci. Philadelphia, 1900, p. 385, pl. xii, figs. 1–3, under the designation *Happia Iheringi*. In 1888, however, Clessin published *Hyalinia Iheringi* in Malak. Blätter, neue Folge, vol. x, p. 166, from Taguara, South Brazil, This species is undoubtedly also a *Happia*, since Clessin compares it with *Happia ammoniformis*, Orbigny, which he also assigns to *Hyalinia*, and since, to judge from the rather scanty description by Clessin, the two species, although evidently near allies, are not co-specific, and Clessin's name having priority, it becomes necessary to rename Pilsbry's species, for which I propose *Happia Pilsbryi*, nom. mut. In 1910 D'Ailly, in working out the mollusca collected by the Kilimandjaro–Meru Expedition, described *Helix alienus* (Wissens. Ergebn. Schwed. Zool. Exped. Kilimandjaro, Meru, Deutsch-Ost-Africa, Band i, No. 6, Mollusca, p. 17). Now Pfeiffer as far back as 1841 published *Helix aliena*, a manuscript name of Ziegler's (Symb. Helic., vol. i, p. 39), which was subsequently relegated by him to the synonymy of *Helix umbilicata*, Montagu [*Pyramidula rupestris* (Drap.)] (Mon. Helic. Vivent., vol. i, p. 86, 1848). Since the Rules of Nomenclature adopted in zoology do not permit the use of a synonym to designate another species, I propose to substitute for D'Ailly's species *Helix Aillyi*, nom. mut.

NOTE ON THE GENUS *ARICIA* OF GRAY.

By H. O. N. Shaw, F.Z.S.

Read 8th December, 1911.

The sub-genus *Aricia* was created by Gray in his *Descriptive Catalogue of Shells*, 1832, pp. 7–12, which, it has been conclusively proved, was never published, and can therefore only be regarded as a manuscript.[1] It was formed on conchological grounds for fifty-two species of *Cypræa*, in which were included *C. moneta* and *C. annulus* (p. 8), and contained a collection of species which in no way resemble each other. Whether the characters of the shells were sufficiently distinctive on which to form a sub-genus, which has by Gray himself and others been raised to generic rank, is a matter for each Cypræologist to determine for himself. The point in question is this. As the *Descriptive Catalogue* cannot be accepted as a publication, the first time the generic or sub-generic appellation *Aricia* was published in connexion with Mollusca was by Herrmannsen, *Indicis generum Malac.*, suppl., p. 12, 1852, and contained *C. moneta* only, but as he gave no description of the genus it must be considered as first published in the *Genera of Recent Mollusca*, H. & A. Adams, vol. i, pp. 265–6, 1854, type *C. annulus*, next *C. moneta*. Previous, however, to this use by Herrmannsen in 1852, Adams in 1854, or even by Gray in 1832, *Aricia* had been employed generically by Savigny in 1822,[2] *Description de l'Egypte: Système des Annelides*, vol. i, pt. iii, pp. 3, 12; also by Robineau-Desvoidy in 1830, *Essai sur les Myodaires*, p. 486; and by Macquart in 1835, *Histoire naturelle des Insectes Diptères* (Suites à Buffon), vol. ii, p. 285. It is therefore clear that this name cannot, according to the rules of priority, be retained for a genus or sub-genus of Mollusca. As I have already indicated, Gray's genus contained widely different species, and the group consisted of fifty-two species of *Cypræa*. The next writer to split up *Cypræa* into different genera (on anatomical grounds) was Troschel, *Das Gebiss der Schnecken*, vol. i, pp. 205, 212, 1856. In this work he used the genus *Aricia*, Gray, and created the sub-genus *Monetaria* for ten species of *Cypræa*, containing *C. moneta*, *C. annulus*, and *C. obvallata*. Since *Aricia* was created for *C. moneta* amongst others, it is clear that this genus or sub-genus, according to the value assigned to it, must now be known as *Monetaria*, Troschel.

Jousseaume in 1884, Bull. Soc. Zool. France, p. 96, used *Monetaria*, Troschel, as a genus. Although he restricted the species contained in it to *C. moneta*, *C. icterina*, *C. annulus*, and *C. obvallata*, he retained *C. moneta* as his type. A footnote by Rochebrune, Bull. Soc. Malac. France, vol. i, p. 74, 1884, gives in six lines a certain amount of the information contained in the present paper, but as no references, etc., are given, it is hoped that the further information now added may be of use.

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[1] Sherborn & Shaw, "Sowerby's *Conchological Illustrations* and Gray's *Descriptive Catalogue of Shells*": Proc. Malac. Soc., vol. viii, pt. vi, pp. 331–40, Sept., 1909. Shaw, "Notes on the genera *Cypræa* and *Trivia*": ibid., pt. v, pp. 289–90, July, 1909.

[2] Date taken from Sherborn, "On the Dates of the Natural History portion of Savigny's *Description de l'Egypte*": Proc. Zool. Soc., 1897, pp. 285–8.

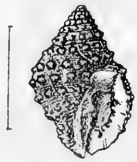
DESCRIPTION OF *SISTRUM OPARENSE*, N.SP., FROM THE SOUTH PACIFIC.

By J. Cosmo Melvill, M.A., D.Sc.

Read 8th December, 1911.

Sistrum Oparense, n.sp.

S. testa ovata, solida, versus apicem paullum attenuata, regularite. spiraliter tuberculata, et minute transversim squamulata, anfractibus 5–6, quorum duo apicales in omnibus speciminibus hactenus visis multum attriti, vel partim fracti, albi, læves, cæteris spiraliter tuberculatis, tuberculis rotundis, regularibus, nitidis, ochraceis, supernis duobus, ultimo anfractu quintis ordinibus decoratis, cætera superficie transversim minute simul ac regulariter imbricato-squamulata vel striata, apertura ovata, peristomate pallide lilacino, labro intus 4–5 noduloso-dentato, margine columellari incrassato, supra excavato, dein binoduloso, canali brevissimo, operculi nucleo laterali. Long. 15, lat. 10 mm.



Hab.—Insula Rapa vel Opara, e grege Tubaiensi vel Australi, Oceano Pacifico.

I first noted this very attractive little species in the Shrewsbury Museum, the specimens being gummed to a card, labelled on the underside "*Sistrum*, sp , new?" presumably in the handwriting of Mr. J. C. Lambert, whose well-selected general collection had lately (1908) been presented to that institution. Upon my taking them for comparison to the British Museum (Nat. Hist.), Mr. Edgar Smith and I soon found corresponding examples, presented by Mr. Lambert, with the fuller locality, as above recorded, given. The species is allied to *S. tuberculatum*, Blainville, *morus*, Lamk., etc., but may be at once known by its much smaller size, regular symmetry, and colour, of a pleasing ochraceous-chestnut, the tubercles being of a slightly darker hue. Minute squamate striæ, spirally arranged, decorate the remainder of the surface; the aperture and peristome are very pale lavender in colour. In common with the majority of authors who have recently added species to this genus,[1] I have preferred continuing to employ the old Montfortian *Sistrum*, 1810, to the more unfamiliar *Drupa* of Bolten. Anyhow, if the genus be considered subdivisible into two sections, whether *Drupa*, Bolten, *Pentadactylus*, Klein, or *Ricinula*, Lamk., be used for the whole

[1] *Vide* Proc. Malac. Soc., vol. viii, pp. 17, 369, 1908–9.

collectively, the name *Sistrum* can still be applied as heretofore for the smaller series of species with simple peristomatal processes. I take the type, or first species mentioned in the *Museum Boltenianum* under *Drupa* [1] as *D. morum*, to be identical with the old *Murex ricinus* of Linnæus (*Ricinula ricinus*) = *R. arachnoides*, Lamk., var. *albolabris*, Blainville, of the typical section. It is well figured by Knorr,[2] and Bolten refers both to his representations and those of Martini (iii, tab. ci, figs. 972, 978).

[1] Mus. Bolten., 1798, p. 55.
[2] "Les délices des yeux et de l'esprit," 1764, tab. xxv, figs. 5, 6.

NOTES ON THE SHELLS OF *TRIDACNA*, AND DESCRIPTION OF A NEW SPECIES.

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

Read 8th December, 1911.

In my endeavours to sort out a large number of shells of this genus, and to place together the supposed species, I have found, as is usually the case in other genera, that some of the characters regarded as specific are inconstant, and that intermediate forms link together some of those apparently distinct. I have examined the hinges of a large number of specimens in the expectation of finding some distinctive characters, but in this respect there appear to be no differences excepting such as may be accounted for by age or circumstances of development. The more or less elongated forms of the shells and the number of radiating ribs do not appear to be reliable characters.

Having brought my investigations to this point, it may seem almost an inconsistency to propose a new species; but the form I propose to call *Tridacna acuticostata* certainly does seem distinct from all the others.

The following are the principal works treating upon the genus:—

(*a*) Monographs of the Shells.

1845. J. C. Chenu, Illustrations Conchyliologiques, pp. 1–2, pls. i–viii.
1862. L. Reeve, Conchologia Iconica, vol. xiv, pls. i–viii.
1868. H. C. Küster, Conchylien-Cabinet, pp. 1–7, pls. i–ii.
1884. G. B. Sowerby, Thesaurus Conchyliorum, vol. v, pp. 179–82, pls. 485–9*.
1903. J. G. Hidalgo, Mem. Real. Acad. Ciencias Madrid, vol. xxi, pp. 382–99.

(*b*) Anatomy.

1865. L. Vaillant, Ann. Sci. Nat. Paris, vol. iv, pp. 64–172, pls. viii–xii.
1890. A. Ménégaux, Recherches circulation Lamellibranches, pp. 130–4.
1899. K. Grobben, Denkschrift. Akad. Wissensch., vol. lxv, pp. 438–44, pl.
1902. H. de Lacaze-Duthiers, Archiv. Zool. Expér., vol. x, pp. 99–212, pl.
1904. R. Anthony, Comptes Rendus Acad. Sci. Paris, vol. cxxxviii, pp. 296–8, figs.

List of Species.

1. T. gigas, Linn. (Sowerby, Thes. Conch., vol. v, p. 179, pl. 188, fig. 11). Of this, largest of all bivalved molluscs, there is a specimen in the British Museum 3 feet in length and weighing 310 lb., and specimens have been recorded attaining to even larger dimensions and weighing 500 lb.[1] I have not been able with any certainty to trace the young of this species; the shells supposed to represent it in Reeve's Conch. Icon., figs. 1*b*, *c*, I regard as very unlikely; at all events they are inseparable from the diversiform *T. elongata*. The shell figured and described by Reeve as *T. gigas* (pl. i, fig. 1) figures in the Thes. Conch. as *T. mutica*, Lamk., but it is identical with the *T. gigas* as figured in Chenu's *Illustrations Conchyliologiques* from the Delessert

[1] See Smith, Proc. Malac. Soc., vol. iii, p. 111.

Collection. This variety has been named by Hidalgo *T. Lamarcki*. A specimen of intermediate size, 18 inches in length, unites these two forms, showing that the differences pointed out in the Thes. Conch. (vol. v, p. 180) are not constant.

2. T. MUTICA, Lamk. (Chenu, *Illustrations Conchyliologiques*). This is quite distinct from the forms mentioned above. It has no appearance of lamellæ or scales, while the fine radiating liræ are very conspicuous. It seems readily separable from all the other species.

3. T. SQUAMOSA, Lamk. (Thes. Conch., vol. v, p. 180, figs. 2, 7, 15). This common well-known species can scarcely be confounded with any other.

4. T. ELONGATA, Lamk. (Conch. Icon., pl. ii, figs. 2*a*, *b*; Thes. Conch., vol. v, pl. 486, figs. 3, 4). I am compelled to unite with this very variable species Reeve's *T. compressa* (Conch. Icon., sp. 5) and *T. rudis* (Conch. Icon., figs. 4*a*, *b*). It seems to me also that *T. lanceolata*, Sowerby (Thes. Conch., vol. v, p. 181, pl. 489*, fig. 18), is only a more than usually lanceolate form of the same. *T. elongatissima*, Bianconi,[1] is the variety *compressa*, Reeve. Hidalgo has given the name *T. Reevei* to the shell figured in Reeve's Conch. Icon., fig. 2*b*, which differs from the type in being more sharply acuminated in front.

I have exhibited an abnormal form shaped like a *Trigonia*, and another of the variety *compressa*, a very curious malformation, in which the animal having formed a very perfect little shell made a fresh start from the umbones, leaving the young shell as a decorative appendage.

5. T. CROCEA, Lamk. (Reeve, Conch. Icon., pl. viii, figs. 9*a*, *b*). This is of a very different type from the preceding, but so variable in form that I am obliged to unite with it *T. Cumingi*, Reeve (Conch. Icon., pl. vii, figs. 7*a*, *b*), *T. ferruginea*, Reeve (Conch. Icon., sp. 8), and *T. scapha*, Meusch. (Thes. Conch., fig. 16).

6. T. SERRIFERA, Lamk. (Thes. Conch., vol. v, pl. 489*, fig. 17, as var. of *T. squamosa*). This species seems to stand alone. The beautiful specimen in the British Museum is yellow; it has no lamellæ or prominent scales, but is serrated near the umbones with a few very small sharp scales. Our specimens from the Philippines are white, smaller, and more compressed.

7. T. OBESA, Sowerby (Proc. Malac. Soc., vol. iii, p. 210, 1899). Beyond the three specimens mentioned of this very distinct species I have as yet seen no others.

8. TRIDACNA ACUTICOSTATA, n.sp.

Shell oblong, white, anterior produced, rounded at the extremity, posterior shorter, sloping, and forming at the extremity with the ventral margin a rather acute angle; byssal orifice large, oblong-acuminate, revealing two short rows of nodules at the posterior end; ribs about 9, angular, distant, surmounted by small, close-set, angular, and nodulous scales, interstices broadly concave, lirate, crossed by stout

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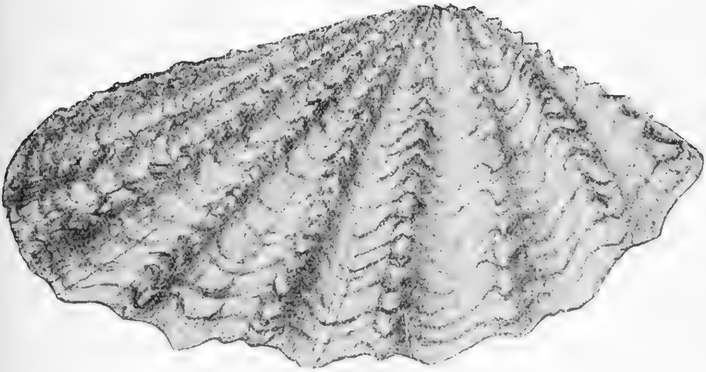
[1] Spec. Zoolog. Mosambicana, p. 238, pl. iv, fig. 2.

irregular waved ridges. Hinge as in other *Tridacnæ*, the principal cardinal tooth in each valve being moderately thick. Length 125, height 68 mm.

Hab.—Philippines.

This species differs from *T. elongata* chiefly in the angularity of its ribs, the absence of lamellæ, and the very different character and small size of the scales on the ribs.



All the species mentioned in this paper, with the exception of *T. mutica* (which I have not seen), were received from the Philippines in the year 1898, when I described *T. obesa*; most of them, however, are pretty generally distributed in the Indian and Pacific Oceans.

I am much indebted to Mr. E. A. Smith, I.S.O., for his valuable assistance, and particularly for his insertion in my paper of references to works on the subject.

ON A CASE OF PRESUMED VIVIPARITY IN *LIMICOLARIA*.

By G. C. Robson, B.A.

(By permission of the Trustees of the British Museum.)

Read 8th December, 1911.

In September of the present year Mr. H. B. Preston received some living specimens of *Limicolaria* from South-West Uganda and Belgian Congo. Two species were represented—*L. Smithi* and a new species as yet undescribed. After some time the uterus, in both cases, was found to be full of apparently well-developed young. In view of the fact that viviparity is not a phenomenon of frequent occurrence among Mollusca the matter was deemed worthy of some consideration, and Mr. Preston kindly handed the specimens over to me to report upon.

In the new species the young are well advanced, are all totally free from any envelope, and already show traces of coloration upon the shell. In *L. Smithi*, however, the majority are still encased in a thin membrane of a soft and pliant nature which is attached to the mouth-region by a chalaza-like structure, remains of which are to be seen in the young of the previously mentioned species. The young of *L. Smithi* are fairly well developed, and the shell has advanced considerably beyond the rudimentary stage. The envelope has disappeared over nearly all the region opposed to the aperture of the shell. The parent in this case contained also three or four eggs with hard shells. These had been perforated in situ in two or more places, and contained only some loose tissue of doubtful nature.

The specimen of the unnamed species certainly, then, is viviparous. Can we say the same of the specimens of *L. Smithi*? The young were certainly encased in a membrane; but as a matter of fact the latter in nearly all cases was frayed away and perforated over all the aperture of the shell. On considering the difference in degree of development between the two species I am inclined to think that the condition seen in *L. Smithi* is an early stage of the complete freedom from enveloping structures seen in the new species.

The question that arises out of these data is whether this is actually a case of normal viviparity, and further whether the genus *Limicolaria* as a whole is viviparous.

We may briefly deal with the latter consideration by saying that, as far as can be made out, no references to the reproduction of this genus are to be found in the literature of Pulmonate ontogeny. *Achatina*, a very near relative, has several ovoviviparous species (1, 2, 3).

Turning to our first question, we should be careful before we accept this evidence as proving that *Limicolaria* is viviparous. It is possible that the young in these two species may have been retained longer in the uterus of the parent than is natural under ordinary circumstances, owing to the change in environment to which they had been subjected.

Transference from a tropical climate to that of England may well have caused a normally ovoviviparous or oviparous animal to become viviparous. I believe a similar result was achieved (artificially) by Kämmerer (4), who has changed the mode of reproduction in *Salamandra* by alteration of the environmental conditions. Unfortunately I have not been able to verify the facts of this experiment, but I believe *S. maculosa* ordinarily keeps its embryos a short time in the uterus, and eventually they are hatched out as larvæ. If, however, the temperature is lowered, the ova remain a longer time in the uterus, and the larval stages are suppressed.

I have mentioned the fact that the eggs which were found in *L. Smithi* were perforated, and a good part of their contents absent. In addition several of the young in the new species had holes in their shells, and the integument of the foot and mantle seemed to be frayed and torn. It suggests itself to me that we have here a case of inter-uterine cannibalism, in which, owing to the inability of the young to obtain food as the result of their delayed delivery from the parental uterus, they were forced to obtain their supply of food and calcareous matter from each other. Such a phenomenon undoubtedly does occur as a natural process among Mollusca. Cases are known among the Streptoneura in which the embryos devour one another and have developed as a consequence larval excretory organs. An especially interesting case is recorded by Glaser (5) in his account of the development of *Fasciolaria*. I am indebted to Dr. Jenkinson, lecturer in Embryology in the University of Oxford, for reminding me of this instance. The difference between it and the phenomena under consideration in this paper is of course that in *Fasciolaria* it is of regular occurrence and constitutes part of the necessary events of ontogeny, while in *Limicolaria* I presume it to be exceptional in its occurrence. Lastly, as a point of detail, in *Fasciolaria* the cannibal embryos and their victims are all within the same capsule, which is not the case in *Limicolaria*.

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NOTE ON THE GENUS *PANOPE*, MENARD.

By Dr. W. H. Dall.

Read 12th January, 1912.

On the 17th of December, 1806, before the Faculty of the Museum of Natural History of Paris, France, M. Ménard de la Groye read a paper entitled "Mémoire sur un Nouveau Genre de Coquille bivalve-équivalve de la famille des Solenoides", etc., which was printed as a separate pamphlet in small quarto of thirty-seven pages, with one plate and a separate title-page, dated January, 1807. On the title-page it is indicated that the paper would appear in the issue of the Annales for February, 1807, as No. 19 of the collection; but in my copy, which is annotated by the author himself, this statement is corrected to read the issues for March and April, Nos. 50 and 51 of the collection of memoirs. In any case, the issue of the pamphlet antedates by at least a month the issue in the Annales. Turning to the latter, we see that not only is the memoir condensed from thirty-seven pages to nine, but the title is slightly shortened by leaving out the 'bivalve-équivalve', and it stops short after 'Solenoides'. Other important changes are made, as we shall see.

In the memoir of January, after thirty preliminary pages, the genus is formally described under the name *Panope*, which is stated on p. 16 to be the well-known name of a sea nymph in classical mythology. This name appears also on p. 30. No other Latin version of it occurs in the memoir; elsewhere the French equivalent alone is used, or the initial P. M. Ménard states expressly that Lamarck agreed with him as to the necessity for a new name for the genus, but does not state on what grounds.

The reason may well have been that twenty-one years before Lamarck applied the generic name of *Glycimeris* to this genus in his *Prodrome* of 1799, Da Costa had given it in binomial form to the *Arca glycimeris* of Linné.

In 1606 Ulysses Aldrovandus, in his work on animals without red blood, discussed the species to which the ancients had given the name of *Chama glycymeris* (p. 472), and figures a *Mya* (?), an *Anodonta*, and the recent *Panope* of the Mediterranean. He does not apply any special name to either of them. In the third book of Lister's *Historiæ Conchyliorum* (edition of 1687) he figures the same shell under the caption "Sect. 10. De Chamis" and refers to it (fig. 258) as "*Chama glycymeris Aldrovandi*", although it is only one of Aldrovandus' species. This citation has been accepted by nearly all subsequent authors. Gualtieri in 1742 referred it to his group of *Musculus* and described it in a phrase beginning "*Musculus rugis transversis*", etc. Finally, Born (Test. Mus. Cæs. Vind., 1780, p. 20) gives it the binomial name of *Mya glycymeris*, with a figure and references to the earlier authors, and is followed by Chemnitz in 1782 and Gmelin in 1792. It is to this shell that Ménard gives the name of *Panope Aldrovandi* in his January memoir.

Now, on referring to the abbreviated synopsis of the January memoir which appears in the Annales du Muséum (vol. ix, pp. 131–9, pl. xii) in the March and April numbers (probably issued in May), we find at the head of the formal description and on the following page in the synonymy that the name *Panope* has been changed to *Panopea*. This change is of course inadmissible under the rules of nomenclature, and the first published name for the genus must stand. The specific name given by Ménard to the Mediterranean recent species must give way to that applied to it by Born twenty-seven years previously, and the name of the type of the genus will therefore be *Panope glycymeris* (Born).

In 1812, in his *Extrait du Cours de Zoologie*, a synopsis of lectures delivered at the Museum, Lamarck uses the name *Panope* (p. 108), but in 1818, in the fifth volume of the *Animaux sans Vertèbres* (p. 456), he introduces the erroneous form *Panopæa* without comment. This form is indicated by Carus and Englemann (Bibl. Zool., ii, p. 922, 1861) as used by Ménard in the Nouveau Bulletin des Sciences, Société Philomatique (Paris, 1809, t. i, No. 19, pp. 513–14), but on reference to the paper itself this is seen to be erroneous, as only the French form of the word is used in the review of Ménard's paper there printed. This laxity of citation appears in the work of nearly everyone who has referred to the nomenclature of the genus, and only a reference to the original will ensure to the student freedom from error.

The only other reference to the correct name I have been able to find is that of Herrmannsen, who, not having seen the original paper, cites it as *Panopæa* (Index Gen. Mal., ii, p. 197, 1847) with doubt, and in his Addenda et Corrigenda of 1852 notes it as "*Panope sive Panopea*, Virgilio". To this authors seem to have paid no attention. Under various forms, *Panopea*, *Panopia*, etc., the name has remained in the works of those citing the genus. In 1889 the Marquis di Monterosato proposed (Journ. de Conchyl., xxxvii, p. 26, note, 1889) to reserve the specific name *glycymeris*, Born, for the form found on the coasts of Spain, and to apply a new name, *cyclopana*, to the more elongated type found on the shores of Sicily and the Cyclopean Islands. The present writer has seen too few specimens of the European shell to have formed a positive opinion, but, if one may judge by analogy from the Floridan and Californian species of *Panope*, such modifications would fall well within the limits of specific variation.

THE NOMENCLATURE OF THE VENERIDÆ: A REPLY TO DR. W. H. DALL.

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

Read 12th January, 1912.

In the September number of these "Proceedings" there is a short article on this subject by Dr. W. H. Dall which contains many statements that cannot be passed over in silence. Dr. Dall naturally defends his own views on nomenclature and generic grouping, but he also makes assertions which cannot be supported, e.g. when he declares my writings to show that my "idea of the relation of species is largely based on superficial characters".

I am quite sure that anyone who carefully peruses my papers on the Veneridæ will see that my generic groups are based on a full consideration of all the characters of the shells, internal as well as external, and that I have not allowed myself to magnify the importance of some one or two characters, as Dr. Dall has done in the case of the *Mercenaria* group, which he separates from the *Chione* group on small differences of sculpture and tooth-granulation. I unite them under the name of *Venus*.

Again, it is not correct to say that in uniting *Protothaca* with *Chione* I ignore "the anatomical differences, the pallial sinus, the hinge, and everything except the more or less reticulate surface sculpture". Dr. Dall has apparently forgotten that in 1907 I wrote to him about this very group, expressing my surprise that he had detached it from *Chione* and had placed it under *Tapes*. I then asked him his reasons for doing so, since they were not obvious from his description of the *Protothaca* shell, and I inquired about the anatomy of the animal. The following was all the reply which he vouchsafed: "In putting *Protothaca* under *Paphia*, or associated with the European forms, I have perhaps been biassed by the uniform practice of naturalists for more than a century, but on reflection I see no reason to change the location." I have only two comments to make on this extraordinary statement—first, that if true it would be a very weak argument; secondly, that it is incorrect. It has not been the uniform practice of conchologists to refer these shells to *Tapes*; the practice in Europe has been to refer them to *Chione*; thus Deshayes in 1853 placed most of the species under *Chione*, though he referred the type (*Venus Dombei*) to his *Venus* group; the Messrs. Adams adopted the same grouping in 1857; by Römer in 1867 they were all included under *Chione*. I need only add that the principal species were listed as *Chione* by G. B. Sowerby in his Catalogue of the Pelecypoda (1903) to prove the inaccuracy of Dr. Dall's statement.

It must also be noticed that Dr. Dall's reply to my inquiry omits any reference to anatomical differences. It is true that in his Synopsis of 1902 he says of the animal of *Protothaca* that "the siphons are short and united, the foot hatchet-shaped and not byssiferous", while under *Chione* he states that the siphons are short and separate; but if this latter statement is meant to apply to all sections of *Chione*, as seems to be intended, then it is erroneous, for most of the European species have their siphons more or less united. The common *C. gallina* and the British variety *C. striatula* have siphons united for more than half their length; in *C. fasciata* they are united for about half the length, and of *C.* (*Timoclea*) *ovata* Forbes & Hanley say that "the siphons are united nearly to the extremities, but they diverge at the ends". The length of the siphons varies in different species and sections of *Chione*.

Consequently the *onus probandi* rests upon Dr. Dall, not upon me. If he still persists in his opinion he must justify it by a full and complete comparison, stating clearly the characters in which he thinks *Protothaca* (both shell and animal) differs from *Chione*, and those in which it resembles *Tapes*. In my opinion the hinge is that of *Chione* and not that of *Tapes*. The only point, so far as I can see, in which *Protothaca* resembles the latter more than the former is in the pallial sinus, which is deeper and more rounded at the extremity than in typical *Chione*, but some species of the *Timoclea* section, such as *T. gallinula* and *T. lagopus*, have a similar rounded sinus.

Dr. Dall makes another extraordinary statement when he writes that because genera proposed with only one species are monotypical, "on this basis I have regarded the species cited in Lamarck's Prodrome of 1799 as typical of the genera *accepted* or proposed by him in that publication." The italics are mine, for there is all the difference in the world between proposing a new genus and accepting an old one! The example given by Lamarck for his genus *Meretrix* is of course to be taken as the type, but that given for the Linnean genus *Venus* is not necessarily the type, because he did not specify it as such. Hence it is untrue to say that I have objected to "the acceptation of the monotypical genus". Dr. Dall must have read my paper very carelessly, or he would not have failed to notice that I began by drawing attention to the recent decision of the International Committee on Zoological Nomenclature to the effect that "mention of a species as an illustration or example of a genus does not constitute a selection of a type".

I do maintain that *Gafrarium* (as adopted by the Adams brothers) is monotypical, because the five supposed species listed by the Adams are now acknowledged to be only varieties of one species, and I quoted Dr. Dall's own statement to that effect, viz. that "the type and sole recent species is *Venus fimbriata*, Linn."

If Bolten's names are to be accepted *Corbis* must give way to *Gafrarium*, but I trust that the rigid application of the priority rule will not be enforced. I entirely approve of the proposal that the International Committee should publish an official list of generic names, and that they should be authorized to establish certain names which have been in general use for half a century or more on a permanent basis by exempting them from change. I would, in fact, have them bar the use of any of Bolten's names in preference to those of Lamarck.

I also continue to maintain that Dr. Dall made a mistake in his selection of a type for *Paphia* (Bolten). As he repudiates having made any mistake, I proceed to make it more clear. In selecting a type for *Paphia* in 1903 he proceeded by elimination only without any other consideration, for he wrote simply, "from *Paphia*, Bolten, *Sunetta* and *Meretrix* have been eliminated, leaving only species ordinarily called *Tapes*, which must retain Bolten's name." That is true, but what are we to understand by the genus *Meretrix*? Dr. Dall himself claims it as 'monotypical', and it certainly can only carry the species of the *Venus meretrix* group, not the large and comprehensive assemblage afterwards catalogued by Lamarck. For the purpose of elimination the genus *Meretrix* is that recognized by modern conchologists (including Dr. Dall) and typified by *V. meretrix*, and no such *Meretrix* occurs in Bolten's list. No one would now include in this genus the *Callista* or *Macrocallista* type, i.e., either *Venus chione*, Linn., or *V. gigantea*, Gmelin, which under the name of *V. ala-avis* is the first species on Bolten's list.

Since we cannot adopt the name *Callista* from Poli, and since *Macrocallista* was not proposed till 1876, while *Tapes* was established by Megerle in 1811, I hold that *Tapes* was wrongly displaced by Dr. Dall, who should have eliminated the species of *Tapes* and have selected *V. ala-avis* as the type of Bolten's *Paphia*. The question is, does such a mistake invalidate his selection of a type, or is any selection good on whatever grounds it is made? The Committee can solve the question in this case by simply authorizing the use of the name *Callista* for the *Venus chione* group.

THE OCCURRENCE OF *HELICELLA HERIPENSIS* (MABILLE) IN GREAT BRITAIN.

By A. W. Stelfox.

Read 12th January, 1912.

PLATE II.

In the month of October, 1907, when collecting in the neighbourhood of Canterbury, I found a shell which appeared to me to be distinct from any known British species. It was evident from the first that it belonged to the group of *Helicella caperata* (Mont.), and most collectors to whom I showed specimens were inclined to consider them as a variety of that common species. Some examples were sent by Mr. A. S. Kennard to the late Professor Boettger, who pronounced them to be *Helicella Heripensis* (Mab.),[1] but that in his opinion this was not specifically distinct from *H. caperata* (Mont.). Since 1907 I have collected this shell many times in the southern counties, and have observed no trace of an intermediate form between *H. Heripensis* and *H. caperata*, although they live frequently in close proximity to each other. Though it is with great diffidence that I venture to differ from Dr. Boettger, I do not think we can do otherwise than regard *H. Heripensis* as a good species.

In case the accompanying illustrations are not sufficient to permit of the separation of the two shells mentioned above, I give below what appears to me to be the chief distinguishing characters of each, though it is a much easier matter to observe these in actual specimens than to describe them on paper.

Helicella caperata (Montagu). (Figs. 12–17.)	Helicella Heripensis (Mabille). (Figs. 1–11.)
GENERAL COLOURING.	
Varies greatly in colour from pure white to almost black.	Usually of a creamy - brown colour, but often pale cream, with radiating markings.
BANDS.	
Montagu's type has a dark band above the periphery, visible on all the whorls, while "at the base of the shell are generally several small circular bands; these are frequently interrupted or broken, and appear spotted".	The bands above the periphery are always more or less interrupted and faint, and never as dark nor as distinct as in certain forms of *H. caperata*. Bands beneath, numerous, seldom interrupted, and frequently darkening near the lip, and then ceasing abruptly.

[1] Bull. Soc. Zool. France, 1877, p. 304.

Helicella caperata (Montagu).	Helicella Heripensis (Mabille).
SIZE.	
Montagu gives the diameter of the shell as "three-eighths of an inch, rarely half an inch". This equals 9·5–12·7 mm. The largest examples which I possess from the south-east of England are, however, all under 10 mm. in diameter. (In the west of Ireland this shell attains a maximum diameter of about 12 mm.)	Usually larger than *H. caperata*, but not always so. Specimens from the Thames Embankment near Laleham, Middlesex, do not measure more than 8 to 9 mm. The average diameter is from 10 to 12 mm. It sometimes, however, exceeds 13 mm.
SPIRE.	
Spire usually distinctly raised, and somewhat conical.	Spire low, and pyramidal rather than conical.
SUTURE.	
Marked by a distinct furrow.	Less distinctly marked.
UMBILICUS.	
Well marked, deep, and of more or less uniform rate of increase throughout. The reflection of the lip tends to obscure the umbilicus.	Narrow, until the last whorl is reached, then increasing with remarkable rapidity. The chief superficial character of the shell.
STRIATION.	
Very strongly marked, but irregular and rugged when examined closely.	At a rough glance the shell appears to be smooth. In reality it is closely, finely, and regularly striated in comparison with *H. caperata*.
PERISTOME.	
Sharp, and not reflected, except towards the umbilicus. Furnished with a strong white internal rib.	Sharp, but more delicate than that of *H. caperata*. The internal rib is frequently of a flesh colour, and is not so strongly marked.
HABITAT.	
More commonly met with in open and uncultivated ground than in shady places.	Hedges and grassy banks. Common in the autumn months in certain places on the withered stems of *Sisymbrium officinale*, upon which its colouring renders it great protection.

The range of this shell would appear to be confined in these islands to southern Britain. Thanks to Mr. A. G. Stubbs—who appears to have been the first in this country to observe the differences between these two shells, but has not published his discovery—and Mr. A. S. Kennard, I am able to record it here from many localities that I have not visited myself. Mr. C. E. Wright has also separated the shells, and a number of his records are given below. The remainder are from shells in the cabinet of Mr. R. J. Welch, of Belfast.

SURREY. Addington (A. S. Kennard); Merrow Down (A. W. Stelfox, 24th October, 1906); Ranmore Common (A. W. S., 24th May, 1908).

WEST KENT. Luddesdown, Wrotham, Cobham, and Erith (A. S. Kennard).

EAST KENT. Canterbury (A. W. S., 14th October, 1907).

EAST SUSSEX. Lewes (A. W. S., September, 1911).

WEST SUSSEX. Devil's Dyke (A. G. Stubbs; also A. W. S., 17th February, 1908); near Duncton (A. W. S., 5th April, 1908).

SOUTH HANTS. Stoner Hill, Petersfield (A. W. S., 31st May, 1908).

MIDDLESEX. Thames Embankment, near Laleham (A. W. S., 3rd November, 1907); River Gate, Hampton Court (A. W. S., 16th November, 1907).

BUCKS. Wendover (A. W. S., 3rd May, 1908); Stony Stratford (C. E. Wright, 1909).

HERTS. Near Watford (A. W. S., 10th November, 1907).

EAST SUFFOLK. Blythburgh and Kessingland (A. S. Kennard).

SOUTH LINCOLN. Ruckland, near Louth (A. S. Kennard).

NORTHANTS. Ringstead, Weldon, Oakley, and Kettering (C. E. Wright, 1909).

HUNTS. Buckden (C. E. Wright, 1909).

CAMBRIDGE. Cambridge (C. E. Wright, 1909).

LEICESTERSHIRE. Market Harborough (C. E. Wright, 1909).

EAST GLOUCESTER. Tredworth and other localities (A. G. Stubbs).

PEMBROKE. Pembroke (C. E. Wright); Tenby (J. W. Boult, 1899, ex coll. R. J. Welch).

SOUTH-WEST YORKS. Pontefract (A. G. Stubbs).

SOUTH-EAST YORKS. Brough, near Hull (J. W. Boult, 1909, ex coll. R. J. W.).

NORTH-EAST YORKS. Scarborough (J. W. Boult, 1909, ex coll. R. J. W.).

It is probable that *H. Heripensis* is the *H. caperata*, var. *Gigaxii*, of Jeffreys and other British authors, and from the description given in the *Fauna Europæa Molluscorum Extramarinorum Prodromus* (1876) it is the *H. Gigaxi* of Westerlund.

In this work (p. 111) Westerlund records *H. Gigaxi* as occurring in "Lusitania, Gallia, Britann., Belgia".

Locard[1] includes twenty-three 'species' under the group of *H. Heripensis*, one of which is *H. Gigaxi*. This latter form is stated to be met with in southern France, while *H. Heripensis* is recorded from northern and central France.

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[1] *Catalogue Général des Mollusques vivants de France*, 1882, pp. 107–11.

NOTES ON SOME BRITISH NON-MARINE MOLLUSCA.

By A. W. Stelfox.

Read 12th January, 1912.

PLATE II.

1. Planorbis vorticulus, Troschel.

In 1908 Mr. A. S. Kennard recorded this species in a recent state from Pevensey in Sussex, from examples collected by the late P. Rufford in Pevensey Level (Proc. Malac. Soc. London, vol. viii, p. 46). Mr. Rufford was unaware of the specific identity of these shells, he having considered them as *P. vortex*. As the exact locality from which the shells came is unknown, Mr. Kennard urged me to keep a sharp look out for it when in Sussex. It was not, however, until September, 1911, that I was fortunate enough to meet with it. Upon this occasion a party consisting of L. E. Adams, E. Collier, R. J. Welch, C. E. Wright, and myself were working the district round Lewes in East Sussex. *P. vorticulus* was taken by us in five different stations, viz., in the moat of Pevensey Castle; in the marshes east of Pevensey; in the marshes between Pevensey and Eastbourne; in those east of Lewes (near Stoneham Farm); and in those north-west of Lewes, beyond the Abbey, and along the south side of the Cockshute River. In all the above stations, except the first, *P. vortex* occurred also, and there can be no doubt that *P. vorticulus* has been passed over as the young of *P. vortex*. In most of the localities *P. vorticulus* was scarce, one example occurring to about fifty of *P. vortex*. In its habits it rather resembles *P. fontanus* than *P. vortex*, since it appears to be almost confined to the extreme edge of the drains, preferring the grassy margins to the open water of the centre. When this vegetation is disturbed the shells float off, and remain upon the surface of the water for some time. Mr. Kennard informs me that he has taken it alive at Thorpe near Norwich, East Norfolk, and that it also occurs in the Holocene peat near Ely (example in Sedgwick Museum, Cambridge). Since no illustration of this species has yet been given in this country, Mr. Welch has kindly photographed it (Fig. 22) beside *P. vortex* (Fig. 23).

2. Valvata macrostoma, Steenbuch.

At my first unsuccessful attempt to obtain *Planorbis vorticulus* in Pevensey Level I was compensated by finding the present species (Kennard & Stelfox, Proc. Malac. Soc. London, vol. ix, p. 123, 1910). Upon returning to Sussex in September, 1911, I obtained further examples in the marshes near Stoneham Farm, east of Lewes, also in East Sussex, and it was taken sparingly by our party in the marsh east of Pevensey. Like *Valvata piscinalis* (Müll.), this species is generally found on the bottom or sides of the drains. In the marsh at Lewes I found the three British species of this genus in association, but only in one spot. In many places *V. cristata* and *V. piscinalis*

R. Welch, Photo.

SOME BRITISH NON-MARINE MOLLUSCA.

occurred together, in others *V. cristata* and *V. macrostoma*, whilst in several only one species of the three was found. Some of the Lewes examples are flatter in the spire than the original ones from Pevensey Level. This form appears to be the *V. depressa*, Pfeiffer, of Clessin[1] and the var. *pulchella* of Westerlund. In one of the latest German works[2] the name *V. pulchella*, Studer, is used instead of *V. macrostoma*, Steenbuch, but Mr. Kennard tells me that Studer's name is a *nomen nudum*. (Figs. 18–21.)

3. Paludestrina confusa (Frauenfeld), in West Sussex.

Through the hamlet of Bury, which is situated on the Arun not far from Amberley Station, there flows a small stream. The bottom of this is very muddy and the sides overgrown with various plants, which are at high tides covered by the waters of the Arun backing up into this tributary. Among this vegetation lives *P. confusa*, as well as in the small pools remaining after the tide has subsided, along the sloping banks of this and the Arun itself. In September, 1911, only a few very young shells were collected in the former locality, while a single example was taken by R. J. Welch in the main river. In May, 1908, the species was common in the tributary stream, when it was discovered by Mr. C. P. Harrington and myself. In the Arun at this point *Neritina fluviatilis* and a stunted and eroded form of *Vivipara vivipara* occur, while the marshes are chiefly remarkable for the absence of *Paludestrina Jenkinsi*, one of the characteristic species of those near Lewes, Eastbourne, and Rye.

4. Vertigo Moulinsiana (Dupuy), in Surrey.

When collecting between Haslemere and Godalming in October, 1907, I found a colony of this somewhat local species close to the main road. The locality is not far from Witley, and is a marshy spot beside the small stream which flows from Lea Park through a series of ponds marked upon the Ordnance Map as Hammer Ponds. On a second visit in March, 1909, the shell was again taken, while *V. antivertigo* occurred with it and *V. substriata* and *V. pygmæa* not far away. Upon my last visit in September, 1911, when I was accompanied by Messrs. C. E. Wright and R. J. Welch, no trace of any Vertigoes were to be seen in the locality. Perhaps the severe drought had something to do with their disappearance. I may add that in the stream close by a very dwarf form of *Anodonta cygnea* was found living in 6 inches of water. The locality is one which would well repay further work.

DESCRIPTION OF PLATE II.

Figures 18–23 are magnified 1·25 diameters; the remainder are natural size.

Fig.		
1.	*Helicella Heripensis* (Mab.).	Devil's Dyke, near Brighton, West Sussex.
2.	,, ,,	Canterbury, East Kent.
3.	,, ,,	Lewes, East Sussex.

[1] *Deutsche Excursions—Mollusken-Fauna*, 1876, p. 307, fig. 167.

[2] *Die Süsswasserfauna Deutschlands*, Heft xix; *Mollusca*, J. Thiele (1909) p. 29, fig. 68.

Fig.		
4.	*Helicella Heripensis* (Mab.).	Eastbourne, East Sussex.
5.	,, ,,	Stoner Hill, near Petersfield, South Hants.
6.	,, ,,	Laleham, Middlesex.
7.	,, ,,	Cambridge.
8.	,, ,,	Ringstead, Northants.
9.	,, ,,	Market Harborough, Leicestershire.
10.	,, ,,	Brough, near Hull, South-East Yorks.
11.	,, ,,	Oakley, Northants.
12.	,, *caperata* (Mont.).	Devil's Dyke, near Brighton, West Sussex.
13.	,, ,,	Bignor, West Sussex.
14.	,, ,,	Buckden, Hunts.
15.	,, ,,	Horn Head, West Donegal.
16. 17.	,, ,,	Stradbally, Dingle Peninsula, South Kerry.
18.	*Valvata cristata*, Müll.	Marshes near Lewes, East Sussex.
19.	*V. macrostoma*, Steenbuch.	Marshes near Lewes, East Sussex.
20.	,, ,,	Marshes near Eastbourne, East Sussex.
21.	*V. piscinalis*, Müll.	Marshes near Lewes, East Sussex.
22.	*Planorbis vorticulus*, Troschel.	Marshes near Lewes, East Sussex.
23.	*P. vortex* (Linn.).	Marshes near Lewes, East Sussex.

The uppermost of the four specimens shown in Fig. 10 is an immature shell, which has the somewhat sharp peripheral keel characteristic of juvenile examples of *H. Heripensis*.

Figs. 15, 16, and 17 represent the large Western Irish form of *H. caperata*.

The lowest examples given in Figs. 19 and 21 are juveniles, which may be compared with specimens of *V. cristata* of equal diameter. The shells shown in Figs. 18, 19, and 21 were all taken in the same habitat.

ON THE OCCURRENCE OF *PUPISOMA* IN SOUTH AFRICA.

By Henry C. Burnup.

Read 12th January, 1912.

Through the generosity of Mr. J. H. Ponsonby in placing at my disposal for study and comparison every specimen of *Pupisoma* in his collection, I have been enabled to identify two representatives of the genus in South Africa; and through the kindness of Mr. H. Suter and Dr. H. A. Pilsbry in checking and confirming my tentative conclusions, I am able to publish the results of my investigation.

1. Pupisoma orcula (Bens.).[1]

Originally described from India, this species is widely distributed through South Africa, specimens having been examined by me from Port Elizabeth (Crawford, per Ponsonby), Grahamstown (Farquhar), Pretoria (Connolly), Victoria Falls, Zambesi (Warren and Connolly), and the following localities in Natal: Richmond (Wakefield and Cooper), Karkloof (Taynton and Burnup), Maritzburg, Edendale, Dargle, and Ntimbankulu, Mid-Illovo (Burnup).

Under a strong lens fine, undulating, spiral striæ may be seen in the spaces between the oblique costulate growth-lines, especially on the base, a feature not recorded in Benson's original description. This is not confined to the South African specimens, but has also been observed in the examples from India, Java, and Japan that I have examined.

In Natal the shells are found on the trunks, branches, and leaves of *Cussonia* and other native shrubs and trees in woods, as well as on orange- and apple-trees in orchards. Mr. Wakefield, of Richmond, attributes to these snails a beneficial influence in the matter of clearing orange-trees of *scale*, but I have not been able to obtain further confirmative evidence on the subject. Sometimes a distinct varix, showing a former resting-place, is formed upon the shell.

It is difficult to decide in these minute, thin-lipped shells when maturity has been reached; therefore to record average dimensions of the shells measured would be misleading. I have, however, chosen a few shells which seem mature, and hereunder give their dimensions—

Height.	Width.	$\frac{\text{Height}}{\text{Width}} \times 100.$
mm.	mm.	
1·57	1·75	90
1·62	1·88	86
2·00	1·74	115
2·18	1·94	112

[1] *Helix orcula*, Bens., Ann. Mag. Nat. Hist., ser. II, vol. vi, p. 251, 1850. Reeve, Conch. Icon., vol. vii, *Helix*, pl. 174, fig. 1176, 1853. *Pupa* (*Pupisoma*) *orcula*, G. Nevill, Handlist Moll. Ind. Mus., i, p. 192, 1878. *Pupisoma orcula*, Pilsbry, Man. Conch., ser. II, vol. ix, p. 52, 1894; Hirase, Conch. Mag., vol. iii, pl. ix, figs. 30, 31, 1909.

The ratio of height to width shows, as is substantiated by further measurements taken but not recorded here, that in the later stages of development the shells are proportionately high for their width.

A remarkable shell, much larger than any other that I have examined, local or foreign, collected by Major Connolly at Victoria Falls, measures 2·8 mm. high and 2·5 mm. wide, the ratio of height to width being 112 to 100. It has 4½ whorls.

Both this species and the following are ovoviviparous, many of the specimens examined containing one young mollusc furnished with a shell, and some few containing two, one much larger than the other.

Mr. H. Suter and Dr. H. A. Pilsbry concur in the determination of this form.

2. Pupisoma Japonicum, Pils.[1]

I have not received specimens of this species from any of my South African correspondents, but have myself collected it at Maritzburg, Edendale, Karkloof, and Ntimbankulu, Natal; commensal with *P. orcula* on indigenous trees and shrubs. The following are some of the measurements that I have taken of apparently mature specimens:—

Height.	Width.	$\frac{\text{Height}}{\text{Width}} \times 100.$
mm.	mm.	
1·22	1·16	105
1·32	1·24	106
1·35	1·32	102
1·41	1·37	103

By these figures it will be seen that this species is much truer to a normal proportion than *P. orcula*, the ratio of height to width remaining nearly constant.

In this species I cannot find any trace of the minute spiral striæ to be seen in *P. orcula*, Bens., *pulvisculum*, Issel, and other species.

As compared with *P. orcula*, *Japonicum* is of a much more regular form, strongly suggesting *Trigonephrus globulus* (Müll.) in miniature. By this difference in form, by the umbilical perforation being open instead of nearly covered by the triangular reflection of the columellar lip, by the absence of the revolving striæ, and by the much smaller size, this species is easily separable from *P. orcula*.

I have submitted examples to Dr. H. A. Pilsbry, who confirms the above determination.

---

[1] *Nautilus*, vol. xvi, p. 21, 1902.

Malacological Society of London.

(Founded 27th February, 1893.)

Officers and Council—elected 9th February, 1912.

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By kind permission of the Council of the Linnean Society, the **MEETINGS** are held in their apartments at Burlington House, Piccadilly, W., on the second Friday in each month from November to June.

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

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Vol. X. Part II. JUNE, 1912. Price 7s. 6d. net.

PROCEEDINGS

OF THE

[M]ALACOLOGICAL SOCIETY

OF LONDON.

EDITED BY

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

Under the direction of the Publication Committee.

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DULAU & CO., LTD.,
37 SOHO SQUARE, W.

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

John H. Ponsonby, Hon. Treasurer.
January 26, 1912.

HENRY WOODWARD } Auditors
GUY C. ROBSON }

ANNUAL GENERAL MEETING.

FRIDAY, 9TH FEBRUARY, 1912.

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

Mr. R. H. Burne and Mr. A. S. Kennard were appointed scrutineers.

The following report was read :—

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

"During that period thirteen new members have been elected, while death has removed two of our old ones, namely, Miss Mary Lodder and Mr. Robert Cairns.

"The membership of the Society on December 31, 1911, stood as follows :—

Ordinary members	70
Corresponding members	90
Total .	160

an increase of eleven as compared with the preceding year.

"The financial condition of the Society shows an improvement, partly through the increase of membership and partly on account of the increased price of the 'Proceedings'. The current account consequently has a credit balance of £9 6*s.* 3*d.* The special fund, created three years ago, and which last year was transferred to the current account, has been resuscitated. This was made possible by a donation from a member, and this fund now has £12 7*s.* standing to its credit. Moreover, the Society still holds the sum of £50 invested in Metropolitan 2½ per cent stock.

"During the year 1911 the usual three parts of the 'Proceedings' have been issued, forming the second half of Vol. IX. They contain 149 pages, illustrated with 4 plates and 53 text-figures.

"The following gentlemen have very kindly contributed towards the cost of the illustrations or have supplied drawings or photographs for the plates and text-figures: H. H. Bloomer, Rev. A. H. Cooke, Lieut.-Col. H. H. Godwin-Austen, R. Bullen Newton, Major A. J. Peile, H. B. Preston, E. A. Smith, G. B. Sowerby, and E. R. Sykes. It is only through such liberal assistance that it is possible to illustrate the 'Proceedings' so fully.

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

On the motion of the Rev. E. W. Bowell, seconded by Mr. C. P. Crick, the above was adopted as the Annual Report of the Society.

The following were elected as Officers and Council for 1912 :—

President.—R. Bullen Newton, F.G.S.

Vice-Presidents.—Rev. A. H. Cooke, M.A., F.Z.S.; G. C. Crick, F.G.S.; Rev. Professor H. M. Gwatkin, D.D.; B. B. Woodward, F.L.S.

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

ORDINARY MEETING.

Friday, 9th February, 1912.

R. Bullen Newton, F.G.S., President, in the Chair.

The President delivered his annual address, entitled "On the Lower Tertiary Mollusca of the Fayum Province of Egypt", which was illustrated by some of the shells mentioned, including the types of several new species. Afterwards numerous views of the district in question, kindly provided by Dr. C. W. Andrews, were thrown on the screen.

On the motion of Mr. B. B. Woodward, seconded by Mr. C. P. Crick, a vote of thanks was passed to the President for his address, and he was asked to permit it being printed *in extenso*. Dr. Andrews, who had been in charge of the expedition and who brought the fossils home, made some interesting observations.

ORDINARY MEETING.

Friday, 8th March, 1912.

R. Bullen Newton, F.G.S., President, in the Chair.

Mr. H. C. Napier was elected a member of the Society.

The following communications were read:—

1. "The Distribution and Habits of *Alopia*, a sub-genus of *Clausilia*." By the Rev. A. H. Cooke, M.A., F.Z.S.
2. "A Synopsis of the Recent and Tertiary Land and Freshwater Mollusca of the Californian Province." By H. Hannibal.
3. "Note on the existence of two editions of Férussac's *Tableaux Systématiques*." By M. Conolly.
4. "Note on *Pleurotoma* (*Clionella*) *bipartita*, Smith." By E. A. Smith, I.S.O.

The Rev. A. H. Cooke exhibited ten specimens of *Eremina desertorum*, forming part of a collection of forty taken by him near Cairo in 1904, which had been placed in a tin box and kept without food until January last, when it was found that ten individuals were still alive; they were supplied with lettuce leaves which, however, they would not touch, whereas some desert sand was greedily devoured by them. Of these ten specimens seven had since died, but the other three were still alive.

Mr. A. S. Kennard exhibited a fragmentary valve of *Unio batavus*, Lam., from the Pleistocene of Swanscombe, a species not hitherto recorded from these Islands. Two other specimens had been forwarded by him to Dr. Haas of Frankfurt a/M., who confirmed the specific determination.

ORDINARY MEETING.

Friday, 12th April, 1912.

R. Bullen Newton, F.G.S., President, in the Chair.

Mr. E. W. Vredenburg was elected a member of the Society.

The following communications were read:—

1. "The genus *Dosinia* and its subdivisions." By A. J. Jukes-Browne, F.R.S., F.G.S.

2. "On the generic name to be applied to the *Venus islandica*, Linn." By E. A. Smith, I.S.O.

3. "Note on *Lapparia Parki*, Suter." By Henry Suter.

4. "Characters of three new species of freshwater shells from Uruguay" and "Descriptions of five new species of *Limicolaria* from British East Africa". By H. B. Preston, F.Z.S.

The Rev. R. Ashington Bullen exhibited a series of living mollusca collected by him in the island of Grand Canary, comprising *Euparypha Grasseti*, *Helicella monilifera*, *Caracollina Parryi*, and *Folliculus folliculus*; a piece of limestone rock containing *Zonitoides minusculus*, from the Upper Pliocene, Warwick, Bermuda; and, on behalf of Miss Dorothy Bate, Pleistocene cave shells from Mallorca and Minorca.

OBITUARY NOTICES.

By the death of Colonel Richard Henry Beddome, F.L.S., this Society has lost one of its original members. As a conchologist he was particularly distinguished among those who collected in Peninsular India. For twenty-five years he was in the Forest Department, having been appointed to it in 1857 by Dr. Cleghorn, Conservator, Captain Beddome being his chief assistant, and for twenty-two years he was the superintendent. His departmental tours gave him splendid opportunities for collecting in many branches of Natural History in the then little-known hill ranges and forests of Central and Southern India, opportunities of which he took the fullest advantage, as shown by the number of new species he discovered, not only of the land mollusca but of mammals and reptiles, and by valuable notes respecting their geographical distribution, which led to association with Dr. W. T. Blanford, Dr. T. C. Jerdon, and many other naturalists working in that part of India.

Colonel Beddome, however, was essentially a botanist, and in the study of the flora of Southern India he devoted the best days of his life, the result of which was the publication of quite a series of valuable works containing figures of numberless species, the drawings being executed with great fidelity by the native draughtsmen he had trained to the work.

Some of his botanical publications are as follow:—

Trees of the Madras Presidency, 1863; *Flora Sylvatica for Southern India*, 1869–73; *Ferns of Southern India*, 1873; *Ferns of British India*, 1876; *Forester's Manual of Botany for Southern India*, 1869–74; *Icones Plantarum Indiæ Orientalis*, 1874; *Handbook of the Ferns of British India, Ceylon, and the Malay Peninsula*, 1883 (Supplement, 1892).

On Reptilia and Batrachians he wrote no less than fifteen papers, most valuable contributions to their study.

The following is a complete list of his papers on Mollusca:—

1. "Descriptions of some new Operculated Land-shells from Southern India and Ceylon," 1875.
2. "Descriptions of Land-shells from the Island of Koror, Pelew Group," 1889.
3. "Descriptions of some new Land-shells from the Indian Region," 1891.
4. "Notes on Indian and Ceylonese species of *Glessula*," 1906.
5. "Descriptions of *Labyrinthus euclausus* and *Neocyclotus Belli*, n.spp., from Colombia," 1908.

In conjunction with myself—

6. "New species of *Cyclophorus* and a *Spiraculum* from the Khasi and Naga Hills, Assam."

Beddome formed a fine collection of land shells from India and other parts of the world, among which the operculates, especially the minute forms, were, I think, his favourites.

I feel this notice is late in its appearance, but had it come out earlier I could not have put on record, which I do with considerable pleasure, and it will I am sure be shared by the fellows of this Society, that all the Indian types and rarer Indian species in the

Beddome Collection will find a resting-place in the Natural History Museum alongside species found by Benson, many made by Henry and William Blanford, Theobald, myself, and others. This will make the collection from India and adjacent countries almost complete and wonderfully rich in types. For this generous gift we have to thank his widow, who, having a deep interest in what it took hours and hours of her husband's life to bring together, desired to see it placed where it would be most appreciated and helpful to those engaged in malacological and conchological investigations. This is quite what Colonel Beddome would have desired, for I know that in the preparation of the Mollusca volume of the "Fauna of British India" Beddome placed his collection at the disposal of Dr. Blanford and assisted him in every way.

Colonel Beddome's death on the 23rd February, 1911, was sudden and quite unexpected by his conchological friends. He attended the Council Meeting of this Society on 20th January, and I met him just before it began, and we talked over a new species of *Oxytes* he had just received from Burma and which is now named after him. He was the eldest son of Richard Boswell Brandon Beddome, solicitor, of Clapham Common, S.W., and was born 12th May, 1830, so was in his 81st year. He was educated at Charterhouse School, and Hart's Army List gives the following dates of his commissions: Ensign 20th January, 1848; Lieutenant 15th November, 1853; Captain 18th February, 1861; Major 20th January, 1868; Lieut.-Colonel 20th January, 1874; Colonel 20th January, 1879. I have been able to glean that he first studied for the legal profession, but he could not get interested in it, and, preferring a life abroad, entered the Army in the Hon. East India Company's service. Obtaining a direct cadetship, and going out to India, he joined the 42nd Madras Native Infantry, and was with that regiment at Jabbalpur in 1856, being at that time Quartermaster and Interpreter of the regiment; from there he went to Secunderabad, and soon after his arrival at this station, about the end of the year 1856, he was appointed to the Madras Forest Department, and never again rejoined his regiment.

H. H. Godwin-Austen.

NOTES.

NOTE ON THE EXISTENCE OF TWO EDITIONS OF FÉRUSSAC'S *TABLEAUX SYSTÉMATIQUES*. (*Read 8th March*, 1912.)—It does not appear to be generally known that there were in 1821 two printings of what, from the pagination, may be called parts ii and iii of the above work. I have only examined two copies, one in the Natural History Museum, South Kensington, and the other in the Jenyns Library, Bath Literary and Scientific Institute.

The first page of part ii, in each case, is inscribed: "Tableau Systématique / de la Famille / des Limaces, *Limaces*, / servant de Supplément provisoire / à notre Histoire naturelle de ces Animaux. / (Voyez page 21 et suivantes de notre ouvrage.) /" In the South Kensington copy, however, the date which follows is "Janvier 1821", while in the Bath one it is "Juin 1821".

The ensuing twenty-eight pages of this part are alike in each copy, but in the following part, "Tableau Systématique / de la Famille / des Limacons, *Cochleæ* /," occurs what must be a fruitful source of confusion to reference hunters. On p. 3 of the January printing is an "Avertissement", which occupies four pages, and p. 7 commences with "Observations Générales sur la Famille". The work thus runs on to p. 114, and concludes with a "Récapitulation des espèces mentionnées" and "Liste des Espèces . . . que nous n'avons pas vues".

In the June printing of part iii, "Tableau . . . des Limacons," the "Avertissement" is omitted, and the "Observations Générales" begin on p. 3, with the result that from this point to the end of the volume each page bears a number lower by four than the corresponding page in the January print, and the final "Récapitulation" appears on p. 110 instead of p. 114. There is also one extra page, 111, containing a "Table des Matières", in which references are correctly made to the pages as they are numbered in this printing, but it is noteworthy that on p. 67, in the list of corrections and additions, the altered numbering has escaped notice, so that each correction is referred to a page four later than should be the case, as if the pagination were the same as in the earlier printing.

Since the above was written, Mr. Gude has informed me that his own copy of the *Tableaux*, as well as that in the library of the Zoological Society, agrees with the Bath edition.

M. CONNOLLY.

NOTE ON *PLEUROTOMA* (*CLIONELLA*) *BIPARTITA*, SMITH. (*Read 8th March*, 1912.)—Dr. Herman Strebel has very kindly called my attention to some confusion attaching to this South African species. It has arisen from a typographical error; *bipartita* should have been printed *tripartita*. A reference to the description at once shows this, since it is stated that the whorls are divided into *three* parts. This description was published in 1877, but the previous year Weinkauff described this shell as *Pleurotoma* (*Clavatula*) *tripartita*, E. Smith, from specimens received from Mr. G. B. Sowerby, who doubtless had named his shells from the British Museum collection, where the tablet was labelled *tripartita*, Smith, although at the time the description had not been published.

The synonymy of the species is as follows :—

CLIONELLA TRIPARTITA (Weinkauff).

1876. *Pleurotoma (Clavatula) tripartita* (E. Smith, MSS.). Weinkauff, Conchyl. Cab., p. 120, pl. xxvi, figs. 12, 13.

1877. *P. (Clionella) bipartita* (typographical error for *tripartita*), Smith, Ann. Mag. Nat. Hist., 1877, vol. xix, p. 500.

1884. *Clavatula (Clionella) bipartita*, Smith: Tryon, Man. Conch., vol. vi, p. 234.

1884. *C. (Perrona) obesa*, Reeve: Tryon (*partim*), op. cit., p. 232, pl. viii, fig. 4.

1892. *Pleurotoma (Clionella) bipartita*, Smith: Sowerby, Marine Shells of South Africa, p. 6, pl. iv, fig. 83.

1904. *Clionella bipartita*, Smith, Journ. Malac., vol. xi, p. 22.

Neither of the figures quoted above is of much use. That in *The Marine Shells of South Africa* is simply a caricature, and that in Weinkauff's work is not much better, since it does not show the bipartite feature of the whorls.

With regard to the relationship of *Pleurotoma obesa* of Reeve to this species, as suggested by Tryon, I would merely repeat Mr. Sowerby's observation that "it is quite unlike it, and certainly belongs to a different section of the genus", namely *Perrona*.

E. A. SMITH.

ON THE OCCURRENCE OF *PISIDIUM HIBERNICUM* IN SOUTHERN SWEDEN (*Read 12th April*, 1912.)—This species was described by Westerlund in 1894 from specimens found by Dr. R. F. Scharff in Lough Nagarriva, about 4 miles north of Glengarrif, just over the boundary in co. Kerry.

A few years later it was taken by Mr. Stelfox in Lough Namaddra and another small unnamed tarn, both close to Lough Nagarriva but within the co. Cork boundary.

More recently I identified the species among specimens sent by

Mr. Stelfox from Lough Gowlanagower, on Inishbofin, West Galway, and a few weeks ago found a single valve attached to a caddis-case from Lough Tallanafrankagh, South Galway, sent by Mr. R. A. Phillips.

Whether the species belonged to the Lusitanian group, like the Kerry slug (*Geomalacus*), or was of boreal origin, was in doubt till a few days ago, when I received from Dr. Nils H. Odhner, of the Riksmuseum, Stockholm, a quantity from South Sweden.

Dr. Odhner's specimens came from the Tåkern See, Östergötland, to the east of Omberg, and close to the Wetter See. They occurred abundantly in an area of a square metre and at about one metre in depth, amongst *Chara*, in company with *P. subtruncatum*, *P. Casertanum*, *P. nitidum*, *P. milium*, and *P. Lilljeborgii.*

B. B. WOODWARD.

NOTE ON *LAPPARIA PARKI*. (*Read* 12*th April*, 1912.)—Being occupied with examining the type-specimens of the Tertiary fossils of New Zealand, which were used by the late Captain Hutton when writing his *Catalogue of the Tertiary Mollusca of New Zealand*, 1873, I had before me, a short time ago, his *Voluta* (*Lyria*) *corrugata* (*Cat. Tert. Moll.*, p. 7). The specimen being devoid of the protoconch, the curator of the Canterbury Museum most kindly allowed me to examine a specimen with this part of the shell in perfect condition. I was surprised to find a very distinct caricelloid pullus, and this at once reminded me of the immature shells I described and figured in these Proceedings (vol. vii, p. 207, pl. xviii, figs. 1, 2, 1907), under the name of *Lapparia Parki.* I now consider them to be absolutely identical with *Lapparia corrugata*, Hutton, and my name therefore falls into synonymy of Hutton's species.

H. SUTER.

PRESIDENTIAL ADDRESS.

(Delivered 9th February, 1912.)

ON THE LOWER TERTIARY MOLLUSCA OF THE FAYUM PROVINCE OF EGYPT.[1]

By R. Bullen Newton, F.G.S.

PLATES III AND IV.

I. Introduction.

In recent years the Fayum Province of Egypt has been the scene of some remarkable palæontological discoveries which have brought to light an entirely new vertebrate fauna, consisting of mammals, birds, reptiles, and fishes, that had their existence during the Eocene stage of Lower Tertiary times. These interesting remains were collected by Mr. H. J. L. Beadnell, F.G.S., when, as an officer of the Geological Survey of Egypt, he was investigating the structure of the region, as well as by Dr. C. W. Andrews, F.R.S.,[2] of the British Museum, the latter having also fully described them in an elaborate memoir published by the Trustees of the British Museum. For the stratigraphical knowledge of this subject, however, we are mainly indebted to Mr. Beadnell,[3] who has written a complete history of the beds in which these animals were found, with a review of all previous opinions upon the subject.

But besides these relics of a vertebrate fauna, the same rocks of the Fayum have yielded a large number of invertebrate remains which are of immense interest and claim an equal scientific importance, since they constitute a material part of the faunistic characters of that area of Egypt. Such fossils, belonging to all groups of the invertebrata, have been known to palæontologists for many years; but by far the most numerously represented are the Mollusca, particularly the Pelecypoda and Gastropoda, the Scaphopoda and Cephalopoda being comparatively seldom found. The chief authorities on the Lower Tertiary Mollusca of the Fayum include the names of the late Professor Mayer-Eymar, M. Cossmann, Dr. Blanckenhorn, and Dr. Paul Oppenheim.

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[1] Published by permission of the Trustees of the British Museum.
[2] *A Descriptive Catalogue of the Tertiary Vertebrata of the Fayum, Egypt*, 1906.
[3] *The Topography and Geology of the Fayum Province of Egypt.* Survey Dept., Egypt (Cairo), 1905.

Before proceeding further, however, it will be necessary to refer briefly to the stratigraphical features of the district under consideration, which have been so ably described by Mr. Beadnell. From his memoir we gather that the Fayum is one of the great depressions of the Libyan Desert, being of circular contour and comprising about 12,000 square kilometres; it lies some fifty miles south-west of Cairo and immediately west of that part of the Nile Valley which is between Kafr el Ayat and Feshn. The more southern and western portions include Wadi Muela, Wadi Rayan, and Gar el Gehannem; the northern boundary being a range of hills known as Jebel el Qatrani. Mr. Beadnell divides the region into cultivated land, lake, and desert. The main part of the 'cultivated land' is in the eastern half of the depression, where the villages mostly abound. Like the Nile Valley itself, the soil here is of alluvial character, being nourished by a complete system of irrigation which emanates from the Nile through the natural canal of Bahr Yusef and its many offshoots, and so furnishing the area with an abundant water supply, many of the streams ultimately draining into Birket el Qurun. This latter, situated to the north-west of the cultivated land, forms the 'lake' area of the province, being a large sheet of brackish water, with a nearly east and west axis of 40 kilometres and a maximum breadth of 10 kilometres; it forms the lowest part of the depression. This lake, in Post-Tertiary and early historical times, must have been far more extensive than now obtains, as lacustrine deposits can be traced over wide areas of what is now desert country. It is supposed to represent all that remains of the ancient Lake Moeris when its waters, according to Mr. Beadnell, must have covered an area ten times the size of that occupied by Birket el Qurun at the present day.

The 'desert' country of the Fayum may be said to surround the lake and cultivated lands. This is the region of greatest antiquity, being formed of Lower Tertiary rocks belonging to the Middle and Upper Eocene Series, which have yielded the vertebrate and invertebrate fossils as well as large masses of silicified tree remains. It is in the escarpment area between the northern shores of Birket el Qurun and Jebel el Qatrani that the chief fossiliferous tract occurs. Speaking, generally, the strata of the Fayum are of a purely sedimentary character, consisting of limestones, marls, clays, sandstones, etc., which vary greatly in hardness and durability, the beds being nearly horizontal or with only a slight northerly dip. Igneous rocks are sometimes present, but they are regarded as having originated, more or less, from local lava-flows. The stratigraphical sequence is given as Middle Eocene, Upper Eocene, Oligocene, Pliocene, Post-Pliocene, and Recent. Certain igneous rocks referred to as intercalated basalts occur between the topmost Eocene and the Oligocene, which are considered to represent an arbitrary demarcation separating those two formations. Further divisions have been recognized in these strata. The Middle Eocene or Lutetian of European nomenclature is divided by Mr. Beadnell into four groups. The first or oldest, at the base, are termed the *Wadi Rayan Series*, containing marine shells and *Nummulites Gizehensis*, and which occur at Wadi Muela, Wadi Rayan, and Gar el Gehannem. These are succeeded by the *Ravine Series*, also of marine character, with mollusca, fish, and cetacean remains, forming the valleys of El Bats and El Wadi, which stretch eastwards towards the Nile Valley, then northwards to Tamia, constituting as well the basal rocks of the island (Geziret el Qorn) on Birket el Qurun, then extending westwards to Gar el Gehannem. The third group is the *Birket el Qurun Series*, with marine shells and cetacea, which are developed in the south-eastern regions of the Fayum (Qalamsha) and along its eastern sides to the northern confines of the cultivated area (Tamia, etc.); they also form part of the rock structure of the island on Birket el Qurun, as well as the Gar el Gehannem in the west. These beds are followed by the *Qasr el Sagha Series*, containing land and marine vertebrates as well as numerous shells (*Carolia*, etc.), mostly marine, but with occasional fluviatile forms (*Lanistes*), the whole fauna giving evidence of estuarine conditions prevailing during the deposition of the beds. This series is mostly found in the northern areas of the Fayum as well as at Gar el Gehannem, the best development forming the cliff escarpments overlooking the Birket el Qurun.

The different 'series' of beds here enumerated belong to the Mokattam or Parisian rocks, the lower of which, comprising the Rayan, the Ravine, and the Birket el Qurun, being bracketed as Lower Mokattam, while the Qasr el Sagha Series is referred to as the Upper Mokattam. Above these occur the Upper Eocene or Bartonian rocks, which are developed among the escarpments of the northern part of the depression to Jebel el Qatrani. The lower part of this series contains quantities of silicified woods, remains of land animals, crocodiles, tortoises, etc., while the upper part shows an assemblage of mollusca of marine and freshwater habits, such as *Unio*, *Lanistes*, *Pleurotoma*, *Turritella*, etc., a repetition of the estuarine or fluvio-marine features noticeable in the older series of the Qasr el Sagha. The whole of the Bartonian is capped by the basalt, beyond the boundary of which the Oligocene rocks are thought to occur, although strata of that age have not been palæontologically determined as being present within the actual confines of the Fayum. The Miocene formation is entirely absent, although known at Mogara, some 100 kilometres in a north-westerly direction from the Fayum, as well as at localities eastward of Cairo. Certain gravel terraces on the north-east of the region have been referred to the Pliocene epoch, as well as some sandy beds at Sidmant el Jebel and Qalamsha on the south-east boundary of the depression, where the well-known Pliocene ostreiform shell occurs, *Alectryonia cucullata*. The Post-Pliocene and Recent deposits are found covering the cultivated lands and the north and west of Birket el Qurun. They contain freshwater mollusca comparable to forms found in the Nile and other African waters, which include *Lanistes carinatus*, Olivier, sp., *Viviparus unicolor*, Olivier, sp., etc.

The whole of the divisions may be epitomized as follows in the succeeding table:—

			Average depth of strata in metres.	
RECENT AND POST-PLIOCENE.				Alluvial soils, clays, sands, etc., containing *Ampullaria ovata*, *Lanistes carinatus*, *Viviparus unicolor*, *Unio teretiusculus*, *Corbicula fluminalis*, etc. Blown Sand. Lacustrine clays extending 23 metres above sea-level.
PLIOCENE.			50	Gravel Terraces (? Post-Pliocene). Shell boring on rock surfaces. Sidmant deposits, with *Alectryonia cucullata*.
OLIGOCENE.	TONGRIAN		30	*Jebel el Qatrani Series:* Fluvio-marine beds: sandstones and sandstone grits, with silicified trees, otherwise unfossiliferous. Basalt sheets, interbedded and contemporaneous.
UPPER EOCENE.	BARTONIAN.		250	Fluvio-marine beds: variegated sands, sandstones, clays, and marls, with limestone grits and thin bands of limestone. The uppermost beds contain: *Unio* sp., *Lanistes Bartonianus*, *Potamides scalaroides*, *P. tristriatus*, *Pleurotoma ingens*, etc. The lower part of the section exhibits vertebrate remains, such as *Palæomastodon*, *Arsinoitherium*, *Ancodon*, *Mœritherium*, *Pterodon*, etc.
MIDDLE EOCENE.	LUTETIAN OR PARISIAN.	Upper Mokattam.	155	*Qasr el Sagha Series* (*Carolia* beds): alternating limestones, marls, clays, and sandstones. The upper beds have yielded such shells as *Nautilus*, *Lanistes antiquus*, *Turritella Pharaonica*, *Mesalia fasciata*, *Alectryonia Clot-beyi*, *Carolia placunoides*, *Macrosolen Hollowaysi*, etc. The highest and lower beds of this series contain vertebrate remains, such as *Mœritherium*, *Zeuglodon*, *Tomistoma*, etc.
		Lower Mokattam.	50	*Birket el Qurun Series* (*Operculina*–Nummulite beds): sandstones and clays, with sandy limestones and one or more well-marked concretionary sandstones. The mollusca represented are: *Lucina Pharaonis*, *Plicatula polymorpha*, *Voluta Beadnelli* (= *Arabica*), *Turritella transitoria* = *Pharaonica*, species of *Clavalithes*, etc., *Nautilus*. In the lower beds of this section are found *Zeuglodon* remains.
			70	*Ravine Series:* white marls and marly limestones, with *Corbula* cf. *pixidicula*, *Tellina tenuistriata*, etc. Fish-remains and *Zeuglodons* also occur.
			130	*Wadi Rayan Series* (*Nummulites Gizehensis* beds): limestones, marls, clays, etc. *Carolia placunoides*, *Lucina*, *Mitra*, etc., occur in these beds, but no vertebrates.

II. On the Geological Age of the Jebel el Qatrani Deposits.

Since the publication of Mr. Beadnell's principal memoir on the Fayum, some criticisms have arisen as to the horizons determined of certain of the beds forming the Lower Tertiary rocks. No objection has been raised to accepting as Middle Eocene or Lutetian the three lowest groups of the Fayum succession, viz. the Wadi Rayan, Ravine, and Birket el Qurun Series. The Qasr el Sagha Beds, which follow next in ascending order and which undoubtedly belong also to the Lutetian (Upper Mokattam) stage of the Eocene period, as hitherto advocated by all geologists who have studied them, have quite recently been regarded as of Upper Eocene age by Dr. Dacqué [1] in a memoir on some fossil tortoises from Egypt, in connexion with which it should be mentioned that the Upper Mokattam rocks of Egypt had a short time previously been considered by Dr. Emile Haug [2] as representing the Auversian stage of the Eocene of Europe, which is the lowest part of the Bartonian.

Some conflicting views have been, likewise, published as to the proper place in stratigraphy of the Jebel el Qatrani or Fluvio-marine Series, which Mr. Beadnell, Dr. Blanckenhorn, and others assume to be Bartonian or Upper Eocene. To properly understand the discussion it is necessary to glance briefly at the literature dealing with this question, but previously it may be well to explain that the geological explorations of the Fayum were commenced by Mr. Beadnell in 1898, although he published no views thereon until 1901. During that period, however, Mr. Beadnell was making valuable collections of fossils, chiefly invertebrates, the majority of which were ultimately forwarded to the British Museum for determination, although prior to this they had been subjected to examination by Dr. Blanckenhorn, especially some molluscan remains of estuarine character which had been obtained from the Jebel el Qatrani Series, high up above the vertebrate remains occurring near the base of the section. Dr. Blanckenhorn, with the assistance of Dr. Oppenheim, was able to recognize among these specimens certain forms of Gastropods, which were characteristic of the 'Beauchamp Sands' of the Paris Basin and therefore of Bartonian or Upper Eocene age, hence they were regarded as belonging to that horizon and duly published as such in the year 1900.[3]

Almost simultaneously with the appearance of this first account of the Jebel el Qatrani Beds and their mollusca, Mr. Beadnell placed a paper before the Geological Congress at Paris, which was published in 1901, on the geology of the Nile and the Libyan Desert,[4] in which reference was made to the geological structure of the Fayum.

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[1] Geol. Pal. Abhandl. [Koken], N.S., vol. x, pt. iv, pp. 61, 1912.

[2] *Traité de Géologie*, 1911, pt. ii, p. 1503.

[3] "Neues zur Geologie und Palaeontologie Aegyptens.—Das Palaeogen; Das Eocän": Zeitsch. Deutsch. Geol. Ges., vol. lii, p. 456, 1900.

[4] "Découvertes Géologiques Récentes dans la vallée du Nil et le Désert Libyen": Congrès Geol. Intern. [Paris], 1901, fasc. ii, pp. 858–61. An English translation of this account was privately published in London in the same year.

He pointed out that the Upper Mokattam rocks of that region were succeeded in its northern part by a series of beds over 200 metres in thickness, which resembled a fluvio-marine area similar to the Oligocene of Hampshire in England. He also referred to the Upper Eocene age of the deposits as determined by Dr. Blanckenhorn from a study of the shells collected by himself. This was rapidly followed by Mr. Beadnell's[1] English abstract of the French memoir in which the beds in question were provisionally assigned to the Oligocene. At the end of the same year (1901) Mr. Beadnell[2] definitely recognized these rocks as the 'Fluvio-marine Series (Jebel el Qatrani Beds)', their age being given as Upper Eocene for the deposits below the basalts, and for those above the basalts, where only silicified woods occurred, a Lower Oligocene horizon was suggested.

In a later work by Dr. Blanckenhorn[3] on the stratigraphy of Egypt, reference is again made to the estuarine shells of the Jebel el Qatrani Series, found below the basalts, which he still regarded as indicative of an Upper Eocene age. Allusion was also made to the occurrence of Lower Oligocene mollusca, outside the Fayum area, between Birket el Qurun and Wadi Natrun, quoting such forms as *Cerithium conjunctum*, Deshayes, and *Melania Nysti*, Nyst, belonging to the "Sables de Fontainebleau" of France, and therefore of Stampian age. When we come to Mr. Beadnell's chief memoir[4] these particular beds beneath the basalts are similarly regarded as Upper Eocene, although in addition determined as Bartonian, the same geological views being also adopted by Dr. C. W. Andrews[5] in his monograph on the fossil vertebrates from the Fayum. Succeeding this Dr. Oppenheim's important monograph[6] on the older Tertiary mollusca of Egypt was published, in which the fluvio-marine Gastropods previously referred to by Dr. Blanckenhorn as from the Jebel el Qatrani Series were noticed as belonging to the Upper Eocene or Lower Oligocene.

Soon after the publication of this last work Professor Ch. Depéret[7] questioned the Bartonian horizon of the vertebrates occurring near the base of the Jebel el Qatrani Series. He claimed that the relationship existing between *Ancodon Gorringei* of Andrews and Beadnell, and his *Brachyodus Cluai* from the Sannoisian–Stampian division of

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[1] "On some recent Geological Discoveries in the Nile Valley and Libyan Desert": Geol. Mag., 1901, p. 27.

[2] "The Fayum Depression: a preliminary notice of the geology of a district in Egypt containing a new Paleogene vertebrate Fauna": Geol. Mag., 1901, pp. 544–5.

[3] "Neue geologisch-stratigraphische Beobachtungen in Aegypten": Sitz. Akad. Wiss. München, vol. xxxii, p. 400, 1903.

[4] *The Topography and Geology of the Fayum Province of Egypt*, Survey Dept., Egypt, 1905, p. 53.

[5] *A Descriptive Catalogue of the Tertiary Vertebrata of the Fayum, Egypt*, 1906, pp. viii, ix of Introduction.

[6] "Zur Kenntniss alttertiärer Faunen in Aegypten": Palæontographica, vol. xxx, pt. iii, fasc. 2, pp. 278, 282, 284, 1906.

[7] "Sur l'âge des couches à *Palæomastodon* du Fayoum": Bull. Soc. géol. France, sér. IV, vol. vii, pp. 193, 194, 1907.

the Oligocene of Spain, would be in favour of a similar age for the *Palæomastodon* and associated vertebrates of the Fayum.

Such views, however, have been objected to by Dr. Oppenheim,[1] who regarded the *Palæomastodon* beds as of Ludian age and on the same horizon as the 'Gypse de Paris', in his own language stating very explicitly: "De cette manière on pourrait à la rigueur l'âge des couches à *Palæomastodon* et *Arsinoitherium* comme Ludien."

Dr. Oppenheim further mentioned the occurrence of the mollusca in the upper part of the series, which he unreservedly regarded as of Eocene age. A reference was likewise made to Mayer-Eymar's discovery of a molluscan fauna at 'Walther Hill', one of the so-called 'Sandberger Hills', which are situated some 20 kilometres west of the Great Pyramids and to the north-east of the Fayum escarpment, and consequently outside the limits of the Fayum depression, where *Natica crassatina* and other shells had been found, and considered to belong to the Lower Tongrian stage of the Oligocene. This was followed by a second statement from Professor Depéret[2] involving further vertebrate evidence in support of the Oligocene age, he being of opinion that the *Palæomastodon* of the Fayum is more recent than the *Palæotherium* fauna of the 'Gypse de Paris'. Referring to the shells found high up above the vertebrates, he mentioned their bad preservation, although one of the forms, *Turritella angulata* of Sowerby, related to *T. Pharaonica*, Cossmann, which is usually in a good condition, was quoted as ranging from Middle Eocene to the Priabonian of Eastern countries such as Tunisia, Syria, and India. Professor Depéret also called attention to the Oligocene facies (already acknowledged) of the shells determined by Dr. Blanckenhorn and Mayer-Eymar, including *Natica crassatina*, etc., which were really from the 'Sandberger Hills', and therefore not within the region of the Fayum.

With the exception of Dr. A. von Reinach, who adopts the geological horizons for the vertebrate beds of the Fayum, as recognized by Dr. Blanckenhorn, Mr. Beadnell, and Dr. Andrews, we find that later investigators on the subject, such as Professor H. F. Osborn, Dr. E. Stromer, Professor Fraas, and Dr. M. Schlosser, accept Professor Depéret's views as to the Sannoisian–Stampian stage of the Oligocene formation being the correct geological horizon for the so-called *Palæomastodon* beds of the Fayum. Quite recently Dr. Dacqué, in his memoir on the fossil tortoises of Egypt, has expressed similar stratigraphical views.

A summary of these opinions may be interesting:—

1900. Dr. Blanckenhorn, assisted by Dr. Oppenheim, regarded the mollusca of the Jebel el Qatrani deposits as of Upper Eocene or Bartonian age and on the horizon of the Beauchamp Sands of the Paris Basin.

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[1] P. Oppenheim, "Observations sur l'âge des couches à *Palæomastodon* du Fayoum": Bull. Soc. géol. France, sér. IV, vol. vii, pp. 358–60, 1907.

[2] Ch. Depéret, "Sur l'âge des couches à *Palæomastodon* du Fayoum": Bull. Soc. géol. France, sér. IV, vol. vii, pp. 455, 456, 1907.

1901. Mr. Beadnell alluded to the above views of Dr. Blanckenhorn, but regarded the whole of the Jebel el Qatrani Series as resembling a fluvio-marine area similar to the Oligocene of Hampshire in England.

1901. The beds were again referred to by Mr. Beadnell and assigned provisionally to the Oligocene period.

1901. Mr. Beadnell next definitely recognized these rocks as Upper Eocene for the beds below the basalts, and for those above a Lower Oligocene age was suggested.

1903. After further studies, Dr. Blanckenhorn still regarded the beds as Upper Eocene.

1905. In Mr. Beadnell's principal and final work the beds were referred to as Upper Eocene or Bartonian.

1906. Similar stratigraphical views to those finally published by Mr. Beadnell were expressed by Dr. C. W. Andrews in his monograph on the fossil vertebrates of the Fayum.

1906. Dr. Oppenheim regarded the Jebel el Qatrani mollusca as Upper Eocene or Lower Oligocene in his monograph on the older Tertiary shells of Egypt.

1907. Professor Depéret noticed the nearly basal deposits of the Jebel el Qatrani Series containing the vertebrates as of the Sannoisian–Stampian stage of the Oligocene.

1907. Dr. Oppenheim, contrary to Professor Depéret's views, recognized the same beds as of Ludian age (Ludian Beds being above the Bartonian and necessarily younger), but the upper beds of the Jebel el Qatrani Series containing the mollusca were unreservedly regarded as Eocene.

1907. Professor Depéret again called attention to the subject by supporting the Oligocene age for the vertebrates, an opinion followed by nearly all the later writers on the vertebrate palæontology of the Fayum.

1912. The Jebel el Qatrani or Fluvio-marine Series was regarded by Dr. Dacqué as of Lower Oligocene age.

In the chief elements of this discussion it is obvious that we are indebted to Dr. Blanckenhorn (who was assisted by Dr. Oppenheim) as to the stratigraphical value of the mollusca occurring in the upper or younger deposits of the Jebel el Qatrani Series.

Later, however, Dr. Oppenheim monographed the shells as of Upper Eocene or Lower Oligocene age, and subsequently the same author somewhat changed his views, stating that the vertebrates were of Ludian age, and that the mollusca were Eocene, without definition as to the particular stage of that formation. It should be understood that the Ludian strata follow the Bartonian, and that they are variously regarded as topmost Eocene or the lowest Oligocene, such rocks being also known as Priabonian. We can only assume, therefore, although not definitely stated, that Dr. Oppenheim no longer regarded these deposits as Bartonian but Ludian.

The Jebel el Qatrani rocks, which succeed, without unconformity, the Qasr el Sagha Series, show a total thickness of some 270 metres, the beds extending from the base near the north-west of Qasr el Sagha to the summit of the escarpment, not far from the north-western area of Widan el Faras. Mr. Beadnell has numbered the beds from 1 to 54, the latter being near the base of the series and therefore the oldest. The more important of the fossiliferous bands are No. 49, where *Palæomastodon* and other associated vertebrates occur; No. 15, containing the estuarine mollusca *Unio*, *Lanistes*, *Turritella*, etc.; and No. 7, bed with similar estuarine shells as in No. 15, with, however, the addition of the marine shell *Pleurotoma ingens*. Some further mollusca of the same habit were obtained from about 14 kilometres north of Qasr el Sagha, these being regarded by Mr. Beadnell as on the same horizon of bed No. 15. As previously stated, the more estuarine shells from these deposits were determined by Dr. Blanckenhorn as Bartonian and on the same horizon as the 'Beauchamp Sands' of the Paris Basin.

According to Mr. Beadnell the Jebel el Qatrani Series consist of variegated sands and sandstones, with alternating beds of clay and clayey marls, in contradistinction to the older Qasr el Sagha Beds below, which are characterized by ever-recurring bands of limestone. The Jebel el Qatrani vertebrates are found very low down in the series, whereas the estuarine shells are located a hundred or more metres higher up, in the same section; it follows, therefore, that the vertebrates were first deposited and must of necessity be the most ancient. These vertebrates consist more exclusively of the remains of terrestrial mammals, while those of the Qasr el Sagha Series are mostly marine and estuarine, with only a few land mammals. Such difference in facies, together with the lithological variations noticeable in the beds themselves, have suggested the succeeding age of Bartonian for the Jebel el Qatrani vertebrates.

Turning for a moment to the Qasr el Sagha vertebrates, we find that they occupy a very high position in the section made by Mr. Beadnell of these beds, which are composed of thirty divisions, the fossils being restricted to beds 16, 17, 9, 7, and 2, in ascending order. The numerous mollusca occurring both above and below and throughout this series of deposits are referred to the Upper Mokattam horizon of Egypt, which is included in the Lutetian or Middle Eocene formation of Europe, some of the species occurring in Anglo-Parisian rocks of that age. Among the more characteristic shells are *Alectryonia Clot-beyi*, *Exogyra Fraasi*, *Carolia placunoides*, *Macrosolen Hollowaysi*, *Spondylus Egyptiacus*, *Turritella transitoria*, *Mesalia fasciata*, *Cerithium lamellosum*, *Naticina debilis*, *Lanistes antiquus*, etc. There has been no hesitation hitherto as to these Upper Mokattam Beds of Qasr el Sagha belonging to the Lutetian or Middle Eocene Series, and yet quite recently Dr. Dacqué, before referred to, considered that they belong to the Upper Eocene. There seems to be little difficulty, therefore, in accepting the Lutetian age for these beds, more especially when it is known that shells like *Alectryonia Clot-beyi* and *Carolia placunoides*, which are found above and below the strata containing the vertebrates, are also of frequent occurrence throughout the section, besides being met with in rocks of the same age in the Mokattam district and in the neighbouring country of Tunisia.

Returning to the consideration of the age of the Jebel el Qatrani Series of vertebrates, it is almost possible that, instead of regarding them as younger than Bartonian, as has been suggested, the field evidence might even favour an older period for their deposition. This suggestion would arise out of the fact that there is only a distance of a few metres between the base of the Jebel el Qatrani Series and Bed No. 2 of the Qasr el Sagha section, containing the youngest of the vertebrate remains of that series, and only some 70 metres below to Beds Nos. 16 and 17 where the chief of the vertebrates are found. In any case, a generic resemblance has been observed in the two sets of beds, and it is interesting to note that *Mœritherium* and *Stereogenys* occur alike in the Qasr el Sagha and the Jebel el Qatrani Series.

The Jebel el Qatrani mollusca now in the Egyptian Geological Survey Museum at Cairo consist of the following species, the 'Beds' referred to being those described by Mr. Beadnell, while the asterisks mark Dr. Blanckenhorn's published determinations.

GASTROPODA.

**Lanistes Bartonianus*, Blanckenhorn (Bed No. 15).
**Potamides scalaroides*, Deshayes (Bed No. 7).
**Potamides tristriatus*, Lamarck (Bed No. 7).
**Melania*, n.sp., Blanckenhorn [related to *M. Nysti*] (Bed No. 7).
**Cerithium tiarella*, Deshayes (Bed No. 7).
Pleurotoma ingens, Mayer-Eymar (Bed No. 7).
Turritella transitoria, Mayer-Eymar [related to *T. angulata*, J. de C. Sowerby] (Bed No. 7).

PELECYPODA.

Lithophagus allied to *cordatus*, Lamarck.
Arca, *Lucina*, *Tellina*, **Unio*, **Mutela*, **Spatha* (all these forms are probably from Bed No. 15).

The specimens mostly comprised hard calcareous sandstone casts, the smaller Gastropods being represented by hollow cavities, impressions of which were taken in wax so as to obtain a reproduction of the shell and its sculpture. In this way there is still preserved among the Egyptian fossils at the British Museum (Natural History) reproductions in wax of the two more important freshwater species, *Potamides scalaroides* and *tristriatus*. These I have quite recently re-examined; and I am still convinced that the original determinations are correct, and that in those species we have a fragment of a fauna which can only be synchronized with the 'Beauchamp Sands' of Paris, as demonstrated in Dr. Blanckenhorn's published paper of 1900.

According to the latest work on the geology of the Paris Basin, M. Lemoine[1] regards the 'Beauchamp Sands' as belonging to the Ermenouvillien stage of the Bartonian, which is quite the lower or older portion of that group of rocks, and consequently far removed from either the Ludian or Sannoisian–Stampian horizon, which some authorities have acknowledged as the more accurate age for the shells

[1] *Géologie du Bassin de Paris*, 1911, pp. 239–47.

in question. In the same treatise *Potamides tristriatus* is placed in the younger Lutetian beds of France (eastern region of the Paris Basin), known as the 'Calcaire Grossier Supérieur'.

The *Melania*, n.sp., has been briefly described by Dr. Blanckenhorn (Zeitsch. Deutsch. geol. Ges., vol. lii, footnote on p. 456, 1900), and reproduced in English by Mr. Beadnell (Fayum Memoir, 1905, footnote p. 60) as follows:—"It has 4–5 flat spiral rows, the uppermost of which on the last whorls is often more strongly developed, but not keel-shaped as in *M. muricata.* There are longitudinal ribs to the number of 8–12 over the whorls; the largest example was 9 millimetres long, and had 8 whorls." Dr. Blanckenhorn was further of opinion that this new form of *Melania* had its nearest relation in *M. Nysti* (Duchastel), Nyst, of the Lower Oligocene deposits of Europe.

With regard to the marine shells, *Cerithium tiarella* ranges from the Lutetian to the Bartonian, and never occurs in the Oligocene Series. On my determination a fragmentary sandstone cast was referred to *Pleurotoma ingens* of Mayer-Eymar. The original type of this shell had a length of 170 millimetres, and was described from the Upper Mokattam Beds of the Qasr el Sagha Series of the Fayum. In a similar way *Turritella Pharaonica* of Cossmann, or more accurately *T. transitoria* of Mayer-Eymar, a close ally of *T. angulata* of J. de C. Sowerby from the Indian Eocene and Oligocene rocks, which is well known in the Upper Mokattam Beds of the Fayum and the area of Mokattam near Cairo, is also a striking fossil of these deposits and usually well preserved.

On such evidence, therefore, we may conclude that the fluvio-marine mollusca of the Jebel el Qatrani Series present, if anything, a Lutetian–Bartonian facies rather than Sannoisian–Stampian or even Ludian. I am quite aware of the presence of Priabonian or Ligurian rocks, which are regarded as lowest Oligocene, outside the area of the Fayum depression, containing among other shells *Natica crassatina*, a species never found in Eocene strata, which was discovered and referred to in literature by Mayer-Eymar as coming from the 'Sandberger Hill', west of the great Pyramids and from beneath the basalts, although Dr. Andrews has given me to understand that the lava sheets are of considerable irregularity and probably of more than one age.

In dismissing this part of my subject, it certainly appears that if any permanent alteration were to take place in the stratigraphical views enunciated by Dr. Blanckenhorn and Mr. Beadnell with regard to the Fayum succession, it would be necessary to completely revise our previous conceptions as to the sequence of the Tertiary rocks of Egypt and adjacent countries.

III. The Lutetian Mollusca of the Fayum, with list of species, as monographed by Dr. Oppenheim.

A brief survey of the Mokattam or Lutetian shells of the Fayum, as described by Dr. Oppenheim in the *Palæontographica* for 1903 and 1906, will now be proceeded with.

Among the Pelecypoda, Ostreiform shells are largely represented, belonging to the genera *Gryphæa*, *Ostrea*, and *Alectryonia*, the last genus having both its valves plicated; *Alectryonia Clot-beyi* is frequently met with in the Fayum, occurring in the Ravine Series up to nearly the top of the Qasr el Sagha Series. The species is also represented in the Mokattam rocks near Cairo, and in the Lutetian deposits of Tunis, where it is associated with *Carolia placunoides*.

The Anomiidæ are represented by *Carolia placunoides*, a form related to the recent *Placuna* of the Pacific and the genus *Anomia*. In the young state this shell exhibits a large byssal foramen in the cardinal region which is gradually closed up with age, and forms interiorly a prominent transversely oval cartilage process. The species is found throughout the Fayum Lower Tertiary deposits, but more particularly in the Qasr el Sagha Series. It also occurs in other areas of Egypt, and in Tunisia, where it is recognized as of Lutetian age.

Pectens are rare, only one form having been found belonging to *Pseudamusium*; the genus *Plicatula* is well represented, one species, *P. polymorpha*, being characteristic of the Qasr el Sagha Beds; there are three species of *Spondylus* which occur in the Lower Mokattam beds, that of *S. Ægyptiacus* being probably the most frequently found; the interesting genus *Vulsella* is restricted to the Lower Mokattam Series, although one of the species, *V. crispata*, ranges from that horizon to the Priabonian of the Siwah Oasis of Egypt; species of the Nuculidæ are apparently rare, only one being referred to, while some forms of *Arca* and a species of *Cucullæa*, etc., are regarded as of Upper Mokattam age; *Glycymeris* (= *Pectunculus*), several species of *Cardita*, and *Crassatellites* also occur; species of *Lucina* are fairly common, as well as the allied genus, *Diplodonta*, *Divaricella* being also present; among the Cardiidæ, *Loxocardium* is represented; the presence of *Corbicula* in the Upper Mokattam Beds (Qasr el Sagha) is of interest in proving the estuarine character of those deposits; under the family Veneridæ are included several species of *Meretrix*, *M. sulcataria* of Lamarck being of importance as occurring besides in the Eocene deposits of the Paris Basin; Telliniform shells include the genera *Macaliopsis* and *Arcopagia*, while the genus *Macrosolen* of the Solenidæ occurs throughout the Mokattam Beds of Egypt, and is also found in the well-known Bracklesham deposits of England; a fine form of *Pholadomya* occurs in the rocks of the island on Birket el Qurun, as well as *Mactra compressa*, a species characteristic of the Bartonian of France and England; two species of *Corbula* are noted from the Upper Mokattam Beds, which is again evidence in favour of the estuarine origin of the deposits.

The Scaphopoda group is represented by one form, *Fustiaria Stromeri*.

The Gastropoda contain genera of the families Fissurellidæ, Patellidæ, Trochidæ, and Neritidæ, the last represented by the familiar *Velates Schmidelianus*, which is restricted to the Lower Mokattam deposits of Egypt, being known also to range from the lowest to the Middle Eocene horizons in India and Europe; *Turritellæ* are numerously represented in the Fayum throughout the Mokattam Series; the Capulidæ contain *Calyptræa aperta*, a species well known throughout the Eocene beds of France and England; various forms of Naticidæ are of frequent occurrence; among the Ampullariidæ are the two interesting freshwater shells *Lanistes antiquus* from the Lutetian Beds and *Lanistes Bartonianus* from the Bartonian, the former species being also found in the Mokattam Beds of the neighbourhood of Cairo; various specimens of the Melaniidæ occur, including *Bayania stygis*, found also in the Eocene of Italy, and *Diastoma costellatum*, which is known from the Mokattam Beds near Cairo, as also from the Lutetian and Bartonian horizons of Europe; *Terebellum sopitum* is found in the Lower Mokattam Beds of Muela and other areas of Egypt, occurring also in the Lutetian of the Paris Basin, besides ranging in England from Lutetian to Lower Oligocene times; there are shells belonging to the Cassididæ, Pyrulidæ, and Lampusidæ (Tritonidæ), as well as the Fusidæ, which contain some striking forms of the genus *Clavalithes*; the family Turbinellidæ is represented by the genus *Vasum*; the Melongenidæ contain *Heligmotoma*, *Pugilina*, and *Tudicla*; among the Volutidæ is *Voluta Arabica* of Mayer-Eymar, a preoccupied name, and for which that of *Voluta Beadnelli* [1] is now proposed; a giant form of a Pleurotomoid shell, *Surcula ingens*, has been found in the Qasr el Sagha and Jebel el Qatrani Series; shells belonging to the Bullidæ also occur in the Fayum, *Acera striatella* being characteristic of Parisian and English Eocene beds.

No forms of Cephalopods are referred to by Dr. Oppenheim as occurring in the Fayum, but Dr. Schweinfurth collected *Nautilus* in the 'Zeuglodon Valley', 12 kil. W.S.W. of Gar el Gehannem in the Birket el Qurun Series (Zeitsch. Ges. Erdkunde, Berlin, vol. xxi, p. 240, 1886); while Mr. Beadnell recorded specimens of the same genus from the Qasr el Sagha Series at the western end of Birket el Qurun accompanied by *Alectryonia Clot-beyi*, *Plicatula polymorpha*, etc. Mr. Beadnell also noted that the fossils from the 'Zeuglodon Valley' are found as pseudomorphs in sulphate of strontian (celestine).

Dr. Oppenheim's monograph on the older Tertiary mollusca of Egypt (*Palæontographica*, vol. xxx, pt. iii, pl. xxvii, p. 348, 1903 and 1906) recognized 141 species of shells as occurring in the Middle Eocene or Lutetian formation of the Fayum, composed of 83 Pelecypoda, Scaphopoda, and 57 Gastropoda; 45 of these species are known only in the Fayum, whereas the remainder are distributed over the other Lutetian areas of Egypt and further countries of Northern Africa, besides the Lutetian districts of Europe. In the following list the species follow the order and arrangement as adopted in that work, with some slight changes in nomenclature, an asterisk being placed against those forms which are restricted to the Fayum:—

PELECYPODA.

Family OSTREIDÆ.

*GRYPHÆA PHARAONUM, Oppenheim (= *Ostrea dorsata*, Fraas, *non* Deshayes; *Gryphæa Escheri*, Mayer-Eymar MS., *G. Gumbeli*, M.-E. MS., *G. Kaufmanni*, M.-E. MS.).

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[1] *Voluta Beadnelli*, nom. mut.

*G. WHITEHOUSEI, Oppenheim.
*G. EDMONDSTONEI, Oppenheim.
*G. (?) HISTRIO, Oppenheim.
*G. (?) ARABICA, Mayer-Eymar.
OSTREA ELEGANS, Deshayes, var. CORNIGERA, Mayer-Eymar.
O. FRAASI, Mayer-Eymar.
O. STANLEYI, Mayer-Eymar.
O. CAILLIAUDI, Mayer-Eymar.
O. RAMOSA, Mayer-Eymar.
O. PLICATA, Solander.
O. CUBITUS, Lamarck, var. PAUCICOSTATA, Oppenheim.
O. REILI, Fraas.
*O. SCHWEINFURTHI, Mayer-Eymar.
*O. SICKENBERGI, Mayer-Eymar.
O. HESSI, Oppenheim.
O. QERUNIANA, Mayer-Eymar (= *Ostrea Ægyptiaca*, Mayer-Eymar).
O. GIGANTICA, Solander (= *Ostrea latissima*, Deshayes; *O. longirostris*, Lamarck).
ALECTRYONIA CLOT-BEYI, Bellardi (= *Ostrea subarmata*, Bellardi).
A. SEMIPECTINATA, Schafhæutl (= *Ostrea suborbicularis*, Schafhæutl; *O. abscissa*, Schafhæutl; *O. Martinsi*, Archiac; *O. alticostata*, Mayer-Eymar).
*A. MEHEMETI, Oppenheim.
A. BELLARDII, Oppenheim (= *Ostrea* (*Alectryonia*) *Heberti*, Mayer-Eymar, *non* Coquand).

Family ANOMIIDÆ.

CAROLIA PLACUNOIDES, Cantraine (= *Placuna placenta*, Cailliaud, *non* Lamarck).

Family PECTINIDÆ.

PSEUDAMUSIUM MOELHENSIS, Mayer-Eymar.

Family SPONDYLIDÆ.

PLICATULA POLYMORPHA, Bellardi (= *Terebratella pyramidarum*, Fraas; *Plicatula abundans*, Mayer-Eymar; *P. Bovensis*, Oppenheim, *pars*).
P. BELLARDII, Mayer-Eymar (= *Plicatula Bovensis*, De Gregorio; *P. polymorpha*, Bellardi, *pars*).
P. INDIGENA, Mayer-Eymar (= *Plicatula Cairensis*, Mayer-Eymar; *P. Bovensis*, Oppenheim, *pars*).
*P. SCHWEINFURTHI, Oppenheim.
SPONDYLUS ÆGYPTIACUS, R. B. Newton.
S. ROUAULTI, Archiac.
S. PERHORRIDUS, Oppenheim.

Family PTERIIDÆ (= *Aviculidæ*).

VULSELLA CRISPATA, P. Fischer (= *Vulsella lingulata*, Lamarck; *V. Cailliaudi*, Zittel; *V. deperdita*, Mayer-Eymar).
*V. LIGNARIA, Oppenheim.
*V. MOELHENSIS, Oppenheim.
V. CHAMIFORMIS, Mayer-Eymar.

Family NUCULIDÆ.

*Nucula Mœridis, Oppenheim.

Family ARCIDÆ.

*Cucullæa Dimehensis, Oppenheim.
Arca subplanicosta, Oppenheim (= *Arca planicosta*, Fraas, *non* Deshayes).
A. uniformis, Oppenheim.
*A. sp., Oppenheim (= *Arca Edwardsi*, Mayer-Eymar, *non* Deshayes).
Barbatia tethyis, Oppenheim (= *Arca planicosta*, Fraas, *pars*).
Fossularca tenuifilosa, Cossmann, sp.
*Parallelipipedum Fajumensis, Oppenheim.
Glycymeris juxtadentata, Cossmann (= *Axinæa* and *Pectunculus*).
*G. Ægyptiaca, Oppenheim (= *Axinæa* and *Pectunculus*).

Family ASTARTIDÆ.

Cardita acuticostata, Lamarck (= *Cardita complanata*, Fraas; *C. multicostata*, Fraas; *Cardium obliquum*, Fraas).
C. Fajumensis, Oppenheim (= *Cardita* (*Cossmannella*) *Ægyptiaca*, Mayer-Eymar, *non* Fraas).
C. Mokattamensis, Oppenheim.
C. fidelis, Oppenheim.
C. mosis, Oppenheim.

Family CRASSATELLITIDÆ.

*Crassatellites (= *Crassatella*) Fajumensis, Oppenheim.
*C. (= *Crassatella*) Junkeri, Mayer-Eymar.
*C. (= *Crassatella*) puellula, Mayer-Eymar.
*C. (= *Crassatella*) trigonata, Lamarck.

Family LUCINIDÆ.

Lucina Pharaonis, Bellardi (= *L. bialata*, Bellardi; *L. Ægyptiaca*, Bellardi; *L. Mævusi*, Coquand; *L. subcircularis*, Fraas, *non* Deshayes; *L. evanida*, Fraas, *non* Deshayes; *L. pomum*, Mayer-Eymar, *non* Dujardin; *L. Libyca*, Cossmann).
Lucina Rai, Oppenheim (= *L. concinna*, Fraas, *non* Deshayes).
L. polythele, Oppenheim (= *L. Fortisiana*, Fraas, *non* Defrance).
L. calliste, Oppenheim.
L. gibbosula, Lamarck.
*L. Fajumensis, Oppenheim.
*Divaricella sinuosa, Bellardi, sp.
Diplodonta cycloidea, Bellardi, sp. (= *Lucina detrita*, Fraas, *non* Deshayes; *L. pomum*, Mayer-Eymar, *non* Dujardin).
D. inflata, Bellardi, sp.
D. corpusculum, Oppenheim.

Family CARDIIDÆ.

*Loxocardium Schweinfurthi, Mayer-Eymar, sp.

Family CORBICULIDÆ.

*Corbicula Blanckenhorni, Oppenheim.

Family CYPRINIDÆ.

*Cyprina Ægyptiaca, Oppenheim.

Family VENERIDÆ.

Meretrix (= *Cytherea*) transversa, J. de C. Sowerby.
M. (= *Cytherea*) sulcataria, Lamarck, sp.
M. (= *Cytherea*) Newboldi, Mayer-Eymar.
M. (= *Cytherea*) incrassata, J. Sowerby, sp. (= *Cyprina brevis*, Fuchs).

Family TELLINIDÆ.

Macaliopsis reticulata, Bellardi, sp.
M. plicatella, Mayer-Eymar, sp. (= *Tellina Bellardii*, Mayer-Eymar).
Mœra (?) Fajumensis, Oppenheim.
Arcopagia Zitteli, Mayer-Eymar, sp. (= *Tellina pellucida*, Mayer-Eymar, *non* Deshayes; *T. grandis*, Mayer-Eymar; *T. latissima*, Mayer-Eymar).

Family SOLENIDÆ.

Macrosolen Hollowaysi, J. Sowerby, sp. (= *Solen uniradiatus*, Bellardi; *S. obliquus*, Fraas; *Sanguinolaria* (*Macrosolen*) *Hollowaysi*, Mayer-Eymar; *Macrosolen Hollowaysi*, R. B. Newton).

Family PHOLADOMYIDÆ.

*Pholadomya Ægyptiaca, Oppenheim.
*Thracia Ægyptiaca, Oppenheim.

Family MACTRIDÆ.

Mactra compressa, Deshayes (= *M. depressa*, Deshayes & J. de C. Sowerby, *non* Lamarck).
*M. Fourtaui, Cossmann.
*Raeta Schweinfurthi, Mayer-Eymar, sp. (= *Lovellia Schweinfurthi*, Mayer-Eymar).

Family MYIDÆ.

Bicorbula Gallica, Lamarck, sp.
*Corbula Lyonsi, Oppenheim.
Tugonia Zitteli, Oppenheim.

Family GASTROCHÆNIDÆ.

Fistulana Ægyptiaca, Oppenheim.

SCAPHOPODA.

Family DENTALIIDÆ.

*Fustiaria Stromeri, Oppenheim.

GASTROPODA.

Family FISSURELLIDÆ.

*Fissurella acuticosta, Mayer-Eymar.

Family PATELLIDÆ.

*Patella facilis, Mayer-Eymar.

Family TROCHIDÆ.

Solariella humilis, Oppenheim (= *Turbo Parkinsoni*, Mayer-Eymar, *non* Basterot).

Family NERITIDÆ.

*Peloronta Fajumensis, Oppenheim.
Velates Schmidelianus, Chemnitz (= *Neritina grandis*, J. de C. Sowerby; *Patella Cairensis*, Fraas).

Family ARCHITECTONICIDÆ.

Architectonica subpatulum, Oppenheim.

Family TURRITELLIDÆ.

Turritella transitoria, Mayer-Eymar (= *T. angulata*, Bellardi, *non* J. de C. Sowerby; *T. Pharaonica*, Cossmann).
T. vinculata, Zittel (= *T. Parisiana*, Mayer-Eymar).
T. Lessepsi, Mayer-Eymar (= *Mesalia oxycrepis*, Cossmann, *non* Mayer-Eymar).
T. pseudimbricataria, Oppenheim (= *T. Desmaresti*, Mayer-Eymar, *non* Basterot).
*T. Crocodili, Oppenheim.
*T. fraudatrix, Oppenheim.
T. carinifera, Deshayes.
Mesalia Hofana, Mayer-Eymar (= *Mesalia electa*, Locard).
M. Locardi, Cossmann (= *M. obruta*, Locard).
M. fasciata, Lamarck, sp. (= *T. fasciculata*, Fraas; *T. bilirata*, Mayer-Eymar).
*M. analoga, Oppenheim.

Family VERMETIDÆ.

Serpulorbis clathratus, Deshayes, sp.

Family XENOPHORIDÆ.

Tugurium agglutinans, Lamarck, sp. (= *Trochus umbilicaris*, Solander; *Xenophora splendida*, Vinassa de Regny).

Family CAPULIDÆ.

Calyptræa aperta, Solander, sp. (= *Calyptræa trochiformis*, Lamarck; *C. pectinata*, Mayer-Eymar).
Hipponyx Mokattamensis, Oppenheim (= ? *Crepidula indigena*, Mayer-Eymar).

Family NATICIDÆ.

AMPULLINA LONGA, Bellardi, sp. (= *Natica spirata*, Fraas; *N. ammonis*, Blanckenhorn).
A. SIGARETINA, Lamarck, sp.
*NEVERITA CLEOPATRÆ, Oppenheim.
NATICINA ÆGYPTIACA, Oppenheim.
N. DEBILIS, Bayan, sp.

Family AMPULLARIIDÆ.

LANISTES ANTIQUUS, Blanckenhorn (= *L. Bolteni*, Mayer-Eymar, *non* Chemnitz; *Ampullaria subcarinata*, Bellardi, *non* G. B. & J. Sowerby).

Family MELANIIDÆ.

*BAYANIA STYGIS, Brongniart, sp. (= *Melania melaniæformis*, Bayan).
DIASTOMA COSTELLATUM, Lamarck, sp. (= *M. costellata*, var. *Roncana*, Brongniart; *M. elongata*, De Gregorio).

Family CERITHIIDÆ.

CERITHIUM LAMELLOSUM, Bruguière.
POTAMIDES FAJUMENSIS, Oppenheim.
P. ORENGÆ (Vidal), Cossmann.

Family APORRHAIDÆ.

APORRHAIS ARTINI, Mayer-Eymar, sp.

Family STROMBIDÆ.

RIMELLA (?) ÆGYPTIACA, Oppenheim.
PEREIRÆA BEYRICHI, Mayer-Eymar.
TEREBELLUM SOPITUM, Solander, sp. (= *T. convolutum*, Lamarck).

Family CASSIDIDÆ.

CASSIS NILOTICA, Bellardi (= *Cassis tricarinata*, Fraas).
C. ÆGYPTIACA, Oppenheim.

Family PYRULIDÆ.

*PYRULA RAI, Oppenheim (= ? *Pyrula nexilis*, Bellardi; *Ficula tricarinata*, Mayer-Eymar).

Family LAMPUSIDÆ (= Tritonidæ).

LAMPUSIA (= TRITONIUM) cf. VIPERINA, Lamarck.

Family BUCCINIDÆ.

*LATRUNCULUS STROMERI, Oppenheim.

Family FUSIDÆ.

CLAVALITHES LONGÆVUS, Solander, sp. (= *Fusus scalaris*, Lamarck).
C. GONIOPHORUS, Bellardi, sp.
*C. SPINOSUS, Mayer-Eymar.
C. NOÆ, Chemnitz, sp.

Family TURBINELLIDÆ.

VASUM FREQUENS, Mayer-Eymar, sp. (= *Voluta labiella*, Fraas, *non* Lamarck).

Family MELONGENIDÆ.

HELIGMOTOMA NILOTICUM, Mayer-Eymar.
*PUGILINA KOENENI, Mayer-Eymar.
*TUDICLA UMBILICARIS, Mayer-Eymar.

Family VOLUTIDÆ.

VOLUTA BEADNELLI,[1] R. B. Newton, nom. mut. (= *Turbinella prisca*, Locard, *non* Conrad; *Voluta Arabica*, Mayer-Eymar, *non* Gmelin).

Family HARPIDÆ.

HARPA MUTICA, Lamarck.

Family PLEUROTOMIDÆ.

*SURCULA INGENS, Mayer-Eymar.
PLEUROTOMA FAJUMENSIS, Oppenheim.

Family BULLIDÆ.

*BULLA OASIDIS, Oppenheim.
*B. DESERTORUM, Oppenheim.
ACERA STRIATELLA, Lamarck.
*A. STROMERI, Oppenheim.

IV. OBSERVATIONS ON SOME NEW, OR OTHERWISE INTERESTING, GASTROPODA FROM THE EOCENE DEPOSITS OF THE FAYUM.

The following account deals with certain forms of Gastropods which are of interest, either on account of good preservation or because of some suggested alteration in their nomenclature; it also includes some new or unrecorded species from this area of Egypt.

LANISTES ANTIQUUS, Blanckenhorn. Pl. III, Figs. 1, 2.

Cirrus, Orlebar, Journ. Bombay Branch Roy. As. Soc., 1846, p. 243, pl. iii, fig. 18 (Geology Egyptian Desert).

Ampullaria subcarinata, Bellardi, Mem. R. Accad. Sci. Torino, ser. II, vol. xv, p. 176, pl. i, fig. 10, 1854 (Foss. Nummulit. Egitto), *non* G. B. & J. Sowerby, 1822.

A. (*Lanistes*) *Bolteni*, Mayer-Eymar, Viertelj. Naturf. Ges. Zurich, vol. xlvi, p. 23, pl. i, figs. 1–2, 1901 (Gastropoden Untertertiär Egyptens), *non* Chemnitz.

Lanistes antiquus, Blanckenhorn, Centralblatt Mineral., 1901, No. 9, p. 271, woodcut figures 1, 2 (Palaeogens in Aegypten).

L. subcarinatus, Oppenheim, Palæontographica, vol. xxx, pt. iii, p. 277, pl. xxvi, fig. 1, 1906 (Alttertiärer Faunen Ägypten).

Remarks.—During some palæontological explorations in the Fayum in 1902, Dr. C. W. Andrews was fortunate in collecting some

[1] *Voluta Beadnelli*, nom. mut.

interesting molluscan remains from the Qasr el Sagha Beds, among them being a giant form of the freshwater shell *Lanistes antiquus*, which is worthy of placing on record. Its measurements are diam. 85, height 50 mm. The largest example previously known appears to be that mentioned by Dr. Blanckenhorn, exhibiting a diameter of 53 and a height of 28 mm. The specimen under consideration is a natural cast formed of a yellowish-red sandy matrix, with no vestige of shell-structure remaining; small fragmentary ostreiform shells are seen in the rock material filling up the aperture. It belongs to the depressed forms of *Lanistes*, of which Olivier's *Ampullaria carinata* may be regarded as the type. The volutions, numbering about five, are fairly deep and laterally compressed, while the base shows considerable inflation, being besides furnished with a wide and deeply excavated umbilical region, in which the inner whorls are well exposed. According to Mr. Beadnell's section of the Qasr el Sagha Beds (p. 51 of his memoir), this mollusc occurs in Bed 18, associated with marine shells, hence we may assume that the deposits were laid down under estuarine or brackish-water conditions. The Qasr el Sagha Series belongs to the Upper Mokattam or Parisian division of the Eocene, and are consequently of Lutetian age. This species was originally figured by Orlebar from the 'Yellow Limestone' of the Mokattam Hills as *Cirrus*, and subsequently by Bellardi as *Ampullaria subcarinata* from the Nummulitic beds in the neighbourhood of Cairo. Without any reference to these two writers, Mayer-Eymar, nearly fifty years later, claimed the shell as belonging to the recent form of Chemnitz's *Helix terrestris Bolteniana contraria*, and so figured and described it as *Ampullaria* (*Lanistes*) *Bolteni*, from the Upper Parisian of Egypt (near Dimé, and the north of Mokattam), being found in the *Alectryonia Clot-beyi* beds of that formation. Dr. Blanckenhorn next discussed the shell, pointing out its wrong determination as a recent species, and established for it the new name of *Lanistes antiquus*. In the latest account of this fossil Dr. Oppenheim restored Bellardi's name, recognizing it as *Lanistes subcarinatus*. From the synonymy now offered it is apparent that *Ampullaria subcarinata*, as determined by Bellardi, is no longer tenable, because much earlier in the last century G. B. and James Sowerby (Genera of Shells, 1822) had used the same name for a recent shell from the Congo River of Africa. It follows, then, that Dr. Blanckenhorn's *Lanistes antiquus* should be the recognized name for this shell. The genus *Lanistes* appears to be entirely restricted to African freshwaters at the present day; and the fossil species now referred to, in all probability, represents the ancestral form of *L. carinatus*, Olivier, sp. (= *L. Bolteniana*), which exists in Birket el Qurun, in the Nile, near Alexandria, and at numerous other places on the same river or its tributaries, as far south as the Victoria Nyanza (according to Professor E. von Martens, Deutsch-Ost-Afrika, vol. iv, p. 169, 1898), Lake Dembea, etc., and occurring also in some profusion in the younger Post-Pliocene deposits of the Fayum depression.

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

RHOPALITHES GONIOPHORUS, Bellardi. Pl. IV, Fig. 1.

Fusus goniophorus, Bellardi, Cat. Foss. Nummulit. Egitto: Mem. R. Accad. Sci. Torino, ser. II, vol. xv, p. 181, pl. i, fig. 8, 1854.

Clavalithes goniophorus, Oppenheim, Zur Kenntn. alttertiärer Faunen Ägypten: Palæontographica, vol. xxx, pt. iii, fasc. 2, p. 315, pl. xxiii, fig. 6, 1906.

Remarks.—I have regarded this species as belonging to Grabau's genus *Rhopalithes*, which has been established on protoconchal characters besides the presence of two or more oblique plications on the columella, and the type of which is *Fusus Noæ* of Lamarck from the Lutetian and Bartonian of the Paris Basin (see *Phylogeny of Fusus and its Allies*: Smithsonian Miscellaneous Collections, vol. xliv, No. 1417, p. 135, 1904). A form from Dimé has been well figured by Dr. Oppenheim agreeing in all essentials with the present specimen from the same series of beds near Qasr el Sagha, although the latter is without its apical whorls. The angulated character of the spire is characteristic. The whorls, of which there are four or five, possess a very narrow and horizontal sutural platform, followed by an obliquity reaching to a median carination, from which proceeds a vertical basal region to the suture. A well-marked obtuse carination occurs on the anterior area of the body-whorl, followed by a prolonged canal. This species is closely related to *Fusus Noæ* of Lamarck, but differs in its more angulate whorls, in the much contracted and more elongate aperture, and in the possession of depressed sides to the body-whorl. Bellardi's original figure of the shell represents a very imperfect specimen, although the obliquity of the whorl posteriorly is well seen. We are indebted, however, to Dr. Oppenheim for the most useful figure of this form, which gives a dorsal view of an excellent example exhibiting the early whorls of the spire with their narrowly rounded and elevated vertical costæ, crossed by numerous horizontal spiral striations. In the succeeding volutions of the same specimen the posterior obliquity and the anterior vertical surface of each are well displayed. According to Dr. Oppenheim this fossil belongs to the Upper Mokattam Beds of the neighbourhood of Cairo as well as of the Fayum, and is therefore of Lutetian age.

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

CLAVALITHES BEADNELLI, n.sp. Pl. IV, Fig. 2.

Shell of large size, robust, scalariform, smooth; whorls deep, laterally compressed, vertical, sulcated posteriorly, and surmounted by a wide horizontal sutural platform (*rampe* of French authors), with projecting margin; last whorl moderately inflated from the lower margin of the sulcation to a depth of 32 millimetres, when contraction sets in to form the narrow anterior canal; columella covered with a spreading callus; sculpture consisting of obscure concentric ridges crossed by numerous, closely set, extremely fine and microscopical striations. Diam. 80 mm.; penultimate whorl, diam. 58, depth 25 mm.

Remarks.—This specimen is a large robust type of shell with remains of the four last whorls, and a very much fractured apertural region, and is doubtless closely allied to *Fusus scalaris* of Lamarck, found in the Lutetian and Bartonian Beds of Europe, excellent figures of which are to be seen in Deshayes's Descr. Coq. Foss. Paris, vol. ii, p. 525, pl. lxxii, figs. 13, 14, 1835. It differs, however, not only in size, but in the possession of the widely excavated sulcation, which forms so prominent a character beneath the margin of the projecting *rampe*. This sulcation has a maximum width of 15 millimetres, the *rampe* also offering a similar measurement. There is no corresponding furrow in Lamarck's species referred to, and only a slight depression exists, which merges rapidly into the ordinary inflation of the whorl. The Fayum shell has besides vertically-sided whorls to the spire, whereas in *scalaris* they are gently sloping. The smoothness of the projecting margins would also separate it from *Murex longævus*, which, according to Solander's old figures, pl. ii, fig. 40, and pl. vi, fig. 73, exhibits a form with mostly irregular and spinous outer margins to the sutural shelf or *rampe*. *Clavalithes* and its species have been studied by Dr. A. W. Grabau, and his work on the *Phylogeny of Fusus and its Allies* (Smithsonian Miscellaneous Collections, vol. xliv, No. 1417, p. 117, 1904) supplies us with much valuable knowledge on the evolutionary characters of this genus. According to M. Cossmann (*Essais de Paléoconchologie Comparée*, 1901, pt. iv, p. 18) the genus ranges through the Eocene, Oligocene, Miocene, and Pliocene formations, and a well-characterized species lives at the present day in Polynesia (*C. serotina*, Hinds).

I have united the name of Mr. Beadnell with this fine example of *Clavalithes* in recognition of his critical and careful work on the geological structure of the Fayum depression.

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

CLAVALITHES SOLANDERI, Grabau. Pl. IV, Fig. 3.

Murex longævus, Solander, *Fossilia Hantoniensia*, 1766, p. 22, pl. viii, fig. 93 (*non* figs. 40 and 73 = the true *longævus*).

Fusus longævus, J. Sowerby, *Mineral Conchology*, 1814, vol. i, pl. lxiii.

Clavalithes Solanderi, Grabau, Smithsonian Miscellaneous Collections, 1904, No. 1417, p. 123, pl. xiv, figs. 5, 6, pl. xv, figs. 1, 2, and text-figs. pp. 123–5.

C. longævus, Oppenheim, Palæontographica, vol. xxx, pt. iii, sect. 2, p. 315, 1906, *non* Solander.

Remarks.—This is a form separated by Dr. Grabau from the true *Murex longævus* of Solander, which possesses irregular and spinous outer margins to the posterior shelves of the volutions. The same author regards as a gerontic example of this species James Sowerby's *Fusus longævus*, figured in 1814, pointing out that the spinous prolongations seen on that specimen are the result of age, and that they are only present on the sutural platform of the last whorl. The Fayum fossil appears to be of medium size, consisting of about seven volutions which are well elevated, closely fitting, and very narrowly shelved. Well-marked sculpture is seen on the three earliest whorls, consisting of fairly distant and swollen longitudinal costæ crossed by spiral striations; the succeeding whorls are spirally and longitudinally striate. More mature forms of this species from English localities show a greater development of sutural platform.

Distribution.—This form is unknown in the Paris Basin, although it is a frequent British fossil, being found at Barton, in the Upper Eocene, and occurring also in the Lutetian or Middle Eocene of Bramshaw, Bracklesham Bay, Brook, and Huntingbridge.

This specimen was collected from the south of Dimé, and it forms one of the duplicate specimens presented to the British Museum (Nat. Hist.) by the Geological Survey of Egypt.

Formation.—Lutetian (Middle Eocene).

Locality.—South of Dimé (H. J. L. Beadnell).

Hemifusus errans, Solander. Pl. IV, Fig. 4.

Strombus errans, Solander, Brander's *Fossilia Hantoniensia*, 1766, p. 23, pl. ii, fig. 42.

Fusus errans, J. de C. Sowerby, *Mineral Conchology*, vol. iv, p. 139, pl. 400, 1823; and in Dixon's *Geology of Sussex*, 1850, pp. 104, 185, pl. vii, fig. 31.

F. (*Hemifusus*) *errans*, A. von Koenen, "Norddeutsche unter-Oligocän Mollusk.-Fauna": Abhandl. geol. Specialkarte Preussen, etc., vol. x, p. 233, pl. xvii, fig. 5, 1889.

Chrysodomus errans, R. B. Newton, *Syst. List Edwards Coll., Brit. Mus., British Oligocene and Eocene Mollusca*, 1891, p. 157.

Semifusus (*Mayeria*) *errans*, Cossmann, *Essais de Paléoconchologie Comparée*, 1901, pt. iv, p. 93, pl. iv, fig. 13.

Solander's original description of this shell is as follows: "Testa striata, anfractibus carina acuta notatis. Testa oblongo-ovata, utrinque conica, transversim striata, ventre anfractibusque omnibus carina acuta notatis."

Remarks. — With the exception of mineralization the specimen referred to this species is fairly well preserved. The general contour is biconical, while the spire, which is shorter than the aperture, is strikingly carinated on each volution, the posterior surfaces of which are wide and oblique, besides being depressed and spirally striated. The spiral ridges of the body-whorl are coarser and thicker than in European forms of the species, probably largely due to mineralization. Crossing the spiral sculpture are numerous regularly arranged oblique striations, which, however, are more evident on the body-whorl than elsewhere.

A little fracturing has taken place on the front aspect of the specimen, although the straightness and smoothness of the columella are to be observed, as well as the narrow elongate aperture which bends slightly inwards at the base to form a moderately open and short canal; the posterior angulation is rather longer and more sloping than in European examples, although it is noticeable that a fragment of a Spondyloid shell has attached itself to the external surface of that region of the aperture, thus producing a longer obliquity than may really exist there. Length 50, diam. 30 mm.

Distribution.—The species has a wide distribution, being found in the London Clay, the Bracklesham and Barton Beds of England, and, according to Von Koenen, in the Lower Oligocene deposits of Northern Germany (Helmstadt).

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

MELONGENA ANDREWSI, n.sp. Pl. IV, Figs. 5, 6.

Shell ovately pyriform, thick, solid, smooth, regularly margined; whorls depressed, only slightly elevated, slightly concave, increasing about one-third, vertical, subangulate, and narrowly exposed at the suture; base terminating in a narrow short canal, and laterally furnished with a thickened, transversely twisted, semicircular wall, which circumscribes an elongate umbilical cavity; aperture elongate, narrow, slightly dilated, bending moderately inwards at base to form anterior canal, posteriorly angulated and oblique; columella smooth, covered with an extensive callus, which extends considerably over the umbilical excavation; sculpture consisting of microscopically fine and obscure spiral striations, crossed by numerous and much more evident longitudinal lines of growth, arranged more or less in equidistant groups, which curve outwards in their descent, then inwards, becoming part of the twisted umbilical wall at the base. Height 52, diam. 35 mm.

Remarks.—This shell, on account of its robust and thick test, is in a remarkably good state of preservation. It is one of the smooth and regularly margined examples of *Melongena*, being related among recent shells to the form of *Pyrum paradisiacum* of Martini, as adopted by Reeve under the genus *Pyrula* (*Conchologia Iconica*, 1847, pl. v, fig. 17*b*), which may possess either a nodulose or smooth spiral region. The fossil is also characterized by the closely fitting, depressed, and only slightly elevated whorls, which are nearly on the same plane, and by the umbilical details at the base. The extremely fine ornamentation of the surface, when well preserved, amounts almost to a delicate decussation.

It may be mentioned that Mayer-Eymar has described *Melongena* (*Pugilina*) *Koeneni* from the Lutetian (Upper Parisian) of 'Jebel Schweinfurth' to the south of Dimé in the Fayum (Journ. Conchyl., vol. xlvi, p. 233, pl. xiv, fig. 1, 1898), which differs from the present shell in possessing strong spiral ridges, a modulated spire, and marginal irregularities.

The specimen appears to represent quite a new type of shell among fossil mollusca, and I am not aware of any similar form having been recorded from the Lower Tertiary strata of Northern Africa, Europe, or India.

According to M. Cossmann (*Essais de Paléoconchologie Comparée*, 1901, pt. iv, pp. 85, 86) the true *Melongena* commenced in the Oligocene (Tongrian) period, and is living at the present day in the Indian Ocean. The specific name is suggested in honour of the collector, Dr. C. W. Andrews, F.R.S., of the British Museum, to whom we are indebted for our knowledge of the fossil vertebrata of the Fayum province of Egypt.

Formation.—Lutetian (Middle Eocene).

Locality.—Near Qasr el Sagha (Dr. C. W. Andrews).

VOLUTA BEADNELLI, nom. mut.

Turbinella prisca, Locard, Moll. Tert. inf. Tunisie, 1888, p. 7, pl. vii, fig. 4 (*non* Conrad).

Voluta (*Volutolyria*) *Arabica*, Mayer-Eymar, Journ. Conchyl., vol. xliii, p. 52, pl. iii, fig. 1, 1895 (*non* Gmelin).

V. Arabica, Cossmann, Bull. Inst. Égyptien, 1901, p. 177, pl. i, fig. 2; Oppenheim, Palæontographica, vol. xxx, pt. iii, fasc. 2, p. 327, pl. xxiv, figs. 12, 13, 1906.

Remarks.—This entry is made to call attention to the necessity of introducing a new specific name in place of *Voluta Arabica*, which is preoccupied.

Formation.—Lutetian (Upper Mokattam).

Locality.—Near Dimé.

This species is also found in rocks of the same age in the neighbourhood of Cairo.

TURRITELLA TRANSITORIA, Mayer-Eymar. Pl. III, Figs. 3, 4.

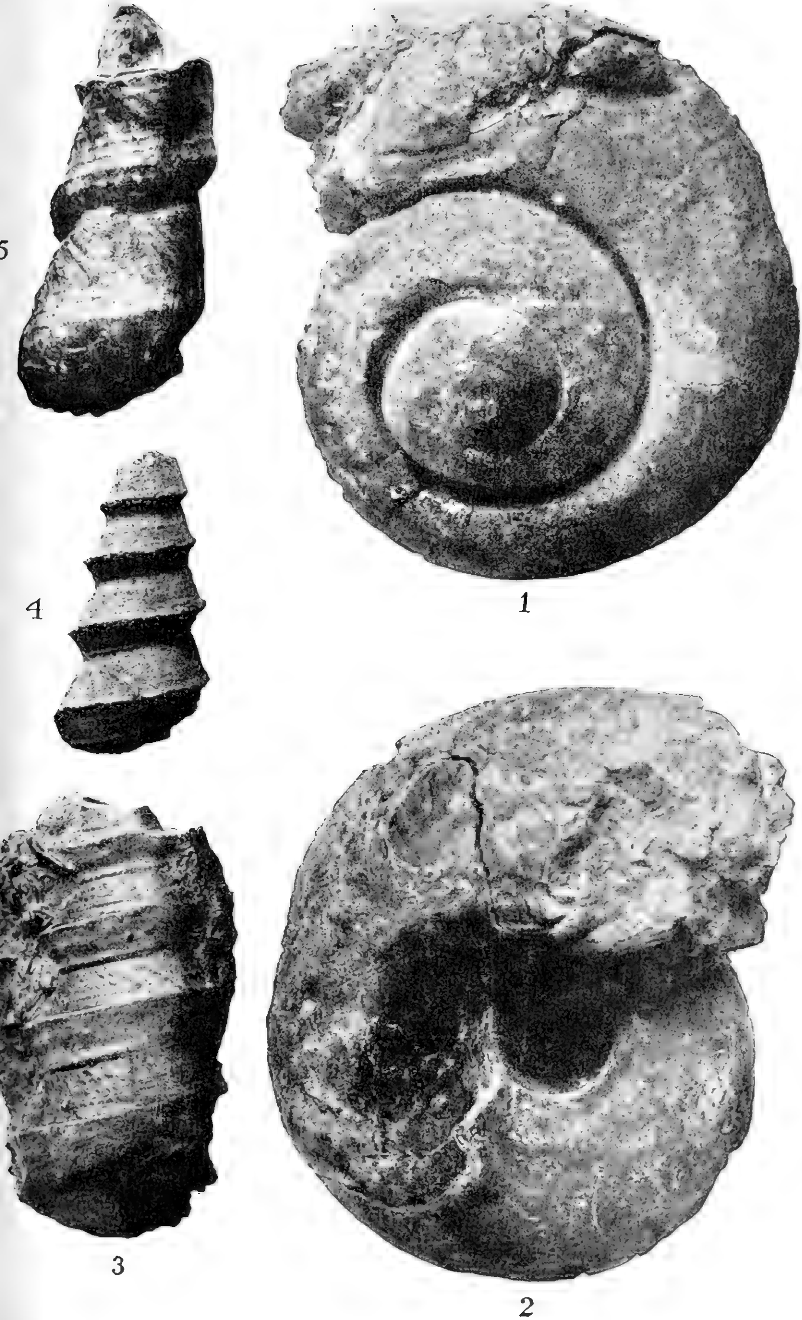
Turritella angulata, Bellardi, Mem. R. Accad. Sci. Torino, ser. II, vol. xv, p. 175, 1854 (*non* J. de C. Sowerby).

T. transitoria, Mayer-Eymar, Palæontographica, vol. xxx, p. 76, pl. xxiii, fig. 6, 1883.

T. Pharaonica, Cossmann, Bull. Inst. Égyptien, 1901, p. 181, pl. ii, figs. 1, 2; Beadnell, Topogr. Geol. Fayum, Egypt, 1905, pp. 34, 35; Oppenheim, Palæontographica, vol. xxx, pt. iii, fasc. 2, p. 237, pl. xxiii, fig. 10, 1906.

Remarks.—This shell was originally recognized from Egypt by Mayer-Eymar as Archiac's *T. angulata* of India, but according to M. Cossmann certain differences exist which demanded their separation, hence his introduction of *T. Pharaonica* for the Egyptian fossil. Previously, however, Mayer-Eymar described *T. transitoria* from the Upper Mokattam deposits of the island (Geziret el Qorn) on Birket el Qurun in the Fayum, which certainly appears to be Cossmann's *T. Pharaonica*, but exhibiting a spirally granulate sculpture, much more clearly preserved than is generally the case with ordinary Fayum fossils, otherwise the ornamentation is quite similar although much more obscure, the granulations having been smoothed down, or sometimes entirely removed by erosive agencies. The mere fact that Mayer-Eymar's figure shows a slightly more slender form of this species than usually obtains, forms no real distinction, as much variation is observable among a number of examples. Strange to say, Dr. Oppenheim admits *T. transitoria* in his synonymy, and yet adopts *T. Pharaonica* for the shell, a name established some eighteen years later. There is no alternative, therefore, but to recognize Mayer-Eymar's name of 1883. Two specimens are now figured, one large form from the Qasr el Sagha deposits, and an intermediate example which is of considerable interest, having been found in the Jebel el Qatrani Series associated with the estuarine mollusca previously referred to in this address.

These specimens were among some duplicates presented to the British Museum (Natural History) by the Geological Survey of Egypt.



EOCENE GASTROPODA FROM THE FAYUM PROVINCE OF EGYPT.

Formations.—Lutetian (Middle Eocene) and Bartonian (Upper Eocene).

Localities.—South of Dimé; Jebel el Qatrani (H. J. L. Beadnell).

TURRITELLA OPPENHEIMI, nom. mut. Pl. III, Fig. 5.

Turritella carinifera, Deshayes, Descr. Coq. Foss. Paris, vol. ii, p. 273, pl. xxxvi, figs. 1, 2, 1833 (*non* Lamarck),[1] 1822; Mayer-Eymar, Palæontographica, vol. xxx, p. 76, pl. xxiii, fig. 8, 1883; Cossmann, Bull. Inst. Égyptien, 1901, p. 181, pl. ii, figs. 5, 6; Oppenheim, Palæontographica, vol. xxx, pt. iii, p. 248, 1906.

Remarks.—The specimen figured on this occasion is in a fragmentary condition, with a somewhat eroded and polished exterior, although, otherwise, it forms a striking example of the adult condition of this species. It exhibits the oblong contour of the whorls, with their slightly excavated surfaces, ornamented with equidistant spiral striations of more or less granulate structure, and crossed by deeply sinuous lines of growth; the doubly margined and prominent anterior carination is, likewise, most evident. Attention is principally called to this shell, however, because of an alteration necessitated in its specific name. Known hitherto as *Turritella carinifera* of Deshayes, it is imperative to point out that the same designation had been previously introduced into literature by Lamarck for quite a different form of *Turritella*; hence the proposed new name of *T. Oppenheimi* is suggested to replace that of Deshayes, in admiration of Dr. Paul Oppenheim's researches on the older Tertiary shells of Egypt.

Distribution.—This species occurs throughout the Eocene series of the Paris Basin (see Cossmann, Ann. Soc. R. Mal. Belgique, vol. xxiii, p. 296, 1888), and in the Middle Eocene or Lutetian beds of England (R. B. Newton, *Syst. List Edwards Coll. British Oligocene and Eocene Mollusca, British Museum*, 1891, p. 205). Mayer-Eymar recorded a well-preserved fragment from the island on Birket el Qurun. Cossmann described it from the neighbourhood of Dimé, and Oppenheim has recognized the shell from similar localities, as well as numerous other places in Egypt, especially in the neighbourhood of Cairo and the Pyramids.

This specimen forms one of the duplicates presented to the British Museum (Natural History) by the Geological Survey of Egypt.

Formation.—Lutetian (Middle Eocene).

Locality.—South of Dimé (H. J. L. Beadnell).

EXPLANATION OF PLATES III AND IV.

All figures are photographed natural size.

PLATE III.

LANISTES ANTIQUUS, Blanckenhorn.

FIG. 1. Spiral view of a large example of this species, preserved as a calcareous sandstone cast.

,, 2. Basal view of same specimen, showing a great umbilical depth with the inner volutions. The costated remains of a small Ostreiform shell are present in the matrix of the aperture.

[1] Hist. Nat. Anim. sans Vert., vol. vii, p. 59, 1822.

TURRITELLA TRANSITORIA, Mayer-Eymar.

FIG. 3. Front aspect of an adult fragmentary example, much polished from wind and sand erosion, although partially preserving the spirally granulate ornamentation of this species.

,, 4. Dorsal view of a medium-sized specimen, with four whorls, showing obscure sculpturing and granulated margins to the carinations. This is one of the few marine shells found in the Jebel el Qatrani beds, and is therefore of Bartonian or Upper Eocene age.

TURRITELLA OPPENHEIMI, nom. mut.

FIG. 5. A fragmentary adult specimen, somewhat polished through sand and wind erosion, showing the elongate and slightly excavated whorls with the basal carination and fairly deep suture. The equidistant spiral striations and sinuous growth-lines are also well seen.

PLATE IV.

RHOPALITHES GONIOPHORUS, Bellardi, sp.

FIG. 1. Front view of an eroded specimen, showing the narrowly elongate aperture, the vertical and obliquely constituted whorl with its median carination, as well as obscure evidence of sculpture on the earlier whorls (= marginal tuberculation).

CLAVALITHES BEADNELLI, n.sp.

FIG. 2. Latero-dorsal view of the only example known, showing the prominently sulcated, vertical whorls and the horizontal sutural region. The body-whorl exhibits a part of the columellar callosity. The perforations on the surface of this specimen are probably of some organic origin.

CLAVALITHES SOLANDERI, Grabau.

FIG. 3. Dorsal view of a medium-sized specimen, showing the tall and closely built whorls, with no evidence of irregular or spiny margins.

HEMIFUSUS ERRANS, Solander, sp.

FIG. 4. Dorsal aspect of shell, with the characteristic form and ornamentation of this species.

MELONGENA ANDREWSI, n.sp.

FIG. 5. Front view of the only specimen known, showing the depressed and slightly elevated whorls, the narrow and elongate aperture, and the narrow basal umbilical perforation bounded by an inflated outer margin.

,, 6. Dorsal view of same, exhibiting fine sculpture striations and the swollen twisted region at the base which circumscribes the perforation.

The specimens figured are preserved in the British Museum (Natural History).

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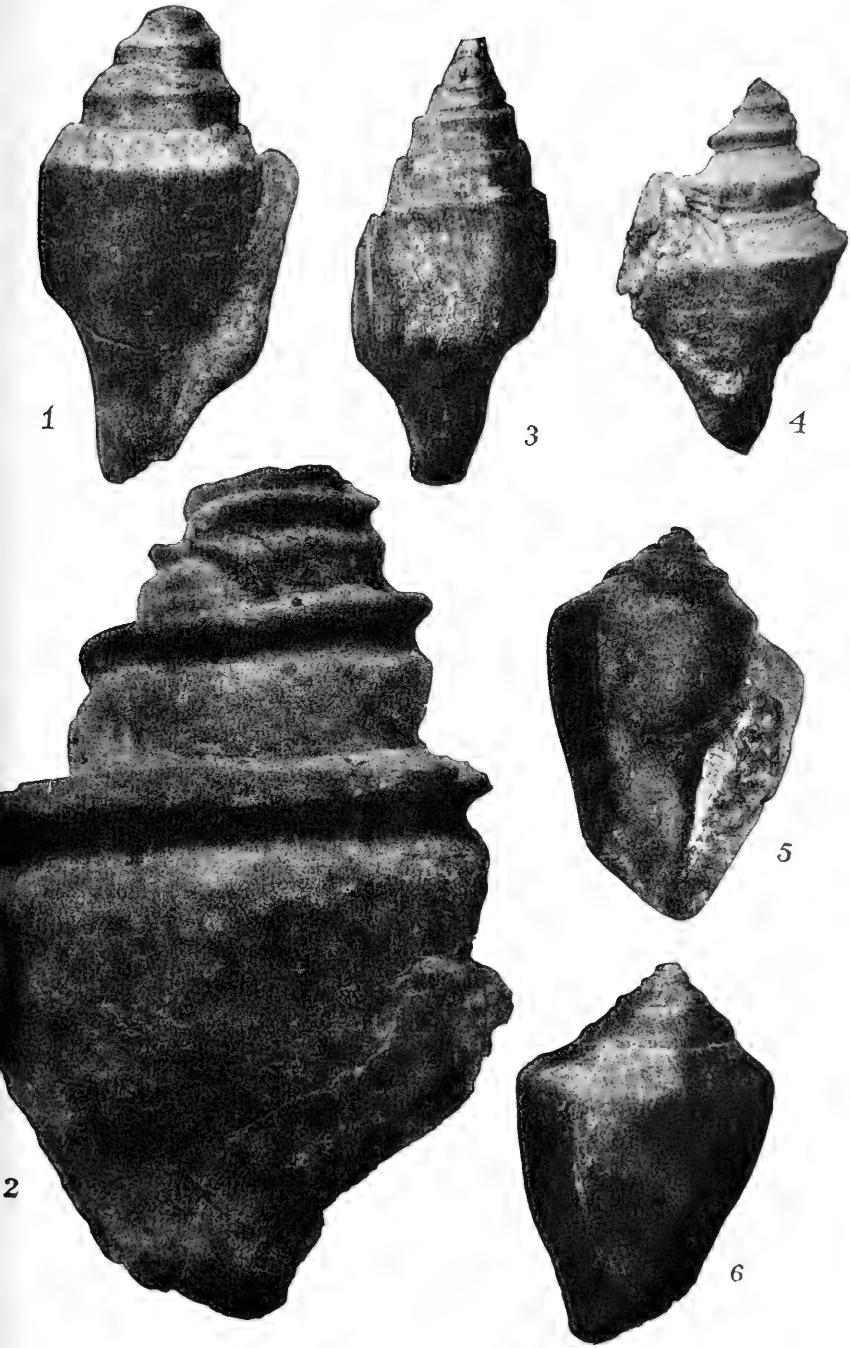

EOCENE GASTROPODA FROM THE FAYUM PROVINCE OF EGYPT.

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FELIX (J.). "Korallen aus ägyptischen Tertiärbildungen": Zeitsch. Deutsch. Geol. Ges., vol. xxxvi, pp. 415–53, pls. iii–v, 1884.

MAYER-EYMAR (C.). "Die Versteinerungen der Tertiären Schichten von der westlichen Insel im Birket el Qurun See": Palæontographica, vol. xxx, pp. 67–77, pl. xxiii, 1883.

This memoir contains descriptions and figures of Fayum mollusca collected by Schweinfurth in 1879, which were supposed to possess a Bartonian facies (now regarded as of Lutetian or Middle Eocene age):—

PELECYPODA.—*Ostrea plicata*, Defrance; *O. digitalina*, Dubois; *O. gigantea*, Solander; *O. longirostris*, Lamarck; *O. producta*, Delbos & Raulin; *Arca Edwardsi*, Deshayes; *Lucina pomum*, Dujardin; *L.* cf. *tabulata*, Deshayes; *Cardium Schweinfurthi*, Mayer-Eymar; *Isocardia cyprinoides*, Bronn; *Cytherea Newboldi*, Mayer-Eymar; *Tellina pellucida*, Deshayes; *Mactra compressa*, Deshayes; *Corbula pixidicula*, Deshayes.

GASTROPODA.—*Calyptræa trochiformis*, Lamarck; *Turritella angulata*, J. de C. Sowerby; *T. carinifera*, Deshayes; *T. transitoria*,

Mayer-Eymar; *T. turris*, Basterot; *Turbo Parkinsoni*, Defrance; *Pleurotoma* sp.; *Ficula tricarinata*, Mayer-Eymar.

MAYER-EYMAR (C.). "Plicatularum sex novæ e stratis Aegyptiæ Parisianis": Viertelj. Nat. Ges. Zurich, vol. xxxiv, pp. 392–5, 1889.

Describes *Plicatula abundans*, Mayer-Eymar, from the Lutetian or Middle Eocene of the Fayum.

—— "Diagnoses Ostrearum novarum ex agris Aegyptiæ nummuliticis": Viertelj. Nat. Ges. Zurich, vol. xxxiv, pp. 289–99, 1889. [Reprint in Mém. Soc. Belge Géol. Pal. Hydrol. (Bruxelles), vol. iii, pp. 401–8, 1889.]

The following forms from the Lutetian of the Fayum are described but not figured: *Ostrea* (*Alectryonia*) *Lenzi*, *O. ægyptiaca*, *O. Qeruniana*, *O. Ismaeli*.

—— "Description de Coquilles fossiles des Terrains tertiaires inférieurs": Journ. de Conch. [Paris] for 1887, 1888, 1895, 1896, 1898.

The following mollusca from the Lutetian or Middle Eocene formation of the Fayum are described and frequently figured in the various volumes of this periodical: (1887) *Lovellia Schweinfurthi*; (1888) *Ostrea Fraasi* and var. *Fajumensis*, *Pecten Moelhensis*; (1895) *Melongena* (*Heligmotoma*) *Nilotica*, *Mesalia Hofana*, *Fusus* (*Clavellites*) *spinosus*, *Tudicula umbilicaris*, *Pleurotoma ingens*, *Pereiræa Beyrichi*, *Voluta* (*Volutolyria*) *Arabica*; (1896) *Cardita* (*Cossmannella*) *Ægyptiaca*; (1898) *Ostrea* (*Gryphæa*) *Arabica*, *Tellina Damesi*, *T. grandis*, *T. latissima*, *T. Zitteli*, *Melongena* (*Pugilina*) *Koeneni*, *Ostrea Schweinfurthi*, *Ostrea Sickenbergi*, *Crassatella Junkeri*, *C. puellula*, *Chenopus Artini*.

—— "Diagnoses Mytilorum ex agris Ægyptiæ nummuliticis": Viertelj. Nat. Ges. Zurich, vol. xxxvi, pp. 169–75, 1891.

Describes, but without figuring, the new species, *Mytilus Niloticus*, from the Lutetian or Middle Eocene of the Fayum.

—— "L'Oasis de Moëleh": Bull. Inst. Egypten, ser. III, No. 3, pp. 44–53, 1892.

The following mollusca from the Lutetian deposits are listed from this area of the Fayum:—

PELECYPODA.—*Ostrea Gumbeli*, Mayer-Eymar MS.; *Pecten Moelhensis*, Mayer-Eymar; *P. corneus*, J. Sowerby; *Vulsella chamiformis*, Mayer-Eymar; *Lucina globulosa*, Deshayes; *L. consobrina*, Deshayes; *L. Defrancei*, Deshayes.

GASTROPODA.—*Velates Schmiedeli*, Chemnitz; *Cerithium fodicatum*, Bellardi.

—— "*Ampullaria* (*Lanistes*) *Bolteni*, Chemnitz": Eclog. Geol. Helvetiæ, vol. vi, p. 120, 1900.

—— "Les Ampullaires de l'Éocène d'Égypte": Bull. Inst. Égyptien, ser. IV, No. 2, fasc. 4, pp. 205–7, 1901.

—— "Interessante neue Gastropoden aus dem Untertertiär Egyptens": Viertelj. Nat. Ges. Zurich, vol. xlvi, pp. 23–7, pl. i, figs. 1, 2, 1901.

Describes and figures *Ampullaria* (*Lanistes*) *Bolteni*, Chemnitz, from the Lutetian (*Ostrea Clot-beyi* Beds) of the Fayum.

MAYER-EYMAR (C.). "Liste der nummulitischen Turritelliden Egyptens auf der geologischen Sammlung in Zurich": Viertelj. Nat. Ges. Zurich, vol. xlvii, pp. 385–92, pl. xxii, 1903.

Records the following Turritellidæ from the Lutetian of the Fayum: *Protoma cathedralis*, Brongniart; *Turritella angulata*, J. de C. Sowerby; *T. bicarinata*, Eichwald; *T. carinifera*, Deshayes; *T. Desmaresti*, Basterot; *T. Lessepsi*, Mayer-Eymar; *T. mitis*, Deshayes; *T. nana*, Mayer-Eymar; *T. Tihana*, Mayer-Eymar; *T. vinculata*, Zittel (= *T. Parisiana*, Mayer-Eymar); *Mesalia bilirata*, Mayer-Eymar; *M. obruta*, Locard (= *M. Locardi*, Cossmann); *M. electa*, Locard; *M. terebriformis*, Mayer-Eymar.

—— "Nummulitische Dentaliiden, Fissurelliden, Capuliden, und Hipponiciden Aegyptens auf der geologischen Sammlung in Zurich": Viertelj. Nat. Ges. Zurich, vol. xlviii, pp. 271–86, 1903.

Describes the following forms from the Lutetian or Middle Eocene of the Fayum: *Fissurella acuticosta*, Mayer-Eymar; *Calyptræa Chinensis*, Linnæus; *C. pectinata*, Mayer-Eymar; *Dentalium striatum*, Sowerby; *D. circinatum*, Sowerby; *D. lucidum*, Deshayes; *D. Michelottii*, Haern.

—— "Revue des grandes Ovules ou *Gisortia*, Jousseaume": Viertelj. Nat. Ges. Zurich, vol. xlix, pp. 35–9, 1904.

Records *Ovula* (*Gisortia*) *gigantea*, Münster, sp. (= *O. Murchisoni*, Archiac), from the Lutetian of the Fayum.

OPPENHEIM (PAUL). "Zur Kenntnis altertertiärer Faunen in Ägypten": Palæontographica, vol. xxx, pt. iii, sect. 1, Bivalves, 1903; sect. 2, Bivalves, Gastropoda, Scaphopoda, Cephalopoda, 1906 (plates and text).

—— "Observation sur l'Âge des Couches à *Palæomastodon* du Fayoum": Bull. Soc. géol. France, ser. IV, vol. vii, pp. 358–60, 1907.

REINACH (A. von). "Schildkrötenreste aus dem ägyptischen Tertiär": Abhandl. Senckenberg. Nat. Ges. [Frankfurt a. M.], vol. xxix, pp. 64, 1903.

SCHWEINFURTH (G.). "Reise in das Depressionsgebiet im Umkreise des Fajūm im Januar, 1886": Zeitsch. Ges. Erdkunde, Berlin, vol. xxi, pp. 96–149, with a map (topographical), 1886.

STROMER (E.). "Geologische Beobachtungen im Fajum und am unteren Niltal": Abhandl. Senckenberg. Nat. Ges. [Frankfurt a. M.], vol. xxix, pp. 135–47, pl. xxi, 1907.

VI. INDEX TO THE GENERA AND SPECIES OF THE MOLLUSCA.

THE DISTRIBUTION AND HABITS OF *ALOPIA*, A SUB-GENUS OF *CLAUSILIA*.

By the Rev. A. H. Cooke, M.A., F.Z.S.

Read 8th March, 1912.

The sub-genus *Alopia* was first constituted by H. & A. Adams in 1858 for a group of dextrorsal *Clausilia* inhabiting Transylvania. The description given in Adams is a word-for-word translation of Charpentier's characterization of his section[1] in his grouping of *Clausilia*,[2] but the French author gave no sub-generic names to his sections. Both authors grouped only three species under *Alopia*, viz., *Bielzi*, Pfr. (Parr.), *Lischkeana*, Parr., *pruinosa*, Parr., while they placed several other species now reckoned as *Alopia* (e.g. *plumbea*, Rossm., *straminicollis*, Parr., *canescens*, Parr., *regalis*, Parr.) under another section.

Two discoveries caused the subsequent enlargement of the sub-genus. In the first place it was observed, by E. A. Bielz and others, that several sinistral species were also to be grouped under *Alopia*, and, secondly, Adolph Schmidt pointed out[3] that the so-called *Balea* or *Baleo-Clausilia* of the Southern Carpathians were also *Alopia*, and that the absence of a clausilium was no true ground for separating them sub-generically, a view stoutly contested by E. A. Bielz.[4]

My object in the present paper is not so much to attempt to settle disputed points of classification or identification, as to record the impressions I have myself received from two visits paid to Transylvania in the autumns of 1909 and 1911, with the special purpose of observing the habits, mode of life, and distribution of the group.

1. *Distribution.*—The *Alopia* group is entirely peculiar to Hungary and the part of Roumania immediately adjacent. More than this, of the seventy-two species, sub-species, and varieties enumerated by Kimakowicz,[5] seventy-one are found in the south-east corner of Hungary known to us as Transylvania, and to the Austrians as Siebenbürgen, and on the Roumanian slope of the adjacent Carpathians. More than this still, of these seventy-one, sixty occur within a radius of 40 km. from Kronstadt (Hung. Brassó), which town, lying as it does at the foot of the Carpathians, and only 13 km. as the crow flies from the Roumanian frontier, may be regarded as the nucleus of the group. And further, if a circle be described with Kronstadt as the centre, and radius 40 km., and a diameter be run across this circle from east to west, of the sixty species, sub-species, and varieties living within the circle, six only occur to the north of the diameter and fifty-four to the south, a sufficient indication that *Alopia* is essentially a mountain-dwelling group.

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[1] *Genera*, vol. ii, p. 181.
[2] Journal de Conchyliologie, sér. I, vol. iii, p. 361, 1852.
[3] Syst. Europ. Clausilien, 1868, pp. 3, 4, 18–28; Zeitsch. Ges. Naturwiss., vol. viii, pp. 407–13, 1856.
[4] *Fauna der Land- und Süsswasser-Mollusken Siebenbürgens*[2], 1867, p. 103.
[5] Verh. Siebenbürg. Ver., vol. xliii, pp. 19–58, 1894.

On the main chain of the South Carpathians the range of the group is sharply defined. It is not found west of the Königstein, or east of the village of Bodza-vama, at the foot of the Czukás and the Dobromir. In other words, it inhabits about 65 to 70 km. only of the main chain. The highest peaks of the range stretch unbroken westward of the Königstein, but at the Königstein *Alopia* stops dead, to appear once more, in a single species and two varieties, 150 km. to the west, near the Szurduk Pass into Roumania.

2. *Locality.*—Within these limits *Alopia* occurs exclusively in the Jurassic, Cretaceous, and Eocene limestones. It is essentially a rock-haunting group; in vain will you look for it on trees, or on mossy banks, or amongst nettle-roots, or under stones, or in any of the localities affected by the ordinary British or Continental *Clausilia*. The open mountain ridges, the perpendicular cliffs, the huge boulders which have become detached from the precipices, are its chosen home, and it occurs nowhere else. Quite exceptionally I have found a few specimens of *Meschendörferi*, Bielz, on tree trunks growing close to great boulders, but this was under circumstances which made it crawl about in a state of excitement, and *plumbea*, Rossm., may be found on old walls in Kronstadt itself. But one soon learns the lesson that it is waste of time to look for *Alopia* on any mountain within the favoured area, unless that mountain contains bare faces of limestone cliff; if these occur, it may be predicted with some certainty that *Alopia* will be present also.

The great limestone range of the South Carpathians is cut into deep and precipitous valleys. These 'Schluchten', the sides of which often rise in cliffs 500 to 1,000 feet high, and are sometimes so narrow that you can almost touch both sides with outstretched arms, are invariably tenanted by *Alopia*, and the same species will often vary considerably, e.g. in the upper and lower ends of the same 'Schlucht'. How variable the group is, is shown by the fact that Kimakowicz only recognizes fourteen species and sub-species, while he enumerates fifty-eight named varieties.

It is remarkable within what narrow limits a species or a definite variety will occur. I will give some instances of this. Bielz[1] describes *A. Meschendörferi* as occurring exclusively on the Zeidnerberg, a somewhat isolated mountain about seven miles from Brassó. In 1909 I went up the Zeidnerberg with the object of collecting this species. On the ascent I searched for it in every possible locality without any success. I arrived within two minutes of the top without having secured a single specimen, and seriously thought I must have climbed the wrong mountain. Suddenly, on a low piece of exposed rock face, the species appeared in abundance, and it is no exaggeration to say that, for the remaining 50 feet, if I had wanted a thousand living specimens, I could easily have taken them.

The Great and Little Königstein are separated by a narrow and steep Schlucht called the Krepatura. On the perpendicular sides of the Schlucht *A. Fussiana*, Bielz, var. *insignis*, a sinistral form with

[1] *Fauna der Land- und Süsswasser-Mollusken Siebenbürgens*, p. 127.

well-marked riblets, occurs in fair abundance. When you get to the top of the Krepatura, you step over a little saddle, perhaps 40 feet wide, and descend equally steeply on the other side. The moment you get to the top, *A. Fussiana*, var. *insignis*, stops dead, and is replaced on the rocks of the Schlucht on the other side by a dextral form, *A. Fussiana*, var. *pruinosa*, Parr.

A. Bielzi, Pfr., var. *Potaissanensis*, Kim., occurs only in the Schlucht of Torda, and I made a special expedition to Torda to obtain it. The Schlucht, whose perpendicular limestone sides appeared most favourable for the occurrence of *Alopia*, was searched from one end to the other without the slightest success. At last, when almost giving up the search in despair, one came upon it in abundance on a certain buttress of steep rock, but, search as one might on both sides of the Schlucht, not a single specimen was found except on this patch of rock, which measured no more than 30 feet in length, and apparently differed in no respect from neighbouring patches.

But the Donghavás mountain is perhaps more remarkable than any for its breeding of varieties. It is a round, stumpy mountain of about 5,000 feet, covered with forest, and with streaks of limestone cliff on all its faces. Kimakowicz enumerates five distinct varieties of *Alopia* from different sides of the mountain, and all peculiar. I cannot pretend to have found all these, but I found three forms of the same species wholly distinct from one another, each occurring within sharply defined limits. Not half a mile from the Donghavás rises another mountain, the Tésla, also round-topped, covered with forest, and with streaks of limestone cliff. On the Tésla cliffs an *Alopia* (*glauca*, Bielz) occurs, entirely distinct from anything in the Donghavás, and scarcely varying at all, while *A. Haueri* on the Donghavás has five separate varieties.

Alopia elegans, Bielz, a very well-marked species, is confined to the Dumboviciora Schlucht in Roumania, on the far south side of the Königstein. Two good varieties are found in the upper part of the same Schlucht, *cerasina*, A. Schm., and *intercedens*, A. Schm.

Although the species and varieties are so numerous, and although the area over which the majority of the group occurs is relatively so small, the species never overlap. No two distinct species ever live together on the same cliff face. So far as external features go, the Malajester, Propasta, Bogater, Dumboviciora Schluchten appear equally adapted for the habitation of *Alopia*, and yet each has its one species and no more, the Malajester *livida*, Menke, the Dumboviciora *elegans*, Bielz, the Bogater *Bogatensis*, Bielz, the Propasta *Lischkeana*, Parr., the Krepatura *Fussiana*, Bielz, var. *insignis*. In the two latter cases, the Schluchten in question form part of the same mountain, which is not of great area, and open on to the plain at no great distance from one another.

These restrictions of locality perhaps do not stand alone and could be paralleled by similar instances in other genera. But what makes them more remarkable in this case is, that many other forms of *Clausilia*, not being *Alopia*, occur abundantly all over the district, with no such restrictions of distribution, and no appreciable tendency to extremes of variation. Thus, of the *Alinda* group, *critica*, Bielz, *fallax*, Rossm., *stabilis*, Zieg, are found everywhere, and the same is the case with *cana*, Held, and *plicata*, Desh. (*Laciniaria*), *marginata*, Zieg, *transsylvanica*, Zieg, and *orthostoma*, Menke (*Marpessa*), *latestriata*, Bielz, and *dubia*, Drap. (*Iphigenia*). Some of these forms occur wherever an *Alopia* is found (I have a specimen of *cana* from the top of the Butschetsch, 8,230 feet), and they are spread impartially all over the district.

3. *Habits of Life and Food.*—One notices that though all Alopias live on limestone rocks, and nowhere else, there are certain differences of method in the various species. In the Krepatura, *A. Fussiana*, var. *insignis*, is scattered in ones and twos on the perpendicular face of the cliff, and seldom packs closely together. On the Donghavás, *A. Haueri*, var. *ambigua*, has similar habits, and a closely related form from the Czukás is scattered over rocks, showing a special predilection, which I have noticed in other groups, for bands of moist clay. On the Tésla, *A. glauca* does not gather gregariously in cracks or holes, but stands out singly on the face of the rock. The same is the case with *livida* in the Malajester Schlucht, and with a form of whose exact identity I am not quite certain, found on the Furnica in Roumania. On the other hand, *A. Fussiana*, var. *pruinosa*, from a similar locality to the east of the Königstein, fairly astonished me by its propensity for clotting together in masses at the foot of the cliffs close to the ground. I first found a bunch of twenty-seven, then another of sixty, and finally measured a space 2 feet long by 2½ inches high, and counted on it over 200 living specimens, all adult. *A. Meschendörferi*, on the Zeidnerberg, gathers in bunches in the hollows of the limestone. On the top of the Piatra Mare *A. canescens* is fairly abundant, but if you look on the rock faces you will hardly find a single specimen, even in the shady cracks; the species occurs half buried in the grass at the foot of the rocks and under ledges which are almost flush with the ground.

The food of *Alopia* is, as a rule, minute mosses and lichens. There is no doubt that the microscopic algæ and vegetable organisms occurring on the disintegrated limestone surfaces are also eaten by them. On the conglomerate it can only find moss and lichen. I have never found one on a green leaf.

4. *Variation in Size.*—When large numbers of a given species are examined, specimens will generally be found of a large and also of a small form, in each case fully grown. The fact is very marked in the case of *livida* from the Malajester Schlucht, *glauca* from the Tésla, *Haueri*, var. *ambigua* from the West Donghavás, *plumbea* from near Kronstadt, *Fussiana* from the Königstein. In each of these cases the larger form sometimes contains two whorls more than the shorter, and the shell appears much finer and more fully developed. It seems probable that this difference in size is not due to any cause marking an optimum or pessimum of locality, or to any distinctions in the conditions of food supply. One is more inclined to support a view[1]

[1] Küster, *Die Binnenconchylien Dalmatiens*, p. 10.

which refers the difference to causes purely mechanical. A long spiral shell which is accustomed to live and grow without support is likely to become produced in the spire, purely by the operation of its own weight, while a shell which is to a certain extent supported, or at all events which has not to bear the continual downward pull of its own weight, would not exhibit this tendency to become produced. It follows that shells which creep habitually upon the surface of perpendicular rocks will tend to be, as a rule, longer than shells of the same species which creep on the level, or on a surface approaching the level, where the effect of weight is not so pronounced. That this actually occurs I have noticed in the cases mentioned above, particularly in that of *livida*, Menke, where specimens taken from boulders in the Malajester Schlucht were appreciably smaller than specimens from the perpendicular cliffs which rose a few score yards away.

5. *Derivation of the group.*—One is tempted to indulge in speculations as to where the origin should be looked for of this interesting group, which, from the absence of a clausilium in some of its species, and its instability in others, appears[1] to be a survival of a stage in the development of *Clausilia*, whose nearest relatives must be sought for in groups now extinct and represented only by fossil or sub-fossil forms. It seems quite clear that the group, as it is now represented, originated high up on the mountains,[2] and did not climb up into them from the plain. One is led to this conclusion by observing that when the conformation of a mountain admits of it, a species descends low; where it does not, it remains high up. Thus, *A. livida*, Menke, *begins* at about 200 feet below the Schutzhütte in the Malajester Tal, that is, at about 5,000 feet, and continues up to the top of the Butschetsch (8,230 feet). It comes no lower, because the great boulders and cliffs cease in that Schlucht at about 5,000 feet, and it cannot live except on these. On the other hand, the forms characteristic of the Propasta and the Krepatura (*Lischkeana*, Parr., and *Fussiana*, Bielz, var. *insignis*) almost reach the level of the plain near Zernest (about 2,000 feet), because the Schluchten in which they live spring almost from the plain itself, and they have thus been able to descend the mountain to the lower level. The most striking instance of this is *plumbea*, Rossm., which occurs all over the Schuler (5,900 feet), the nearest mountain to Brassó, but it is also found on the walls of Brassó itself (1,800 feet), because (1) there occurs between the Schuler and Brassó a series of cliff faces and rocks, never separated by a very distant interval, and (2) the species seems to have accustomed itself, more than any other of the group, to living on smaller rock-faces and smaller boulders.

Questions relating to the validity and relationship of the various species and varieties will be dealt with in a further paper.

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[1] Boettger, *Clausilienstudien*, pp. 6, 24.

[2] Kimakowicz is bold enough to regard the Czukás and the Butschetsch Mountains as the two original homes of the parent stock or stocks.

THE GENUS *DOSINIA* AND ITS SUBDIVISIONS.

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

Read 12th April, 1912.

The genus *Dosinia* includes a large number of species, and these vary considerably both in external and internal characters. It is by no means the compact genus that the definitions given by Woodward, Adams, and Fischer would lead one to suppose, for these definitions do not apply to all the species.

In his *Catalogue of the Conchifera or Bivalve Shells in the British Museum*, Part I, Veneridæ, etc. (1853), Deshayes enumerated 85 species; Adams described several new species in 1855; Römer again recorded others in 1860 and 1862, so that his monograph on *Dosinia* (published in 1862) contains the names and descriptions of 105 species, notwithstanding the fact that he united some of the forms which had been described under different names.

In such an assemblage of species it is only likely that differentiation should have produced several natural groups, and it is not surprising to find that several authors have arranged the species in a number of sections. Sowerby and Deshayes grouped them solely by the different characters of the dorsal border, but though the importance of these may be admitted, reliance on any one such set of characters does not lead to a very natural arrangement. Sowerby made seven such groups or sections, while Deshayes was content with five, which he defined in Latin as follows:—

1. Margine dorsali integro. [No escutcheon.]
    (1) Striæ simplices.
    (2) Striæ ad latera scabræ vel lamellosæ.
2. Margine dorsali circumscripto. [A defined escutcheon.]
    (3) Area dorsali in medio prominente.
    (4) Area dorsali depressa, plana.
    (5) Area dorsali excavata.

Römer in his monograph objects to Sowerby's divisions as being unnatural, and himself proposes a series of eleven sections, but these are no more natural or satisfactory than those made by Sowerby and Deshayes. Moreover, he gave no definitions of his sections, merely indicating them by the name of a typical species, his groups being as follows:—

1.	Sectio	D. concentricæ.	7.	Sectio	D. juvenis.
2.	,,	D. excisæ.	8.	,,	D. scabriusculæ.
3.	,,	D. isocardiæ.	9.	,,	D. angulosæ.
4.	,,	D. prostratæ.	10.	,,	D. Bruguieri.
5.	,,	D. exoletæ.	11.	,,	D. lucinalis.
6.	,,	D. Africanæ.			

The first of these sections is practically the same as those of Sowerby and Deshayes, and is undoubtedly a natural group. The second is also a natural assemblage of peculiar species which I have classed as a sub-genus under the name of *Sinodia*. His *isocardia* group is quite too restricted, including only that species, *D. lupinus*, and *D. modesta*, the last being probably only a variety of *lupinus*. None of his other groups are satisfactory, and it is often difficult to understand his reasons for associating or separating certain species. Thus he puts *lincta* in the *exoleta* section and *Africana* in another one (No. 6), whereas, in reality, *lincta* and *Africana* are so closely allied that some consider the latter to be only a variety of the former.

I cannot find that anyone else dealt systematically with the genus between the years 1862 and 1902, but in the latter year Dr. W. H. Dall published a "Synopsis of the Veneridæ",[1] and under the head of *Dosinia* he definitely proposed six sections, each with a special name, in addition to the group represented by the type species, *D. Africana*. As most of these are additions to conchological nomenclature, they must be critically examined in order to ascertain what other species besides the one selected as a type should be referred to each section; further, whether all the known species of *Dosinia* can be distributed among these sections. Their names and types are as follows:—

Dosinia, sensu stricto.	Type,	*D. Africana* (Gray).
Orbiculus, Megerle.	,,	*D. exoleta* (Lin.).
Austrodosinia, Dall.	,,	*D. anus* (Phil.).
Dosinisca, Dall.	,,	*D. alata* (Reeve).
Dosinorbis, Dall.	,,	*D. bilunulata* (Gray).
Dosinidia, Dall.	,,	*D. concentrica* (Born).
Dosinella, Dall.	,,	*D. angulosa* (Phil.).

The principal characters of the type section (*Dosinia*, s.s.) as defined by Dr. Dall are—"Lunule impressed small, escutcheon narrow, elongate, bordered on each side by a ridge or keel; middle cardinals often grooved . . . ; pallial sinus angular, ascending, usually narrow and extended forward at least halfway from the posterior to the anterior adductor." He further remarks that "the form of the escutcheon differs in this group from an obscure flattening, often unequal in the two valves, to a distinctly keeled area with sculpture differing from that outside the boundary, but in the series of species almost every gradation between these forms may be observed". No mention, however, is made of any of the species he would refer to the group; but under *Orbiculus* he remarks that *D. prostrata* (Linn.) is a typical *Dosinia*, a view with which I cannot agree unless he intended also to include *D. Japonica*, *D. scabriuscula*, and other species hereafter noted.

It is conceivable that he meant to accept Römer's "Section of *D. Africana*", but if so he should have said so, for that section exhibits some obvious inconsistencies, including as it does *D. fibula*, but not *D. cretacea*, and excluding *D. lincta*, which is so closely allied to *D. Africana*. All these species certainly belong to this section as well as *D. Adansoni*, *D. Orbignyi*, and *D. alta*. Probably also *D. lupinus*

[1] Proc. U.S. National Museum, vol. xxvi, p. 335, 1902.

should be referred to it, but *D. hepatica* should not, because its lunule is not impressed, and it has no escutcheon. One wonders whether he would include such shells as *D. cærulea* and *D. subrosea*, which agree with his wide definition except in regard to their pallial sinus, which is short, broad, and nearly horizontal, not ascending.

His *Orbiculus* section he briefly defines as follows: "There is no escutcheon, the pallial sinus is very long and narrow, and the anterior lateral is strong." As a matter of fact the anterior lateral is no stronger in *D. exoleta* than it is in *D. lincta*, while the middle cardinal of the left valve shows differences which Dr. Dall failed to perceive or to think of any importance.

I have elsewhere pointed out that under the present rules of zoological nomenclature Da Costa's genus *Pectunculus* must be recognized, and I selected his *P. capillaceus* (*Dosinia exoleta*) as the most convenient type. Hence the name *Orbiculus* must give place to *Pectunculus*. The *D. exoleta* group is easy to recognize as a natural section; it includes *D. radiata*, Sow. (which is probably only a West African variety of *exoleta*), *D. erythræa*, Römer, *D. amphidesmoides*, Reeve, *D. grata*, Desh., *D. nobilis*, Desh., *D. hepatica*, Lam., and *D. sculpta*, Hanley, with probably *D. conglobata*, Römer, though I have not seen a specimen of that species.

Dosinidia.—This section appears to represent the preceding group on American coasts, but differs from *Pectunculus* in the bright shining white surface of the shells, the sculpture being of flattened riblets separated by grooves, and in having a short angular pallial sinus. Dr. Dall also notes that in the nepionic young the posterior cardinal teeth are serrate or corrugated, though generally smooth in the adult; in *D. Dunkeri*, however, this condition sometimes persists, and I have a specimen in which it is clearly seen.

This section includes *D. concentrica* (Born), type; *D. elegans*, Conrad; *D. discus*, Reeve; *D. ponderosa*, Gray; *D. distans*, Sow. (if distinct from *ponderosa*); *D. Dunkeri*, Phil.; *D. Annæ*, Carp.; *D. nitens*, Reeve; which, however, is probably only a synonym of *D. Patagonica*, Phil. It must also include *D. plana* of Chinese waters, which is closely allied to *discus*, and consequently the section is not restricted to American seas as stated by Dr. Dall. *D. plana* and *D. discus* are the two most compressed and flattened species of the genus. *D. Hanleyana* (= *D. simplex*, Hanley) also probably belongs to this section, and is found at Singapore and in the Gulf of Siam.

Austrodosinia.—For this section Dr. Dall chose *D. anus* as his type, and he defined it as having the "lunule deeply impressed, escutcheon impressed and bordered by prominent keels; pallial sinus short and angular; anterior lateral and the pit into which it is received, and some of the anterior cardinal teeth sharply corrugated; the middle cardinals bifid". This description, however, is hardly correct, for the escutcheon of *D. anus* is only well defined in the left valve, the concentric riblets of the right valve being continuous to the ligamental margin. It does not differ, in fact, from the escutcheon of many species belonging to the typical section. Again, the middle cardinal teeth are not bifid in adult shells, being merely rugose; in young shells the left middle cardinal is grooved near the top, but that of the right is not bifid.

Dr. Dall states that "this group is represented in New Zealand and Japan", but what special Japanese species he would group with *anus* I cannot imagine, for *Japonica* is quite different, both as regards escutcheon and teeth. The fact is that *D. anus* has peculiarities which are shared by few other species, those which come nearest to it being in my opinion *D. histrio*, *D. variegata*, and *D. laminata*; but I should group in this section *D. juvenis*, *D. scalaris*, *D. Gruneri*, *D. cærulea*, *D. Kraussi*, and *D. ferruginea*, which are similar in dentition and form of pallial sinus.

Dosinorbis.—It will be convenient to take this supposed section next, Dr. Dall having created it for a single species, *D. bilunulata*, which, he says, "appears to be unique in the genus." The only unique feature about this species is the so-called double lunule, for all its other characters are shared by *D. Japonica* and other species. Moreover, there is only one real lunule, the outer one being merely an area of the anterior border defined by a sudden interruption of the concentric riblets which ornament the shell; these terminate anteriorly in erect crests along a definite line, thus limiting an area which resembles that of the escutcheon; but it is not a lunule, only a peculiar feature of the surface sculpture. No good purpose can be served by separating a single species under the guise of a 'section' when its special characteristic is not correlated with other peculiarities, and is therefore merely a specific character.

Dosinisca.—In the definition of this section and in the choice of *D. alata* (Reeve) as its typical species, Dr. Dall has excelled himself. His definition is as follows: "Areas of the lunule and escutcheon pouting mesially, defined by a deep sulcus, forming a posterior wing which recalls *Phacoides* (= *Lucina*); sculpture of fine, rather distant sharp lamellæ, sometimes with radial striation; pallial sinus deep and angular." He adds this group is distributed in Australia and Japan.

Now there are several species of which the lunular and escutcheon areas may be said to pout mesially, but only two species have ever been represented as possessing a groove or sulcus on the posterior side; these are *D. lucinalis* (Lam.) and *D. alata* (Reeve). Of the first very little is known. Mr. E. A. Smith informs me that it was figured by Delessert,[1] and that the type is doubtless at Geneva; also that the delineator of Chenu's *Illustrations Conchyliologiques* seems to have had a specimen of the true *lucinalis* before him, though not the actual type. No one else seems to have seen a specimen, for though it is mentioned by Hanley and Römer they clearly did not know the shell.

Of *D. alata* I could learn nothing beyond the description given by Reeve, and so far as I could ascertain no private collector in England possessed a specimen. I then applied to Mr. E. A. Smith, who kindly informed me that the type of *D. alata* is in the British Museum, and that he regarded it as merely an abnormal specimen of *D. plana*, Reeve; the type of *alata* being identical with *plana* in every respect

[1] *Recueil coquilles de Lamarck*, pt. ix, figs. 2, *a–c*.

except in having the curious groove. He has never seen or heard of a second specimen. Thus Dr. Dall's *Dosinisca* is based on a freak or deformed specimen, and has no real existence, because there is no group possessing all the characters indicated in his definition. Whether a second similar deformity exists in the U.S. National Museum, or whether Dr. Dall carelessly adopted Reeve's species without making any inquiry, is only known to himself, but the name *Dosinisca* will have to be abandoned.

Dosinella.—Here, again, Dr. Dall separated a single species to constitute a section by itself; at least he evidently thought he was doing so, though I am of opinion that the species in question, *D. angulosa*, is only the extreme form of a small natural group, for which the name *Dosinella* may consequently be adopted.

The special characters of *D. angulosa* are stated by Dr. Dall in the following terms: "Valves sub-orbicular with a shallow, flattish lunule; the escutcheon narrow, flattish, hardly defined; pallid sinus ample, ascending, deep, bluntly rounded at the anterior end; anterior lateral and right posterior cardinal teeth absent or obsolete." He further explains that the peculiar sinus and the obsolescent teeth of this form led him, "after some hesitation, to separate it sectionally."

It would seem, therefore, that he was unacquainted with *D. Bruguieri* (Gray) and *D. penicillata* (Reeve), which have precisely the same form of sinus, and very small anterior lateral teeth; they have, in fact, all the same shell-characters except that of the obsolescent posterior left cardinal, for I presume that Dr. Dall really meant the *left* cardinal and not the *right* as printed.

In *D. penicillata*, which is an Australian and Philippine species, the anterior lateral tooth is obsolescent in the adult, though quite well developed in a young specimen sent me by Mr. E. J. Banfield from Dunk Island, Queensland. In *D. Bruguieri* this tooth is still obvious in full-grown shells, though small and low.

D. angulosa and *D. penicillata* are also characterized by the complete absence of the second posterior cardinal in the right valve of the adult shell, though it exists as a faint line in the young, and again this feature persists in the adult *D. Bruguieri*.

Thus the three species form a series with *angulosa* at one end and *Bruguieri* at the other. The *D. funiculata* of Römer is probably only a variety of *angulosa*, but the *D. corrugata* of Reeve may be a good species, and if Römer's fuller description of it is correct it also would appear to belong to this group. *D. dilecta* of Adams, from Siam (as figured by H. Lynge [1]), also appear to belong to *Dosinella*.

I have now reviewed all the sections proposed by Dr. Dall, and it will be seen that they are not all satisfactory natural groups. Four of them can stand, namely, *Orbiculus* (= *Pectunculus*), *Austrodosinia*, *Dosinidia*, and *Dosinella*, while *Dosinorbis* and *Dosinisca* should be dropped as useless. But there are a number of well-known species of *Dosinia* which cannot be referred to any of these sections, at any rate as I have interpreted them, nor do they belong to the typical (*Africana*)

[1] Man. Acad. Roy. Sc. et L. de Danemark, ser. VII, t. V, p. 100, 1909.

group. Some of these species I separated in 1908 under the name of *Sinodia* with *D. trigona* as type; others remain which must now be considered, and chief of these is the group which includes *D. Japonica*, Desh., and *D. scabriuscula* (Phil.).

For this group I propose the name *Phacosoma*, from φακος and σῶμα = lentil-body. This section I define as follows.

PHACOSOMA (sectio nova).

Type, *Dosinia Japonica*, Reeve.

Shell orbicular, convex; lunule deeply impressed; escutcheon rather wide and pouting mesially on each side of the ligament, defined by raised lamellose ridges. In the left valve a strong anterior lateral, generally rugose; a narrow tall anterior cardinal, an oblique median which is not bifid, but rugosely striated, and runs back so that its outer edge is nearly parallel to the posterior tooth. Pallial sinus fairly deep, angular, and generally horizontal. Margin of right valve grooved posteriorly.

To this section the following other species belong: *scabriuscula* (Phil.), *biscocta* (Reeve), *cærulea* (Reeve), *prostrata* (Linn.), *exasperata* (Phil.), *contusa* (Reeve), *pubescens* (Phil.), *labiosa* (Römer), *lamellata* (Reeve), *Roemeri* (Dunker), and *subrosea* (Gray). In this group I should also place *D. bilunulata* (Gray), which Dr. Dall separates as a section by itself.

With respect to the *Sinodia* group it differs so much from all the sections above mentioned that I regard it as a sub-genus, and now give a condensed description of it.

SINODIA, Jukes-Browne.

Type, *Dosinia trigona*, Reeve.

Shell trigonal, oval, or orbicular. Lunule non-existent, but part of the anterior side is circumscribed by a faintly impressed line. Escutcheon area not defined, but sometimes depressed. In the left valve the anterior lateral is strong and distant from the anterior cardinal; the middle cardinal is entire, solid, and equidistant from the other two, but united at the top to the anterior tooth. Both valves are grooved on the posterior margins, the right having a long deep groove, the left a shorter and shallower one. The pallial sinus is variable, but generally rather short and rounded.

Most of the species are trigonal, and all have an expanded anterior side; but *D. excisa* (Chem.) is sub-orbicular and *D. globa* (Melvill) is more completely orbicular, still in its hinge and other internal characters it resembles *trigona* and *sphæricula*.

CORDIOPSIS, Cossmann.

Lastly, there are some fossil species which I regard as belonging to the genus *Dosinia*, but which have been separated by M. Cossmann as a sub-genus of *Meretrix* under the name of *Cordiopsis*. The type of this group is a well-known Oligocene fossil, the *Cytherea incrassata* of Sowerby, which I referred to *Sinodia* in 1908, remarking that it agreed with *Sinodia* in all the points which I then mentioned, and that it further resembled *Dosinia* in the thickness of the hinge-plate, in the rugosity of the anterior lateral tooth, and in the manner in which the right posterior cardinal springs from the end of the incurved anterior margin. It also agrees with *Dosinia* and with *Aphrodina* in the forward direction of the right anterior cardinal, which in *Pitaria* and in typical *Callista* is more directly transverse, and nearly parallel to the middle cardinal.

M. Cossmann, writing in 1909,[1] differs from me with regard to the affinities of this species, and remarks as follows (in French, which I translate): "*Cordiopsis* evidently belongs to *Meretrix* by its form, by its smooth surface, without a carinated escutcheon, and especially by the small tooth A II [the anterior lateral], which is always isolated from $2a$" [the anterior cardinal]. He distinguishes it from *Pitaria* "by the disposition of its cardinal teeth, the form of its sinus, by its much more cordiform shape, and by the disappearance of A I and A II. He further remarks: On the other hand, it seems to us impossible to connect it with *Dosinia*, which is a genus well differentiated by its orbicular and flattened form, as well as by its narrow and pointed sinus, by its impressed lunule, by its grooved surface, etc."

Now the characters by which he connects *Cordiopsis* with *Meretrix* are of no value whatever, for *Venus incrassata* is not absolutely smooth and glossy like *Meretrix* and *Callista*, but is finely concentrically striated like *Pitaria* and many *Dosiniæ*. Again, the anterior lateral tooth of *V. incrassata* is pustular and tends to disappear with age, as in some species of *Dosinia*, whereas in *Meretrix* and *Callista* it is elongate, tall, and persistent.

Moreover, the points by which he tries to distinguish *Cordiopsis* from *Dosinia* show that he does not at all understand the real characteristics of that genus, the shells of which are not always flattened, the sinus is not always narrow and pointed, nor is the lunule always impressed. It is clear, in fact, that M. Cossmann's principles of classification differ from those of most modern conchologists in that he regards the external characters of the shell and the form of the pallial sinus as being of equal or greater importance than the characters of the hinge. I adhere to the prevalent view that the latter afford a much better and more constant criterion for distinguishing genera and sub-genera from one another than any other feature in Lamellibranch shells.

Comparing the type of *Cordiopsis* with that of *Sinodia* he says, "the contour of the hinge-plate is much more excavated and sinuous in *C. incrassata*, which when of the same size has a more remote (posterior lateral) tooth $3b$, and a much deeper pit to receive A II, with two protuberances (A I and A III) which are not so noticeable in *Sinodia*." . . . "The polymorphic ontogeny of *Cordiopsis*, its cordiform aspect at all ages, its less developed and narrower sinus, make it certain that we cannot confuse it with *Sinodia*, if we do not rely exclusively on the single criterion of the hinge in the classification

[1] "Conchologie Néogénique de l'Aquitaine": Actes Soc. Lin. Bordeaux, t. lxiv, p. 387, 1910.

of sub-genera. It is for this reason that we admit *Sinodia* as a section distinct from *Cordiopsis*, of which it is the modern degenerate representative."

On the contrary, I am still of opinion that both *Sinodia* and *Cordiopsis* belong to the genus *Dosinia*, and are altogether distinct from *Meretrix*, though they are related to *Pitaria*. At the same time I admit that there are some differences between the two groups, and I am quite willing to accept M. Cossmann's separation of them; the more so as he is able to associate several Miocene and Pliocene species with *C. incrassata*. These are *Cyprina gigas* (Lam.), *C. islandicoides* (Lam.), *Cordiopsis intercalaris* (Cossmann), and *Venus Brocchii* (Desh.) of the Italian Pliocene. M. Cossmann has figured the three French Miocene species in the memoir referred to, and they are evidently of the *C. incrassata* type. If, however, M. Cossmann means that he would place *Sinodia* as a section of *Cordiopsis* he runs contrary to accepted rules of nomenclature, for the name *Sinodia* has priority. *Cordiopsis* must be regarded either as a section of *Sinodia* or as a separate sub-genus of *Dosinia*.

Summary.—Hitherto I have dealt chiefly with the descriptions of sections and sub-genera given by other authors, and it will now be desirable to mention the characters which I regard as the most useful in distinguishing the subdivisions of *Dosinia* from one another, afterwards giving brief definitions of these subdivisions. The characters on which I rely are (1) the features of the lunule and escutcheon, (2) the teeth of the left valve, (3) the presence or absence of a 4th cardinal in the right valve, (4) the shape and depth of the pallial sinus, (5) the presence or absence of a groove on the posterior margin of the right valve, which receives a ridge on the rim of the left valve. These characters are more or less correlated with one another, and by them all the groups which have been mentioned may be defined in a satisfactory manner.

Dosinia (sensu stricto).—Lunule deeply impressed. Escutcheon narrow, more or less excavated, but often ill-defined. In the L.V. the anterior lateral is large and thick, middle cardinal broadly bifid, the front part being united at top to the anterior cardinal. In the R.V. there is a distinct 4th cardinal (long and narrow), and the posterior margin has a narrow and shallow groove. Pallial sinus long, narrow, obtuse or bluntly angular, and ascending.

Dosinella (Dall).—Lunule shallow and lanceolate. Escutcheon narrow and slightly excavated, but not well defined. In the L.V. the anterior lateral is small or obsolete, the middle cardinal broad and bifid, the front part being united at the top to the anterior cardinal. In the R.V. the 4th cardinal is absent or very weak, and there is no groove on the margin of the valve. The pallial sinus is deep, ascending, of nearly equal width throughout and rounded at the end.

Austrodosinia (Dall).—In this section the lunule is deeply impressed, but the escutcheon is narrow and ill-defined, though often bordered by ridges and sometimes excavated in the left valve. In the L.V. the anterior lateral is strong and rugose, the middle cardinal thick and solid, centrally placed between the other two. In the R.V. there is a strong 4th cardinal, and the posterior margin is grooved. The pallial sinus is short and nearly horizontal, sometimes rounded and sometimes angular.

Phacosoma (Jukes-Browne).—This has been defined on p. 100; it is distinguished from *Austrodosinia* by the broad well-marked escutcheon and by the oblique median tooth of the left valve, between which and the anterior there is a wide triangular space. The pallial sinus is also deeper and is always angular.

Pectunculus (Da Costa).—Lunule moderately impressed. No escutcheon. In the L.V. a small anterior lateral near the anterior cardinal; the middle cardinal broad and obscurely bifid, the front part being united to the anterior tooth. In the R.V. the 4th cardinal is weak or obsolete; the posterior margin has a shallow groove which is often obsolete in adult shells. Pallial sinus deep, rounded or obtusely angular, and generally ascending.

Dosinidia (Dall).—Lunule very little impressed. No escutcheon. In the L.V. a small pustular anterior lateral close to anterior cardinal, middle cardinal broadly bifid and united to anterior tooth; posterior cardinal thin and weak. In the R.V. the 4th cardinal is distinct and sharp, the 3rd is deeply bifid and has an anterior expansion over the median; the marginal groove is absent (except in *Dunkeri* and *Annæ*). Pallial sinus fairly deep, ascending, and angular.

Sinodia (Jukes-Browne).—This has been sufficiently defined on p. 100.

Cordiopsis (Cossmann).—Shell orbicular, thick, generally tumid, with incurved umbones and cordiform frontal aspect. Lunule superficial. No escutcheon. In the left valve a small pustular anterior lateral which becomes obsolete with age; middle cardinal thick, central, rugose, and united at the top to anterior tooth. In R.V. there is no 4th cardinal, but the posterior margin is grooved. Pallial sinus very short, small, and rounded.

In conclusion, a few words about the geographical distribution of the recent species may be useful. Those of the typical section are restricted to the old world, ranging round the shores of Europe, Africa, and Asia, the most eastern species being *D. prostrata* and *D. exasperata*, which occur in the Philippine Islands and in North Australia. The species of *Dosinella* have a restricted distribution, *dilecta* coming from Malacca and Siam, *angulosa* from the East Indian Islands, Malacca, and the Philippines, *penicillata* is Australian, and *Bruguieri* ranges from Australia to Japan. *Austrodosinia* is also an eastern ocean group, the species ranging from the east coast of Africa to Australia, New Zealand, the Philippines, and Japan.

The *Phacosoma* section is essentially Japanese, no fewer than five species occurring in Japanese waters, but *lamellata* is Australian, while *pubescens* and *Roemeri* are East African.

The *Pectunculus* section is distributed round the whole of Europe and Africa, but I cannot find that any occur on Asiatic coasts. There are, however, a number of species in Australian waters, viz. *amphidesmoides*, *grata*, *sculpta*, *nobilis*, and *incisa*.

The *Dosinidia* section is essentially American, occurring on both sides of Central and South America, but it is also represented in Chinese seas by the species *plana* and *Hanleyana*.

Of the distribution of the *Sinodia* group little is yet known. *D. trigona* was supposed to occur in the Red Sea, but this has not been confirmed, while it has recently been obtained from Siam and Malacca. *D. tripla* and *D. derupta* are both reported by Römer as coming from Malacca. The home of *D. excisa* is said to be Tranquebar and the Nicobar Islands, and lastly *D. globa* was found in the Persian Gulf. Thus it would seem that all the species live on the coasts of Southern Asia.

To Mr. J. J. MacAndrew and Mr. J. C. Melvill I offer my sincere thanks for their kindness in sending many specimens from their collections for my examination, and I have also to thank Mr. E. A. Smith for his valuable assistance in the naming of specimens submitted to him, and for looking up the types of certain species in the British Museum.

ON THE GENERIC NAME TO BE APPLIED TO THE *VENUS ISLANDICA*, LINN.

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

Read 12th April, 1912.

A considerable amount of discussion has already taken place concerning the generic name which should be applied to the well-known *Cyprina Islandica*, the *Venus Islandica* of Linnæus, and the latest writer upon the subject, Dr. W. H. Dall,[1] has assigned this shell to the genus " *Cyclas* (Bruguière), Link ".

Now Bruguière's plates in the *Encyclopédie Méthodique* (pls. 301, 302) with the word *Cyclas* at the top (he never published a description) do not include a figure of *Cyprina Islandica*, and the figures 1*a*, 1*b*, on plate 301, referred to by Dall as representing that species are very good illustrations of some form of the genus *Batissa*.

Dr. Dall's mistake may have arisen from the fact that in the explanation of the plates by Bory de St. Vincent,[2] the name *Cyprina Islandica*,[3] Lamk., is given (erroneously) to the two figures quoted above. But of this I feel certain, that Dr. Dall did not actually see the figures, for he is too good a conchologist to have regarded them as representing the above-named species.

The genera figured on Bruguière's two plates are *Batissa*, *Corbicula*, *Cyrena*, and *Sphærium*, as now generally understood, and perhaps *Astarte*, but not *Cyprina*. Bruguière's genus *Cyclas* has therefore nothing to do with *Cyprina*.

Link, in 1807,[4] placed the northern shell in " *Cyclas* (Lam.) ", it being the only species he mentions. But this name cannot be used, as it had already been employed by Lamarck in 1799[5] in a different sense for the *Tellina cornea*, Linn., now known as *Sphærium corneum*. The figure in the *Encyclopédie Méth.* (pl. 301, figs. 1*a*, 1*b*) upon which Dall based the genus " *Cyclas* (Bruguière), Link ", does not, as already observed, represent the *Cyprina Islandica*.[6] The form of the outline is quite different, and the erosion of the apex and the dentition at once indicate a species of the genus *Batissa*. Observe the crenulated lateral teeth in fig. 1*b*, a feature non-existent in *Cyprina Islandica*.

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1 Trans. Wagner Free Inst. Sci. Philad., vol. iii, pt. vi, p. 1500, 1903.

2 Tabl. Encycl. Méthod. Vers. Moll., etc., p. 156.

3 Also quoted by Lamarck as *Cyclas Islandica*, Ann. Mus. Nat. Hist. Paris, vol. vii, p. 420, 1806.

4 Nat. Sammlung, Rostock, 1807, p. 150.

5 Mém. Soc. Hist. Nat. Paris, 1799, p. 84.

6 All the following authors refer to this figure as representing the shell now known as *Batissa violacea*: Deshayes (Encycl. Méth. Vers., vol. ii, p. 49, 1830) under *Cyrena violacea*, Lamk.; id. (Cat. Conch. Brit. Mus., pt. ii, p. 238) under *Batissa violacea* (Lamk.); Philippi (Conchylien, vol. iii, p. 108) under *Cyrena violacea*, Lamk.; Prime (Amer. Journ. Conch., vol. vii, p. 140) under *Batissa violacea* (Lamk.); Clessin (Conch. Cab., p. 208) under *B. violacea*.

On these two plates Bruguière grouped as *Cyclas* a number of freshwater shells, and even the figure 3 on plate 302, said by some to represent an *Astarte*, would equally answer for a *Corbicula*, and Deshayes [1] observes "elle serait plus probablement du genre Cyrène, puisque Bruguière l'a ainsi placée, mais comme elle ne montre pas la charnière, nous conservons du doute".

It now remains to determine what generic name should be applied to the shell in question.

The name *Arctica* of Schumacher (1817) has a year's priority of *Cyprina*, Lamarck, but, as pointed out by various writers, it was preoccupied by Moehring in 1758 for a genus of birds, and therefore is not available. Although *Cyprina*, Lamk., and *Cyprinus*, Linn. (a genus of fishes), are very similar, the derivations according to Agassiz,[2] Herrmannsen,[3] Philippi,[4] Tryon,[5] Fischer,[6] Hoyle,[7] etc., are different. Both therefore can be employed in zoological nomenclature.

The synonymy will therefore stand as follows:—

CYPRINA ISLANDICA (Linn.).

1767. *Venus*, Linn., part.
1806. *Cyclas*, Lamk., part. (non *Cyclas*, Lamk., 1799 = *Sphærium*, Scopoli, 1777).
1807. *Cyclas*, Link. (non *Cyclas*, Lamk., 1799).
1817. *Arctica*, Schumacher (non *Arctica*, Moehring, 1758).
1818. *Cyprina*, Lamarck.
1900. *Cypriniadea*, Rovereto.
1903. *Cyclas* (Bruguière), Link, *fide* Dall (non *Cyclas*, Brug., 1798, nec *Cyclas*, Lam., 1799).

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[1] Lamarck's Hist. Anim. sans Vert., 2nd ed., vol. vi, p. 275.
[2] Nomencl. Zool. Moll., p. 28; Vertebrata.
[3] Indicis Gen. Malac., vol. i, p. 361.
[4] Handbuch Conch. und Malac., p. 306.
[5] Struct. and Syst. Conch., vol. iii, p. 187.
[6] Man. Conchyl., p. 1070.
[7] Journ. of Conch., vol. x, p. 361.

CHARACTERS OF THREE NEW SPECIES OF FRESHWATER SHELLS FROM URUGUAY.

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

Read 12th April, 1912.

Hydrobia Adamsi, n.sp.

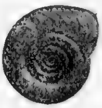
Shell fusiform, thin, pale greenish straw-colour; remaining whorls $6\frac{1}{2}$, flattish, showing traces of spiral striæ, especially on the last whorl, and marked with transverse lines of growth; suture impressed,

margined above; umbilicus very narrow, deep; columella descending in a curve, slightly reflexed; peristome continuous, simple; aperture ovate. Alt. 6·75, diam. maj. 3 mm.; aperture, alt. 2·5, diam. 1 mm.

Hab.—Monte Video (L. E. Adams).

Planorbis levistriatus, n.sp.

Shell sub-orbicular, moderately thin, pale brownish horn-colour; spire concave; whorls $5\frac{1}{2}$, marked with very oblique, arcuate, transverse lines of growth, and sculptured with very fine, closely set, wavy, spiral striæ, the last whorl not descending; suture deeply impressed; umbilicus very wide, shallowly depressed; labrum thin,

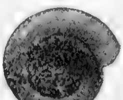


acute, the upper margin projecting considerably beyond that of the lower, both margins joined by a thin, whitish, pearly callus; aperture very broadly sublunate. Alt. 4·5 mm.; diam. maj. 14, min. 11 mm.; aperture, alt. 4·25, diam. 5 mm.

Hab.—The Miguelete River, Monte Video (L. E. Adams).

Planorbis Uruguayensis, n.sp.

Shell discoidal, thin, semi-transparent, pale yellowish horn-colour; spire concave; whorls 6, shining, marked with lines of growth; suture rather deeply impressed; base of shell concave; labrum thin, acute,



the margin diffusing into light whitish callosities which do not unite; aperture broadly lunate. Alt. 1·75, diam. maj. 7 mm.; aperture, alt. 1·75, diam. 1·25 mm.

Hab.—Monte Video (L. E. Adams).

DESCRIPTIONS OF FIVE NEW SPECIES OF *LIMICOLARIA* FROM BRITISH EAST AFRICA.

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

Read 12th April, 1912.

Limicolaria Alhiensis, n.sp.

Shell cylindrically fusiform, thin, semi-transparent, yellowish cream-colour, painted with transverse, narrow bands and flame markings of reddish purple; whorls 7, not very convex, the upper whorls finely decussately sculptured, the sculpture becoming obsolete on the later whorls, the lower portion of the sixth and seventh being quite smooth; suture impressed, slightly crenellate, very narrowly margined below with white; perforation very narrow, almost concealed

by the reflection of the columella; columella whitish, granular, nearly vertically descending above, somewhat obliquely descending below, diffused above into a very thin, minutely granular parietal callus; labrum thin, simple; aperture rather elongately inversely auriform; interior of shell faintly bluish, showing the transverse colour markings through the test. Alt. 37·75, diam. maj. 16·5 mm.; aperture, alt. 15·5, diam. 6·5 mm.

Hab.—Alhi Plains, British East Africa (A. Blayney Percival).

Var. ovata, n.var.

Shell differing from the typical form in its shorter and broader shape and in having a slightly less vertically descending columella. Alt. 33, diam. maj. 17 mm.; aperture, alt. 15·25, diam. 6·75 mm.

Hab.—Alhi Plains, British East Africa (A. Blayney Percival).

Limicolaria Nakuruana, n.sp.

Shell rather shortly and acuminately cylindrical, with rather obtuse apex, moderately solid, yellowish white, painted with irregular, transverse, zigzag bands and streaks of purplish chestnut; whorls 7, marked with coarse growth-lines, and decussately sculptured, the sculpture becoming obsolete on the last whorl; suture impressed, somewhat crenellate with the lines of growth; columella vertically descending, reflexed over the very narrow perforation; labrum acute;

aperture inversely auriform. Alt. 35 mm.; diam. maj. 18, min. 16 mm.; aperture, alt. 14, diam. 8 mm.

Hab.—Nakuru, British East Africa (Robin Kemp).

LIMICOLARIA NYIROENSIS, n.sp.

Shell cylindrically fusiform, with obtuse apex, dark yellowish flesh-colour, stained and painted on the later whorls with broad, flame-like, transverse bands of blackish purple; whorls $6\frac{1}{2}$, slightly convex, rather rapidly increasing, somewhat coarsely decussately sculptured, except on the lower half of the last whorl, where, but

for coarse, transverse, closely set growth-lines, the surface is smooth; suture impressed, narrowly margined with cream-colour below; umbilicus narrow, deep, half concealed by the outward expansion and reflection of the columella; columella livid, descending in a very slight curve, labrum simple, acute; aperture rather squarely inversely auriform; interior of shell blue, edged with a band of dark purple about three millimetres broad behind the labrum. Alt. 49·5, diam. 22·75 mm.; aperture, alt. 21, diam. 11 mm.

Hab.—Mount Nyiro, to the south of Lake Rudolph, at an altitude of 8,300 feet (A. Blayney Percival).

Mr. Percival also collected this species between Eusso Nyiro and the southern slopes of Mount Marsabit, while he also took a single specimen, which agrees very well with the type, on the northern slopes of that mountain; it appears to be somewhat variable both in general shape and also in colour, some specimens being somewhat less obese than others, while the colour varies from olive brown with scarcely any signs of transverse banding to that of the type-specimen.

Var. FLAVIDA, n.var.

Shell differing from the typical form in being of a uniform pale yellowish brown colour, without darker markings of any kind, the columella is rather more curved, and the aperture is proportionately somewhat shorter and more oblique; the interior of the shell is pale lilac without any other colouring. Alt. 47, diam. maj. 21·5 mm.; aperture, alt. 19, diam. 11·75 mm.

Hab.—Northern slopes of Mount Marsabit, British East Africa, at an altitude of 4,600 feet (A. Blayney Percival).

LIMICOLARIA (REBMANNIELLA) PERCURTA, n.sp.

Shell rimate, ovate, light yellowish, painted with blotches, transverse streaks and flame-markings of dark purple; whorls $6\frac{1}{4}$, the last somewhat inflated, sculptured with oblique, transverse ridges crossed by spiral striæ, thus presenting a moderately finely decussate appearance, this sculpture becoming obsolete towards the base of the shell, which is marked only with fine, wavy, spiral, incised striæ;

suture impressed, irregular, crenellate, narrowly margined below; perforation reduced to a narrow fissure by the reflexion of the columella; columella curved, narrowly outwardly bent and reflexed, extending above into a thin, well-defined callus which enters the aperture a short distance behind the upper margin of the labrum;

labrum acute, simple; aperture inversely auriform; interior of shell pale bluish lilac, the transverse flame-markings being visible through the test. Alt. 45·5 mm.; diam. maj. 24·75, min. 22·5 mm.; aperture, alt. 23, diam. 12 mm.

Hab.—Between the Igembi Hills and Nyeri, British East Africa (Robin Kemp).

LIMICOLARIA (REBMANNIELLA) PEROBTUSA, n.sp.

Shell rimate, ovately fusiform, with extremely obtuse apex, the earlier whorls pale flesh-coloured, the median whorls yellow, stained here and there with chestnut and painted with blotches and transverse flame-markings of livid, blackish purple, the last whorl shading below to reddish chestnut; whorls $6\frac{1}{2}$, regularly increasing, the last convex below, coarsely granulate throughout; suture impressed, irregularly crenellate, narrowly margined below with white or pale yellow; columella whitish, very faintly tinged with pale lilac, vertically

descending and narrowly reflexed over the perforation; umbilicus reduced to a narrow chink; labrum simple, lilac-coloured within; aperture elongately inversely auriform. Alt. 55 mm.; diam. maj. 27·5, min. 25·25 mm.; aperture, alt. 26, diam. 12 mm.

Hab.—Mount Kenaugop, Aberdare Range, British East Africa (Robin Kemp).

A very handsome species, whose granular sculpture and extraordinarily obtuse form readily separate it from other members of the group.

A SYNOPSIS OF THE RECENT AND TERTIARY FRESHWATER MOLLUSCA OF THE CALIFORNIAN PROVINCE, BASED UPON AN ONTOGENETIC CLASSIFICATION.

By Harold Hannibal.

Read 8th March, 1912.

PLATES V–VIII.[1]

GENERAL REMARKS.

The Californian Province.

The region covered in the following pages has been termed by Woodward, Tryon, Fischer, and Cooke the Californian Province. Briefly it embraces the Yukon Basin and tundras to the northward, the entire Pacific drainage of North America from Western Alaska south to the vicinity of San Sebastian Viscaino Bay, Baja California, the Great Basin, and the drainage of the Colorado River. This vast area, considered as a whole a well-defined faunal unit, may be conveniently divided into twelve systems,[2] or faunules, which correspond roughly to the principal drainage areas, viz.: *Yukon*, basin of the Yukon River and associated streams flowing into the Arctic Ocean, and tundras to the northward; *Alaska*, the Alaska Peninsula, Aleutian Islands, and coastal drainage south to the Stikine River; *Fraser*, the Fraser basin, and rivers northward to the Portland Canal, Vancouver and Queen Charlotte Islands, the Puget Sound Region, and the streams flowing north and west from the Olympic Peninsula; *Columbia*, entire basin of the Columbia River, and coastal streams from Gray's Harbour to the Umpqua River; *Utah*, basin of the extinct Lake Bonneville; *Colorado*, the Colorado River and its tributaries above the Needles or thereabouts; *Nevada*, the drainless basin of old Lake Lahontan; *Klamath*, coastal streams from the Rogue to the Redwood River, the Klamath drainage, adjacent desert basins of Eastern Oregon, and streams flowing south from Mount Shasta and westward from the Sierra Nevada Mountains, north of Yosemite Valley; *Coast Range*, the Sacremento – San Joaquin Valley, southern Sierra Nevada Mountains, coastal drainage from Mad River to Point Conception, and San Francisco Bay region; *Mojave*, the drainless basins of Owens Valley, Death Valley, Mojave Desert, and the adjacent desert regions of Southern Nevada and South-Eastern California; *Los Angeles*, coastal drainage from Point Conception to the vicinity of San Sebastian Viscaino Bay; *Arizona*, the Colorado Desert and drainage of the Colorado River below the Needles.

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[1] Plates vii and viii will appear in the next part of the 'Proceedings'.

[2] See in this connexion Dall, Pop. Sci. Mo., lxvi, p. 362, 1905; *Alaska*, xiii, 1905, p. 2; Hannibal, in *West Coast Shells*, 1910, p. 229.

Composition of the Fauna.

The Californian fauna, a summary of which is given in the accompanying tables, is a composite one and can only be understood through the Tertiary palæontological history of the region, which may be summarized as follows: —

1. Older Eocene: conditions West Indian, great interior lakes, fauna similar to that of contemporaneous deposits in Rocky Mountains, not closely related to any existing American faunas. (Payette, Truckee.)

2. Younger Eocene, Oligocene: climate continuing nearly tropical and moist, widespread estuary conditions along coast; fauna similar in aspect to preceding, marked, however, by an invasion of Unioids belonging to recent European genera. (Tejon, John Day.)

3. Miocene: conditions similar to those of Mexico, arid period, a few minor lacustrine deposits interbedded with volcanic ejectamenta, fauna consisting of Gulf States or Mexican genera, a few widespread living species first appear. (Mascall, Rosamond, Contra Costa.)

4. Pliocene: introduction of sub-boreal conditions, slightly colder than present, period of extensive lakes; peculiar portion of existing Californian fauna appears abruptly in nearly its present form, widespread recent molluscs few, however; half or more of species living; *Pyrgulopsis* represented by several peculiar species. (Kettleman, Santa Clara, Cache, Idaho.)

5. Quaternary, Recent: existing conditions, temporary periods of widespread lakes; faunas occupied present or approximately present distribution south of limits of glacial ice-sheet. North of lat. 50° the fauna contains no peculiar forms except in portions of Alaska which were unglaciated, merely more hardy and readily distributed species which have immigrated from unglaciated areas since the middle Quaternary. Most of the species which range beyond the limits of the Californian Province first appear at this time. (Lahontan, Bonneville, Le Conte, Yukon loess, various fluvial and spring deposits, species washed into marine terraces along coast.)

The living fauna is made up of four elements: (1) Peculiar species, most of which have come down from the Pliocene (*Pompholyx effusa*, *Ambloxus pliciferus*). (2) Species common to central Europe and the less Arctic portions of Californian Province which appear to have lived on from a late Miocene migration across Bering Straits (*Margaritana margaritifera* (Palæarctic origin), *Anodonta cygnea* (Californian origin). (3) Species common to Alaska and adjacent portions of Siberia, apparently remnants of a Quaternary migration across Bering Straits (*Anodonta cygnea Beringeriana*, probably Californian origin). (4) Species of European or American origin which have immigrated from the eastward at various periods, chiefly during pre-Bonneville–Lahontan times. The European species in the American Province probably date back to a middle Miocene migration (*Physa hypnorum* (European origin ?), *Planorbis antrosus* (American origin)). On the other hand, several species of Californian origin have extended their ranges southward or eastward beyond the limits of the Californian Province (*Margaritana margaritifera falcata*, *Lymnæa solida Cubensis*).

Classification employed.

Since Evolution came to be accepted as a doctrine it has been a general policy to regard mere systematic work as a thing entirely apart from the theoretical considerations of species formation. Hence, in the bulk of zoological writings to-day a treatment of one involves no co-ordination with the other, to the mutual handicap of each. The first writer to break through these trammels of convention was Alpheus Hyatt, and to him the modern classification of the Mollusca is due. In the attempts to place this Phylum upon a stable footing an ever-increasing number of students have laboured, important among whom stand Jackson, Smith, and Grabau. Diverse as were the views on species-change which these several writers held at the onset, in recording the evolutionary modifications as they exist and applying them in their systematic studies, all have arrived at essentially identical conclusions, and the genetic classification [1] has ceased to be the unsupported theories of a philosopher-scientist and become a fact. To quote Hyatt's *Law of Morphogenesis*: "A natural classification may be made by means of a system of analysis, in which the individual is the unit of comparison, because its life in all its phases, morphological and physiological, healthy or pathological, embryo, larva, adolescent, adult, and old (ontogeny) correlates with the morphological and physiological history of the group to which it belongs (phylogeny)."

Syntonia.

Various writers, including Cooke [2] and Dall,[3] have noted the occurrence, in the shells of freshwater molluscs from brackish or enclosed bodies of water subject to concentration, of malleations, plications, or scalarity among the Gastropods, arcuity and roughening among the Pelecypods, and other deviations from the types found under normal circumstances. These examples have been invariably extreme instances, however; the less striking ones pass unnoticed, since hardly a lake, pond, marsh, slough, stagnant stream, semi-estuary, or enclosed or partially enclosed body of water, contains molluscs which are not more or less subject to these aberrancies. Frequently, particularly in the arid regions of Western North America, these forms have been redescribed as separate species,[4] but in no instance are the characters inherited, though the stock may have passed through a long line of abnormal generations. The progeny under such conditions appear to be unusually liable to become abnormal likewise, but this may be explained on the basis of hereditary

[1] Recent accounts of the genetic classification and its application to Mollusca may be found in J. P. Smith, Journ. Geol., v, pp. 509–24, 1897; viii, pp. 413–25, 1900; A. Grabau, Am. Nat., xxxvi, pp. 917–45, 1902; xli, pp. 610–46, 1907.

[2] Mollusca, Cambridge Nat. Hist., vol. iii, p. 85, figs. 33, 34, 1895.

[3] *Science*, i, p. 202, 1883; Proc. Acad. Nat. Sci. Philad., p. 408, 1896.

[4] Within a year one writer, evidently of limited experience in the field, has distinguished as a distinct genus an extreme distortion of the common *Lymnæa auricularia* from this region.

susceptibility, much as tuberculosis passes from one generation to another in the human race.

Forms produced under these circumstances are legion, but appear in every instance not as possessing new characters, but the result of an accentuation of the principal environmental and evolutionary influences which affect the mollusc, hence the term *syntonia* suggested to the writer by Dr. David Starr Jordan.

The thickness of the shell normally depends, within limits, on the amount of lime in the water. Affected by these influences the variation increases, resulting in such extreme forms as typical *Lymnæa auricularia* on the one hand and the so-called *Mighelsi* on the other. *Lymnæa palustris* commonly ranges from 20 to 30 mm. in altitude, depending chiefly on the rapidity of flow of the water. Syntonic forms have been noted 50 mm. in altitude. Ordinarily *Physa fontinalis* varies from about 60° to 70° in the breadth of the apical angle according as it is found respectively in running streams or lakes.[1] In aberrant forms the breadth may be increased to 95°.

An accentuation of the evolutionary influences in the Gastropoda may produce an exaggeration of the rest periods, resulting in the development of more or less regular costæ, of the spiral striæ causing malleations, angulations, or keeling, of the inflation of the aperture (to which cause is due the remarkable typical form of *Lymnæa auricularia*, a particularly susceptible species, of which the so-called *peregra* and *catascopium* represent the normal condition), an unnatural development of the columnar fold as frequently happens in species belonging to typical *Lymnæa*, and the production of irregularities of growth such as are common in *Planorbis trivolvis*. The Pelecypoda appear to be rather less susceptible, but arcuity among the Unioids is generally due to this cause.

No two species of Mollusca are affected to a like degree or exactly in the same manner. *Lymnæa*, *Physa*, and *Anodonta*, for instance, become progressively deformed, and senile individuals show the effects most markedly. On the other hand, in *Ambloxus* it is almost impossible to obtain normal adolescent specimens of certain species, whereas the adults are but rarely aberrant.

The cause of these phenomena has been the source of much discussion. Dall held volcanic dust responsible among the Galapagos Bulimuli, and the salts concentrated in the receding waters of Lake Bonneville in the instance of the Quaternary freshwater species of Utah. Cooke suggested brackish water to account for the deformation of the Lymnæas from the Aral Sea. No one, however, has isolated the particular salt which it is evident is producing the mischief. The only salts which occur widespread or in sufficient abundance to be regarded as probabilities are those of sodium, potassium, calcium, and magnesium. Sodium and potassium salts, known commonly as white and black alkali respectively, are frequently abundant in the arid regions of the west. It has been repeatedly observed that one or the other or both may be present in

[1] Gray's Turton, p. 228, 1857.

such abundance as to cover entirely the ground in the vicinity of a pond or stagnant stream while the Mollusca are indifferently normal or affected, and when affected seldom to the degree one would expect if the distortion could be the result of the salt in question. Calcium salts, as is well known, have no deleterious effect upon molluscan life, but are a prime necessity for its existence. Magnesium compounds, on the other hand, produce remarkable physiological effects and act as poisons.

Reasoning on this basis the writer has undertaken a series of experiments with balanced aquaria which prove beyond doubt that the small quantities of magnesium salts ordinarily present in stagnant water produce these puzzling forms, and, once produced, their results are not readily overcome. Both the sulphate and the chloride appear to be equally pernicious.[1]

Whether or not other salts have similar effects has not been ascertained in every case. The eight or nine commoner ones in ordinary water produce no appreciable distortion.

SYNOPSIS OF SPECIES.

Having considered briefly the faunal subdivisions, origin and development of the fauna, method of classification, and the interfering factor, syntonia, it is now possible to proceed intelligently with an outline of the classification and distribution of the aquatic Mollusca of the Californian Province. It may be noted at the outset that the following pages are intended chiefly as a working nucleus for future papers. A monograph of the fauna would require as many years for its preparation as this synopsis has months, to say nothing of the necessity of far more extensive field-work, hence its deficiencies may be to a degree pardonable.

PELECYPODA.

Superfamily UNIONOIDEÆ (Swainson), 1840.

The ancestral form of the Naiad shell seems to have been heavy, quadrate-discoidal, zigzag sculptured, and possessing a broad, coarse hinge. From this type there has been a general tendency for the more specialized forms to acquire a smooth, thin, posteriorly elongated shell, the markings being carried back to the umbones forming the characteristic beak sculpture and towards a reduction in the breadth of the hinge, followed by a loss first of the lateral teeth, later the pseudo-cardinals, with the ultimate result of a general simplification of all the shell parts.

This *paterina* stage is not represented without some modification by any living species known to the writer. Probably the nearest approach is in such types as *Hyria corrugata*, *Quadrula undulata*, and *Rotundaria tuberculata*, in which the sculpture has been largely carried back to the umbones, a few atavistic, undulating, or broken pustulose

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[1] It is probable since the salts are ionized in solution that the hydrochloric acid present in the salivary juices would change the sulphate to chloride before it entered the circulatory system.

ridges remaining, particularly on the posterior portion of the shell, while the broad hinge and the sub-quadrate shape seem to have suffered little change.[1]

In the next stage, of which *Migranaja littoralis*, *Elliptio crassidens*, and *Lampsilis luteolus* may be taken as representatives, the sculpturing has been carried back to the umbones, the shells become posteriorly elongated and the hinge-area much reduced in breadth. Forms such as *Margaritana margaritifera falcata*, *Stropitus edentulus*, and *Alasmidonta marginata* represent the next condition, in which the laterals have become obsolete, leaving the pseudo-cardinals as tubercles, while in typical *Anodonta* the shell has become elongate-elliptical, the umbones decidedly anterior, and the hinge simple, edentate, and gently curved.

This series of changes is not characteristic of any one group of Naiades, but may be observed with more or less modifications in all, irrespective of the special line of descent. In other words the entire superfamily exhibits an instance of parallel development, and the dissimilarities of the species as one sees them are due to the different stages in the series reached by that species and the degree of unequal parallelism developed by that particular line of descent compared with the whole. Since specialization without differentiation is not very valuable in classification, the shell characters become of secondary importance in the recognition of groups more comprehensive than genera.

In the anatomy, however, one finds a sound foundation on which the higher divisions may be built. Here the specialization which takes place tends to ultimately result in the production of a parasitic larva (unlike any stage in the development of the race) which must pass through a complete metamorphosis before reaching the adolescent condition, and a specialized marsupium for its development. This reaches its culmination only in such genera as *Spatha*, *Anodonta*, and *Proptera*, but all the higher forms show indications of approaching it. It is evident that parallelism likewise exists in the anatomical modifications, in that all the groups modify towards a certain definite end, yet the means by which this is accomplished are diverse, and the resulting marsupia and larvæ are not homologous but strictly analogous.

Margaritana (Margaritaninæ) represents in its anatomical features, independent of the modifications of the shell, the oldest and least differentiated type of Naiad structure. The gill-septa, which in the more specialized groups (except the Hyriinæ) coalesce completely to form the water-tubes, are present on the inner faces of each gill-lamella. These are never united, but instead regularly beaded with low-rounded papillæ lying in rows at right angles to the septa. At occasional and irregular intervals, perhaps once to a septum, its development becomes more pronounced, and one or more of the

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[1] That this shape is really primitive is evident from the inspection of the young stages of almost any Unioid; cf. pl. v, fig. 7, or Lefevre & Curtis, Journ. Exp. Zool., ix, pl. iv, fig. 29, 1910.

papillæ will meet and fuse with their neighbours on the opposite lamella, forming the scattered synapticulæ which hold the gill-plates in shape. Other simple features such as the incomplete diaphragm, undeveloped siphons, indiscriminate use of all the gills as a rudimentary marsupium, and the little modified subglobular-quadrate glochidia, may be noted.

From this simple type differentiation has proceeded in at least two directions, one marked by the southern hemisphere groups, apparently represented in their simplest condition by *Hyria* (Hyriinæ), while *Spatha* (Mutelinæ ?) is a more specialized phase, the other embracing the numerous and diverse genera which occur in the Northern Hemisphere. The simplest aspect and the one least modified from the fundamental Margaritanoid structure among the latter is exemplified in *Quadrula* (Quadrulinæ), in which the interlamellar gill-connexions are completely coalesced into definite water tubes, the diaphragm fully developed, formed solely by the gills, while on the other hand all the branchiæ are retained as a simple marsupium and the glochidia remain undifferentiated. This group has apparently given rise to another closely allied one, in which the brood-pouch has been restricted to the outer gills only. Several American genera, *Pleurobema*, *Rotundaria*, *Elliptio*, etc., belong to this division, which may be termed the Pleurobeminæ. From the Pleurobeminæ in turn no less than two stocks have arisen. One of these is represented by *Lampsilis* (Lampsilinæ), in which a portion of the outer gills in the female are permanently modified to serve as a highly organized marsupium but in which the glochidia remain simple. From this type *Proptera* (Propterinæ) has been derived, distinguished by its peculiarly modified 'axe-head' larvæ, thus representing the culmination of the evolutionary cycle in this branch of the Naiads. *Unio* (Unioninæ) represents the other stock derived from the Pleurobeminæ. Here the glochidia have advanced in specialization, becoming triangular and armed, resembling a spade-head in shape, while the simple marsupium of *Pleurobema* is retained. *Anodonta* is a specialization of this type in which the outer gills of the female become transformed into a temporary highly modified marsupium during the gravid season, having advanced *pari passu* with the modification of the glochidia, thus resulting in a condition analogous to that of *Spatha* and *Proptera*. So much for the internal structure; the problem now confronts the systematist as to how all this may be best classified.

A species in the Hyattian sense consists of a group of related individuals having a similar genetic history and possessing a tendency to evolve along strictly analogous lines. If this group may be divided into sub-groups which occupy a particular stage in the development-series, then they may be termed sub-species,[1] while a group of species

[1] This definition, while very different from that ordinarily given for a sub-species (that it represents a geographic variety), in practice amounts to approximately the same thing. Sub-species either occupy a different geographic area, a different station, or a different life-zone from the type, so far as the writer's experience goes.

derived from the same immediate stock constitutes a superspecies or 'group' of species. Similarly, a genus is a group of allied species evolving along approximately parallel lines, and a family a group of genera whose history is essentially analogous, while sub-genera and sub-families, and supergenera or 'groups' of genera and superfamilies, bear analogous relations to genera and families respectively that subspecies and superspecies do to species.

Applying these criteria to the present group it is obvious that as a whole the Naiades constitute a well-defined superfamily, the Unionoideæ, while the different development stages, of which there are nine, constitute sub-families whose relations may be graphically expressed by the accompanying diagram. These belong to five radicles, and these radicles the writer would regard as families since they are more or less equal in value and conform to the definition. Therefore, on the basis of our present knowledge the Naiades may be tentatively classified as follows:—

Superfamily UNIONOIDEÆ (Swainson), 1840.

MARGARITANIDÆ (Ortmann), 1910.

HYRIIDÆ (Swainson), 1840.
Hyriinæ, s.s.
Mutelinæ (Gray), 1847.

QUADRULIDÆ (Von Ihering), 1901.
Quadrulinæ, s.s.
Pleurobeminæ, nov.

LAMPSILIDÆ (Von Ihering), 1901.
Lampsilinæ, s.s.
Propterinæ, nov.

UNIONIDÆ, Swainson, 1840.
Unioninæ, s.s.
Anodontinæ, Swainson, 1840.

It is probable that with a knowledge of more genera than have at present been studied and made known,[1] the number of families and sub-families will be considerably increased since the internal characters of this group have specialized along a series of similar but distinct lines.

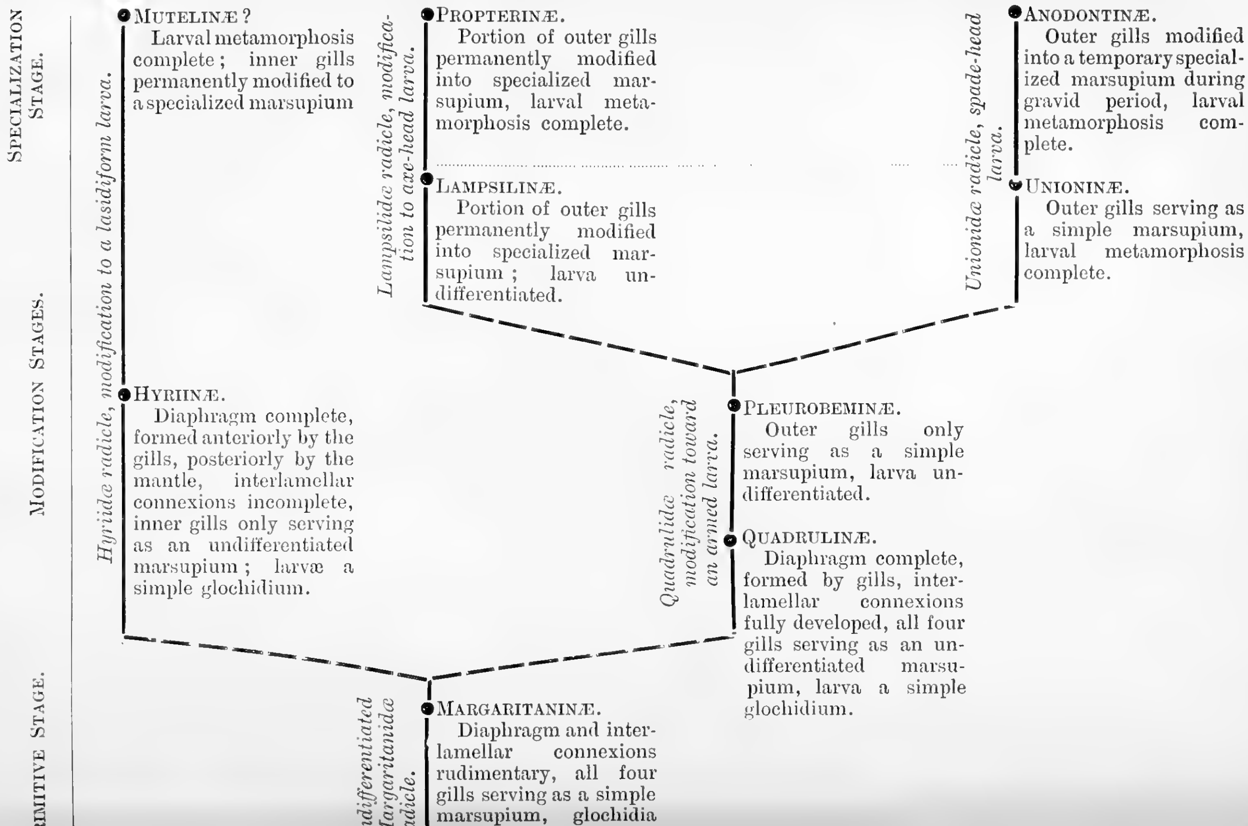
Family MARGARITANIDÆ (Ortmann), 1910.

Shell of moderately large size, quadruliform, unioniform, or margaritaniform; animal as described above, tachytictic; glochidium simple; habitat fluviatile and lacustrine.

The Margaritanidæ, in spite of the fact that modifications of the shell have taken place to a very considerable degree in all the known

[1] See A. E. Ortmann, *Nautilus*, xxiii, pp. 114 ff., 139 ff., 1910; xxiv, pp. 39 ff., 94 ff., 1910; pp. 114 ff., 1911; xxv, pp. 5 ff., 1911; Mem. Carn. Mus., iv, pp. 279–347, pls. lxxxvi–ix, 1911; Lefevre & Curtis, Journ. Exp. Zool., ix, pp. 79–115, pls. i–v, 1910.

EVOLUTIONARY CYCLE OF THE UNIONOIDEÆ (including only the groups from which data are available).



recent representatives, indicate a primitive phase of Naiad structure in so far as the anatomy is concerned.

Margaritana, the only recognized genus, appears to be confined to the Northern Hemisphere. However, *M. monodonta*, an American species, should doubtless be separated as a distinct genus; it differs in important particulars from *M. margaritifera* in the adolescent shell, a certain indication of heterogeneous origin.

Genus Margaritana, Schumacher.

Mya (sp.), Linné, 1758 (*M. margaritifera*, L.); *Unio* (sp.), Retzius, 1788 (*M. margaritifera*, L.); *Margaritana*, Schumacher, 1817 (*M. margaritifera*, L.); *Alasmodonta* (sp.), Barnes, 1823 (*A. arcuata*, Barnes=*M. margaritifera*, L.); *Damaris*, 'Leach MS.,' Gray, 1847 (*M. margaritifera*, L.), in synonymy; *Baphia*, 'Meuschen,' H. & A. Adams, 1857 (*M. margaritifera*, L.).

Type, *Mya margaritifera*, Linné.

Sub-genus Pseudunio, Haas.

Lymnium (sp.), Moquin-Tandon, 1855 (*U. sinuata*, Lam.); *Pseudunio*, Haas, 1910 (*U. sinuata*, Lam.).

Type, *Unio sinuata*, Lamarck.

Sub-genus *Pseudunio*. Shell of moderate size, averaging 120 mm. in length, sub-solid, elongate-elliptical, umbones marked by a few fine sub-nodulous ridges, moderately elevated and lying about one-third of distance from anterior extremity, lateral teeth fairly developed; nacre of concavity marked with numerous small muscle-scars; habitat lacustro-fluviatile and fluviatile.

Sub-genus *Margaritana*, s.s. Shell similar to preceding, but the lateral teeth largely or entirely obsolete; *Pseudunio* stage completed very early during adolescence; habitat running streams.

Margaritana (Pseudunio) Herrei, n.sp. Pl. VII, Fig. 17.

Margaritana '*margaritifera*, Linn.', Walker, 1910 (*partim*).

Shell rather large for genus, resembling *M. margaritifera* in general outline, but narrower and more compressed, with a straighter dorsal line; teeth not obsolete, two clavate pseudo-cardinal and two laterals of moderate length in right valve, one each in left; habitat apparently lacustrine. Length 115, breadth 40, depth of valve 12 mm.

Eocene: local freshwater beds in Tejon formation, California.

One-fourth mile above Carnegie Pottery plant, in cut along Western Pacific Railway, Corral Hollow, Tesla, California (Stanford University Geological Survey, per W. H. Ochsner) (H. Hannibal).

Named after Dr. A. C. Herre, under whose guidance the writer first became interested in the study of molluscs.

Margaritana margaritifera (Linné).

Mya margaritifera, Linné, 1758; *Alasmodonta arcuata*, Barnes, 1823 (syntonic form).

MARGARITANA MARGARITIFERA FALCATA (Gould).

Alasmodonta falcata, Gould, 1850 (syntonic form, hardly typical); *Alasmodon Yubaensis*, Trask, 1855.

M. margaritifera. Shell of moderate size, elongate-elliptical, umbones rather low, lateral teeth sub-obsolete in normal adult, nacre usually bluish or pinkish; habitat rapid streams.

Boreal portion of Palæarctic and Atlantic seabord of Nearctic regions, infrequently with *falcata* in Californian Province.

M. margaritifera falcata. Shell similar to *margaritifera*, but the lateral teeth totally obsolete, pseudo-cardinals much reduced, nacre prevailingly lurid purple or orange; *margaritifera* stage completed before mid-adolescence; habitat similar.

American Province in upper Missouri River. Fraser, Columbia, Klamath, Utah, Nevada, and Coast Range Systems.

Quaternary: Bonneville Lake beds, Utah; Lahontan Lake beds, Nevada.

The distribution of this species has been made the subject of an interesting paper by Walker.[1] The supposed Eocene record is the *Margaritana Herrei*, but the poorly preserved material then at hand from Tesla, California, showed no lateral teeth. It is probable that *M. margaritifera falcata* at no point extends south of the latitude of Monterey Bay, California.

The very young of this mollusc were once obtained, with *Sphærium*, in a little spring under the bank of a brook in which the adults were common.

Unrecognized: '*Unio* (*Margaritana*)' *onariotis*, Mayer, 1869. Miocene (?) of Alaska.

Family UNIONIDÆ, Swainson, 1840.

Shell of moderate size, unioniform, margaritaniform, or anodontiform; animal as described above; glochidium spadiform, each valve armed with a spine; habitat fluviatile and lacustrine.

Sub-family UNIONINÆ, s.s.

Shell of moderate size, unioniform or margaritaniform; animal as described above, tachylictic (?); habitat fluviatile and lacustrine.

Genera: *Unio*, *Migranaja*.

Sub-family ANODONTINÆ, Swainson, 1840.

Shell of moderate size, thin or sub-solid, unioniform, margaritaniform, or anodontiform; animal as described above, brachylictic; habitat lakes and streams.

Genera: *Anodonta*, *Gonidea*, *Arnoldina*.

The recognition of two Unionidæ, unquestionably congeneric with living European species, in the Eocene–Oligocene of the Pacific Coast, throws interesting light upon the former ranges of these genera, not to mention the evidence afforded of their considerable antiquity and the fixity of their characters.

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[1] Proc. Malac. Soc. Lond., ix, pp. 126–45, 1910.

Genus Unio, Retzius.

Mya (sp.), Linné, 1758 (*M. pictorum*, L.); *Unio*, Retzius, 1788 (*M. pictorum*, L.); *Lymnium*, Oken, 1815 (*M. pictorum*, L.); *Unionea*, Rafinesque, 1815 (emended form); *Mysca*, Turton, 1822 (*M. pictorum*, L.).

Type, *Mya pictorum*, Linné.

Shell of moderate size, averaging 60 mm. in length, sub-solid, elongate-elliptical, anteriorly sub-truncate, somewhat pointed posteriorly, slightly indented in front of posterior terminus, umbones small, lying about one-third of distance from anterior end, rather low, and marked by a few doubly looped nodulous ridges, two lateral teeth, and one well-developed and one more or less obsolete pseudo-cardinal in left valve, one lateral and one pseudo-cardinal in right valve, pseudo-cardinals acicular, lying sub-parallel to hinge; habitat lacustro-fluviatile.

Unio transpacifica, Arnold & Hannibal, n.sp.[1] Pl. VII, Fig. 18.

Shell of moderately large size, varying from compressed to somewhat inflated, very similar to *U. pictorum*, but proportionately broader, particularly in the umbonal region, less distinctly truncate anteriorly, margin of shell slightly sinuate in front of posterior extremity, hinge heavier than in *pictorum*, a second pseudo-cardinal imperfectly developed in left valve; habitat apparently lacustrine.

Type: length 58, breadth 30, depth of valves 20 mm. Cotype (cut into exposing hinge in both valves): length 70, breadth 35, depth of valves 26 mm.

Eocene: local freshwater beds in Tejon formation of Washington and California.

Bluffs along Olequa Creek at shoals, one and a half miles above town (types); above shoals two miles above town; bend below railroad bridge, one-third mile below town, Little Falls, Washington (H. Hannibal).

One-fourth mile above Carnegie Pottery plant, in cutting along Western Pacific Railway, Corral Hollow, Tesla, California (Stanford University Geological Survey, per W. H. Ochsner) (H. Hannibal).

The first true American *Unio* known.

'*Unio*' *penultimus*, Gabb.

Pal. Cal., i, p. 182, pl. xxiv, fig. 164, 1864.

Eocene—Tejon formation: coal-mines near Mount Diablo, California.

Whatever may be said of this species, the supposed type of which, in a very fragmentary condition, is preserved in the Geological Museum at the University of California, it is not a Naiad at all. It bears more resemblance to an *Anomia* than any other genus which the writer could recall while examining it.

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[1] The types of this species, of *Viviparus Washingtonianus* (*Pachychilus Drakei*), and of *Ambloxus Olequaensis* were obtained by the writer during the summer of 1911 while collecting marine Eocene fossils at Little Falls, Washington, in the interests of Dr. Ralph Arnold.

Genus Migranaja, n.gen.

Unio (sp.), Lamarck, 1801 (*Unio littoralis*, Lam.).

Type, *Unio littoralis*, Lamarck.

Shell of moderate size, averaging 50 mm. in length, sub-solid, ovate-elliptical, crassiform, rounded in front and behind, umbones broad, elevated, and marked by numerous rather fine wavy ridges, which extend out on later growth, grading into obsolete chevrons; two lateral and two pseudo-cardinal teeth in left valve and one each in right, the pseudo-cardinals clavate, stumpy, and lying obliquely transverse to hinge; habitat lacustro-fluviatile.

The present group, which does not seem to have been heretofore distinguished from *Unio*, but differs obviously in the form of the hinge-teeth and early growth of the shell, has a distribution, considering both fossil and recent records, from Eastern Oregon to Spain, equalled in the Naiades only by *Margaritana*, *Unio*, and *Anodonta*.

Migranaja Condoni (White).

Unio Condoni, White, 1885.

Shell large for genus, similar in outline to *littoralis*, but distinguishable by the broader, more inflated umbonal region; hinge essentially the same, but cardinal teeth heavier; habitat apparently lacustrine.

Oligocene: local freshwater beds in upper portion of John Day formation, Oregon.

Genus Anodonta, Lamarck.

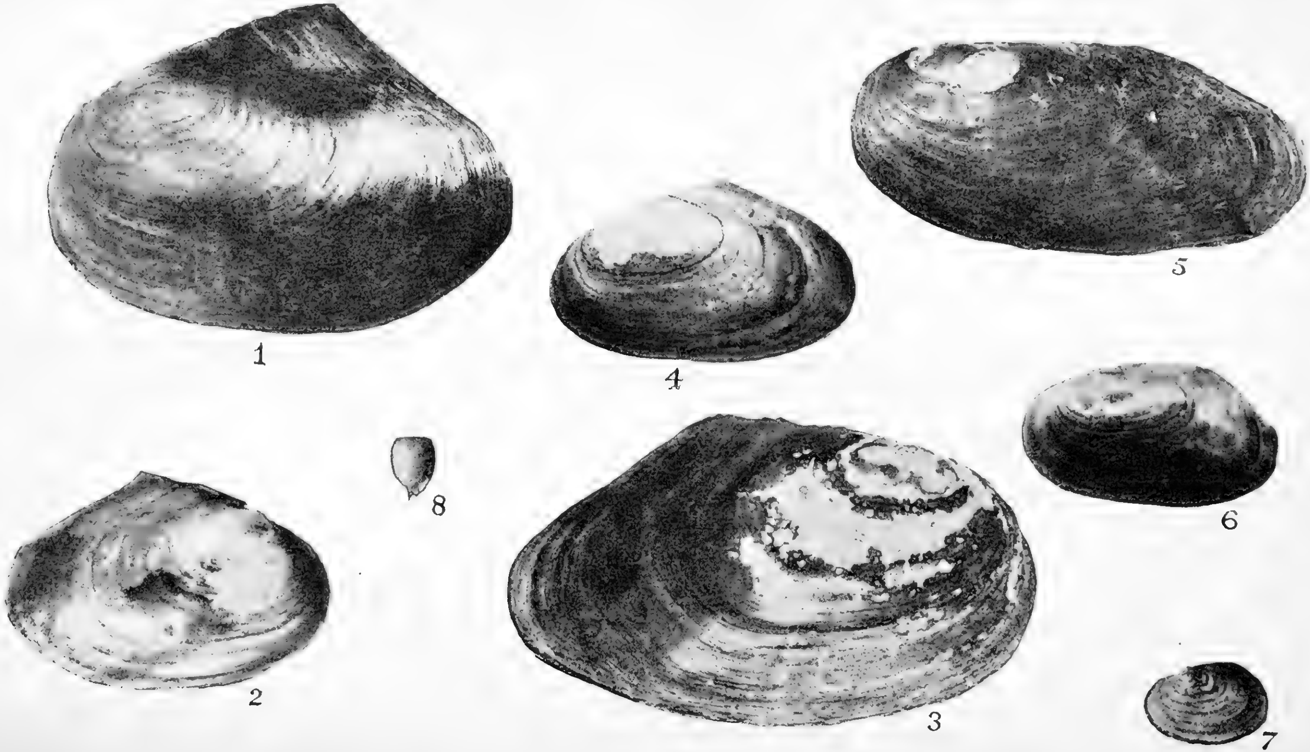
Mytilus (sp.), Linné, 1758 (*M. cygneus*, L.); *Anodontites* (sp.), Bruguière, 1792 (*M. cygneus*, L.); *Anodonta*, Lamarck, 1799 (*M. cygneus*, L.); *Anodon*, Oken, 1815 (emended form); *Anodontes*, Cuvier, 1817 (emended form); *Brachyanodon*,[1] Fischer & Crosse, 1893 (*A. coarctata*, Anton = *A. impura*, Say).

Type, *Mytilus cygneus*, Linné.

Shell of moderate size, averaging 50 mm. in length, anodontiform, thin, broadly ovate, ovate-elliptical, or elongate-elliptical, compressed or inflated, beaks barely elevated above general curvature of shell, and marked by low calycules and a varying number of fine wavy knotted ridges, hinge edentate and gently curved; adolescent growth broadly ovate, alate and compressed; habitat lacustrine and lacustro-fluviatile.

Anodontites of Bruguière has recently been revived for the present group without, in the writer's opinion, good cause. The name appears to have been originally intended for all the edentate Naiades of Europe and elsewhere. *Mytilus cygneus* and *anatinus* are mentioned, but the first species, and the only one described, is the South American *A. crispata*, a species of Hyriinæ. In 1799 Lamarck, doubtless aware of Bruguière's group, proposed *Anodonta* for the European species, thus incidentally restricting *Anodontites* to the single South

[1] With one or two others from the 'Mission Scientifique Mexique' omitted from the Zoological Record.



SUBSPECIES OF ANODONTA CYGNEA FROM WESTERN NORTH AMERICA.

American species. Attempts a hundred years or more later to establish *cygnea* as the type of *Anodontites* are *post mortem*.

The Simpsonian *Anodonta* included a varied assortment of edentate Anodontinæ such as *imbecillis*, *grandis*, *marginata*, *dejecta*, and *suborbiculata*, derived without doubt from several none too closely related stocks possessing hinge-teeth. Since the resemblances are due chiefly to parallel modifications, these can hardly be regarded as congeneric with *A. cygnea*, which is the only true *Anodonta*, in America at least. The proper segregation of these species which lack the most important index to their relationships is hardly a simple problem. The anatomy, of prime import in the discrimination of more comprehensive groups, offers only partial aid, and other characters, such as the adolescent stages and beak sculpture, should enter into consideration. A too conservative use of the latter character cannot be recommended, however; the development of plications, pustules, etc., is subject to considerable individual and colonial variation in species which have not entirely passed beyond the sculptured stage, and it is reasonable to suppose that this variation remains latent, though the sculpturing is carried back to the earliest post-glochidial growth. Anyone may satisfy himself of the truth of this by examining a large series of *Anodonta cygnea* from random localities.

ANODONTA CYGNEA (Linné). Pl. V, Figs. 3, 4, 8.

Mytilus cygneus, Linné, 1758; *M. anatinus*, Linné, 1758 (syntonic form); *A. Cellensis*, C. Pfeiffer, 1821; *A. ponderosa*, C. Pfeiffer, 1825 (syntonic form); *A. Oregonensis*, Lea, 1836; *Anodon cognata*, Gould, 1850; *A. Kennerlyi*, Lea, 1861.

ANODONTA CYGNEA IMPURA (Say). Pl. V, Figs. 1, 2, 7.

A. impura, Say, 1829; *A. Nuttalliana*, Lea, 1838; *A. Wahlamatensis*, Lea, 1838 (syntonic form); *A. coarctata*, Anton, 1839 (syntonic form); *A. Californiensis*, Lea, 1852; *A. triangularis*, Trask, 1855 (syntonic form); *A. rotundovata*, Trask, 1855 (syntonic form); *A. exilior*, Lea, 1871 (syntonic form); *A. Nuttalliana*, var. *Idahoensis*, Hemphill, 1891 (syntonic form); *A. Chapalensis*, Crosse & Fischer, 1892 (syntonic form); *A. Chalcoensis*, Crosse and Fischer, 1893 (syntonic form); *A.* (*Nuttalliana* var. ?) *lignitica*, J. G. Cooper, 1894; *A. Kettlemanensis*, Arnold, 1910 (syntonic form).

ANODONTA CYGNEA BERINGIANA (Middendorf). Pl. V, Figs. 5, 6.

A. Zellensis, var. *Beringiana*, Middendorf, 1851; *A. Youconensis*, Lea, 1867; *A. Youkanensis*, Lea, 1868.

Anodonta cygnea impura. Shell of moderate size, quadrate-discoidal, alate, decidedly broader posteriorly, rather compressed, early growth similar in outline to adult; habitat sluggish streams and lakes.

Western and mountainous portions of Mexican Province from the vicinity of Mexico City northward. Arizona, Los Angeles, Mojave, Colorado, Coast Range, Klamath, Nevada, Utah, and Columbia Systems, rarely farther north.

Quaternary: Bonneville Lake beds, Utah; Lahontan and Carson Prison Lake beds, Nevada; Owens and Le Conte Lake beds, California. Pliocene: Kettleman, Santa Clara, and Cache Lake beds, California. Miocene: Contra Costa Lake beds, California.

A. cygnea. Shell similar to preceding, usually somewhat larger, however, elongate-ovate, sub-alate, somewhat broader posteriorly, tapering to a blunt point, moderately inflated, growth to mid-adolescence as in *impura*; habitat similar.

Entire Palæarctic Region. Alaska, Fraser, Columbia, Klamath, Utah, and Nevada Systems, but occasionally farther to north or south.

Quaternary: Bonneville Lake beds, Utah. Pliocene: Kettleman Lake beds, California; Idaho Lake beds, Idaho and Nevada.

A. cygnea Beringiana. Shell similar to preceding but attenuate-elliptical, not broader posteriorly, barely alate, strongly inflated; *impura* stage pushed back to early adolescence, *cygnea* stage to mid-adolescence; habitat same.

North-Eastern Siberia. Yukon, Alaska, Fraser, rarely in Columbia System.

The accompanying Plate V illustrates the evolution of this species from *impura* through *cygnea* to *Beringiana.* It seems probable that *impura* is of West American origin, and after giving rise to a northern sub-species, *cygnea*, the latter spread to Asia by a land-bridge during the upper Miocene at a time when the climate was somewhat warmer than at present, and *cygnea* doubtless occupied all Alaska. Once in Asia the extension of *cygnea* to Europe and the Mediterranean region has been only a matter of time and facility in taking advantage of stream-captures, etc. There appears to be no evidence that more than the one race is represented in the Old World outside of Kamchatka, though occasional atavistic individuals suggest *impura*, while others tend to acquire the characters of *Beringiana.* It seems improbable that the European Najadologists would overlook these well-marked sub-species if they existed, so thoroughly has this species been studied. *Anodonta cygnea Beringiana* appears to be a sub-species of comparatively late origin, arising in Alaska, doubtless, and taking advantage of the early Quaternary land-bridge to migrate to Siberia. Had it originated in Kamchatka or crossed the Bering Straits during the Miocene connexion it would be difficult to explain why it has not extended its range farther to the westward.

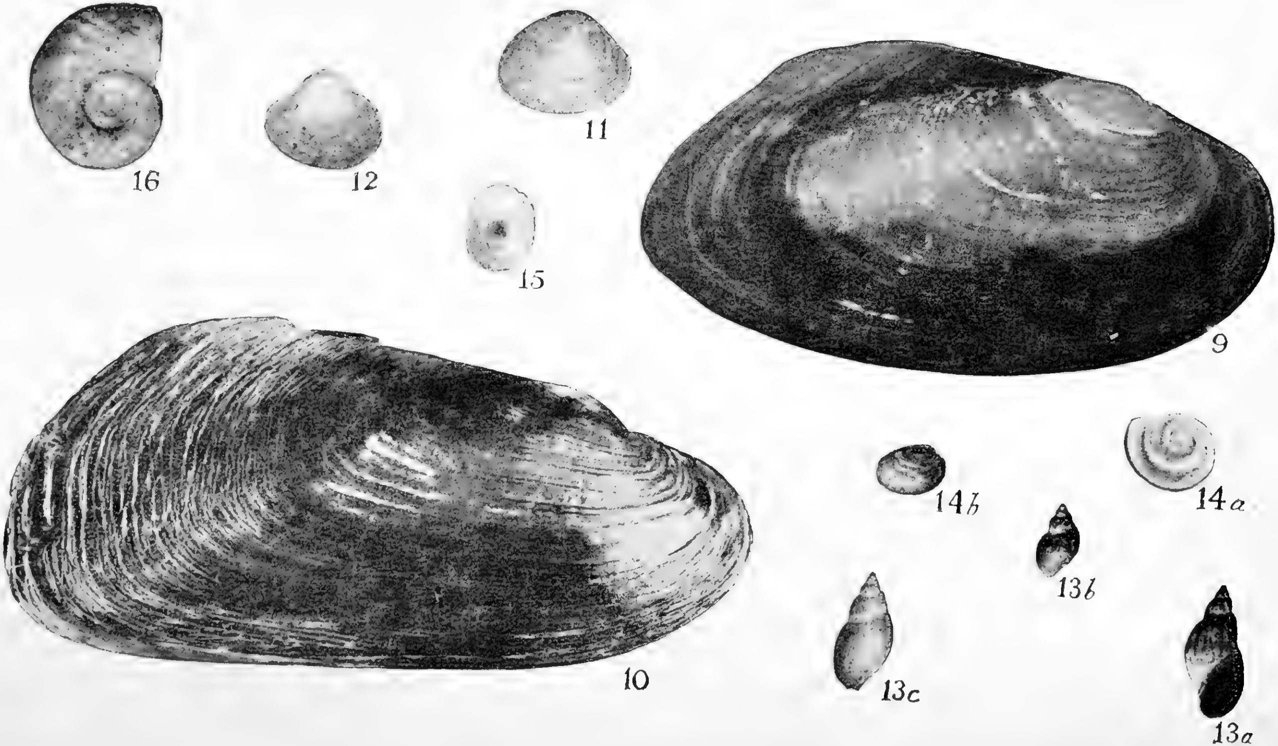
The problem of temperature appears to be an important factor in limiting the north and south distribution of the various sub-species. It is noteworthy that *cygnea* does not extend in the Old World beyond the latitudes of its extreme limits in the Californian Province.

The very young of this species have been frequently obtained in organic mud with *Corneocyclas pulchella.*

Genus Gonidea, Conrad.

Anodonta (sp.), Lea, 1838 (*A. angulata*, Lea); *Gonidea*, Conrad, 1857 (*A. Randalli*, Trask = *A. angulata*, Lea, first species).

Type, *Anodonta angulata*, Lea.



NEW SPECIES FROM WESTERN NORTH AMERICA.

Sub-genus LIMNOBASILISSA, n.sub-gen.

Margaritana (sp.), J. G. Cooper, 1894 (*M. subangulata*, J. G. C.).

Type, *Margaritana subangulata*, J. G. Cooper.

Sub-genus *Limnobasilissa*. Shell of moderate size, averaging 60 mm. in length, margaritaniform, sub-solid, elongate-quadrate, rounded in front, obliquely truncate behind, postero-ventral margin barely acutely angular, posterior slope sub-rounded, beaks marked by several wavy ridges which make an abrupt bend on crossing the postero-ventral slope, early growth similar in outline to adult, hinge with a reduced clavate pseudo-cardinal in each valve, hinge-line sinuate in front of umbones; habitat lacustrine.

Sub-genus *Gonidea*, s.s. Shell of moderate size, similar to *Limnobasilissa*, but anodontiform, more or less elongate-trigonal and anteriorly pointed, posterior slope more or less carinate, hinge with an obsolete pseudo-cardinal in each valve or edentate, but slightly sinuate in front of umbones; *Limnobasilissa* stage carried back to early adolescence; habitat fluviatile.

GONIDEA (LIMNOBASILISSA) ANGULATA SUBANGULATA (J. G. Cooper).

Margaritana subangulata, J. G. Cooper, 1894; *G. Coalingensis*, Arnold, 1910 (syntonic form); *G. Coalingensis*, var. *Cooperi*, Arnold, 1910.

Shell of moderate size, elongate-quadrate, compressed, of about equal width posteriorly and anteriorly, rounded in front, rather squarely decurtate behind, postero-ventral slope barely angular; beaks low, hinge with a reduced pseudo-cardinal in each valve; habitat apparently lacustrine.

Pliocene: Kettleman, Santa Clara, and Cache Lake beds, California.

GONIDEA ANGULATA (Lea).

Anodonta angulata, Lea, 1838; *Anodon feminalis*, Gould, 1850; *A. Randalli*, Trask, 1855; *A. biangulata*, Sowerby, 1869.

GONIDEA ANGULATA HAROLDIANA, Dall. Pl. VI, Fig. 2.

Anodonta angulata, var. *subangulata*, Hemphill, 1891, not *Anodon(ta) subangulata*, Anthony, 1865; *G. angulata*, var. *Haroldiana*, Dall, 1908.

Shell of moderate size, elongate-quadrate, rather compressed, somewhat broader posteriorly, rather obliquely truncate behind, postero-ventral slope exhibiting a rudimentary carina, beaks barely elevated, hinge with a very obsolete pseudo-cardinal in each valve; early adolescent stage as in mature *subangulata*; habitat quiet rivers, creeks, and sloughs.

Fraser, Columbia, Klamath, Coast Range, and Los Angeles Systems.

G. angulata. Shell of moderate size, elongate-trigonal, strongly inflated in the region of the postero-ventral ridge, which is sharply carinate, giving the shell an appearance of being cut off abruptly behind, pointed anteriorly, broad and obliquely truncate posteriorly, beaks somewhat elevated, hinge edentate and but slightly sinuate; shell similar to *Haroldiana* at mid-adolescence, to *subangulata* in very young stages; habitat rivers and brisk streams.

Geographic distribution same as *Haroldiana*.

G. angulata, *angulata Haroldiana*, and *angulata subangulata* all occupy or occupied the same geographic range. *Angulata* is confined to rapid streams and rivers with considerable current; *Haroldiana* to sloughs, sluggish creeks, and slow-moving rivers; while *subangulata* was an abundant Naiad in the great lakes which existed on the Pacific Coast during the Pliocene period, a situation in which *angulata* is never and *Haroldiana* seldom found. This is an excellent instance of a change of station accompanying the evolution of the shell, and therefore of particular interest.

In attempting to classify this species genetically the writer has been in somewhat of a quandary. Either two comprehensive stages equivalent and analogous to sub-genera in all the other Unionidæ must be treated as one sub-genus (necessitating a definition sufficiently broad to cover half the family and several genera which have nothing to do with this series), or the species must be arbitrarily divided into two species simply because the extremes are sufficiently distinct, without regard for an unbroken chain of intermediate stages, or one sub-species must be placed in one sub-genus and two in the other. The last alternative has been followed, since it is most nearly in keeping with natural relationships in the Naiades, though the writer does not regard it as desirable from a classification standpoint. It is an unfortunate limitation of the Linnean System that no disposition was made in case intermediate forms have not died out, or died out but left fossil remains.

The young of this species have been found in deep quiet reaches of water burrowing into stiff mud or clay; juvenile *Haroldiana* occur in similar situations.

Gonidea Hemphilli, n.sp. Pl. VII, Fig. 19.

Shell reminding in a general way of *G. angulata Haroldiana*, but decidedly smaller, proportionally more elongate, the postero-ventral ridge less sharply defined and terminating in a rounded margin, shell not broader posteriorly, and less obliquely decurtate behind, hinge with a very rudimentary pseudo-cardinal in each valve; habitat apparently lacustrine.

Length 31, breadth 14, depth of valve 5 mm.

Miocene: Contra Costa Lake beds, California.

Water-tunnel, head of Telegraph Cañon, Berkeley Hills, California.

Named after Mr. Henry Hemphill, the veteran collector.

Genus Arnoldina, n.gen.

Anodonta (sp.), Lewis, 1875 (*A. dejecta*, Lewis).

Type, *Anodonta dejecta*, Lewis.

Shell of rather large size, averaging 80 mm. in length, anodontiform, sub-solid, elongate-elliptical, distinctly broader posteriorly, moderately inflated, beaks which are not elevated above general curvature of shell, marked by prominent calycules and a few coarse doubly looped ridges alternating with pits which lie along the postero-ventral ridge, early growth elongate-ovate, hinge edentate and gently curved; habitat lacustro-fluviatile.

Arnoldina, named after Dr. Ralph Arnold, includes, so far as known, the sole species, *Anodonta dejecta*, Lewis, a mollusc which has proved an anomaly to everyone who has studied it. The development, peculiar beak-sculpture, and an indescribable velvety texture of the shell preclude its reference to *Anodonta* or any allied genus.

ARNOLDINA DEJECTA (Lewis). Pl. VI, Fig. 9.

Anodonta dejecta, Lewis, 1875, in Yarrow, 1875; *A. Mearnsiana*, Simpson, 1893.

Shell as in genus; inhabits ponds and sluggish streams.

Arizona System.

Quaternary: Le Conte Lake beds, California.

Superfamily CYRENOIDEÆ (Gray), 1840.

The Cyrenoideæ, as here understood, embrace three families—the Cyrenidæ, Gray, 1840 (Corbiculidæ, Gray, 1847), a comprehensive and probably not entirely homogeneous group of brackish-water bivalves, which does not concern this discussion particularly, the Sphæriidæ, Bourguignat, 1885 (Cycladæ, Fleming, 1828), and the Corneocycladidæ, nov. (Pisidiadæ, Gray, 1857), aquatic groups, both of which are represented west of the Rocky Mountains.

The simplest forms in each family have, or at one time had, rudimentary hinge-teeth, a quadrate-elliptical form, and low sub-central umbones. From this type there has been a general tendency to develop a moderately complex hinge, the teeth corresponding to the general formula — R. 101–0101–101, L. 010–1010–010 [1] — followed ultimately by its degeneration, while a trigonal outline and high sub-terminal umbones are acquired. In the Cyrenidæ and Sphæriidæ the umbones migrate toward the anterior extremity, a modification analogous to that taking place in the Unionoideæ and various marine Pelecypoda, notably the Mytilidæ and their allies. In the Corneocycladidæ, however, the migration takes place toward the posterior end. The cause is not understood, but there is reason to suspect it to be produced in the same manner as the sinistral coiling of the Gastropoda—the positions taken by the various cells in the early cleavage stages of the developing embryo.

An interesting feature of the study of the Sphæriidæ and Corneocycladidæ, somewhat aside from the systematic phase, is the colour of the epidermis. Anyone, with the assistance of a few drops of oxalic acid, may convince himself that the shells of the members of these families are uniformly a pale-straw colour. Deposited in the epidermis, however, at the time of its formation, are generally varying amounts of iron salts which produce the grey, green, brown, and

[1] *Eupera*, a tropical genus, has but a single somewhat bifid cardinal in each valve in species seen by the writer, and the cardinals of the right valve of *Corneocyclas*, sub-gen. *Pisidium*, are commonly united above. On the other hand, the Amesodas show a tendency toward a bifurcation of the cardinals.

black colours, commonly described as specific characters. Not improbably this is a protective device on the part of the mollusc; the writer's experience would indicate that such is the case.

Family SPHÆRIIDÆ, Bourguignat, 1885.

Shell small, quadrate, ovate, or trigonal, inflated, concentrically striate, umbones sub-central or somewhat anterior, hinge more or less developed, cardinal teeth small and feeble, laterals short and weak, ligament deep-seated and inconspicuous, pallial line simple; animal hermaphroditic, viviparous; habitat fluviatile and lacustrine.

Sphærium and *Musculium* represent this family in the Nearctic Region. The species are characteristically widespread; none of the recent Californian forms are confined west of the Rocky Mountains, and at least three are common to the Palæarctic Region.

Genus Sphærium, Scopoli.

Tellina (sp.), Linné, 1758 (*T. cornea*, L.); *Sphærium*, Scopoli, 1777 (*T. cornea*, L.); *Cyclas* (sp.), Bruguière, 1798, Lamarck, 1799 (*T. cornea*, L.), not as restricted by Link, 1807, and Dall, 1903; *Cornea*, Megerle, 1811 (*C. communis*, Meg. = *T. cornea*, L.); *Cycladea*, Rafinesque, 1815 (emended form of *Cyclas*); *Cycladites*, Krüger, 1848; *Corneola*, Clessin in Westerlund, 1890 (*T. cornea*, L.), not *Corneola*, Held, 1837.

Type, *Tellina cornea*, Linné.

Sub-genus Amesoda (Rafinesque).

Amesoda, Rafinesque, 1820 (*Cyclas similis*, Say); *Pisum*, Bourguignat, 1857 (*Cyclas rivicola*, Leach), not *Pisum*, Megerle, 1811; *Sphæriastrum*, Bourguignat, 1854 (*Cyclas rivicola*, Leach); *Cyrenastrum*, Bourguignat, 1854 (*Cyclas solida*, Normand).

Type, *Cyclas similis*, Say.

Sub-genus *Sphærium*, s.s. Shell of small size, averaging 10 mm. in length, sub-solid, quadrate-discoidal, finely striate, beaks low, hinge-teeth small, poorly developed, cardinals oblique to hinge, laterals rather short; habitat lacustrine and fluviatile.

Sub-genus *Amesoda*. Shell similar to preceding, but usually larger (averaging 15 mm. in length), and more solidly built, trigonal or quadrate-trigonal in outline, completely coarsely striate, beaks elevated, hinge heavier and better developed, one of the cardinals commonly bifid; *Sphærium* stage passed during early adolescence; habitat similar to *Sphærium*.

Sphærium corneum (Linné).

Tellina cornea, Linné, 1758; *Cyclas rhomboidea*, Say, 1822.

Shell of moderate size, quadrate or quadrate-elliptical, moderately or strongly inflated; habitat lakes and quiet streams.

Boreal portions of Palæarctic and Nearctic Regions. Yukon, Fraser, and Columbia Systems.

Quaternary: Loess of eastern States.

Sphærium tenue (Prime).

Cyclas tenuis, Prime, 1851; *Sphærium occidentale*, Prime, 1860; *S. Uintaense*, Call, 1886; *S. Walkeri*, Sterki, 1901.

Shell small, quadrate-discoidal, moderately compressed; habitat lakes and marshes.

Boreal portions of Nearctic Region. Yukon, Columbia, and Utah Systems.

Quaternary: Loess of eastern States.

Sphærium patellum (Gould).

Cyclas patella, Gould, 1850; *C. fabale*, Prime, 1851; *Sphærium Primeanum*, Clessin, 1878.

Shell of moderate size, quadrate-elliptical, somewhat compressed; habitat marshy lakes and streams.

Boreal portions of Nearctic Region. Fraser and Columbia Systems.

Sphærium (Amesoda) simile (Say).

Cyclas similis, Say, 1817; *C. striatina*, Lamarck, 1818; *C. staminea*, Conrad, 1834; *C. dentata*, Haldeman, 1841; *C. aurea*, Prime, 1851; *C. solidula*, Prime, 1851; *C. nobilis*, Gould, 1855; *Sphærium Vermontanum*, Prime, 1861; *C. tumidum*, Baird, 1863; *S.* '*sulcatum*, Lam.', Keep, 1888; *S. Hendersoni*, Sterki, 1906; *S. Pilsbryanum*, Sterki, 1909; *S. Kettlemanensis*, Arnold, 1910; *S. Cooperi*, Arnold, 1910; not *S.* '*simile*, Say', F. C. Baker, 1898 = *S. sulcatum*, Lam.

Shell of moderate or large size, quadrate-trigonal, varying from moderately compressed to inflated, rather finely or coarsely striate; habitat lakes, marshes, and streams.

Nearctic Region. Fraser, Columbia, Klamath, Utah, Nevada, Colorado, Arizona, and Coast Range Systems.

Quaternary: Loess of eastern States; Bonneville Lake beds, Utah; Lahontan Lake beds, Nevada. Pliocene: Santa Clara, Cache, and Kettleman Lake beds, California.

Sphærium (Amesoda) Idahoense (Meek).

Sphærium (?) *Idahoensis*, Meek, 1870; *S. rugosum*, Meek, 1870 (fig. of type only = juv. individual).

Shell very large, quadrate-trigonal, inflated, coarsely sparsely striate; habitat apparently lacustrine.

Eocene: Truckee Lake beds, Nevada; Payette Lake beds, Idaho.

Sphærium (Amesoda) Rogersi, n.sp. Pl. VII, Fig. 21.

Shell large, elongate-trigonal, moderately inflated, coarsely striate; habitat apparently lacustrine.

Length 20, breadth 14·5, depth of valves 9·5 mm.

Eocene: local freshwater beds in Tejon formation, California.

One-fourth mile above Carnegie Pottery plant, in cutting along Western Pacific Railway, Corral Hollow, Tesla, California (Stanford University Geological Survey, per W. H. Ochsner) (H. Hannibal).

More elongate, more compressed, and more coarsely striate than *S. sulcatum*, which it most resembles. Named after Dr. A. F. Rogers, chief of the Stanford University party who discovered the freshwater deposits in the Eocene of Corral Hollow.

SPHÆRIUM (AMESODA) CATHERINÆ, n.sp. Pl. VII, Fig. 20.

Shell small, striate, elongate-arcæform, umbones high, nearly medial, hinge-line rather straight, anterior and posterior margins rounded; habitat apparently lacustrine.

Length 5, breadth 3·8, depth of valves 4 mm.

Eocene: Truckee Lake beds, Nevada.

Hill near Hawthorne on the Belmont stage-road, Nevada.

There is some doubt whether this species is really a *Sphærium*; the arcæform shape is peculiar. Named after Mrs. Catherine Stevens, of San Diego.

SPHÆRIUM (AMESODA) ANDERSONIANUM, n.sp. Pl. VI, Fig. 11.

Shell very large, comparing in size with *S.* (*A.*) *rivicola* of Europe, but proportionally less inflated, less elongate, and trigonal-quadrate rather than trigonal-ovate, striate, beaks high; habitat apparently lacustrine.

Length 17·5, breadth 15, depth of valve 4 mm.

Pliocene: Idaho Lake beds, Idaho and Oregon.

Badland Hills, one mile east of Sand Hollow, Oregon (type) (R. B. Moran); near Baker City, Oregon (F. M. Anderson, per I. B. Sturges); Oil City, Idaho (E. L. Ickes).

Named after Mr. F. M. Anderson, of the California Academy of Science, who has kindly loaned the writer some interesting material from the Pliocene lake deposits of Eastern Oregon.

Not subsequently recognized:

Sphærium Spokani, Baird, 1863.

Spokane and Kootenai Rivers, British Columbia.

Sphærium Californicum, Clessin, 1878.

California.

Genus MUSCULIUM, Link.

Tellina (sp.), Müller, 1774 (*T. lacustris*, Müll.); *Cyclas* (sp.), Draparnaud, 1805 (*C. caliculata*, Drap. = *T. lacustris*, Müll.); *Musculium*, Link, 1807 (*T. lacustris*, Müll.); *Calyculina*, Clessin, 1872 (*C. caliculata*, Drap. = *T. lacustris*, Müll.); *Primella*, J. G. Cooper, 1890 (*Sphærium* (*Primella*) *Raymondi*, J. G. C. = *T. lacustris*, Müll.).

Type, *Tellina lacustris*, Müller.

Shell of moderate size, averaging 10 mm. in length, fragile, quadrate, quadrate-ovate, or quadrate-trigonal, finely concentrically and radially striate, umbones elevated and usually caliculate, sub-central or slightly anterior, hinge rudimentary, the teeth minute, cardinals frequently undeveloped or when developed those in right valve not separated above; habitat lacustrine.

For a genus possessing such a fragile shell it is remarkable that *Musculium* should occur frequently as a fossil. It might be noted that *Sphærium Florissantense*, Ckll., of the Oligocene of Colorado, groups here.

MUSCULIUM LACUSTRE (Müller).

Tellina lacustris, Müller, 1774; *Cyclas Ryckholti*, Normand, 1841; *C. truncata*, Linsley, 1848; *C. cardissa*, Prime, 1851; *C. rosacea*, Prime, 1851; *C. securis*, Prime, 1851; *C. sphærica*, Anthony, 1852; *Sphærium lenticula*, 'Gould,' Prime, 1862; ? *S. Cooperianum*, Prime, 1869 (nude name); *S.* (*Primella*) *Raymondi*, J. G. Cooper, 1890.

Shell of small or moderate size, quadrate-trigonal, inflated in umbonal region, beaks high; habitat lakes and marshes.

Palæarctic and Nearctic Regions. Fraser, Columbia, Klamath, Coast Range, and Mojave Systems.

Quaternary: Loess of eastern States; post-Glacial deposits of Vancouver Island.

MUSCULIUM OVALE (Férussac).

Cyclas ovalis, Férussac, 1807; *C. transversa*, Say, 1829.

Shell large, elongate-quadrate, somewhat compressed, but varying in this respect, umbones high; habitat lakes and marshes.

European and American Provinces, possibly extending into Colorado System.

MUSCULIUM PARTUMEIUM (Say).

Cyclas partumeia, Say, 1822; *C. elevata*, Haldeman, 1841; *C. Jayensis*, Prime, 1851; *Sphærium* '*patella*, Gould', Keep, 1888.

Shell large, quadrate-ovate, moderately or but slightly inflated, umbones low; habitat lakes and marshes.

Nearctic Region. Klamath and Coast Range Systems.

Quaternary: Loess of eastern States. Miocene: Contra Costa Lake beds, California.

Family CORNEOCYCLADIDÆ, n.fam.

Shell small or minute, sub-solid, ovate or trigonal, compressed or inflated, finely concentrically striate, umbones posterior or posteriorly sub-terminal, hinge well developed or more or less obsolete, ligament deep-seated and inconspicuous, pallial line simple; animal hermaphroditic, viviparous; habitat lakes, marshes, streams, and springs, less frequently in moist situations.

The Californian Corneocycladidæ belong exclusively to the type and principal group *Corneocyclas*. *Corneocyclas* is, however, not coextensive with the old genus *Pisidium*; *Tellina Henslowiana*, Sheppard, of Europe and the eastern States, and *Pisidium cruciatum* of Sterki (American Province) belong to *Tropidocyclas*, a group whose species indicate a radially sculptured stage now outgrown in their phylogenetic histories.

Many of the members of this family are of widespread occurrence. As frequently happens with microscopic species distributed over considerable areas, there has been a rather unnecessary duplication of specific names and consequently much confusion of the literature. The revision of the Nearctic species has not been difficult since cotypes, locotypes, or named specimens (chiefly examined by the late E. W. Roper) of nearly all have been at hand, but the European species constitute a problem which the writer feels neither the inclination or capability of undertaking; hence the synonymy of *Corneocyclas pulchella*, which extends to the Old World, is another story. It is probable that when the Palæarctic forms are thoroughly worked up they will be found to be comparatively few in number, as is true of the North American species. One of the chief stumbling-blocks in classification seems to be the colour of the epidermis. Since this is known to be not of hereditary consequence, and the grouping of the species offers no particular difficulties, the elucidation of the specific synonymy becomes a comparatively simple problem.

Genus Corneocyclas, Férussac.[1]

Tellina (sp.), Gmelin, 1788 (*T. pusilla*, Gmel.); *Cyclas* (sp.), Say, 1817 (*C. dubia*, Say = *T. Virginica*, Gmel.); *Corneocyclas* (*pars*), Férussac, 1818 (*T. pusilla*, Gmel.); *Phymesoda*, Rafinesque, 1820 (*C. dubia*, Say = *T. Virginica*, Gmel.); *Galileja*, Costa, 1839 (*G. tenebrosa*, Costa = *Pisidium pulchellum*, Jenyns); *Euglesia*, 'Leach MS.,' Gray, 1840 (*E. Henslowiana*, 'Leach MS.' (not *T. Henslowiana*, Shepp.) = *T. pusilla*, Gmel.), in synonymy; *Euglesa*, Leach, 1852 (*T. pusilla*, Gmel.); *Cycladina*, Clessin, 1871 (*T. pusilla*, Gmel.); *Cymatocyclas*, Dall, 1903 (*Pisidium compressum*, Prime).

Type, *Tellina pusilla*, Gmelin.

Sub-genus Pisidium (Pfeiffer).

Cardium (sp.), Montagu, 1803 (*Tellina amnica*, Müll.); *Pisidium*, Pfeiffer, 1821 (*P. obliquum*, Pfr. = *T. amnica*, Müll.); *Pera*, 'Leach MS.,' Gray, 1840 (*P. fluviatilis*, Leach MS. = *T. amnica*,

[1] Dall, Trans. Wagn. Inst., iii (4), p. 1460, 1903, has shown that *Corneocyclas*, originally based on an assemblage of Cyrenoideæ, from which *Tellina pusilla*, Gmel., was selected as type, in a restricted sense takes priority over the more familiar name of this group, *Pisidium* of Pfeiffer. *Corneocyclas* has been generally regarded as a synonym of *Sphærium*, hence there have been objections to the use of the name in this novel connexion. The problem resolves itself into choosing the lesser of two evils. *Pisidium* cannot be retained as the genus in any event on account of the prior *Phymesoda* of Rafinesque. Anyone floundering through the maze of spelling and names in the *Monographie* in an attempt to determine what Rafinesque really intended to designate his genus and the species described under it (to say nothing of identifying the former except for the citation of *Cyclas dubia*, Say), would welcome *Corneocyclas* as a straw to a drowning man. Since Dall appears to be the first writer to establish a type for Férussac's group, and the one selected was not excluded from consideration, it does not seem necessary to question why this particular species should have been cited. Already *Corneocyclas* has found a place in the literature of the American and Australian freshwater Cyrenoids, and, if for no other reason, should not be disregarded without good reason.

Müll.), in synonymy; *Pisum*, Gray, 1847 (*T. amnica*, Müll.), not *Pisum*, Megerle, 1811; *Cordula*, Leach, 1852 (*T. amnica*, Müll.); '*Musculium*, Link,' H. & A. Adams, 1857 (*T. amnica*, Müll.); *Fluminina*, Clessin, 1873 (*T. amnica*, Müll.).

Type, *Tellina amnica*, Müller.

Sub-genus *Pisidium*. Shell small or minute, ovate, rather compressed, umbones low, somewhat posterior and naked, hinge well developed, cardinal teeth small and usually joined above in right valve, the anterior transverse, the posterior sub-parallel to hinge, laterals short and weak; habitat chiefly in rivers.

Sub-genus *Corneocyclas*, s.s. Shell similar to preceding but trigonal, umbones elevated, posteriorly sub-terminal, hinge rather poorly developed, teeth sub-obsolete; *Pisidium* stage usually completed in or shortly after leaving the marsupium (species which pass the *Pisidium* stage in the marsupium are frequently caliculate, due to the abrupt change in mode of growth); habitat lakes and springs, uncommonly in streams.

Corneocyclas (Pisidium) pulchella abdita (Haldeman).

Pisidium abditum, Haldeman, 1841; *P. ultramontanum*, Prime, 1865; *P. Angelicum*, Rowell, 1865; *P. nivale*, Westerlund, 1885; *P. Randolphi*, Roper, 1895; *P. Rowelli*, Sterki, 1903; *P. abditum Huachucanum*, Pilsbry & Ferriss, 1906.

Shell of moderate size, rather narrowly ovate and pointed anteriorly, compressed, beaks inconspicuous, hinge moderately developed; habitat streams, forms intergrading toward *pulchella* in lakes and springs.

Palæarctic and Nearctic Regions, Mexican Province.

Quaternary: Loess of eastern States; Summer Lake beds, Oregon.

Intergrading forms between this sub-species and *pulchella* are abundant and often hard to place.

Corneocyclas (Pisidium) Meeki, n.sp. Pl. VI, Fig. 12.

? *Sphærium rugosum*, Meek, 1877 (*pars*).

Shell large, broadly quadrate-ovate, moderately compressed, beaks low, hinge well developed; habitat apparently lacustrine.

Length 11, breadth 11, depth of valve 3 mm.

Eocene: Truckee Lake beds, Nevada; Payette Lake beds, Idaho.

Hill near Hawthorne on the Belmont stage-road, Nevada.

A large species recalling *C.* (*P.*) *amnica*, but broader, more convex, and rather quadrate in outline.

Not recognized by subsequent writers:

Pisidium Sibericum, Clessin, 1870.

Siberia; Port Clarence, Alaska.

Pisidium borealis, Clessin in Westerlund, 1890.

Siberia; Port Clarence, Alaska.

Corneocyclas Virginica (Gmelin).

Tellina Virginica, Gmelin, 1788; *Cyclas dubia*, Say, 1817.

Shell large, broadly trigonal-ovate, moderately inflated, umbones conspicuous and decidedly anterior, hinge fairly developed; habitat lakes and streams.

Boreal portions of American Province. Yukon System.

Quaternary: Loess of eastern States; Yukon Valley, Alaska.

A species more or less intermediate in character between *Pisidium* and *Corneocyclas*, but grouping best with the latter.

Corneocyclas pulchella (Jenyns).

Pisidium pulchellum, Jenyns, 1832; *P. variabile*, Prime, 1851; *P. Adamsi*, Prime, 1851; *P. ferrugineum*, Prime, 1851; *P. noveboracense*, Prime, 1853; *P. occidentale*, Newcomb, 1863; *P. insigne*, Gabb, 1868; *P. Harfordianum*, Prime, 1869 (nude name), *fide* cotypes; *P. arcticum*, Westerlund, 1885; *P. glaciale*, Westerlund, 1885; *P. scutellatum*, Sterki, 1890; *P. Roperi*, Sterki, 1898; *P. Ashmuni*, Sterki, 1903; *P. proximum*, Sterki, 1906; *P. Californicum*, 'Newcomb MS.,' Berry, 1908 (nude name), *fide* locotypes; *P. Marci*, Sterki, 1909.

Shell of moderate size, prevailing smaller than sub-sp. *abdita* apparently, sub-trigonal, inflated, beaks prominent and sub-terminal, hinge not well developed, teeth sub-obsolete; habitat springs, marshes, lakes, and moist places, infrequently in streams intergrading with *abdita*.

Distribution apparently same as *abdita*.

Quaternary: Loess of eastern States; post-Glacial deposits of Vancouver Island; Summer Lake beds, Oregon; Owens Lake beds, California. Pliocene: Cache Lake beds, California.

The specific and varietal names adopted for this *Corneocyclas* and its sub-species are probably not the earliest, but they are the earliest which the writer with the literature and material at hand has been able to satisfy himself were actually applied to it.

Corneocyclas compressa (Prime).

Pisidium compressum, Prime, 1851.

Shell of small size, distinctly trigonal, inflated, beaks narrow and high, sub-terminal, hinge moderately developed; habitat lacustrine.

Nearctic Region. Yukon, Fraser, Columbia, Nevada, Klamath, Coast Range, Arizona, and Los Angeles (locally) Systems.

Quaternary: Loess of eastern States; Lahontan Lake beds, Nevada. Pliocene: Kettleman, Santa Clara, and Cache Lake beds, California. Miocene: Contra Costa Lake beds, California.

Corneocyclas rotundata (Prime).

Pisidium rotundatum, Prime, 1851.

Shell minute, ovate-trigonal, strongly inflated, beaks broad, elevated, and decidedly anterior, hinge much reduced; habitat lacustrine.

Boreal portions of American Province. Yukon System.

CORNEOCYCLAS ÆQUILATERALIS (Prime).

Pisidium æquilaterale, Prime, 1852.

Shell of moderate size, inflated, beaks narrow, anterior, and somewhat elevated, hinge moderately developed; habitat chiefly lakes.

American Province, Siberia. Yukon System.

Quaternary: Loess of Kotzebue Sound, Alaska.

CORNEOCYCLAS IDAHOENSIS (Roper).

Pisidium Idahoensis, Roper, 1896.

Shell of very large size, ovate-trigonal, strongly inflated, beaks broad, elevated, and decidedly anterior, teeth sub-obsolete; habitat lakes.

Boreal portions of American Province. Yukon, Fraser, and Columbia Systems.

CORNEOCYCLAS TREMPERI, n.sp. Pl. VII, Fig. 22.

Shell minute, globular-trigonal, beaks anterior, broad, and somewhat elevated, hinge much reduced; habitat marshy lakes. Length 1·4, altitude 1·3 mm.; depth of valves 1 mm.

Mojave System.

Bluff Lake Cienaga, San Bernardino Mountains, California (H. Hannibal).

Named after Dr. R. H. Tremper, the first conchologist to visit this portion of the San Bernardino Mountains.

GASTROPODA.

Superfamily LYMNOIDEÆ (Broderip), 1839.

The Lymnoideæ, which embrace the purely aquatic inoperculate pulmonates of the North Temperate regions and the bulk of those inhabiting the more tropical portions of the world, include a number of families, all simple types, but differing fundamentally in the manner of whorling and ontogenetic stages. And the anatomy, of which much has been written, but little is actually known that will assist in explaining the internal modifications each group has undergone, appears to have specialized along dissimilar lines. There are excellent reasons for believing that these groups, like less bizarre types in general, are of considerable antiquity. The Planorbidæ had already reached their present specialization at the dawn of the Cenozoic, while a *Physa*, *P. prisca*, Walcott, was described several years ago from the Carboniferous of Nevada, a discovery which carries this genus back to rank as one of the oldest known freshwater molluscs.

Family LYMNÆIDÆ, Broderip, 1839 (emended).

Shell of small or moderate size, dextral or sinistral, spire elevated, whorls varying from appressed to inflated, imperforate to umbilicate, columellar axis varying in different sub-families, aperture ranging from succiniform to auriculiform; animal dextral, hermaphroditic, buccal plate with accessory lateral jaws, tentacles flat and triangular, foot quadrate; habitat aquatic or amphibious.

There are three sub-families as follows:—

Sub-family ACELLINÆ, n.sub-fam.

Whorls appressed, columellar axis imperforate and twisted, produced by a simple oblique reflection of the inner lip, aperture succiniform; habitat deep waters of lakes.

Genus, *Acella*.[1]

Sub-family LYMNÆINÆ, s.s.

Whorls somewhat inflated, columellar axis sub-perforate and twisted, with a more or less distinct marginal fold, aperture sub-auriculiform; habitat lakes and streams, generally in shallow waters.

Genus, *Lymnæa*, s.s.

Sub-family . . . . . .

Whorls inflated, columellar axis straight and umbilicate, the marginal fold obsolete, umbilicus partially hidden by a wide, smooth, vertical expansion of the inner lip, aperture auriculiform; habitat, young stages passed in water, adults more or less amphibious in habits.

Genus, *Lymnæa*; sub-genus, *Galba*.

As with other groups treated in these pages, the old genus *Lymnæa* (frequently spelt *Limnæa*) has undergone various vicissitudes during the last generation, and several classifications have been proposed, of which that of Dall in 1905 is perhaps the best, though unnecessarily elaborate for practical purposes. The North American species, which number about a dozen, may be segregated into *Acella*, Haldeman, a strictly American Province group, and a very primitive one based on a single species, *Lymnæa*, s.s., which includes the larger species of aquatic habits with a gyrate pillar, and *Lymnæa*, sub-genus *Galba*, which embraces the smaller amphibious species with a reflected pillar. Other groups have recently been given generic rank, but space is too valuable to devote to their discussion; the new ones proposed will be found in their proper places in the succeeding synonymy.

Lymnæa, s.s., and *Galba* are circumboreal, and occur extensively in the fossil state. *Lymnæa* ranges from the Mesozoic to the present, while *Galba* is first known from the older Tertiary. *Pleurolimnea*, Meek, based on a Laramie and Eocene fossil, *L. tenuicosta*, M. & H., from the Rocky Mountain region, has gone the rounds of the literature unquestioned as a member of this family. Its striking resemblance to *Zaptychius*, Walcott, of the Nevada Carboniferous, and *Tortacella*, White, of the Utah Cretaceous, which together form a peculiar group of Auriculoid pulmonates, apparently extinct, suggests that its columellar characters should be carefully examined with a view of redetermining its family position.

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[1] *Acella* is included here merely to give an understanding of the classification. No attempt is made to give a complete list of the exotic genera of the various sub-families.

Genus LYMNÆA, Lamarck.

Helix (sp.), Linné, 1758 (*H. stagnalis*, L.); *Lymnæa*, Lamarck, 1799 (*H. stagnalis*, L.); *Limneus*, Draparnaud, 1801 (emended form); *Lymnus*, Montfort, 1810 (emended form); *Radix*, Montfort, 1810 (*H. auricularia*, L.); *Limnæa*, Desmarest, 1812 (emended form), *non* Poli, 1795, polynomial; *Lymneus*, Braird, 1815 (emended form); *Lymnæus*, Cuvier, 1817 (emended form); *Lymnula*, Rafinesque, 1819 (emended form); *Auricularia*, Fabricius, 1823 (nude name); *Lymnea*, Risso, 1826 (emended form), not *Lymnea*, Rafinesque, 1815; *Limnea*, Fleming, 1828 (emended form); *Stagnicola*, 'Leach MS.,' Jeffreys, 1830 (*S. communis*, Leach MS. = *Buccinum palustre*, Müll.), in synonymy; *Gulnaria*, 'Leach MS.,' Turton, 1831 (*H. auricularia*, L.), in synonymy; *Leachia*, Jeffreys, 1833 (*H. stagnalis*, L.), not *Leachia*, Lesueur, 1821, nor Risso, 1829; *Limnophysa*, Fitzinger, 1833 (*B. palustre*, Müll.); *Bulimnea*, Haldeman, 1841 (*L. megasoma*, Say); *Neritostoma*, 'Klein,' H. & A. Adams, 1855 (*H. auricularia*, L.); *Auricula*, 'Klein,' H. & A. Adams, 1858 (*H. stagnalis*, L.); *Eulimneus*, Sandberger, 1875 (*H. stagnalis*, L.); *Polyrhytis*, Meek, 1876 (*Limnæa Kingi*, Meek = *H. Auricularia*, L.); *Pseudosuccinea*, F. C. Baker, 1908 (*L. columella*, Say).

Type, *Helix stagnalis*, Linné.

Sub-genus GALBA (Shrank).

Buccinum (sp.), Müller, 1773 (*B. truncatulum*, Müll.); *Galba*, Shrank, 1808 (*B. truncatulum*, Müll.); *Leptolimnea*, Swainson, 1840 (*Limneus elongatus*, Drap. = *Buccinum glabrum*, Müll.); *Leptolimnæus*, Sandberger, 1875 (emended form); *Fossaria*, Westerlund, 1885 (*B. truncatulum*, Müll.); *Simpsonia*, F. C. Baker, 1911 (*L. humilis*, Say = *B. truncatulum*, Müll.).

Type, *Buccinum truncatulum*, Müller.

Sub-genus *Lymnæa*, s.s. Shell of moderate size, averaging 25 mm. in altitude, dextral, whorls normally sub-appressed or moderately inflated, sub-perforate, aperture succiniform or sub-auriculiform, axis simply reflexed in adolescent stage, with a rudimentary, well-developed, or sub-obsolete marginal fold in adult; habitat aquatic, chiefly in shallower portions of lakes and in sluggish streams, but not entirely confined to such situations.

Sub-genus *Galba*. Shell similar to preceding, but small, averaging 10 mm. in altitude, umbilicate, whorls usually well inflated, axis simply reflexed in early adolescence, with a gyrate marginal fold in later development (*Lymnæa* stage), adult with a smooth vertical expansion of the inner lip reflected over the umbilicus; habitat, the young in aquatic situations, the adults in springs, or more generally in moist places with *Succinea*, particularly on tangles of algæ.

The Lymnæas are characteristically of widespread occurrence. Of the species found west of the Rocky Mountains, four, *L. stagnalis*, *L. palustris*, *L. auricularia*, and *L.* (*Galba*) *truncatula*, are circumboreal, all of the remainder, except the newly characterized *L. Cooperi*, occur in the American Province, while of the species in the latter region but four are absent from the area under consideration. This extent of distribution is without doubt dependent upon the adaptability of the species to a variety of surroundings. *L. Cooperi* and *L. truncatula* may be noted as examples; the former is practically confined to mountain streams, and unknown except in the Coast Ranges and adjacent valleys between San Francisco and Point Conception, California. *L. truncatula*, on the other hand, occurs in a wide variety of situations, marshy borders of lakes, moist banks of streams, and even such artificial situations as greenhouses; it is unquestionably the most extensively distributed member of the family.

Owing to the chaotic condition of the species of this genus in recent literature, it has been considered wise to include a brief account of each of the valid recent American Province forms. Only a few more prominent synonyms are mentioned, and no attempt is made to note the numerous mistaken identifications resulting from certain 'New School' writers using utterly worthless characters in specific discrimination. In case of doubt Binney's *Land and Fresh-water Shells of North America* may usually be taken as a guide in determining the particular species the writer refers to.

Lymnæa stagnalis (Linné).

Helix stagnalis, Linné, 1758; *Lymneus appressus*, Say, 1821; *Limnæus speciosus*, Ziegler in Rossmässler, 1835; *Limnæa 'jugularis*, Say', Haldeman, 1841; *L. lepida*, Gould, 1847 (juvenile); *L. stagnalis*, var. *occidentalis*, Hemphill, 1890 (syntonic form); *L. stagnalis Sanctæmariæ*, Walker, 1892 (syntonic form); *L. stagnalis*, var. *Higleyi*, F. C. Baker, 1905 (syntonic form); *L. stagnalis*, var. *perampla*, Walker, 1908 (syntonic form); *L. stagnalis Lillianæ*, F. C. Baker, 1910; *L. stagnalis Wasatchensis*, 'Hemphill MS.,' F. C. Baker, 1911.

Shell large, spire acuminate, whorls but slightly inflated, imperforate, aperture sub-succiniform, columellar fold pronounced; habitat lakes and marshes.

Boreal and Arctic portions of Palæarctic and Nearctic Regions. Yukon, Alaska, Fraser, Columbia, Utah, Colorado (locally), Nevada, Klamath, and Coast Range (locally) Systems.

Quaternary: Loess of eastern States; Lahontan Lake beds, Nevada; Bonneville Lake beds, Utah; post-Glacial deposits of Vancouver Island.

Lymnæa auricularia (Linné).

Helix auricularia, Linné, 1758 (syntonic form); *Buccinum peregrum*, Müller, 1774; *Lymnæa catascopium*, Say, 1817; *Lymneus emarginatus*, Say, 1821 (syntonic form); *L. pinguis*, Say, 1825 (syntonic form); *Limnæa pallida*, Adams, 1840; *L. decollata*, Mighels, 1841 syntonic form); *L. ampla*, Mighels, 1843 (syntonic form), not *Gulnaria ampla*, Hartm., likewise = *auricularia*, L.; *Limnæus Ontariensis*, 'Muhlfeldt MS.,' Küster in Chemnitz, 1862 (syntonic form); *Limnæa Sumassi*, Baird, 1863 (*partim*, front view);

L. Mighelsi, Binney, 1865; *L. Binneyi*, Tryon, 1865; *L. angulata*, Sowerby, 1872 (syntonic form); *L. Canadensis*, Sowerby, 1872; *L.* (*Polyrhytis*) *Kingi*, Meek, 1877 (syntonic form);[1] *L. scalaris*, Westerlund, 1883 (syntonic form); *Limnophysa Bonnevillensis*, Call, 1884 (syntonic form); *Radix ampla*, var. *Utahensis*, Call, 1884 (syntonic form); *Limnæa ovata*, var. *Atkaensis*, Dall, 1884 (nude name); *Limnæus Atkinensis*, 'Dall,' Clessin, 1886 (syntonic form); *Limnæa Woodruffi*, F. C. Baker, 1901; *L. emarginata*, var. *montana*, Elrod, 1902 (syntonic form); *L. Randolphi*, F. C. Baker, 1904 (syntonic form); *L. decollata Onoroensis*, F. C. Baker, 1904 (syntonic form); *L.* (*Binneyi*, var.?) *Preblei*, Dall, 1905 (syntonic form); *L. Petersi*, Dall, 1905 (syntonic form); *L. Nasoni*, F. C. Baker, 1906 (syntonic form); *L. Hinkleyi*, F. C. Baker, 1906 (syntonic form); *L. Jacksonensis*, F. C. Baker, 1907 (syntonic form); *L. pseudopinguis*, F. C. Baker, 1907 (syntonic form); *L. Davisi*, Walker, 1908 (syntonic form); *L. Pilsbryana*, Walker, 1909 (syntonic form); *L. emarginata Wisconsinensis*, F. C. Baker, 1910 (syntonic form); *Galba catascopium Adamsi*, F. C. Baker, 1911; *G. Alaskensis*, F. C. Baker, 1911 (syntonic form); *G. catascopium Niagraensis*, F. C. Baker, 1911; *G.* '*apicina*, Lea', F. C. Baker, 1911; *G.* '*apicina solida*, Lea', F. C. Baker, 1911.

Shell normally[2] of moderate size, spire broadly elevated, whorls moderately inflated, sub-perforate, aperture auriculiform, columellar fold inclined to partial obsolescence; habitat lakes and sluggish streams.

Boreal portions of Palæarctic and Nearctic Regions. Yukon, Alaska, Fraser, Columbia (locally—headwaters adjacent to upper Missouri Basin only), and Utah Systems.

Quaternary: Loess of eastern States; Bonneville Lake beds, Utah.

Lymnæa palustris (Müller).

Buccinum palustre, Müller, 1774; *Lymneus elodes*, Say, 1821 (syntonic form); *L. desidiosus*, Say, 1821 (syntonic form); *Limneus umbrosus*, Say, 1832; *Limnea expansa*, Haldeman, 1840; *L. Nuttalliana*, Lea, 1841; *L. Vahli*, Beck, in Möller, 1842; *L. Pingelei*, Beck, in Möller, 1842; *L. fragilis*, Haldeman, 1842, not *Helix fragilis*, L. = *L. stagnalis*, L.; *L. proxima*, Lea, 1856 (syntonic form); *L.* '*pallida*, Adams', Lea, 1856; *Limnæa Haydeni*, Lea, 1856 (syntonic form); *L. Sumassi*, Baird, 1863 (except front view); *L. Traski*, Tryon, 1863 (syntonic form); *L.* '*reflexa*, Say', Tryon, 1863 (syntonic form); *L. Traski*, Lea, 1864 (not of Tryon, 1863, likewise = *L. palustris*, Müll.); *L. arctica*, Lea, 1864; *L. Rowelli*, Tryon, 1865 (syntonic form);

[1] Professor G. D. Louderback informs the writer that the 'Pliocene' of Cache Valley, Utah, whence this species was described, is, in all probabilities, merely an extension of the Lake Bonneville sediments.

[2] *L. auricularia* is subject to excessive syntonic variation. *L. peregra*, of Europe, and *L. catascopium*, of America, were based on comparatively normal individuals. No attempt is made to give a description broad enough to cover the aberrant forms.

L. Tryonii, Lea, in Tryon, 1865; *L. Tryoniana*, Lea, 1866; *L.* (*Limnophysa*) *Shurtleffi*, Tryon, 1866 (syntonic form); *L. contracta*, Currier, 1872 (syntonic form); *L. Californica*, Sowerby, 1872 (syntonic form); *L. interstriata*, Sowerby, 1872 (syntonic form); *L. palustris*, var. *septentrionalis*, 'Clessin MS.,' Kobelt, 1880; *Leptolimnæa* '*Kirtlandiana*, Lea', Keep, 1888 (syntonic form); *Limnæa palustris Michiganensis*, Walker, 1892 (syntonic form); *L. reflexa Jolietensis*, F. C. Baker, 1901 (syntonic form); *L. Leai*, F. C. Baker, 1907 (syntonic form); *L. Danielsi*, F. C. Baker, 1907 (syntonic form); *Galba palustris Alpenensis*, F. C. Baker, 1911 (syntonic form); *G. palustris Blachleyi*, F. C. Baker, 1911 (syntonic form); *G. neopalustris*, F. C. Baker, 1911 (syntonic form).

Shell of moderate size, spire well elevated, whorls moderately inflated, sub-perforate, aperture somewhat narrowly auriculiform, columellar fold well developed; habitat lakes, marshes, and sluggish streams.

Boreal portions of Palæarctic and Nearctic Regions. Entire Californian Province except Los Angeles and Arizona Systems.

Quaternary: Loess of eastern States; Lahontan Lake beds, Nevada; Bonneville Lake beds, Utah; post-Glacial deposits of Vancouver and San Juan Islands.

Lymnæa columella, Say.

Lymnæa columella, Say, 1817; *Limnæa chalybea*, Gould, 1840; *L. casta*, Lea, 1841; *L. Francisca*, Poey, 1858; *L. columella*, var. *Championi*, von Martens, 1899.

Shell rather small for group, fragile, spire somewhat elevated, whorls but little inflated, imperforate, aperture sub-succiniform, columellar fold incipiently developed; habitat quiet waters.

St. Lawrence Basin and Hudson Bay drainage south to Florida and Texas (but absent from Great Plains and east slope of Rocky Mountains), American Province; Gulf of Mexico and Pacific drainages south to Panama, Mexican Province; Antillean Province.

Quaternary: Loess of eastern States.

A primitive species. A rather rudimentary columellar fold is developed, while more or less of the succiniform build of the ancestral Acellinæ is still retained.

Lymnæa reflexa (Say).

Lymneus reflexus, Say, 1821; *L. exilis*, Lea, 1837; *L. Kirtlandiana*, Lea, 1841; *Limnæa lanceata*, Gould, 1848; *L. reflexa scalaris*, Walker, 1892, not *L. scalaris*, Braun, 1853; *L. reflexa Walkeri*, F. C. Baker, 1902; *L. reflexa Hemphilliana*, F. C. Baker, 1904.

Shell of moderate size, solid, spire attenuate, whorls but little inflated, imperforate, aperture succiniform, columellar fold imperfectly developed; habitat lakes and sluggish streams.

St. Lawrence drainage and Mississippi Basin above junction of Ohio and Mississippi Rivers, American Province.

Quaternary: Loess of eastern States.

Likewise a decidedly primitive species; the differential character between these two and *L. stagnalis* is, however, rather one of degree than any tangible distinction.

LYMNÆA MEGASOMA (Say).

Lymneus megasomus, Say, 1824.

Shell very large, solid, bulimuliform, spire elevated, whorls inflated, imperforate, aperture sub-auriculiform, columellar fold well developed or sub-obsolete; habitat lakes and sluggish streams.

Hudson Bay and St. Lawrence drainages, American Province.

A fine large species, which at first glance would hardly seem referable to the same genus as *Lymneus stagnalis*, but connected with it by *L. palustris* and similar forms; in essential particulars it is a true *Lymnæa*. The colouring is unusually pronounced, but *L. reflexa*, likewise a heavy-shelled species, presents much of the same thing.

LYMNÆA CONTRACOSTA, J. G. Cooper.

Limnea Contracosta, J. G. Cooper, 1894.

Shell of moderate size, spire acutely elevated, whorls elongate, rather appressed, and imperforate, aperture succiniform, columellar fold well developed; habitat apparently lacustrine.

Miocene: Contra Costa Lake beds, California; Mascall Lake beds, Oregon.

A species suggesting *L. columella*, but more attenuate, and nearly twice the size, whorls long as in *L. megasoma*. The type was badly crushed, hence the original figure does not portray the specific characters well. The species is not uncommon in the Miocene of the Berkeley Hills, however, so that its recognition is comparatively simple.

LYMNÆA STEARNSI, Hannibal.

Limnæa maxima, Stearns, 1902 (nude name), 1906, figure, not *L. stagnalis* var. *maxima*, Collins, 1872; *L. Stearnsi*, Hannibal in F. C. Baker, 1911 (copy of original fig. of *maxima*, Stearns).

Shell large, spire elevated, whorls inflated and imperforate, aperture sub-auriculiform, columella strongly folded; habitat apparently lacustrine.

Miocene: Mascall Lake beds, Oregon.

A species of the build of *L. palustris*, but decidedly larger and proportionally broader. Stearns' figure is nearly half as large again as the natural size and rather crude.

LYMNÆA COOPERI, n.sp. Pl. VI, Figs. 13*a–c*.

Limnæa '*obrussa*, Say', Tryon, 1865 (*partim*); *L.* '*lepida*, Gould', Carlton, 1870; *Limnophysa* '*ferruginea*, Haldeman', J. G. Cooper, 1870; *L.* '*obrussa*, Say', J. G. Cooper, 1872 (*partim*); *Limnæa* '*obrussa*, Say (*desidiosa*, Say)', Wood & Raymond, 1891; *L.* '*obrussa*, Say', Hannibal, 1910.

Shell small for group, spire acuminate, whorls rather compressed and imperforate, aperture narrowly auriculiform, columellar fold moderately developed; habitat chiefly mountain streams, less frequently in lakes and ditches.

Type: altitude 11, breadth 5 mm.; altitude of aperture 6·5, breadth of aperture 3 mm. A small specimen: altitude 7, breadth 3 mm. A large specimen: altitude 16, breadth 6 mm.

Coast Range System.

Santa Cruz Mountains, California: Spring, Wrights (type and small cotype) (H. Hannibal); Adobe Creek, near California Camino Real (large cotype) (H. Hannibal, H. M. Edson); creek at Congress Springs (H. M. Edson); San Andreas Reservoir (H. Hannibal); Crystal Springs Reservoir (H. Hannibal); Matedero Creek, near California Camino Real (H. Hannibal, H. M. Edson); Lagunita, Stanford University (Dr. J. P. Smith, R. E. Snodgrass, H. Hannibal, H. M. Edson, S. S. Berry *fide* Berry MS.); San Francisquito Creek, Stanford University (H. Hannibal, H. M. Edson, S. S. Berry *fide* Berry MS.); San Francisco (W. Wood), *fide* Wood & Raymond!; Allanbee Gulch, Portola Valley (H. M. Edson, H. Hannibal); water-trough, Boulder (H. Hannibal); Stone Water-trough Gulch between Boulder and Ben Lomond (H. Hannibal); creeks near Santa Cruz (J. G. Cooper), *fide* Cooper.

Santa Clara Valley: near San Jose (H. Hemphill), *fide* Cooper; near Santa Clara (Miss A. E. Laws); Cottle-Malavous Slough, Artesian Belt (H. Hannibal).

Diablo Range: San Miguel Cañon (Miss A. E. Laws); Tienan's bog, Hall Valley (H. Hannibal); near Oakland, *fide* Tryon.

Gavilan Range: Bird Cañon at forks, 8 miles west of Hollister (H. Hannibal); Tres Pinos Creek, 2 miles south of Tres Pinos (H. Hannibal).

San Joaquin Valley: irrigating ditches near Fresco (C. E. Jenney); slough 8 miles west of Antioch (Miss Ward), *fide* Carlton!

This little *Lymnæa*, abundant in the mountain streams of middle Western California, from its inconspicuous size and general similarity to *L.* (*Galba*) *obrussa*, a species not known to occur within 200 miles, has commonly masqueraded under one or another of the names applied to that species. On careful inspection it may be distinguished by the compressed nearly shouldered whorls, narrower aperture, and entirely different thin gyrate pillar. Carlton's reference of this species to *L. lepida*, Gould, is interesting on account of the general similarity of *Cooperi* to *stagnalis* at one-fourth scale. The writer takes pleasure in perpetuating the name of the late Dr. J. G. Cooper, who, during the last generation, did more than any other writer to make known the freshwater shells of Western North America.

Lymnæa (Galba) truncatula (Müller).

Buccinum truncatulum, Müller, 1774; *Lymneus humilis*, Say, 1822; *L. modicellus*, Say, 1825; *Limnæa umbilicata*, C. B. Adams, 1840; *L. parva*, Lea, 1841; *L. Griffithiana*, Lea, 1841; *L. curta*, Lea, 1841; *L. rustica*, Lea, 1841; *L. exigua*, Lea, 1841; *L. Holbolli*, Beck in Mörch, 1857; *L.* (*Leptolimnea*) *Pilsbryi*, Hemphill, 1890 (syntonic form); *L.* '*desidiosa*, Say', Dall, 1897; *L. Sterkii*,

F. C. Baker, 1905; *L. Owascaensis*, F. C. Baker, 1905; *L. Dalli*, F. C. Baker, 1906; *L. Alamosensis*, Arnold, 1907; *L. cyclostoma*, Walker, 1908; *Galba Doddsi*, F. C. Baker, 1911; *G. bulimoides* (*partim*), F. C. Baker, 1911.

Shell of small or moderate size for group, spire elevated or acuminate, whorls well inflated and umbilicate, aperture roundly auriculiform, pillar showing no trace of columellar fold, the reflection of the inner lip broad; habitat generally in marshy situations about lakes or streams, also in mountain brooks and springs, frequently in greenhouses.

Entire Palæarctic and Nearctic Regions, extending south into mountainous portions of Mexican Province.

Quaternary: Loess of eastern States; Lahontan Lake beds, Nevada; calcareous spring deposit, Los Alamos Valley, and alluvial deposits of San Soaquin Valley, California. Miocene: Contra Costa Lake beds, California.

Lymnæa (Galba) obrussa (Say).

Lymneus obrussus, Say, 1825; *L. galbanus*, Say, 1825; *L. plica*, Lea, 1841; *L. exigua*, Lea, 1841; *L. Philadelphica*, Lea, 1841; *L. planulata*, Lea, 1841; *Limnæa ferruginea*, Haldeman, 1841; *L. acuta*, Haldeman, 1842; *L. desidiosa* (*partim*), Haldeman, 1842; *L. desidiosa*, var. *Decampi*, Streng, 1896; *L.* '*Adelinæ*, Tryon', Pilsbry, 1898; *L. truncatula*, Dall, 1905 (*partim*); *L. desidiosa*, var. *peninsulæ*, Walker, 1908.

Shell of moderate size, spire elevated or acuminate, whorls somewhat inflated, sub-perforate, aperture narrowly auriculiform, columellar fold nearly or entirely obsolete; habitat streams and lakes on floating algæ or along shore, generally but partially immersed, mountain brooks.

Boreal portions of Nearctic Region extending south to Colorado in Rocky Mountains. Columbia, Utah, and Klamath Systems.

Quaternary: Loess of eastern States; Bonneville Lake beds, Utah.

Reported from Mexico; the record will doubtless prove to have been founded on the preceding species. As with *solida* and the European *glabra*, this Lymnæid is barely beyond the *Lymnæa* stage and hardly a typical *Galba*.

Lymnæa (Galba) caperata (Say).

Lymneus caperatus, Say, 1829; *L. Smithsoniana*, Lea, 1866; *Limnæa Ferrissi*, F. C. Baker, 1902; *L. umbilicata*, *Cubensis*, *Pingelei*, and *opacina* (error for *apicina*) of authors.

Shell of moderate or large size for group, spire bluntly acuminate or sub-pupiform, whorls inflated, marked by spiral fringes of epidermis, and umbilicate, aperture roundly auriculiform, pillar with an obsolete columellar fold; habitat moist places in the vicinity of lakes and sloughs.

Boreal portion of American Province.

Frequently reported from portions of the Californian Province. The records, so far as they have been verified, have proved to have been based on *solida*, *solida Cubensis*, and *truncatula*. On the other hand *caperata* is frequently identified as one or another of these species. Altogether it is a very badly misunderstood *Lymnæa*.

Lymnæa (Galba) solida (Lea).

Limnæa solida, Lea, 1838; *L. apicina*, Lea, 1838; *L. bulimoides*, Lea, 1841; *L. Adelinæ*, Tryon, 1863; *L.* '*ampla*, Mighels', Keep, 1888 (syntonic form); *L.* (*Stagnicola?*) *perpolita*, Dall, 1905 (syntonic form); *L. bulimoides Sonomaensis*, 'Hemphill MS.,' Pilsbry & Ferriss, 1906 (syntonic form); *L. Hendersoni*, F. C. Baker, 1909; *L. Cubensis Sanctijosephi*, Hannibal, 1910 (syntonic form); *Galba* '*caperata*, Say', F. C. Baker, 1911 (*partim*).

Lymnæa (Galba) solida Cubensis (Pfeiffer).

Limnæa Cubensis, Pfeiffer, 1839; *L.* '*caperata*, Say', Tryon, 1863; *L. Lecontei*, Lea, 1864; *L. techella*, Haldeman, 1868; *L.* '*humilis*, Say', Keep, 1888; *L. Bryanti*, F. C. Baker, 1905; *L. Cubensis aspirans*, Pilsbry, 1910; *Galba bulimoides Cassi*, F. C. Baker, 1911; *G.* '*Galbana*, Say', F. C. Baker, 1911 (*partim*).

Lymnæa solida. Shell of moderate size for group, horny, spire bluntly elevated, whorls inflated, sub-perforate, aperture broadly auriculiform, columellar fold sub-obsolete or (usually) obsolete; habitat lakes and sluggish streams, commonly on floating algæ.

Missouri Basin in American Province. Yukon, Alaska, Fraser, Columbia, Utah, Colorado, Nevada, Klamath, and Coast Range Systems, rarely farther south.

Quaternary: Lahontan Lake beds, Nevada; Christmas Lake beds, Oregon.

Lymnæa solida Cubensis. Shell as in preceding, but porcellanous rather than horny, whorls more inflated, more deeply sutured, and more pronouncedly umbilicate, pillar showing no trace of columellar fold in adult; *solida* stage passed during adolescence; habitat with *Succinea* in moist places, particularly marshes and about the borders of lakes and sluggish streams.

Antillean and Mexican Provinces. Gulf region, and northward to Colorado, west of the Mississippi River in American Province. Arizona, Los Angeles, Mojave, Coast Range, Klamath, Nevada, Utah, and Colorado Systems, infrequently farther to north grading into typical *solida*.

The status of these sub-species has not gained general acceptance since the appearance of the new edition of *West Coast Shells*, in which the writer first pointed out their relationships, due to the extremely involved condition of the nomenclature, while recent work by other writers has hindered rather than assisted in simplifying matters. *Lymnæa solida*, Lea, in violation of the law of priority and common-sense as well, has been treated as a sub-species [*sic!*] of *L. apicina*, a synonym according to every writer in fifty years since it was described some months later from the identical locality, and may be distinguished only by a slightly greater elevation of the spire, and the latter identified with a dwarfed syntonic form of *L. auricularia* from the Rocky Mountains and Michigan. The original specimens of *solida* and *apicina* came from the present site of Portland, Oregon, or thereabouts, several hundred miles from the nearest point from which *auricularia* has been recorded. According to the figures and original description the types of these two resemble the forms of *auricularia* only superficially, but agree closely with the *Lymnæa*, later called by Lea *L. bulimoides*, under which name this species has been more commonly known.

Not subsequently recognized:

Limnæa bombycina, 'Lunge,' Wood and Raymond, 1891 (nude name). San Francisco County, California.

Family ANCYLIDÆ, H. & A. Adams, 1855.

Shell of small size, patelliform, crepiduliform, or planorbiform, sinistral or dextral, apex of patelliform genera elevated, medial or posterior, and generally more or less inclined to right or left, spire of planorbiform genera more or less planulate, aperture normally simple; animal sinistral, hermaphroditic, tentacles stoutly triangular, buccal plate with accessory lateral jaws, foot large and oval; habitat lakes and streams.

Four sub-families as follows:—

Sub-family LÆVAPECINÆ, n.sub-fam.

Shell usually large for family, depressed - patelliform; habitat chiefly lacustrine.

Genera: *Lævapex*, *Fisherola*, *Lanx* sub-gen. *Walkerola*.

Sub-family ANCYLINÆ, s.s.

Shell small or of moderate size, elevated-patelliform; habitat lacustrine and fluviatile.

Genera: *Ancylus*, *Zalophancylus*, *Lanx* s.s., *Lævapex* sub-gen. *Ferrissia*, *Gundlachia* sub-gen. *Kincaidilla*.

Sub-family LATIINÆ, n.sub-fam.

Shell small or minute, crepiduliform; habitat chiefly fluviatile.

Genera: *Latia*, *Gundlachia* s.s., *Neoplanorbis* sub-gen. *Amphigyra*.

Sub-family NEOPLANORBINÆ, n.sub-fam.

Shell minute, planorbiform; habitat fluviatile.

Genus, *Neoplanorbis*, s.s.

The genera and species of this family are characterized by their very limited distribution in contrast to nearly all the other aquatic Pulmonata. This, with the simple form and the fact that the distinctive characters lie chiefly in the outline, microscopic sculpture, and position of the apex, has led to a lumping in the genus *Ancylus* of a wide variety of species whose resemblances are due rather to parallel specialization than close affinities.

Genus Gundlachia, Pfeiffer.

Gundlachia, Pfeiffer, 1850 (*G. ancyliformis*, Pfr.); *Poeyia*, Bourguignat, 1862 (*P. gundlachoides*, Bourg.).[1]

Type, *Gundlachia ancyliformis*, Pfeiffer.

Sub-genus Kincaidilla, n.sub-gen.

Type, *Ancylus fragilis*, Tryon.

Ancylus (sp.), Tryon, 1863 (*A. fragilis*, Tryon).

Named after Professor Trevor Kincaid, who has kindly examined this manuscript.

Sub-genus *Kincaidilla*. Shell small, averaging 3 mm. in diameter, patelliform, high-arched, narrowly ovate-elliptical in outline, finely radially and concentrically striate, apex prominent, decidedly sub-dextral, distinctly posterior, and marked by fine concentric and sub-spirally radial striæ; habitat lakes and streams.

Sub-genus *Gundlachia*, s.s. Shell of small size, averaging 2 or 3 mm. in diameter, growth during first year as in *Kincaidilla*; as animal nears adult condition, however, a septum develops, cutting off the posterior half of aperture, succeeding growth crepiduliform; habitat chiefly streams.

Gundlachia, s.s., needs no introduction, since the group has been a matter of discussion for some years, and it only need be noted that several species from New Zealand, Trinidad, etc., referred here, when the apical sculpture and other characters are studied will almost certainly be found to belong to distinct genera which have reached this same stage of specialization. *Kincaidilla* is instituted to receive certain Nearctic Gundlachias heretofore confused with the Ferrissias, from which they differ in the narrowly elliptical outline and high strongly inclined apex. None of the Ferrissias are known to develop a septum either regularly or infrequently, but it is, apparently, occasionally present in all the Kincaidillas. From septate specimens of *G. fragilis* it appears that this may be due to syntonic influence, at least in certain cases.

Gundlachia (Kincaidilla) fragilis (Tryon).

Ancylus fragilis, Tryon, 1863; *Gundlachia Californica*, Rowell, 1863 (syntonic form); *A.* '*patelloides*, Lea', J. G. Cooper, 1872.

Shell minute, elongate, highly arched, apex prominent, decidedly posterior and inclined; habitat streams and (less frequently) ponds, on sticks and submerged vegetation.

Coast Range System.

Genus Lanx, Clessin.

Ancylus (*Velletea*) (sp.), Haldeman, 1844 (*A.* (*V.*) *Nuttalli*, Hald.); *Lanx*, Clessin, 1890 (*A. Newberryi*, Lea = *A. patelloides*, Lea).

Type, *Ancylus patelloides*, Lea.

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[1] Juvenile *Gundlachia*, *vide* Crosse & Fischer.

Sub-genus WALKEROLA, n.sub-gen.

Type, *Lanx Klamathensis*, n.sp.

Named after Mr. Bryant Walker, whose papers on the American *Ancyli* have been of much service in working up the Californian forms.

Sub-genus *Walkerola*. Shell large, averaging 12 mm. in diameter, patelliform, ovate-elliptical in outline, low-arched, coarsely concentrically striate, frequently marked internally by an intermittent radiating white-colour pattern, apex medial, posterior scarcely prominent, smooth or marked by concentric striæ; habitat chiefly lacustro-fluviatile, on rocks and the shells of Naiades.

Sub-genus *Lanx*, s.s. Shell similar to preceding, but decidedly arched and broadly ovate, apex more nearly medial and sub-conspicuous; *Walkerola* stage completed fairly early during adolescence; habitat rapid streams, on rocks and other solid objects.

LANX (WALKEROLA) KLAMATHENSIS, n.sp. Pl. VIII, Fig. 25.

Ancylus Newberryi of authors, not of Lea.

Shell of moderate or large size, fragile, ovate-elliptical, laterally compressed, low-arched, apex sub-central; habitat lakes and sluggish streams on solid objects.

Type: max. diam. 11, min. diam. 7·5, alt. 3 mm. Cotype: max. diam. 16, min. diam. 9·5, alt. 3·5 mm.

Klamath System in basin of Klamath River, Oregon.

Quaternary: Summer Lake beds, Oregon.

Klamath Valley, Oregon: Government Irrigation Dam, Upper Klamath Lake (types) (E. Applegate, H. Hannibal); Upper Klamath Lake (F. M. Anderson); Link River Rapids, Klamath Falls (E. Applegate, H. Hannibal)[1]; Klamath River, Keno (H. Hannibal); (Quaternary) Summer Lake (F. M. Anderson).

This large low-arched *Lanx* is doubtless present in various collections under the name of *Ancylus Newberryi*, Lea, which was described from (Upper) Klamath Lake. A study of Lea's diagnosis and figure and that given by Binney make it certain that Newberry, who collected the specimens, really obtained them from one of the streams flowing south from Mount Shasta in California, since they are unquestionably merely finely developed dark-coloured *Lanx patelloides*, and very distinct from the present species.

LANX NUTTALLI (Haldeman).

Ancylus (*Velletea*) *Nuttalli*, Haldeman, 1841; *A. crassus*, Haldeman, 1843; *A. Kooteniensis*, Baird, 1865; *A.* '*subrotundatus*, Tryon', Keep, 1888.

Shell small, solid, roundly ovate, slightly broader posteriorly, high-arched, apex posterior; habitat streams.

Columbia System in Columbia River and tributaries.

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[1] One specimen probably washed down from Upper Klamath Lake above.

Lanx patelloides (Lea).

Ancylus patelloides, Lea, 1856; *A. Newberryi*, Lea, 1858; *A. altus*, Tryon, 1865.

Shell large, sub-solid, broadly ovate-elliptical, broader posteriorly, moderately regularly conical, apex sub-central; habitat on rocks in streams.

Klamath System in streams draining into Sacremento River.

Lanx subrotundatus (Tryon).

Ancylus subrotundatus, Tryon, 1865; *A. patelloides* and *A. Newberryi* of authors, not of Lea.

Shell large, sub-solid, roundly ovate in outline, slightly broader posteriorly, moderately arched, the anterior and posterior slopes gently rounded, apex sub-posterior; habitat streams.

Columbia System in Umpqua River and tributaries.

Very similar to *patelloides*, but less regularly conical, and the apex distinctly posterior.

Genus Lævapex (Walker).

Lævapex, Walker, 1903 (*A. fuscus*, C. B. Ad.).

Type, *Ancylus fuscus*, C. B. Adams.

Sub-genus Ferrissia, Walker.

Ancylus (sp.), Say, 1819 (*A. rivularis*, Say); ? *Haldemania*, Clessin, 1888 (*A. obscurus*, Hald.), not *Haldemania*, Tryon, 1862; *Ferrissia*, Walker, 1903 (*A. rivularis*, Say).

Type, *Ancylus rivularis*, Say.

Sub-genus *Lævapex*, s.s. Shell of moderate size for group averaging 8 mm. in diameter, patelliform, low-arched, broadly ovate-elliptical in outline, finely radially and concentrically striate, apex sub-dextral, barely posterior, not prominent, and marked only by concentric striæ; habitat chiefly lacustrine.

Sub-genus *Ferrissia*. Shell similar to preceding, but of smaller size, averaging 5 mm. in diameter, patelliform, ovate-elliptical in outline, arched, finely radially and concentrically striate, apex hardly prominent, sub-posterior, and marked by fine concentric and sub-spirally radial striæ; *Lævapex* stage completed during early adolescence; habitat chiefly streams, less frequently in lakes and ponds.

Lævapex (Ferrissia) caurinus (W. Cooper).

Ancylus caurinus, W. Cooper, 1860 (nude name), in Binney, 1865, figure; *A.* '*fragilis*, Tryon', Tryon, 1872; *A.* '*patelloides*, Lea', J. G. Cooper, 1872; *A. Oregonensis*, Clessin, 1881; *A. caurinus subalpinus*, J. G. Cooper, 1892; *A. rivularis* of authors, not of Say; not *A.* '*caurinus*, Coop.', J. Henderson, 1907 = *L. rivularis*.

Shell of moderate size, somewhat elongate, arched, apex sub-posterior, not prominent; habitat streams and ponds on submerged vegetation.

Fraser, Columbia, Utah, Nevada, and Klamath Systems.

LÆVAPEX (FERRISSIA) UNDULATUS (Meek).

Ancylus undulatus, Meek, 1877.

Shell large, arched, apex posterior, slightly inclined, sub-prominent; habitat apparently lacustrine.

Eocene: Truckee Lake beds, Nevada.

The internal casts, of which all the specimens seen consist, retain no trace of the sculpture, hence it is difficult to make certain the generic position of this species. Aside from the large size it groups very well with *Ferrissia*, but it is quite unlike the other *Ancylinæ* in the position of the apex.

Genus NEOPLANORBIS, Pilsbry.

Neoplanorbis, Pilsbry, 1906 (*N. tantillus*, Pils.).

Type, *Neoplanorbis tantillus*, Pilsbry.

Sub-genus AMPHIGYRA (Pilsbry).

Amphigyra, Pilsbry, 1906 (*A. Alabamensis*, Pils.).

Type, *Amphigyra Alabamensis*, Pilsbry.

Sub-genus *Amphigyra*. Shell minute, crepiduliform, dextral, spire lateral, oblique, and smooth, body-whorl spirally striate, aperture large and oblique, a broad concave septum projecting across the posterior portion and reaching up into the spire, indicating an appearance very early in the development; habitat fluviatile.

Sub-genus *Neoplanorbis*, s.s. Shell very minute, planorbiform, dextral, coarsely spirally striate, more or less carinate at periphery, spire sub-planulate, aperture oblique, columellar margin straight; *Amphigyra* stage apparently passed early in development; habitat rapid streams.

NEOPLANORBIS (AMPHIGYRA) DALLI (White).

Latia Dalli, White, 1882.

Shell large for genus, apex small, terminal, sub-spiral, and slightly oblique, aperture very large; habitat apparently lacustrine, at least in part.

Eocene: Payette Lake beds, Idaho.

This species is known to the writer only from White's original descriptions and figures. It is obviously not a *Latia* nor a *Gundlachia*, but appears to resemble *Amphigyra*, and is placed here tentatively.

Genus FISHEROLA, n.gen.

Type, *Fisherola lancides*, n.sp.

Shell of moderate size, averaging 6 mm. in diameter, rounded-ovate, somewhat broader anteriorly, depressed-conic, finely concentrically striate, apex small, indistinct; sub-terminal, but not inclined; habitat sluggish streams.

Fisherola agrees with *Lanx*, s.g. *Walkerola*, in general outline, the medial position of the apex, and the absence of radial striæ, while the nucleus (shaped like a Chinese labourer's hat) is very similar, in contrast to *Ancylus*, *Acroloxus*, or any of the Occidental genera.

No one would mistake the two, however, even at first sight, since the apex of *Fisherola* is more posterior than in *Ancylus*, while in *Lanx* it is very nearly central.

Named after Dr. W. K. Fisher, whose frequent criticisms during the preparation of this paper have been much appreciated.

FISHEROLA LANCIDES, n.sp. Pl. VIII, Fig. 35.

Shell small, fragile, ovate-elliptical, broader anteriorly, low-arched, concentrically striate, apex not inclined, sub-terminally posterior; habitat sluggish streams.

Type: max. diam. 6, min. diam. 3·8, alt. 1·2 mm. Cotype: max. diam. 5·5, min. diam. 4, alt. 1·2 mm.

Columbia System in Snake River Basin.

Snake River, Washington (H. Hemphill).

Genus ZALOPHANCYLUS, n.gen.

Type, *Zalophancylus Morani*, n.sp.

Shell of large size averaging 9 mm. in diameter, rounded-ovate, regularly elevated-conic, concentrically and apparently radially striate, apex central, large, and prominent, not inclined; habitat apparently lacustrine.

ZALOPHANCYLUS MORANI, n.sp. Pl. VI, Fig. 15.

Shell of moderate size, regularly rounded ovate, elevated conic, apex central and distinctly prominent; habitat apparently lacustrine.

Max. diam. 9, min. diam. 7, alt. 3·5 mm.

Pliocene: Idaho Lake beds, Oregon.

Badland Hills, one mile east of Sand Hollow, Oregon (R. B. Moran).

Named after Mr. R. B. Moran, who collected the type-specimens.

Family PLANORBIDÆ (H. & A. Adams), 1855.

Shell of minute, small, or moderate size, physiform or planorbiform, sinistral or ultra-sinistral,[1] sub-carinate above and below in early stages,

[1] The terms ultra-dextral and ultra-sinistral have seen frequent use in the Lymnoids for genera in which the shell is dextral and the animal sinistral, or vice versa. The explanation of Simroth and others is probably the correct one, however, only in the present and one or two analogous cases. It would be very difficult in the *Kincaidilla* stage of *Gundlachia*, for instance, to explain this phenomenon in such a manner without the animal living up on top of its shell, a feature the writer has never observed. In the primitive Planorbidæ, while the animal is dextral the shell is obviously sinistral. In the more specialized stages an ultra-sinistral shell is developed, doubtless the nearest approach possible to a dextral shell to conform to the dextral animal, but there is no evidence that the ancestral type was ever dextral. The development of *Pompholyx* offers similar difficulties.

In the three patelliform groups of Ancylidæ—*Acroloxus*, *Kincaidilla*, and *Ancylus*, for instance—*Acroloxus* is sub-sinistral, *Kincaidilla* sub-dextral, while *Ancylus* is not distinctly either, yet the animal is sinistral in all cases. It seems, therefore, probable that in this family, groups in the patelliform stages exhibit no constant relation between the position of the apex and the abortion of the soft parts.

The families of the Lymnoideæ have doubtless evolved independently frequently throughout life, axially and spirally striate, aperture lunate, retracted above, commonly simple, but dentate in one of the modified groups; animal dextral, hermaphroditic, tentacles filiform, buccal plate with accessory lateral jaws, foot quadrate; habitat lakes and streams.

An examination of the early stages of the members of this family reveals the fact that the old classification into *Planorbis* (edentate species) and *Segmentina* (dentate species) has no genetic significance, since the smaller Planorbes with vertically compressed whorls and more or less acute peripherally prove to be congeneric with *Planorbis* (*Segmentina*) *nitida*, as suggested by Ficinus nearly fifty years ago, constituting species which have either never developed apertural teeth or in which they have been absorbed, while the large species, such as *corneus*, *trivolvis*, etc., belong to *Helisoma*.

Both *Planorbis* and *Helisoma* in the primitive condition have a planulate spire and normal umbilicus, and each tends to develop an invaginate spire and planulate umbilicus to accommodate the dextral animal. So many features of unequal parallelism appear, however, that it has not been considered wise to attempt the recognition of stages or sub-families without the study of additional genera.

Genus Planorbis, Müller.

Helix (sp.), Linné, 1758 (*H. planorbis*, L.); *Planorbis* (*pars*), Müller, 1774 (*P. carinatus*, Müll. = *H. planorbis*, L., type by tautonomy); *Planorbarius*, Dumeril, 1806 (emended form); *Anisus* (*pars*), Studer, 1820 (*P. Planorbis*, L., type by substitution); *Spirorbis*, Swainson, 1840 (*P. vulgaris*, Swains. = *H. vortex*, L.), not *Spirorbis*, Daudin, 1800; *Spiralina*, Hartmann, 1840 (nude name); *Tropidiscus*, Stein, 1850 (*H. complanata*, L. = *H. planorbis*, L.); *Gyrorbis*, Moquin-Tandon, 1855 (*P. carinatus*, Müll. = *H. planorbis*, L., type by substitution), not *Gyrorbis*, Fitzinger, 1833; *Omalodiscus*, Benson, 1855 (*P. vulgaris*, Swains. = *H. vortex*, L., type by substitution); *Diplodiscus*, Westerlund, 1897 (*H. vortex*, L.), not *Diplodiscus*, Diesing, 1850; *Spiralina*, 'Hartmann,' Von Martens, 1899 (*H. vortex*, L.); *Paraspira*, Dall, 1905 (*Planorbis rotundatus*, Poir. = *H. vortex*, L.).

Type, *Helix planorbis*, Linné.

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from simple patelliform ancestors, the Ancylidæ illustrating how this has taken place. Assuming that then, as now, the animal in each group was dextral or sinistral as the case might be, while the shells were indiscriminately sub-sinistral or sub-dextral, a ready explanation is afforded. Once the evolution commenced toward the development of a spiral shell, the position of the apex became a matter of the utmost importance, since it determined absolutely whether the coil would be sinistral, dextral, or enveloped by succeeding whorls; consequently a sinistral or dextral, dextral or sinistral shell is superimposed upon a sinistral or dextral animal for all time. In case an unhappy combination resulted the only relief is in ultra-sinistral or ultra-dextral growth to accommodate the animal. This latter phenomenon is genetically distinct and readily detected as such.

Sub-genus SEGMENTINA (Fleming).

Segmentina, Fleming, 1817 (*Planorbis nitidus*, Müll.); *Hemithalamus*, 'Leach MS.,' Turton, 1831 (*Nautilus lacustris*, Lightf. = *P. nitidus*, Müll.), in synonymy; *Discus*, Haldeman, 1840 (*P. armigera*, Say), not *Discus*, Fitzinger, 1833; *Planorbula*, Haldeman, 1842 (*P. armigera*, Say); *Dentatus*, 'Beck,' Gray, 1847 (*P. armatus*, Gray); *Trochorbis*, Benson, 1855 (*P. trochoides*, Bens.); *Appendiculata*, Ficinus, 1867 (*P. nitidus*, Müll., type by inclusion); *Haldemanina*, Dall, 1905 (*P. Wheatleyi*, Lea).

Type, *Planorbis nitidus*, Müller.

Sub-genus GYRAULUS, Agassiz.

Nautilus (sp.), Linné, 1758 (*N. crista*, L.); *Turbo* (sp.), Linné, 1767 (*T. nautilus*, L. = *N. crista*, L.); *Planaria*, Brown, 1827 (*Planorbis albus*, Müll.), not *Planaria*, Müll., 1776; *Gyraulus*, Agassiz in Charpentier, 1837 (*P. hispidus*, Drap. = *P. albus*, Müll., type by later designation); *Armiger*, Hartmann, 1840 (*N. crista*, L.); *Trochlea*, Haldeman, 1841 (*P. albus*, Müll., type by substitution); *Nautilina* (sp.), Stein, 1850 (*N. crista*, L.); *Torquis*, Dall, 1905 (*P. parvus*, Say).

Type, *Planorbis albus*, Müller.

Sub-genus HIPPEUTIS, Agassiz.

Hippeutis, Agassiz, in Charpentier, 1837 (*Planorbis complanatus*, Drap. = *Helix fontana*, Lightf.); *Bathyomphalus*, Agassiz, in Charpentier, 1837 (*H. contortus*, L.); *Polygyrus*, Gray, 1847 (*H. contortus*, L.), not *Polygyrus*, Beck, 1837; *Discoidina*, Stein, 1850 (*H. contortus*, L.); *Menetus* (sp.), H. & A. Adams, 1855 (*Planorbis opercularis*, Gould = *P. dilatatus*, Gld.); *Helicorbis*, Benson, 1855 (*P. nitidus*, Gray, *non* Müller = *H. fontana*, Lightf.); *Drepanotrema*, Crosse & Fischer, 1880 (*P. Yzabelensis*, C. & F.); *Heterodiscus*, Westerlund, 1902 (*P. Libanicus*, West.), not *Heterodiscus*, Sharp, 1886.

Type, *Helix fontana*, Lightfoot.

Sub-genus *Planorbis*, s.s. Shell of moderate size, averaging 8 mm. in diameter, discoidal, whorls numerous and vertically compressed, sinistral, spire planulate, umbilicus broadly dished, margin of spire-pit and umbilicus normally subangular, periphery carinate, aperture normal, retracted above; habitat lakes and streams among aquatic vegetation.

Sub-genus *Gyraulus*. Shell similar to *Planorbis*, s.s., but smaller, averaging 5 mm. in diameter, saucer-shaped, whorls moderate in number and vertically deeper, the periphery rounded, growth somewhat ultra-sinistral, spire broadly dished; *Planorbis* stage passed fairly early during adolescence; habitat similar to preceding.

Sub-genus *Segmentina*. Shell similar to preceding but nautiliform, the whorls usually not numerous and vertically deeper, spire-pit broadly funicular, umbilicus more or less depressed, aperture dentate some distance back, the teeth or plaits in two series, one on the whorl, the other the columella; *Gyraulus* stage passed during early adolescence, *Planorbis* stage pushed back to earliest post-larval growth; habitat similar to preceding.

Sub-genus *Hippeutis*. Shell similar to preceding but lacking the denticulations (which have been absorbed), whorls usually fewer, spire-pit generally narrower and deeper, umbilicus nearly enveloped; *Segmentina* stage apparently passed fairly early during adolescence; habitat same as preceding.

Planorbis has probably suffered worse vicissitudes than any other genus treated in these pages. Not only has it been incorrectly divided, but the group to which the name has been restricted in recent literature belongs to another genus. Müller instituted *Planorbis* in 1774, ostensibly to receive the present families Planorbidæ and Physidæ. No type was designated, since it was not then customary, but the following species were described:—

Section *, shell depressed.

Planorbis contrarius, Müll. (*Helix cornu-arietis*, L., renamed) = *Marissa cornu-arietis* (L.), South American.
P. purpura, Müll. (*H. cornea*, L.) = *Helisoma cornea* (L.).
P. carinatus, Müll. (*H. planorbis*, L.) = *P. planorbis* (L.).
P. vortex, Müll. (*H. vortex*, L.).
P. umbilicatus, Müll. (*H. complanatus*, L.) = *P. planorbis* (L.).
P. spirorbis, Müll. (*H. spirorbis*, L.) = *P. vortex* (L.).
P. contortus, Müll. (*H. contortus*, L.).
P. nitidus, Müll.
P. albus, Müll.
P. imbricatus, Müll. (*Nautilus crista*, L.) = *P. crista* (L.).
P. similis, Müll. = *Helisoma cornea* (L.), juvenile.

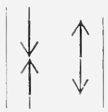
Section **, shell conical.

P. bulla, Müll. (*Bulla fontinalis*, L.) = *Physa fontinalis* (L.).
P. turritus, Müll. (*B. hypnorum*, L.) = *Physa hypnorum* (L.).
P. gelatinus, Müll. = ? *Physa fontinalis*, L.

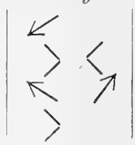
The second section was removed by Müller to *Bulinus* the next year. Lamarck, 1799 and 1801, cites the *Marissa*, an Ampullaroid, the anatomy of which was then unknown, but which has since proved to be very different from that called for in Müller's diagnosis, hence it must be excluded. Swainson (1840), the Adams (1855), and Tryon (1884) give the second species, *Helix corneus* of Linné, as an example, and Dall (1905) cites this as the type. If this were the sum and substance of the matter their example must be followed, and *Planorbis* of future usage, like *Planorbis* of the last seventy years, would be a very different thing from *Planorbis* of Müller, including but two of the original fourteen species, and one of them regarded by the author as doubtfully distinct. Now seven (five, omitting synonyms) of Müller's species are congeneric with *H. planorbis* of Linné, and one is proposed as a substitute for it, the author merely following a current practice of the time of altering the specific name when it became necessary to place the species in a new genus. It seems perfectly obvious that Müller regarded the smaller Planorbidæ, which formed the bulk of his genus, as the typical members, and utilized the suggestive name of an old well-established species of this group, first described some seventy years before when the binomial nomenclature had not yet come into use, to designate it by. In other words *H. planorbis* is the type of *Planorbis* by tautonomy, and the efforts of Swainson or any other writer fifty or more years later to transfer the name to a different group should not be tolerated. If lack of classical examples is claimed, it might be noted that in 1837 Charpentier, utilizing some of Agassiz's manuscript work, first subdivided the genus as it now stands into natural groups, correctly restricting *Planorbis* to the section including *H. planorbis*, L., and *H. vortex*, L.

The genus *Planorbis* in the sense used here embraces the so-called smaller Planorbes, and is characterized particularly by the peripheral keel in typical *Planorbis*, the simple rounded succeeding stage the denticulations developed in the 'throat' of the shell in the sub-genus *Segmentina*, and a second 'round-whorled' stage following that. These denticules take the form of plaits or cusps, and differ radically in each species, thus affording a ready means of identification, and incidentally several unnecessary sectional names. *P. nitida*, of Europe, has a transverse columellar plait and two on the whorl. The American *P. armigera* is more complex, possessing cusps in addition to the plaits, which are in this instance diagonal. The appearance on looking into the aperture when the shell is oriented in its natural position might be diagrammatically expressed as follows:—

P. nitida.



P. armigera.



PLANORBIS (GYRAULUS) ALBUS (Müller).

Planorbis albus, Müller, 1774; *P. deflectus*, Say, 1824; *P. hirsutus*, C. B. Adams, 1839; *P. vermicularis*, Gould, 1847; *P. borealis*, 'Loven MS.,' Westerlund, 1875.

Shell small, whorls rounded, fairly deep, and usually more or less hirsute, spire-pit narrow for group; habitat chiefly in lakes, preferring deep water.

Boreal portions of Palæarctic and Nearctic Regions. Yukon, Alaska, Fraser, Columbia, Klamath, and Coast Range (locally) Systems.

Quaternary: Loess of eastern States.

PLANORBIS (GYRAULUS) PARVUS (Say).

Planorbis parvus, Say, 1817; *P. glaber*, Jeffreys, 1820; *P. levis*, Alder, 1838; *P. elevatus*, C. B. Adams, 1840; *P. vermicularis* of authors in part, not of Gould.

Shell small, whorls compressed, spire-pit widely evenly concave; habitat lakes and streams.

Nearctic Region; European Province.

Quaternary: Loess of eastern States; post-Glacial deposits of Vancouver and San Juan Islands; San Pedro formation (specimens washed into marine terraces), alluvial deposits of San Joaquin Valley, Owen Lake beds, playas of Mojave Desert, and Le Conte Lake beds, California.

PLANORBIS (GYRAULUS) LIEBMANNI (Dunker).

Planorbis Liebmanni, Dunker in Martini & Chemnitz, 1850; *P. gracilentus*, Gould, 1855.

Shell of large size, whorls fairly deep, spire-pit rather broadly concave; habitat lakes and streams.

Mexican and Antillean (?) Provinces. Arizona System (locally).

Le Conte Lake beds, California.

Probably not the earliest name for this species; the Mexican Planorbidæ are in need of careful revision.

PLANORBIS (GYRAULUS) FILOCINCTUS (Pilsbry & Ferriss).

Planorbis filocinctus, Pilsbry & Ferriss, 1906.

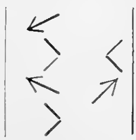
A species of the type of *P. albus* and *P. parvus*, but unknown to the writer except from the original diagnosis in the *Mollusca of the South Western States*, part ii.

Arizona System.

PLANORBIS (SEGMENTINA) ARMIGERUS (Say).

Planorbis armigerus, Say, 1821.

Shell of moderate size, whorls fairly deep, umbilicus and spire-pit broad, the latter deep, aperture armed, the teeth corresponding to the formula

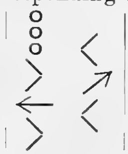


habitat sluggish streams and marshes.

American Province. Yukon System.

PLANORBIS (SEGMENTINA) MOJAVENSIS, n.sp. Pl. VIII, Fig. 27.

Shell large, nautiliform, whorls rounded, deep, not numerous, umbilicus and spire-pit broad, and nearly equal in depth, aperture armed, the denticulations corresponding to the formula



habitat probably lacustrine.

Diam. 9·5, alt. 4·5, diam. of aperture 3 mm.

Miocene: Rosamond Series, California.

Near Barstow, Mojave Desert, California (J. C. Merriam, C. L. Baker).

Resembles *P.* (*Hippeutis*) *contortus* of Europe, somewhat in the nautiliform shape, but decidedly larger, and lacking the numerous whorls of that species. The absence of apertural lamellæ above the periphery on the whorl is peculiar, but characteristic of all the specimens in which this character may be made out.

Planorbis (*Segmentina*) *declivis* (Tate), 1870.

Dall (*Alaska*, xiii, 1905, p. 98) cites this Nicaraguan species from the Umpqua River, Oregon. In several years field-work in California and Oregon the writer has seen nothing corresponding to it, and the species does not appear on a manuscript list of the shells observed in the vicinity of Elkton on the Umpqua River by Fred H. Andrus, an old collector. Is this not another *Unio Oregonensis* ?

Planorbis (Hippeutis) exacutus (Say).

Planorbis exacuous (misprint for *exacutus*), Say, 1821; *P. exacutus*, 'Say' of authors.

Shell of moderate size, whorls vertically compressed, spire-pit broad for group, umbilicus not appreciably depressed; habitat ponds and streams.

American Province. Yukon, Fraser, and Columbia (locally) Systems.

Loess of Yukon Valley, Alaska.

Planorbis (Hippeutis) dilatatus (Gould).

Planorbis lens, Lea, 1838, not of Brongniart, 1810; *P. dilatatus*, Gould, 1841, not of Pfeiffer, 1842; *P. lenticularis*, Lea, 1844, not of Schlotheim, 1818; *P. Buchanensis*, Lea, 1844; *P. Brongniartiana*, Lea, 1844; *P. opercularis*, Gould, 1847 (syntonic form); *P. planulatus*, W. Cooper, 1860 (syntonic form); ? *P.* '*gracilentus*, Gould', Tryon, 1863; *P. Centervillensis*, Tryon, 1872; *P. callioglyptus*, Vanatta, 1895 (syntonic form); *P. opercularis*, var. *Oregonensis*, Vanatta, 1895, not *P. Oregonensis*, Tryon, 1865 = *H. trivolvis*, Say; *P. opercularis*, var. *multilineata*, Vanatta, 1899; *P. Vanvlecki*, Arnold, 1910 (syntonic form); *P. vermicularis* of authors in part, not of Gould.

Shell small or of moderate size, whorls deep, spire-pit narrow but extending to apex, umbilicus not appreciably depressed; habitat lakes and clear streams.

European and American Provinces. Entire Californian Province except Los Angeles and Arizona Systems.

Quaternary: Lahontan Lake beds, Nevada; Owens Lake beds and alluvial deposits of San Joaquin Valley, California; Summer and Christmas Lake beds, Oregon. Pliocene: Idaho Lake beds, Oregon and Idaho; Kettleman Lake beds, California.

A common species in the Californian Province, but sporadic elsewhere if the records may be depended upon. Besides being reported under a variety of names it has doubtless been confused with the preceding species, which is less common west of the Rocky Mountains.

P. Samsoni, Ancey, and *Alabamensis*, Pils., are two of the better known synonyms, which have, however, not been used for the species in the present district.

'*Planorbis* (*Spirorbis*)' *lunatus*, Conrad, 1871.

Oligocene: John Day Series, Oregon.

This is not a *Planorbis*, as supposed by Conrad, but a land snail belonging to the genus *Ammonitella* of J. G. Cooper. Stearns, apparently unaware of Conrad's name, redescribed the species in 1900 as *Ammonitella Yatesi præcursor*. *Ammonitella lunata* is, however, specifically distinct from *A. Yatesi*, a recent species from the Sierra Nevada Mountains, California.

Genus Helisoma, Swainson.

Helisoma, Swainson, 1840 (*Planorbis bicarinatus*, Sowb. = *P. antrosus*, Conr.); *Taphius*, H. & A. Adams, 1855 (*P. andecola*, d'Orb.).

Type, *Planorbis antrosus*, Conrad.

Sub-genus Planorbella, Haldeman.

Helix (sp.), Linné, 1758 (*H. cornea*, L.); *Planorbis* (sp.), Müller, 1774 (*P. purpura*, Müll. = *H. cornea*, L.); *Planorbella*, Haldeman, 1842 (*P. campanulatus*, Say); *Planorbina*, Haldeman, 1842 (*P. olivaceus*, Spix, cited by Dall, 1905); *Coretus*, 'Adanson,' Gray, 1847 (*H. cornea*, L.); *Menetus*, H. & A. Adams, 1855 (for '*Anisus*, Beck, not Fitz.', hence *P. olivaceus*, Spix); *Adula*, H. Adams, 1861 (*P. multivolvis*, Case = *P. campanulatus*, Say, syntonic form), not *Adula*, H. & A. Adams, 1851; *Ancæus*, H. Adams, 1869 (for *Adula*, H. Adams, hence same type), not *Ancæus*, Frauvel, 1863; *Pierosoma*, Dall, 1905 (*P. trivolvis*, Say).

Type, *Planorbis campanulatus*, Say.

Sub-genus Perrinilla, n.sub-gen.

Type, *Helisoma Cordillerana*, n.sp.

Named in honour of Dr. James Perrin Smith, to whom the writer is under obligations for frequent advice, particularly pertaining to the theoretical problems, during the preparation of this paper.

Sub-genus *Planorbella*. Shell large, averaging 20 mm. in diameter, whorls moderately deep, sinistral, the spire planulate, tending to become excavated as the adult condition is reached, its margin sub-carinate, umbilicus narrow and deep, broadening rapidly during later development, margin subangular, aperture retracted above, expanded in adult; habitat lakes and quiet streams.

Sub-genus *Helisoma*, s.s. Shell similar to *Planorbella*, but distinctly ultra-sinistral, the spire-pit and umbilicus funicular, and nearly equal in depth, each margined by a decided peripheral carina, aperture expanded in adult; *Planorbella* stage passed very early during adolescence; habitat similar to *Planorbella*.

Sub-genus *Perrinilla*. Shell similar to *Planorbella*, except that it is totally ultra-sinistral, spire-pit deep and narrow, umbilicus but slightly excavated, superior and inferior peripheries subangular; *Helisoma* stage passed very early during adolescence, *Planorbella* stage not distinguished on account of preservation; habitat apparently similar to *Planorbella.*

Nearly every well-established recent species of this genus has apparently served as the type of its own peculiar sub-genus. The present arrangement is not liable to offer particular difficulties to American conchologists, but the *Planorbella* group is commonly known in Europe under the name of *Corteus.* This was originally used by Adanson (as *Coretus*) in a somewhat different sense, but on its introduction into Linnean nomenclature it was transferred to the present group. Since this did not take place until after the appearance of *Planorbella* it must be suppressed, a procedure that the writer is not sorry for on historical grounds.

Helisoma appears to be a Mesozoic genus, which reached its culmination in the older Tertiary or earlier, and is represented in the living state chiefly by species belonging to the primitive group. *Perrinilla,* which would doubtless be termed by Grabau a 'second round-whorled stage', appears to be an instance of over-specialization resulting in extinction.

HELISOMA (PLANORBELLA) TRIVOLVIS (Say).

Planorbis trivolvis, Say, 1817; *P. tumidus,* Pfeiffer, 1839 (syntonic form); *P.* '*corpulentus,* Say', Haldeman, 1844 (syntonic form); *P.* '*glabratus,* Say', Haldeman, 1844 (*partim*); *P. ammon,* Gould, 1855 (syntonic form); *P. subcrenatus,* Carpenter, 1856 (senile); *P. Traski,* Lea, 1856 (syntonic form); *P. tumens,* Carpenter, 1857 (syntonic form); *P. truncatus,* Miles, 1861 (syntonic form); *P. Horni,* Tryon, 1865 (syntonic form); *P. Oregonensis,* Tryon, 1865 (syntonic form); *P. Binneyi,* Tryon, 1868 (syntonic form); *Helisoma* '*tenuis,* Phil.', Carlton, 1870 (syntonic form); *P. occidentalis,* J. G. Cooper, 1870 (syntonic form); *H. plexata,* Ingersoll, 1874 (syntonic form); *P.* (*subcrenatus,* var.?) *disjectus,* J. G. Cooper, 1890 (syntonic form); *P.* '*lentus,* Say', Stearns, 1893 (syntonic form); *P.* '*vermicularis,* Gould', Arnold, 1903.

Shell large, coarsely striate, whorls deep, not numerous, superior margin sub-prominently carinate, forming an evenly concave spire-pit, aperture somewhat expanded in adult; habitat lakes and sluggish streams.

Entire Nearctic Region. Mexican Province.

Quaternary: Loess of eastern States; San Pedro Formation (specimens washed into marine terraces), alluvial deposits of San Joaquin Valley, and Le Conte Lake beds, California; Lahontan Lake beds, Nevada; Bonneville Lake beds, Utah; post-Glacial deposits of Vancouver Island. Pliocene: Santa Clara and Cache Lake beds, California.

HELISOMA ANTROSA (Conrad).

Planorbis bicarinatus, Say, 1817, not of Lamarck, 1804; *Helix angulata,* Rackett, 1821, not of Burrow, 1815; *P. antrosus,* Conrad, 1834; *P. elongatus,* Conrad, 1835; *P. bicarinatus,* Sowerby, 1840, not of Lamarck, 1804; *P. angistoma,* Haldeman, 1844; *P. lautus,* H. Adams, 1861.

Shell rather small, finely striate, whorls deep and of moderate size, umbilicus and spire-pit prominently funicular, the former particularly so, superior and inferior peripheries pronouncedly carinate, aperture expanded in adult; habitat lakes and quiet streams.

American Province. Columbia and Fraser Systems.

Quaternary: Loess of eastern States.

HELISOMA (PERRINILLA) PABLOANA (J. G. Cooper).

Planorbis Pabloanus, J. G. Cooper, 1894.

Shell small, coarsely striate, whorls not deep and rather small, umbilical carina nearly obsolete, sub-marginal, the umbilicus unevenly concave, spire-pit rather broad for group, aperture but slightly expanded; habitat apparently lacustrine.

Miocene: Contra Costa Lake beds, California.

A small inconspicuous species lacking the evenly dished umbilicus of *Cordillerana.* The type was crushed flat, and alone would hardly be sufficient to distinguish the species if still in existence. Several fairly preserved specimens from the vicinity of the original locality permit a diagnosis, however.

HELISOMA (PERRINILLA) CORDILLERANA, n.sp. Pl. IV, Fig. 34; Pl. VI, Fig. 16.

Shell of considerable size, whorls large, somewhat compressed, and strongly ultra-sinistral, the umbilicus barely concave, superior and inferior peripheries subangular in young stages, becoming rounded in adult, growth-striæ strong, spiral striæ occasionally preserved, aperture expanded somewhat in adult; habitat apparently lacustrine.

Diam. 22, alt. 9, diam. of aperture 12 mm.

Eocene: Truckee Lake beds, Nevada.

Hill near Hawthorne on the Belmont stage road (types); near Hawthorne (probably same locality) (H. W. Turner); one mile south-east of coal-mine, Silver Peak Range (S. A. Knapp, H. W. Turner); $1\frac{1}{2}$ miles south-east of coal-mine (H. W. Turner); hill immediately back of coal-mine (H. W. Turner); 7·7 km. north-east of Emigrant Gap, and 8·6 km. south-east of coal-mine, Silver Peak Range (H. W. Turner).

Possibly co-specific with *Planorbis Utahensis*, Meek, from the same horizon in the Rocky Mountains. The species belongs to this group, but the figures are not characteristic and no specimens are available.

Family POMPHOLIGIDÆ, Dall, 1866.

Shell of small or moderate size, velutiniform or sub-planorbiform, dextral, showing fine spiral and growth striæ, aperture ovate or ovate-quadrate, columella simple, imperforate, or umbilicate; animal sinistral, hermaphroditic, tentacles clavate, buccal plate sub-cordiform, lateral jaws absent, foot quadrate-elliptical; habitat lakes and clear streams.

The genus *Pompholyx,* the sole known representative of this family and a strictly Californian group, contains four Cenozoic species which differ rather widely in superficial appearance, and with the exception of the recently described *P. Sanctæclaræ* have served as the types of one or more genera and sub-genera. With a limited series at hand it might be possible to make such distinctions conscientiously, but the species vary so widely, and individuals of one so closely approach some other except for some apparently trivial character, that the writer has felt obliged to reduce the classification to as compact a form as possible.

The reference of the Baikalian *Choanomphalus* to this group, first suggested with doubt forty years ago when that genus was unknown anatomically, has been taken up and treated as established in spite of the fact that Dybowski some years later pointed out that it possesses a truly Planorboid radula.

Genus Pompholyx, Lea.

Pompholyx, Lea, 1856 (*P. effusa*, Lea); *Pompholopsis*, Call, 1888 (*Pompholopsis Whitei*, Call = *P. effusa*, Lea, syntonic form).

Type, *Pompholyx effusa*, Lea.

Sub-genus Carinifex, Binney.

Planorbis (sp.), Lea, 1858 (*Planorbis Newberryi*, Lea); *Carinifex*, Binney, 1865 (*P. Newberryi*, Lea); *Megasystropha*, Lea, 1866 (*P. Newberryi*, Lea); *Vorticifex*, Meek, 1870 (*Carinifex Binneyi*, Meek).

Type, *Planorbis Newberryi*, Lea.

Sub-genus *Pompholyx*, s.s. Shell of moderate size, averaging 8 mm. in diameter, velutiniform, imperforate or sub-perforate, spire but slightly elevated, aperture expanded; habitat lakes and clear streams.

Sub-genus *Carinifex*. Shell similar to preceding but sub-planorbiform, whorls usually more or less angular, concave above the periphery, which is superior, sloping inward below to a broad more or less funicular umbilicus, spire but little elevated, aperture rather trigonal, broader above; *Pompholyx* stage carried back to very early adolescence; habitat lakes and clear streams.

Pompholyx effusa, Lea.

P. effusa, Lea, 1856; *P. solida*, Dall, 1870; *Pompholopsis Whitei*, Call, 1888 (syntonic form); *Pompholyx Leana*, H. & A. Adams, *fide* Dall, 1870.

Shell as in sub-genus, whorls moderately deep; habitat lakes and clear streams.

Klamath, Nevada, Mojave, and Coast Range (locally) Systems.

Quaternary: Lahontan Lake beds, Nevada; Owens Lake beds and playa deposits of Mojave Desert, California; Christmas and Summer Lake beds, Oregon. Pliocene: Santa Clara Lake beds, California.

Pompholyx (Carinifex) Newberryi (Lea).

Planorbis Newberryi, Lea, 1858; *Carinifex Breweri*, 'Newcomb MS.,' Binney, 1865 (nude name); *C. Newberryi*, var. *minor*, J. G. Cooper, 1870; *C. Ponsonbyi*, E. A. Smith, 1875.

Shell large, spire but little elevated, whorls deep, nearly planulate, and slightly concave above with a more or less distinct marginal keel, aperture sinuate and retracted below, umbilicus regularly broadly funicular, the margin keeled; habitat lakes and clear streams.

Klamath, Nevada, and locally in Coast Range Systems.

Quaternary: Lahontan Lake beds, Nevada; Christmas and Summer Lake beds, Oregon; Owens Lake beds, California.

Pompholyx (Carinifex) Binneyi (Meek).

Carinifex (*Vorticifex*) *Binneyi*, Meek, 1870; *C. Tryoni*, Meek, 1870; *C. Tryoni*, var. *concava*, Meek, 1870.

Shell very large, whorls deep, planulate above, the margin subangular, umbilicus broadly funicular, the margin angular, aperture retracted below; habitat apparently lacustrine.

Eocene: Truckee Lake beds, Nevada; Payette Lake beds, Idaho.

Pompholyx (Carinifex) Sanctæclaræ (Hannibal).
Pl. VI, Figs. 14*a–b*.

Carinifex Sanctæclaræ, Hannibal, 1909; *C. Marshalli*, Arnold, 1910.

Shell small or of moderate size, spire somewhat elevated, whorls not deep, coronate at suture, the upper surface concave, superior margin rounded, umbilicus moderately broad and regularly funicular, the margin acutely angular, aperture retracted below; habitat apparently lacustrine.

Pliocene: Santa Clara and Kettleman Lake beds, California.

Family PHYSIDÆ, Dall, 1871.

Shell small, oliviform, sinistral, columella variable, simple or plicate, imperforate or sub-umbilicate; animal sinistral, hermaphroditic, tentacles filiform, buccal plate without accessory lateral jaws, foot elongate-trigonal; habitat aquatic situations.

The American Physidæ have been variously maltreated and mutilated, and from a dozen to over a hundred and fifty nominal species recognized, depending on the author. Two years ago, after an examination of several thousand specimens, the writer expressed the opinion[1] that the entire aggregation was reducible to three forms—*Aplexa hypnorum*, *Physa heterostropha*, and *P. heterostropha osculans*. Wider experience has proved the correctness of the position taken at that time, and it only remains to untangle the nomenclature and return to first principles.

Bulla hypnorum, of Linné, has been generally separated generically as *Aplexa* from *B. fontinalis*, the type of *Physa*, on the basis of a more polished shell, absence of mantle-digitations expanded across the columella, and the dentition. The dentition, however, differs chiefly in the development of the teeth, for the fundamental type is essentially the same; the mantle-fingers, while nearly always present in *fontinalis*, vary widely in number and grouping, and cannot be regarded as very essential in generic discrimination, and, in lieu of other characters, the elevation of the spire and polish of the shell must be considered as of no more than specific value. Furthermore, the early stages indicate

[1] *West Coast Shells*, 1910, p. 312.

that a decidedly closer relationship exists between these species than would be expected in different genera.

Genus Physa, Draparnaud.

Bulla (sp.), Linné, 1758 (*B. fontinalis*, L.); *Planorbis* (sp.), Müller, 1774 (*P. bulla*, Müll. = *B. fontinalis*, L.); *Bulinus* (sp.), Müller, 1781 (*B. perla*, Müll. = *B. fontinalis*, L.); *Turbo* (sp.), Walker, 1787 (*T. stagnalis*, Walker = *B. hypnorum*, L.); *Physa*, Draparnaud, 1801 (*B. fontinalis*, L.); *Physina*, Rafinesque, 1815 (emended form); *Lymnæa* (sp.), Say, 1817 (*L. heterostropha*, Say = *B. fontinalis*, L.); *Anisus* (sp.), Studer, 1820 (*B. fontinalis*, L.); *Aplexa*, 'Fleming,' Sowerby, 1822 (*B. hypnorum*, L.); *Nauta*, 'Leach MS.,' Turton, 1831 (*B. hypnorum*, L.), in synonymy; *Rivicola*, Fitzinger, 1833 (*B. fontinalis*, L.); *Physella*, Haldeman, 1842 (*P.* (*Physella*) *globosa*, Hald. = *B. fontinalis*, L.); *Physodon*, Haldeman, 1842 (*P.* (*Physodon*) *microstoma*, Hald. = *B. fontinalis*, L.); *Aplecta*, Herrmannsen, 1846 (emended form of *Aplexa*); *Myxas*, Gray, 1847 (*B. hypnorum*, L.), not *Myxas*, Leach, 1822; *Costatella*, Dall, 1870 (*P. costata*, Newc. = *B. fontinalis*, L., syntonic form).

Type, *Bulla fontinalis*, Linné.

Shell as in family, averaging 15 mm. in altitude; habitat aquatic situations of all sorts.

Physa fontinalis (Linné).

Bulla fontinalis, Linné, 1758; *Lymnæa heterostropha*, Say, 1817; *Physa gyrina*, Say, 1821; *P. ancillaria*, Say, 1825; *P. concolor*, Haldeman, 1841; *P. bullata*, Gould, 1855, not of Potiez and Michaud, 1838; *P. triticea*, Lea, 1856; *P. Lordi*, Baird, 1863 (syntonic form); *P. ampullacea*, Gould in Carpenter, 1863; *P. Nuttalli*, Lea, 1864; *P. venusta*, Lea, 1864; *P. propinqua*, Tryon, 1865; *P. politissima*, Tryon, 1865; *P. malleata*, Tryon, 1865; *P. hordacea*, Lea, 1866; *P. Wolfiana*, Lea, 1869; *P. Parkeri*, Currier in DeCamp, 1881 (syntonic form); *Physella Columbiana*, Hemphill in Keep, 1888 (syntonic form).

Physa fontinalis acuta (Draparnaud).

Physa acuta, Draparnaud, 1805; *P. osculans*, Haldeman, 1843 (as subsequently restricted); *P. Mexicana*, Philippi in Martini and Chemnitz, 1844; *P. virginea*, Gould, 1847; *P. humerosa*, Gould, 1855 (syntonic form); *P. virgata*, Gould, 1855; *P. costata*, Newcomb, 1861 (syntonic form); *P. Gabbi*, Tryon, 1863 (syntonic form); *P. striata*, Lea, 1864, not of Menke, 1830; *P. Staffordi*, Lea, 1864; *P. parva*, Lea, 1864; *P. Hawni*, Lea, 1864; *P. Grosvenori*, Lea, 1864; *P. Traski*, Lea, 1864; *P. Blandi*, Lea, 1864; *P. Cooperi*, Tryon, 1865; *P. diaphana*, Tryon, 1865; *P. distinguenda*, Tryon, 1865; *P. occidentalis*, Tryon, 1865 (syntonic form); *P. sparsistriata*, Tryon, 1865; *P. Dorbignyana*, Lea, 1866; *P. coniformis*, Tryon, 1866; *P. Carltoni*, Lea, 1869; *P. Wattsi*, Arnold, 1910 (syntonic form).

Physa fontinalis. Shell of moderate size, spire rather obtuse, whorls inflated, sutures somewhat impressed, columella short and oblique; habitat everywhere in aquatic situations.

Boreal portion of European Province and Nearctic Region. Yukon, Alaska, Fraser, Columbia, Klamath, Utah, Nevada, and Coast Range Systems, occasionally farther south.

Quaternary: Loess of eastern States; post-Glacial deposits of Vancouver and San Juan Islands.

Physa fontinalis acuta. Shell similar to *fontinalis*, but the whorls slightly more inflated, the sutures deeper, and the columella long and straight, with a rudimentary fold; *fontinalis* stage passed during late adolescence; habitat same.

Temperate and sub-tropic portions of European Province and Nearctic Region; Mexican and Antillean Provinces. Utah, Nevada, Klamath, Coast Range, Los Angeles, Mojave, Colorado, and Arizona Systems, infrequently farther north.

Quaternary: Bonneville Lake beds, Utah; Lahontan Lake beds, Nevada; marls of Santa Rosa Island, alluvial deposits of San Joaquin Valley, and San Pedro Formation (specimens washed into marine terraces), California. Pliocene: Kettleman, Cache, and Santa Clara Lake beds, California.

For those writers who fondly believe that nothing of importance has been done by the Europeans that will assist in the classification of the New World molluscs, a consultation of Moquin-Tandon's *Histoire Naturelle des Mollusques terrestres et fluviatiles de France* in this connexion is suggested. That work was written in 1855–6 at a time when writers on American conchology had contributed but a score or so of synonyms to *fontinalis* and its sub-species, instead of the ten score which now burden the literature, yet the characters used there to distinguish the species are identical with those suggested by the writer, quite independently, two years ago, and, except that *acuta* is given sub-specific rather than full rank, the nomenclature accepted in these pages follows the French author closely.

Physa hypnorum (Linné).

Bulla hypnorum, Linné, 1758; *Bulinus Tryoni*, Currier, 1867.

Shell of moderate size, spire acute, whorls rather appressed, sutures not appreciably impressed, columella short and oblique; habitat lakes, rivers, and sloughs.

Boreal portions of American and European Provinces. Yukon, Utah, and locally in Columbia System.

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. X. Part III. OCTOBER, 1912. Price 7s. 6d. net.

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OF THE

ALACOLOGICAL SOCIETY

OF LONDON.

EDITED BY

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

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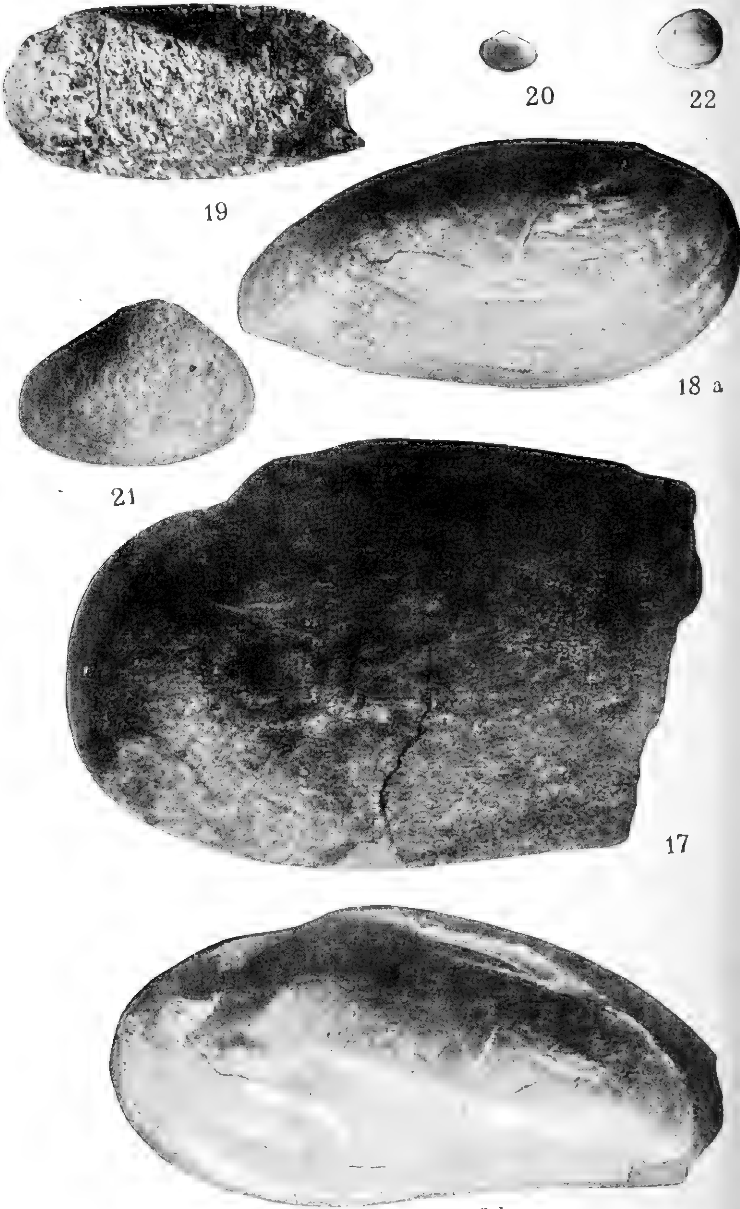

RECENT AND TERTIARY MOLLUSCA FROM WESTERN NORTH AMERICA.

A SYNOPSIS OF THE RECENT AND TERTIARY FRESHWATER MOLLUSCA OF THE CALIFORNIAN PROVINCE, BASED UPON AN ONTOGENETIC CLASSIFICATION.

(*Concluded from p. 165.*)

By Harold Hannibal.

Read 10th May, 1912.

PLATES VII–VIII.

Superfamily MELANOIDEÆ (Swainson), 1840.

The Melanoideæ include several families of cerithiform operculates inhabiting the marine littoral zone, estuaries, amphibious situations near the sea, and purely fresh waters, among which may be noted the Melaniidæ, Swainson, 1840, Turritellidæ, H. & A. Adams, 1854, Cerithiidæ, H. & A. Adams, 1854, Melanopsidæ (H. & A. Adams), 1854, Pleuroceridæ, Fischer, 1887, and Ellipstomidæ, n.fam. In few other groups of Gastropods is the classification more involved than among the brackish and freshwater Melanoids; species but distantly related so closely resemble one another that the only safe criterion by which to distinguish them lies in the anatomy. Even in the following family, however, represented in fully two-thirds of the streams of the United States, the internal characters have not been sufficiently described to offer a clue to what constitutes generic differences.

Family PLEUROCERIDÆ, Fischer, 1887.

Shell of variable size, fusiform or conical, covered with a greenish or tawny epidermis frequently marked by darker spiral bands, whorls more or less appressed, sutures but little impressed, aperture in its simplest form normal, the outer lip sinuate, slightly retracted and produced below, in the more specialized forms with an elongate fusiform canal or sutural pleurotomariform cleft; animal oviparous, mantle-margin simple, operculum horny and concentric; habitat chiefly fluviatile.

Two stages or sub-families depending chiefly on the modification of the aperture are recognizable as follows:—

Sub-family PLEUROCERINÆ, s.s.

Shell melaniform, periphery generally smooth and rounded, aperture simple, the outer lip sinuate, slightly retracted and produced below.

Genera, *Pleurocera*, s.s., *Ambloxus*, *Gyrotoma*, sub-gen. *Goniobasis*.

Sub-family GYROTOMINÆ, n.sub-fam.

Shell not typically melaniform, whorls more or less peripherally carinate and nodose or nodose-spinous, aperture produced below into a fusiform canal, or retracted above into a sutural cleft; *Pleurocerinæ* stage passed during adolescence.

Genera, *Gyrotoma*, s.s., *Pleurocera*, sub-gen. *Io*.

Through the efforts of Rafinesque, Lea, Haldeman, Anthony, and the Adams during the early and middle parts of the last century the classification of this family has been so burdened with unreduced specific synonyms and a superabundance of genera that no subsequent writer has cared to undertake its thorough revision, while but two, Tryon [1] and Pilsbry,[2] have given serious attention to the group since that time.

In an endeavour to straighten out the involved generic nomenclature of the Western forms the recent members of the entire family have been reviewed, and from among the hundreds of nominal species nine species and four sub-species, representing three genera, have been selected as entitled to serious consideration.[3]

It is not anticipated that this treatment will meet with general approval in every instance. In the absence of a field acquaintance with the species from east of the Rocky Mountains (the family is restricted to the Nearctic Region, and chiefly to the Mississippi Valley), and the necessity of depending on figures, locotypes, and named specimens, certain errors are bound to creep in. If, however, the way is paved for a thorough revision, the mission of these pages will have been fulfilled. To assist in this types have been cited for all the group names current in the literature, without, however,

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[1] Strepomatidæ, *Smith. Misc. Coll.*, No. 253, 1873.

[2] In Pilsbry & Rhodes, Proc. Philad. Acad. Nat. Sci., 1896, pp. 495 ff.

[3] The genus *Ellipstoma* (+ *Anculosa*, Say), ordinarily included in this family, in reality groups by itself in the Ellipstomidæ, nov. The species (if there is more than one with several sub-species) are wholly confined to the waters east of the Mississippi River, and hardly concern us here. The following is a summary of the generic arrangement :—

Genus ELLIPSTOMA, Rafinesque.

Ellipstoma, Rafinesque, 1818 (*E. gibbosa*, Raf.) ; *Lithasia*, Haldeman, 1840 (*Anculosa* (*Lithasia*) *genicula*, Hald. = *E. gibbosa*, Raf.).

Type, *Ellipstoma gibbosa*, Rafinesque.

Sub-genus ANCULOSA, Say.

Leptoxis, Rafinesque, 1818 (no species cited, description apparently based on *prærosa*) ; *Anculosa*, Say, 1821 (*Melania* (*Anculosa*) *prærosa*, Say) ; *Anculotus*, Say, 1825 (emended form) ; *Leptoxis*, 'Rafinesque,' Haldeman, 1847 (*L. retusa*, Raf. = ? *A. prærosa*, Say) ; *Eurycælon*, Lea, 1864 (*Goniobasis* (*Eurycælon*) *umbonatum*, Lea = *A. prærosa*, Say).

Type, *Melania* (*Anculosa*) *prærosa*, Say.

Sub-genus MUDALIA, Haldeman.

Bulimus (sp.), Bruguière, 1792 (*B. carinatus*, Brug.) ; *Paludina* (sp.), Say, 1819 (*P. dissimilis*, Say = *B. carinatus*, Brug.) ; *Mudalia*, Haldeman, 1840 (*P. dissimilis*, Say = *B. carinatus*, Brug.) ; *Nitocris*, H. & A. Adams, 1854 (*Anculosa carinata*, Lea = *B. carinatus*, Brug., first species) ; *Spirodon*, 'Anthony MS.,' Tryon, 1873 (*A. monodontoides*, Conr. = *B. carinatus*, Brug.), in synonymy.

Type, *Bulimus carinatus*, Bruguière.

The genetic relations of these three are in reverse order. *Mudalia* represents the most primitive, and *Ellipstoma* the most highly modified stage.

interposing unnecessary changes in the existing nomenclature, thus eliminating them as possibilities for future disturbance. One of the most knotty problems has been the recognition of Rafinesque's genera. The English language is not forceful enough to adequately express the feeling of the systematist who has to judge these crimes in the name of science.

Genus Pleurocera, Rafinesque.

Pleurocera, Rafinesque, 1818, 1819 (generic diagnosis only); *Pleurocera*, Rafinesque, 1820 (*P. verrucosa*, Raf.); *Melania* (sp.), Say, 1821 (*M. canaliculata*, Say); *Telescopella*, Gray, 1837 (*M. undulata*, Say = *canaliculata*, Say); *Ceriphasia*, Swainson, 1840 (*C. sulcata*, Swains. = *M. canaliculata*, Say); *Angitrema*, Haldeman, 1841 (*M. armigera*, Say); *Elimia* (sp.), H. & A. Adams, 1854 (*M. elevata*, Say = *canaliculata*, Say); *Megara* (*pars*), H. & A. Adams, 1854 (*M. lima*, Conr. = *P. verrucosa*, Raf.); *Streptobasis*, Lea, 1861 (*S. Spillmanii*, Lea = *M. bitæniata*, Conr.); *Tryphanostoma*, Lea, 1862 (*M. canaliculata*, Say); *Strepoma*, 'Rafinesque MS.,' Haldeman, 1863 (*Ceriphasia sulcata*, Swains. = *M. canaliculata*, Say, by substitution); *Meseschiza*, Lea, 1864 (*M. Grosvenorii*, Lea = *M. armigera*, Say, deformed).

Type, *Pleurocera verrucosa*, Rafinesque.[1]

---

[1] No type species has ever been cited for *Pleurocera* so far as the writer has been able to determine. Tryon, Fischer, and Pilsbry appear to have regarded *Melania canaliculata*, Say (not described till 1821), as typical, but do not identify it with any of Rafinesque's species. Rafinesque first described the genus in 1818 in the *American Monthly Magazine and Critical Review*, and repeated the diagnosis in a somewhat altered form in the *Journal de Physique* for 1819. Six species were named in the former instance, but it does not appear that they ever passed the *nomen nudum* stage. The generic description, with a little imagination, would fit any member of this section of the family about equally well, so that nothing can be gained from that. In the *Annals of Nature*, i, p. 11, 1820, Rafinesque described *Pleurocera verrucosa*, and mentioned that the genus had been diagnosed in the *Journal de Physique*. Tryon says in regard to this species: "With no disposition to give place to the description of Mr. Rafinesque, at the expense of naturalists of honesty and reputation, I am still constrained, in this instance, to quote his name for the shell that is so well known amongst us as Mr. Say's *nupera*. Indeed, I cannot find any description of a species of shell, by Rafinesque, which indicates so unmistakably the shell intended by him, as does the one here quoted. It may be mentioned, not as proof in itself, but merely as collateral evidence of the correctness of my views of this species, that in a manuscript by Rafinesque, entitled *Conchologia Ohioensis*, belonging to the Smithsonian Institution, a rough pen sketch of *Pleurocera verrucosa* is given, which is a very good representation of Mr. Say's *nupera*." *Pleurocera* must therefore be dated from 1820, with *P. verrucosa* as the monotype.

That Rafinesque's group was probably no more homogeneous than the later divisions of the Adams and Lea, may be judged from the fact that in 1831 three more species were added, of which *P. gonula*, probably, and *P. quadrosa* certainly are referable to *canaliculata*, while *P. acuta* is doubtless *Ambloxus virginicum*.

Sub-genus Io (Lea).

? *Oxytrema*, Rafinesque, 1819 (no type cited, description appears to have been based on smooth form of *fluviatilis*); *Fusus* (sp.), Say, 1823 (*F. fluviatilis*, Say); *Io*, Lea, 1832 (*I. fusiformis*, Lea = *F. fluviatilis*, Say); *Melafusus*, Swainson, 1840 (no species cited, description apparently based on *fluviatilis*).

Type, *Fusus fluviatilis*, Say.

Sub-genus *Pleurocera*, s.s. Shell of rather large size, averaging 30 mm. in altitude, solid, spire elevated-conic, early whorls normally smooth and rounded, adult whorls barely inflated or appressed, frequently more or less nodose on the periphery, which has a tendency to become sub-carinate, aperture simple, pillar straight and imperforate, outer lip sinuate, somewhat produced and channelled below; habitat streams.

Sub-genus *Io*. Shell similar to preceding but larger, averaging 40 mm. in altitude, moderately thin, spire elevated-conic, whorls barely inflated or appressed, periphery sub-carinate and more or less ornamented with nodes which increase in size and complexity with the later growth tending to acquire the character of spines, imperforate, outer lip deeply sinuate, and produced below into a fusiform canal; *Pleurocera* stage passed during adolescence; habitat in streams.

Pleurocera includes the usually peripherally nodose, straight-pillared, more or less conical American Melanoids, the canalled forms composing the sub-genus *Io*. A somewhat anomalous state of affairs exists, but one to be expected in the history of all genera, in that all the Ios are represented by sub-species in typical *Pleurocera*.

PLEUROCERA VERRUCOSA, Rafinesque.

P. verrucosa, Rafinesque, 1820; *Melania nupera*, Say, 1829; *Melanopsis semigranulosa*, Deshayes, 1830; *M. lima*, Conrad, 1834; *M. Hydei*, Conrad, 1834; *M. Florentiana*, Lea, 1841; *M. fuliginosa*, Lea, 1841; *M. venusta*, Lea, 1841; *M. Holstonia*, Lea, 1841; *Lithasia dilatata*, Lea, 1841.

Shell of moderate size, broadly conical, whorls barely inflated, periphery rounded, early volutions smooth, penultimate and body-whorls with about five rows of tubercles, the fourth row peripheral, aperture elliptical and somewhat produced below, outer lip sub-sinuate and channelled at base; habitat streams.

Holston, Tennessee, and lower Ohio Rivers, American Province.

PLEUROCERA CANALICULATUM, Say.

Melania canaliculata, Say, 1821; *M. conica*, Say, 1821 (preocc.); *M. Sayi*, Wood, 1828; *M. undulata*, Say, 1829; *M. exarata*, Menke, 1830; *M. ligata*, Menke, 1830; *M. auriscalpium*, Menke, 1830; *Pleurocera quadrosa*, Rafinesque, 1831; *M. alvearis*, Conrad, 1834; *M. annulifera*, Conrad, 1834; *M. excurtata*, Conrad, 1834; *M. prasinata*, Conrad, 1834; *M. pyrenellum*, Conrad, 1834; *Ceriphasia sulcata*, Swainson, 1840; *M. substricta*, Haldeman, 1840; *M. 'nupera*, Say', Say, 1840 (*pars*);

M. regularis, Lea, 1841; *M. exarata*, Lea, 1841 (preocc.); *M. turgida*, Lea, 1841; *M. arata*, Lea, 1841; *M. producta*, Lea, 1842; *M. Foremanii*, Lea, 1842; *M. curvatum*, Lea, 1842; *M. torquata*, Lea, 1842; *M. Ordiana*, Lea, 1842; *M. torta*, Lea, 1842; *M. filum*, Lea, 1845; *M. pernodosa*, Lea, 1845; *M. Brumbyi*, Lea, 1852; *M. gradata*, Anthony, 1854; *M. planogyrum*, Anthony, 1854; *M. eximia*, Anthony, 1854; *M. glans*, Anthony, 1854 (preocc.); *M. incrassa*, Anthony, 1854; *M. fastigiata*, Anthony, 1854; *M. opaca*, Anthony, 1860; *M. ponderosa*, Anthony, 1860; *M. grossa*, Anthony, 1860; *M. infrafasciata*, Anthony, 1860; *M. glandula*, Anthony, 1860; *M. iostoma*, Anthony, 1860; *M. nigrostoma*, 'Anth. MS.,' Reeve, 1860; *M. rorata*, Reeve, 1860; *Io gracilis*, Lea, 1861; *I. robusta*, Lea, 1861; *I. viridula*, Lea, 1861; *Tryphanostoma dux*, Lea, 1862; *T. Troostii*, Lea, 1862; *T. viride*, Lea, 1862; *T. ligatum*, Lea, 1862; *T. Showaltherii*, Lea, 1862; *T. Thorntonii*, Lea, 1862; *T. trivittatum*, Lea, 1862; *T. Postellii*, Lea, 1862; *T. incurvum*, Lea, 1862; *T. Alabamense*, Lea, 1862; *T. Florencense*, Lea, 1862; *T. olivaceum*, Lea, 1862; *T. simplex*, Lea, 1862; *T. canalitium*, Lea, 1862; *T. Clarkii*, Lea, 1862; *T. Anthonyi*, Lea, 1862; *T. moriforme*, Lea, 1862; *T. Pybasii*, Lea, 1862; *T. Jayi*, Lea, 1862; *T. Hartmanii*, Lea, 1862; *T. bivittatum*, Lea, 1862; *T. Spillmanii*, Lea, 1862; *T. tortum*, Lea, 1862; *T. Tennessee'nse*, Lea, 1862; *T. minor*, Lea, 1862; *T. dignum*, Lea, 1862; *T. moniliferum*, Lea, 1862; *T. trochulus*, Lea, 1862; *T. pumilium*, Lea, 1862; *T. Christyi*, Lea, 1862; *T. Tuomeyi*, Lea, 1862; *T. labiatum*, Lea, 1862; *T. Lewisii*, Lea, 1862; *T. curtatum*, Lea, 1863; *P. plicatum*, Tryon, 1863; *T. Roanense*, Lea, 1864; *T. Lesleyi*, Lea, 1864; *T. univittatum*, Lea, 1864; *T. subrobustum*, Lea, 1864; *T. cinctum*, Lea, 1864; *T. cylindraceum*, Lea, 1864; *T. napoideum*, Lea, 1864; *T. affine*, Lea, 1864; *P. Leaii*, Tryon, 1873; *P. Parkerii*, Tryon, 1873.

Shell large, rather broadly conical, whorls closely appressed, sutures not impressed, periphery sub-rounded or angular, aperture elliptical and more or less produced below, the outer lip sinuate and channelled at base; habitat chiefly streams.

Ohio, Tennessee, and Alabama River Systems, American Province.

Pleurocera fluviatilis armigera (Say).

Melania armigera, Say, 1821; *M. stygia*, Say, 1829; *M. tuberculata*, Lea, 1830 (preocc.); *M. Duttoniana*, Lea, 1841; *M. Jayana*, Lea, 1841; *M. Spixiana*, Lea, 1848; *M. robulina*, Anthony, 1850; *Io rota*, Reeve, 1860; *L. fasciolata*, Reeve, 1860; *M. nodata*, Reeve, 1860; *Angitrema Wheatleyi*, Tryon, 1866.

Shell of moderate size, broadly conical, whorls appressed, periphery subangular and more or less nodose on body-whorl, aperture elliptical and slightly produced below, outer lip barely sinuate and channelled at base; habitat streams.

Cumberland, Wabash, and lower Tennessee Rivers, Alabama, American Province.

Pleurocera bitæniata (Conrad).

Melania bitæniata, Conrad, 1834; *M. curta*, Haldeman, 1841; *M. pumilia*, Lea, 1845; *M. solida*, Lea, 1845 (preocc.); *M. corpulenta*, Anthony, 1854; *Streptobasis Spillmanii*, Lea, 1861; *S. cornea*, Lea, 1861; *S. Clarkii*, Lea, 1861; *S. olivaria*, Lea, 1862; *S. carinata*, Lea, 1862; *S. Lyonii*, Lea, 1864.

Shell of moderate size, conic-subpupiform, whorls appressed, compressed, and somewhat concave above the sub-rounded periphery, aperture sub-elliptical, narrowing above, columella callused, outer lip sinuate and channelled at base; habitat streams.

Tennessee and Alabama Rivers, American Province.

Pleurocera solida (Lea).

Anculosa solida, Lea, 1842; *Melania brevis*, Lea, 1842; *Lithasia Showaltherii*, Lea, 1850; *M. compacta*, Anthony, 1857; *L. nuclea*, Lea, 1860; *M. trivittata*, Reeve, 1860; *L. fusiformis*, Lea, 1861; *L. vittata*, Lea, 1862; *L. Downiei*, Lea, 1862.

Shell similar to preceding but more slender-conic, whorls appressed and slightly shouldered at periphery, aperture narrowly elliptical and produced above and below, columella not heavily callused, outer lip but slightly sinuate and not prominently channelled at base; habitat streams.

Coosa and ? Cumberland Rivers, Alabama, American Province.

Tryon has written *solida* as a synonym of *brevis*, described by Lea on a preceding page of the same article. He says, however: "Mr. Reeve has not recognized the genus *Lithasia*, and accordingly changes the name (i.e. *brevis*) to *trivittata*, Reeve, because Mr. Lea had already used *brevis* for a Melanian." Reeve's monograph has not been at hand to verify Tryon's statement, and there is no record in Scudder's Index that Lea described more than the one *Melania brevis*. Owing, however, to the enormous number of specific names used under *Melania* it is not unlikely that *brevis* is preoccupied several times. Until the classification is thoroughly cleared up it seems preferable to write *solida*.

Pleurocera (Io) fluviatilis (Say).

Fusus fluviatilis, Say, 1825; *Io fusiformis*, Lea, 1831; *I. spinosa*, Lea, 1834; *I. tenebrosa*, Lea, 1834; *I. brevis*, Anthony, 1860; *I. spirostoma*, Anthony, 1860; *I. turrita*, Anthony, 1860; *I. inermis*, Anthony, 1860; *I. verrucosa*, Reeve, 1860 (preocc.); *I. lurida*, 'Anth. MS.,' Reeve, 1860; *I. gibbosa*, 'Anth. MS.,' Reeve, 1860; *I. rhombica*, 'Anth. MS.,' Reeve, 1860; *I. recta*, 'Anth. MS.,' Reeve, 1860.

Shell of large size, broadly conical, the mid-adolescent whorls subangular at periphery, and more or less ornamented with nodes which increase in size and complexity on the later volutions, developing on the body-whorl into hollow spines, aperture broadly elliptical and very much produced below, the canal nearly equal in length to the spire; *armigera* stage completed during early adolescence; habitat streams.

Tennessee River and tributaries above Jackson County, Alabama (*fide* Jas. Lewis), American Province.

Apparently a northern sub-species of *armigera*.

PLEUROCERA (IO) CANALICULATUM NOBILE (Lea).

Melania nobilis, Lea, 1845; *Io Spillmanii*, Lea, 1861; *I. variabilis*, Lea, 1861; *I. nodosa*, Lea, 1861; *I. modesta*, Lea, 1861.

Shell similar to *canaliculatum* but larger, a sub-carinate nodose periphery developed on the body-whorl, aperture produced into a short gyrate canal; *canaliculatum* stage passed during late adolescence; habitat streams.

Little Tennessee and Tennessee Rivers, Alabama, American Province.

A poorly marked southern race of *canaliculatum*.

Genus AMBLOXUS (Rafinesque).[1]

Buccinum (sp.), Gmelin, 1788 (*B. Virginicum*, Gmel.); *Paludina* (sp.), Say, 1819 (*B. Virginicum*, Gmel.); *Melania* (sp.), Say, 1824 (*B. Virginicum*, Gmel.); *Ambloxus*, Rafinesque, 1831 (*Melania* (*Ambloxus*) *rugosa*, Raf. = *B. Virginicum*, Gmel.); *Hemisinus* (sp.), H. & A. Adams, 1854 (*M. bulbosa*, Gld. = *M. plicifera*, Lea); *Pachycheilus* (*Pachychilus*, Lea, em.) (sp.), H. & A. Adams, 1854 (*M. simplex*, Say = *B. Virginicum*, Gmel.); *Potadoma* (sp.), H. & A. Adams, 1854 (*M. depygis*, Say = *B. Virginicum*, Gmel.); *Elimia*

[1] While no mention of previous publications is made, it would appear at first glance that *Ambloxus*, Rafinesque, 1831, is a *lapsus* for *Ambloxis*, Rafinesque, 1818, under which two species, *A. eburnea* and *A. ventricosa*, were named but not described. However, it would take a deal of imagination—more than the writer possesses—to fit one of the slender Pleurocerids described in 1831 to the diagnosis of *Ambloxis*, 1818, which was doubtless intended for some Viviparoid. This is borne out by the fact that in 1865 Binney, in the third part of his *Land and Freshwater Shells of North America*, figured *Ambloxis major* or *Lymnea eburnea* and *Lymnula ventricosa* from Rafinesque's manuscript, referring them to *Melantho* (= *Campeloma*) *decisa* as synonyms. Rafinesque must be credited with a considerable amount of acumen in recognizing genera; his groups for homogeneity were fully up to the standard of the time and in this family about equal to any work that has ever been done. It seems unreasonable, therefore, to accuse him of referring a vertically plaited syntonic form of *Buccinum Virginicum*, Gmel., to a genus of Lioplacidæ. Rafinesque has *Amblema*, *Amblotrema*, *Amblasmodon*, *Ambloxis*, and, according to Binney, *Amblostoma*, so that *Ambloxus* is evidently another formed on the same favourite plan, though it is unfortunate that he ran out of desirable etymological combinations of *acutus* before this was named. The confusion of these two is merely the outcome of the notorious carelessness of this author in his writings, but cannot affect the status of *Ambloxus*, 1831, which was given to include two species, of which the first is certainly recognizable and the second doubtfully so. *Ambloxus* and *Ambloxis* are sufficiently distinct to stand side by side nomenclaturally, but occurring as they do in allied groups from the same region there is opportunity for confusion on that score. However, *Ambloxis*, Rafinesque, 1818, has no status, and *Ambloxis*, 'Rafinesque,' Binney, 1865, stands as a synonym of *Campeloma*, leaving the field clear for *Ambloxus*, Rafinesque, 1831

(*pars*), H. & A. Adams, 1854 (*M. acuticarinata* (error for *acutocarinata*), Lea = *B. Virginicum*, Gmel.); *Melasma*, H. & A. Adams, 1854 (*Melania blanda*, Lea = *B. Virginicum*, Gmel.); *Juga*, H. & A. Adams, 1854 (*B. Virginicum*, Gmel.); *Tryphanostoma* (sp.), Lea, 1862 (*T. Knoxvillense*, Lea = *B. Virginicum*, Gmel.); *Goniobasis* (sp.), Lea, 1862 (*G. Draytonii*, Lea = *M. plicifera*, Lea).

Type, *Buccinum Virginicum*, Gmelin.

Shell of moderate size, averaging 25 mm. in altitude, sub-solid, spire attenuate, whorls normally barely rounded or slightly incurved between the suture and the rounded periphery, aperture simple, the pillar curved and imperforate, outer lip sinuate and somewhat produced below; habitat lakes and streams, occupying a wider variety of situations than any other genus in this family.

Ambloxus includes the fusiform Pleurocerids, the last genus of the family to be definitely separated from the Lamarckian *Melania*, and hence one which has suffered considerable nomenclatural vicissitude.

None of the species are known to have specialized up to the stage corresponding to *Io* in the preceding genus, or *Gyrotoma*, s.s., in the one to follow. The members of this group are very similar, and not always easy to separate, but with the exception of the Eocene *tenerus* and the recent *Virginicus* all seem sufficiently distinct. Normally each is smooth, but malleated, axially plicate, suturally carinate, peripherally carinate, multicarinate, and spirally frilled forms or types embodying a combination of two or more of these characters apparently occur in every species. These are unquestionably of the nature of syntonic modifications, but, in contrast to other groups so affected, the early growth appears to be the most frequently and seriously deformed, the distortion prevailing in the adult condition only in extreme instances. The philosophy of this is not entirely understood, but it is probable that the stage preceding the present adult stage was a sculptured one, and certain atavistic tendencies are so influenced that the shell assumes bizarre forms.

The synonymy of *A. Virginicus* in spite of its length has been given in full in order to suggest the vast multiplicity of forms that may be expected in a rampantly susceptible species, distributed over a wide area and naturally exposed to many influences. While probably by no means complete, it is yet a striking testimonial of how the American Melanoids should not be classified. Since the bulk of the synonyms are based on syntonic forms, for brevity a few of the better-known normal forms are so noted.

Ambloxus Virginicus (Gmelin).

Buccinum Virginicum, Gmelin, 1788 (normal); *Melania carinifera*, Lamarck, 1801; *M. elevata*, Say, 1821; *M. multilineata*, Say, 1822; *M. catenaria*, Say, 1822; *M. proxima*, Say, 1825; *M. simplex*, Say, 1825; *M. laqueata*, Say, 1829; *M. depygis*, Say, 1829; *M. cancellata*, Say, 1829; *M. semicarinata*, Say, 1829; *M. acuta*, Lea, 1830; *M. subularis*, Lea, 1830; *M. livescens*, Menke, 1830; *M. fasciata*, Menke, 1830; *M. auriscalpium*, Menke, 1830; *M. curta*, Menke, 1830; *M.* (*Ambloxus*) *rugosa*, Rafinesque, 1831; ? *M.* (*Ambloxus*) *viridis*, Rafinesque, 1831; *Pleurocera acuta*, Rafinesque, 1831; *M. elongata*, Lea, 1831; *M. dislocata*, Ravenal, 1834; *M. carinata*, Ravenal, 1834; *M. bella*, Conrad, 1834; *M. comma*, Conrad, 1834; *M. vestita*, Conrad, 1834; *M. formosa*, Conrad, 1834; *M. semicostata*, Conrad, 1834; *M. nassula*, Conrad, 1834; *M. congesta*, Conrad, 1834; *M. exilis*, Haldeman, 1840; *M. catenaria*, Lea, 1840 (preocc.); *M. catenoides*, Lea, 1840; *M. Boykiniana*, Lea, 1840; *M. suturalis*, Haldeman, 1840; *M. interrupta*, Haldeman, 1840; *M. picta*, Lea, 1841; *M. Ocoëensis*, Lea, 1841; *M. lævigata*, Lea, 1841; *M. nitens*, Lea, 1841; *M. dubiosa*, Lea, 1841; *M. gibbosa*, Lea, 1841; *M. Edgariana*, Lea, 1841; *M. nitida*, Lea, 1841; *M. nodulosa*, Lea, 1841; *M. Nickliniana*, Lea, 1841; *M. circincta*, Lea, 1841; *M. castanea*, Lea, 1841; *M. tenebrosa*, Lea, 1841; *M. sordida*, Lea, 1841; *M. costulata*, Lea, 1841; *M. dubia*, Lea, 1841; *M. striata*, Lea, 1841 (preocc.); *M. blanda*, Lea, 1841; *M. teres*, Lea, 1841; *M. Potosiensis*, Lea, 1841; *M. decora*, Lea, 1841; *M. rufa*, Lea, 1841; *M. crebricostata*, Lea, 1841; *M. Niagraensis*, Lea, 1841; *M. terebralis*, Lea, 1841; *M. Curryana*, Lea, 1841; *M. Troostiana*, Lea, 1841; *M. ebenum*, Lea, 1841; *M. acutocarinata*, Lea, 1841; *M. glabra*, Lea, 1841; *M. sulcosa*, Lea, 1841; *M. columella*, Lea, 1841; *M. caliginosa*, Lea, 1841; *M. concinna*, Lea, 1841; *M. subsolida*, Lea, 1841; *M. Warderiana*, Lea, 1841; *M. Lecontiana*, Lea, 1841; *M. clavæformis*, Lea, 1841; *M. perfusca*, Lea, 1841; *M. obtusa*, Lea, 1841; *M. plicatula*, Lea, 1841 (preocc.); *M. Taitiana*, Lea, 1841; *M. corrugata*, Lea, 1841 (preocc.); *M. gracilis*, Lea, 1841; *M. Kirtlandiana*, Lea, 1841; *M. monozonalis*, Lea, 1841; *M. strigosa*, Lea, 1841; *M. subcylindracea*, Lea, 1841; *M. Babylonica*, Lea, 1841; *M. rufula*, Haldeman, Lea, 1841; *M. gracilis*, Anthony in Haldeman, 1841 (preocc.); *M. bella-crenata*, Haldeman, 1841; *M. costifera*, Haldeman, 1841; *M. approxima*, Haldeman, 1841; *M. symmetrica*, Haldeman, 1841; *M. intersita*, Haldeman, 1841; *M. unicalis*, Haldeman, 1841; *M. rugosa*, Lea, 1842; *M. expansa*, Lea, 1842; *M. striatula*, Lea, 1842; *M. lævis*, Lea, 1842 (preocc.); *M. Deshayesiana*, Lea, 1842; *M. lævigata*, Lea, 1842 (preocc.); *M. rufescens*, 'Lea,' De Kay, 1843; *M. gemma*, De Kay, 1843; *M. bizonalis*, De Kay, 1843; *M. substricta*, Haldeman, 1844; *M. Curryana*, Lea, 1844; *M. lugubris*, Lea, 1844; *M. abrupta*, Lea, 1845; *M. ovoidea*, Lea, 1845; *M. carinocostata*, Lea, 1845; *M. Alexandriensis*, Lea, 1845; *M. spurca*, Lea, 1845; *M. Buddii*, Lea, 1845; *M. Haleiana*, Lea, 1845; *M. pallescens*, Lea, 1845; *M. modesta*, Lea, 1847; *M. spinalis*, Lea, 1847; *M. symmetrica*, Conrad, 1849 (preocc.); *M. nebulosa*, Conrad, 1849; *M. percarinata*, Conrad, 1849; *M. perangulata*, Conrad, 1849; *M. sublirata*, Conrad, 1850; *M. brevispira*, Anthony, 1850; *M. succinulata*, Anthony, 1850; *M. inornata*, Anthony, 1850; *M. abbreviata*, Anthony, 1850; *M. bicolorata*, Anthony, 1850; *M. densa*, Anthony, 1850; *M. elata*, Anthony, 1850; *M. tracta*, Anthony, 1850; *M. inempta*, Anthony, 1850; *M. pulchella*, Anthony, 1850;

M. cuspidata, Anthony, 1850 (preocc.); *M. plebeius*, Anthony, 1850; *M. coracina*, Anthony, 1850; *M. napella*, Anthony, 1850; *M. pagodiformis*, Anthony, 1850; *M. monilifera*, 'Anthony,' Jay, 1852; *M. Sellersiana*, Lea, 1852; *M. Ohioensis*, Lea, 1852; *M. Saffordi*, Lea, 1852; *M. furva*, Lea, 1852; *M. perstriata*, Lea, 1852; *M. Clarkii*, Lea, 1852; *M. sculptis*, Lea, 1852; *M. oblita*, Lea, 1852; *M. varicosa*, 'Ward MS.,' Haldeman, 1854; *M. viridula*, Anthony, 1854; *M. eliminata*, Anthony, 1854; *M. neglecta*, Anthony, 1854; *M. torulosa*, Anthony, 1854; *M. tecta*, Anthony, 1854; *M. tabulata*, Anthony, 1854; *M. hastata*, Anthony, 1854; *M. bacula*, Anthony, 1854; *M. curvilabris*, Anthony, 1854; *M. nigrocincta*, Anthony, 1854; *M. vittata*, Anthony, 1854; *M. subangulata*, Anthony, 1854; *M. pallidula*, Anthony, 1854; *M. imbricata*, Anthony, 1854; *M. altipeta*, Anthony, 1854; *M. bicincta*, Anthony, 1854; *M. iota*, Anthony, 1854; *M. arachnoidea*, Anthony, 1854; *M. coronilla*, Anthony, 1854; *M. brunnea*, Anthony, 1854; *M. virens*, Anthony, 1854; *M. gracilor*, Anthony, 1854; *M. casta*, Anthony, 1854; *M. rhombica*, Anthony, 1854; *M. angulata*, Anthony, 1854; *M. athleta*, Anthony, 1854; *M. latitans*, Anthony, 1854; *M. vicina*, Anthony, 1854; *M. elegantula*, Anthony, 1854; *M. Postelli*, Lea, 1858; *M. crenatella*, Lea, 1860; *M. funebralis*, Anthony, 1860; *M. cubicoides*, Anthony, 1860; *M. angustispira*, Anthony, 1860; *M. adusta*, Anthony, 1860; *M. tenebrocincta*, Anthony, 1860; *M. bicostata*, Anthony, 1860; *M. occulta*, Anthony, 1860; *M. assimilis*, Anthony, 1860; *M. cognata*, Anthony, 1860; *M. valida*, Anthony, 1860; *M. bicincta*, Anthony, 1860; *M. corneola*, Anthony, 1860; *M. paucicostata*, Anthony, 1860; *M. hybrida*, Anthony, 1860; *M. glauca*, Anthony, 1860; *M. gracillima*, Anthony, 1860; *M. rigida*, Anthony, 1860; *M. pulcherrima*, Anthony, 1860; *M. intertexta*, Anthony, 1860; *M. versipellis*, Anthony, 1860; *M. tripartita*, Reeve, 1860; *M. intensa*, 'Anth. MS.,' Reeve, 1860; *M. surgillata*, Reeve, 1860; *M. Floridensis*, Reeve, 1860; *M. bicolor*, 'Anth. MS.,' Reeve, 1860; *M. incurta*, 'Anth. MS.,' Reeve, 1860; *M. cinnamomea*, 'Anth. MS.,' Reeve, 1860; *M. angusta*, 'Anth. MS.,' Reeve, 1860; *M. larvæformis*, 'Lea MS.,' Reeve, 1860; *M. abjecta*, 'Hald. MS.,' Reeve, 1860; *M. Deshayesiana*, Reeve, 1860 (preocc.); *M. scabrella*, 'Anth. MS.,' Reeve, 1860; *M. semigradata*, Reeve, 1861; *M. densicostata*, Reeve, 1861; *M. Etowahensis*, Lea in Reeve, 1861; *M. livida*, Reeve, 1861; *M. curvirostata*, 'Anth. MS.,' Reeve, 1861; *M. papillosa*, 'Anth. MS.,' Reeve, 1861; *M. tenera*, 'Anth. MS.,' Reeve, 1861, not of Hall, 1845; *M. paula*, Lea, 1861; *M. Cahawbensis*, Lea, 1861; *M. Leaii*, Brot, 1862; *M. scabriuscula*, Brot, 1862; *M. correcta*, Brot, 1862; *M. mutata*, Brot, 1862; *M. Conradi*, Brot, 1862; *M. charybæa*, 'Anth. MS.,' Brot, 1862; *Goniobasis auricoma*, Lea, 1862; *G. Lyonii*, Lea, 1862; *G. Binneyana*, Lea, 1862; *G. intercedens*, Lea, 1862; *G. cruda*, Lea, 1862; *G. strenua*, Lea, 1862; *G. Pybasii*, Lea, 1862; *G. rubella*, Lea, 1862; *G. spinella*, Lea, 1862; *G. Christyi*, Lea, 1862; *G. olivella*, Lea, 1862; *G. Liedyana*, Lea, 1862; *G. Grosvenorii*, Lea, 1862; *G. rubricata*, Lea, 1862; *G. Whitei*, Lea, 1862 (preocc.); *G. Estabrookii*, Lea, 1862; *G. Downieana*, Lea, 1862; *G. parva*, Lea, 1862; *G. Gabbiana*, Lea, 1862; *G. rostellata*, Lea, 1862; *G. viridicata*, Lea, 1862; *G. subulæformis*, Lea, 1862; *G. Bentoniensis*, Lea, 1862; *G. stricta*, Lea, 1862; *G. Spillmanii*, Lea, 1862; *G. Spartanburgensis*, Lea, 1862; *G. amœna*, Lea, 1862; *G. Lindsleyi*, Lea, 1862; *G. paupercula*, Lea, 1862; *G. proletaria*, Lea, 1862; *G. purpurella*, Lea, 1862; *G. continens*, Lea, 1862; *G. attenuata*, Lea, 1862; *G. Toumeyi*, Lea, 1862; *G. mediocris*, Lea, 1862; *G. interveniens*, Lea, 1862; *G. Duttonii*, Lea, 1862; *G. ornatella*, Lea, 1862; *G. Anthonyi*, Lea, 1862; *G. Georgiana*, Lea, 1862; *G. Canbyi*, Lea, 1862; *G. instabilis*, Lea, 1862; *G. Carolinensis*, Lea, 1862; *G. induta*, Lea, 1862; *G. mutabilis*, Lea, 1862; *G. macella*, Lea, 1862; *G. Doolyensis*, Lea, 1862; *G. sparsa*, Lea, 1862; *G. Elliottii*, Lea, 1862; *G. cerea*, Lea, 1862; *G. Thorntonii*, Lea, 1862; *G. Viennaensis*, Lea, 1862; *G. Abbevillensis*, Lea, 1862; *G. inosculata*, Lea, 1862; *G. Brumbyi*, Lea, 1862; *G. difficilis*, Lea, 1862; *G. Couperii*, Lea, 1862; *G. cinerea*, Lea, 1862; *G. Hallenbeckii*, Lea, 1862; *G. inclinans*, Lea, 1862; *G. cadus*, Lea, 1862; *G. Vanuxemii*, Lea, 1862; *G. Uchee'nsis*, Lea, 1862; *G. crispa*, Lea, 1862: *G. Barrattii*, Lea, 1862; *G. cinerella*, Lea, 1862; *G. Vauxiana*, Lea, 1862; *G. inconstans*, Lea, 1862; *Tryphanostoma Vanuxemii*, Lea, 1862; *T. mucronatum*, Lea, 1862; *T. Knoxvillense*, Lea, 1862; *T. Sycamore'nse*, Lea, 1862; *T. Chakasahense*, Lea, 1862; *T. Whitei*, Lea, 1862 (preocc.); *T. subulare*, Lea, 1862; *T. strictum*, Lea, 1862; *T. Henryanum*, Lea, 1862; *T. simplex*, Lea, 1862; *T. parvum*, Lea, 1862; *T. Knoxense*, Lea, 1862; *T. attenuatum*, Lea, 1862; *T. pallidum*, Lea, 1862; *T. Estabrookii*, Lea, 1862; *T. Carolinense*, Lea, 1862; *T. mæstum*, Lea, 1862; *T. lativittatum*, Lea, 1862; *T. striatum*, Lea, 1862; *T. rostellatum*, Lea, 1862; *G. Decampii*, Lea, 1863; *G. Louisvillensis*, Lea, 1863; *G. infantula*, Lea, 1863; *G. lithasoides*, Lea, 1863; *G. aterina*, Lea, 1863; *G. Milesii*, Lea, 1863; *G. informis*, Lea, 1863; *G. Cumberlandiensis*, Lea, 1863; *G. porrecta*, Lea, 1863; *G. vittatella*, Lea, 1863; *T. Currierianum*, Lea, 1863; *T. Lyonii*, Lea, 1863; *T. luteum*, Lea, 1863; *G. Prestoniana*, Lea, 1864; *T. carinatum*, Lea, 1864; *T. corneum*, Lea, 1864; *G. Catabæa*, Haldeman, 1865; *G. graminea*, Haldeman, 1865; *G. translucens*, Anthony, 1865; *G. interlineata*, Anthony, 1865; *G. Haldemani*, Tryon, 1865; *B. Conradi*, Tryon, 1865; *G. Canbyi*, Tryon, 1873; *G. Stearnsiana*, Call, 1886; *G. Crandalli*, Pilsbry, 1890; *G. Comalensis*, Pilsbry, 1896; ? *G. Columbiensis*, Whiteaves, 1905.

Shell of moderate size, acutely conic, whorls barely inflated, periphery normally sub-rounded, aperture elliptical, outer lip more or less sinuate and somewhat produced below; habitat lakes and streams.

Connecticut River, south to Florida, west to Michigan, Arkansas, and Texas, American Province.

Quaternary: Loess of eastern States.

Reported from Upper Columbia Lake, British Columbia, by Whiteaves. The record is a dubious one.

Ambloxus pliciferus (Lea).

Melania plicifera, Lea, 1838; *M. occata*, Hinds, 1844; *M. bulbosa*, Gould, 1847 (normal); *M. silicula*, Gould, 1847; *M. Shastensis*, Lea, 1856; *M. nigrina*, Lea, 1856 (normal); *M. Wahlamatensis*, 'Lea,' Carpenter, 1857 (nude name); *M. 'plicata*, Lea', Carpenter, 1857 (error for *plicifera*); *M. 'Shortensis*, Lea', W. Cooper, 1860 (error for *Shastensis*); *M. Newberryi*, Lea, 1860; *M. rudens*, Reeve, 1860; *Goniobasis Draytonii*, Lea, 1862; *G. Bairdiana*, Lea, 1862; *G. rubiginosa*, Lea, 1863; *G. plicifera*, var. *Oregonensis*, Tryon, 1865; *G. plicifera*, var. *bulimoides*, Tryon, 1865; *G. circumlineata*, Tryon, 1865; *M. Californica*, Clessin, 1882; *M.* (*Goniobasis*?) *acutifilosa*, Stearns, 1891; *G. acutifilosa Siskiyouensis*, Pilsbry, 1899; *G. Kettlemanensis*, Arnold, 1910.

Shell of moderate size, attenuate-conic, whorls rounded, sutures moderately impressed, periphery showing no trace of a carina, aperture elliptical, outer lip slightly sinuate, and somewhat produced below; habitat running streams and springs, infrequently in lakes.

Columbia, Klamath, Fraser (locally), Nevada (locally), and Coast Range (locally) Systems.

Pliocene: Kettleman Lake beds, California.

Ambloxus tener (Hall).

Cerithium tenerum, Hall, 1845; *C. nodulosum*, Hall, 1845; *Goniobasis Carteri*, Conrad, 1869; *G. columinaris*, White, 1883, not *Melania tenera*, 'Anth. MS.,' Reeve, 1861 = *A. Virginicus*.

Shell similar to *A. Virginicus*, but the whorls usually more attenuate and less compressed, aperture but slightly sinuate; habitat apparently more or less lacustrine.

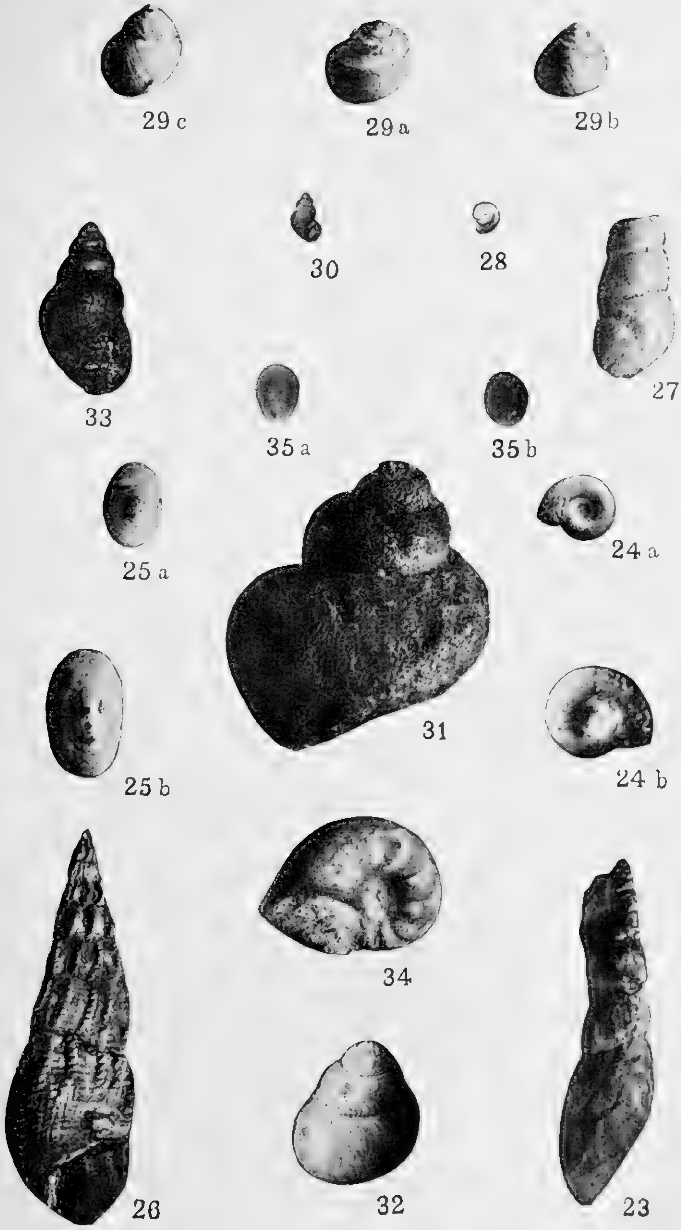
Eocene: Wasach, Green River, and Bridger formations of Rocky Mountains; Truckee Lake beds, Nevada.

Ambloxus Olequaensis, Arnold & Hannibal, n.sp.
Pl. VIII, Fig. 27.

Shell slender-conic, similar in general outline and size to *A. Virginicus*, but more regularly elongate, with proportionally longer whorls, straight-sided above, and bending in rapidly at the suture somewhat after the manner of *Pleurocera bitæniata*; sculptured forms with vertical plications and spiral ridges and frills as in *A. plicifera*; aperture deeply sinuate and slightly produced below; habitat apparently lacustrine, at least in part.

Altitude (estimated), 32 mm.; breadth, 9·5 mm.; altitude of body-whorl, 9 mm.

Eocene: Local freshwater beds in Tejon formation, Washington.



RECENT AND TERTIARY MOLLUSCA FROM WESTERN NORTH AMERICA.

Little Falls, Washington; bluffs along Olequa Creek above shoals 2 miles north of town (types); at shoals $1\frac{1}{2}$ miles north of town; bend half a mile south of town (H. Hannibal).

Genus Gyrotoma, Shuttleworth.

Schizostoma, Lea, 1842 (*Melania* (*Schizostoma*) *excisa*, Lea), not *Schizostoma*, Bronn, 1835; *Gyrotoma*, Shuttleworth, 1845 (*G. ovoidea*, Shutt. = *M. excisa*, Lea); '*Melatoma*, Swainson,' Gray, 1847; *Schizochilus*, Lea, 1852 (*M. excisa*, Lea, by substitution), preocc. in Coleoptera; *Aphella*, 'Mighels MS.,' Anthony, 1860 (no described species cited), in synonymy.

Sub-genus Goniobasis (Lea).

Melania (sp.), Conrad, 1834 (*M. olivula*, Conr.); *Megara* (sp.), H. & A. Adams, 1854 (*M. olivula*, Conr.); *Goniobasis* (*pars*), Lea, 1862 (*G. osculata*, Lea = *M. olivula*, Conr.); *Macrolimen*, Lea, 1862 (*Melania* (*Macrolimen*) *Showaltherii*, Lea = *M. olivula*, Conr.).

Type, *Melania olivula*, Conrad.[1]

Sub-genus *Goniobasis*. Shell rather small, averaging 20 mm. in altitude, solid, regularly conic, whorls appressed and normally smooth, with a rounded periphery, aperture ovate-elliptical, columella curved, outer lip barely sinuate, produced below, and slightly retracted above; habitat streams.

Sub-genus *Gyrotoma*, s.s. Shell as in *Goniobasis*, but the whorls sub-nodose below the suture, outer lip sinuate, terminating above in a sutural pleurotomariform cleft; *Goniobasis* stage passed during early adolescence; habitat streams.

Gyrotoma embraces two species and two sub-species characteristic of the Gulf States drainage. Two, both sub-species, belong to typical *Gyrotoma*, characterized by a remarkable pleurotomariform cleft analogous to the canal of *Io*, while the remaining forms group in *Goniobasis*, in which the more primitive normal character of the aperture is retained.

On the basis of the aperture alone *Goniobasis* is liable to be confused with *Ambloxus*, an error already fallen into by several writers,

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[1] In describing *Goniobasis* Lea omitted to designate a type. The contents are referable to *Virginicus*, about sixty-five synonyms; *olivula*, eleven synonyms; *pliciferus*, two synonyms, etc. Some synonym of *Virginicus* would be the natural choice, but Lea expressly stated that *Virginicus* itself was to be retained in *Melania* for the time being, hence it cannot be regarded as a species available to become the type of the present group, and thus saves the name from falling into the synonymy of *Ambloxus*. Lea stated further that the genus might be divided into two sections, of which the first was to include the conical species (i.e. *olivula*), and the second the fusiform (i.e. *Virginicus* and *pliciferus*). The first species named is *G. osculata*, a synonym of *olivula*, which may be accepted since it constitutes the nearest approach to Lea's original intentions, regardless of what later writers have attempted to do with the name. The earlier *Megara* of the Adams was apparently intended for this same group, and, judging by the contents, would be a preferable name. However, it includes the monotype of the prior genus *Pleurocera*, and is unavailable.

while the build distinctly reminds one of *Pleurocera*, s.s. Conchologically the adults of these three form an almost complete transition from *Pleurocera* on the one hand to *Ambloxus* on the other, yet there is no reason to regard them as anything but generically distinct. To the systematists, following out the idea embodied in Pelseneer's classification of the Pelecypoda, this may doubtless seem irrational; a simpler arrangement would be to group all the species in *Pleurocera* as the oldest generic name. Well and good, but *Pleurocera* represents a stock which has in it the latent possibilities of developing a fusiform canal, *Goniobasis* a pleurotomariform cleft, while the line of modification of *Ambloxus* is not known, but would doubtless involve some similar modification of the aperture. In other words, these represent three closely allied stocks modifying in an analogous but not a homologous manner. The similarities are due to the fact that they have reached the same stage of specialization. It has been noted in *Helisoma* that a round-whorled stage is succeeded by a sculptured stage (carinate in that particular instance), and that in turn by a second round-whorled stage, while in the allied *Planorbis* a sculptured stage (carinate) is succeeded by a round-whorled, that in turn by a second sculptured stage (dentate), and that by another round-whorled stage. This alternation of sculptured and round-whorled stages is as characteristic of Gastropod evolution as the ever-increasing complexity of the lobing of the Ammonoids or the migration of the umbones to a terminal position in the Pelecypoda. These sculptured Gastropod stages invariably form a key to the relationships of species, but the round-whorled stages may not. In the Helicoid land shells, for instance, several families so closely resemble one another that it has only been with the study of the anatomy and embryonic whorls in recent years that even an approximation of relationships has been established. When the development of each species is studied carefully, numerous additional changes must be expected.

Of course, the anatomy should be examined to confirm the separations into *Pleurocera*, *Ambloxus*, and *Goniobasis*. But the fact that the anatomy is unknown is no excuse for the sort of guesswork that has pervaded this group.

The genus is not certainly known in the fossil state.

GYROTOMA (GONIOBASIS) OLIVULA (Conrad).

Melania olivula, Conrad, 1834; *M. cylindracea*, Conrad, 1834; *M. æqualis*, Haldeman, 1841; *M. impressa*, Lea, 1841; *M. fusiformis*, Lea, 1841; *M. crebristriata*, Lea, 1841; *M. Hayesiana*, Lea, 1842; *M. Vanuxemiana*, Lea, 1842; *M. protea*, Lea, 1845; *M. auriculæformis*, Lea, 1845; *M. harpa*, Lea, 1845; *M. basalis*, Lea, 1845; *M. arctata*, Lea, 1845; *M. cœlatura*, Conrad, 1849; *M. oppugnata*, Lea, 1852; *M. clara*, Anthony, 1854; *M. textilosa*, Anthony, 1854; *M. pupoidea*, Anthony, 1854; *M. cristata*, Anthony, 1854; *M. ampla*, Anthony, 1854; *M. ambusta*, Anthony, 1854; *M. abscida*, Anthony, 1860; *M. decorata*, Anthony, 1860; *M. grata*, Anthony, 1860; *M. lachryma*, 'Anthony MS.,' Reeve, 1861; *M. varians*, Lea, 1861; *M. blanda*, Lea, 1861; *M. purpurea*, Lea, 1861; *M. punicea*, Lea, 1861; *M. quadrivittata*, Lea, 1861; *M. clausa*, Lea, 1861; *M. fascinans*, Lea, 1861; *M. propria*, Lea, 1861 (preocc.); *M. rara*, Lea, 1861; *M. fallax*, Lea, 1861; *M. Coosaensis*, Lea, 1861; *M. rubicunda*, Lea, 1861; *M. propinqua*, Lea, 1861; *M. solidula*, Lea, 1861; *M. gratiosa*, Lea, 1861; *M. capillaris*, Lea, 1861; *M. elliptica*, Lea, 1861; *M. midas*, Lea, 1861; *M. fumea*, Lea, 1861; *M. lita*, Lea, 1861; *M. gracilor*, Lea, 1861 (preocc.); *M. Shelbyensis*, Lea, 1861; *M. pergrata*, Lea, 1861; *M. Alabamensis*, Lea, 1861; *M. nubia*, Lea, 1861; *M. crepera*, Lea, 1861; *M. Showaltherii*, Lea, 1861; *M. æqua*, Lea, 1861; *M. Hartmaniana*, Lea, 1861; *M. luteola*, Lea, 1861; *M. straminea*, Lea, 1861; *Goniobasis flavescens*, Lea, 1862; *G. granata*, Lea, 1862; *G. Stewardsoniana*, Lea, 1862; *G. Tryoniana*, Lea, 1862; *G. negata*, Lea, 1862; *G. fabalis*, Lea, 1862; *G. Prairiensis*, Lea, 1862; *G. flava*, Lea, 1862; *G. tenebrovittata*, Lea, 1862; *G. Bridgesiana*, Lea, 1862; *G. Gerhardtii*, Lea, 1862; *G. infusca*, Lea, 1862; *G. osculata*, Lea, 1862; *G. gibberosa*, Lea, 1862; *G. Hartmanii*, Lea, 1862; *G. pudica*, Lea, 1863; *G. ellipsoides*, Lea, 1863; *G. lepida*, Lea, 1863; *G. quadricincta*, Lea, 1864; *Eurycælon Leaii*, Tryon, Lea, 1866; *G. Leai*, Tryon, 1873; *G. 'inosculata*, Lea', Tryon, 1873.

Shell of moderate size, conical, whorls sub-inflated, aperture narrowly elliptical; habitat streams.

Coosa and adjacent streams flowing into the Gulf of Mexico; American Province.

GYROTOMA (GONIOBASIS) LÆTA (Jay).

Melania læta, Jay, 1839; *M. inflata*, Haldeman, 1841; *M. robusta*, Lea, 1841; *M. ovalis*, Lea, 1842; *M. gravida*, Anthony, 1860; *M. Germana*, Anthony, 1860; *M. grisea*, Anthony, 1860; *M. tæniolata*, Anthony, 1860; *M. 'Buddii*, Lea', Reeve, 1860; *M. obesa*, 'Anthony MS.,' Reeve, 1861; *M. orbicula*, Lea, 1861; *M. copiosa*, Lea, 1861; *M. virgulata*, Lea, 1861; *M. culta*, Lea, 1861; *M. glandaria*, Lea, 1861; *M. variata*, Lea, 1861; *M. sauvis*, Lea, 1861; *M. bellula*, Lea, 1861; *M. calenoides*, Lea, 1861; *M. Lewisii*, Lea, 1861.

Shell of moderate size, broadly conical, whorls not inflated, aperture broadly elliptical; habitat streams.

Coosa and adjacent streams flowing into the Gulf of Mexico, east to Florida; American Province.

GYROTOMA OLIVULA EXCISA (Lea).

Melania (*Schizostoma*) *excisa*, Lea, 1842; *Schizostoma curtum*, Mighels, 1844; *S. cylindraceum*, Mighels, 1844; *S. laciniatum*, Lea, 1845; *Gyrotoma ovoidea*, Shuttleworth, 1845; *G. carinifera*, Anthony, 1860; *G. ampla*, Anthony, 1860; *G. bulbosa*, Anthony, 1860; *G. ovalis*, Anthony, 1860; *Melatoma sphærica*, 'Anth. MS.,' Reeve, 1860; *M. nucula*, 'Anth. MS.,' Reeve, 1860; *M. elliptica*, 'Anth. MS.,' Reeve, 1860; *M. 'Alabamensis*, Lea', Reeve, 1860; *S. Showaltherii*, Lea, 1860; *S. castaneum*, Lea, 1860; *S. pumilum*, Lea, 1860; *S. globosum*, Lea, 1860; *S. glans*, Lea, 1860.

Shell as in *olivula*, but the outer lip sinuate and terminating above in a rather broad deep sutural pleurotomariform cleft, body-whorl sub-suturally nodose; *olivula* stage passed during adolescence; habitat streams.

Coosa River, Alabama; American Province.

GYROTOMA LÆTA INCISA (Lea).

Melania (*Schizostoma*) *incisa*, Lea, 1842; *Schizostoma pagoda*, Lea, 1845; *S. Babylonicum*, Lea, 1845; *S. funiculatum*, Lea, 1845; *S. Buddii*, Lea, 1845; *S. constrictum*, Lea, 1845; *Gyrotoma pyramidata*, Shuttleworth, 1845; *S. Wetumpkaense*, Lea, 1860; *S. Alabamense*, Lea, 1860; *S. Hartmanii*, Lea, 1860; *S. glandula*, Lea, 1860; *S. virens*, Lea, 1860; *G. quadrata*, Anthony, 1860; *G. robusta*, Anthony, 1860; *G. salebrosa*, Anthony, 1860; *G. recta*, Anthony, 1860; *G. demissa*, Anthony, 1860; *Melatoma ornata*, 'Anth. MS.,' Reeve, 1860; *M. Anthonyi*, Reeve, 1860; *S. Spillmanii*, Lea, 1861; *S. Showaltherii*, Lea, 1864 (preocc.); *S. Showaltherianum*, Tryon, 1873.

Shell similar to *læta*, but the outer lip somewhat sinuate and terminating above in a very deep narrow pleurotomariform cleft, whorls sub-nodose below the suture; *læta* stage passed during adolescence; habitat streams.

Coosa River, Alabama; American Province.

Like the preceding a well-marked northern or western race.

Unrecognized: *Melania* (*Goniobasis*) *Furuhjelmi*, Mayer, 1869. Miocene (?) of Alaska.

Family MELANOPSIDÆ, H. & A. Adams, 1854.

Genus PACHYCHILUS, Lea.

Pachychilus, Lea, 1850 (*P. Cumingii*, Lea); *Pachycheilus*, H. & A. Adams, 1854 (emended form).

Type, *Pachychilus Cumingii*, Lea.

Three Melanoids from the sub-tropical Eocene and Miocene deposits, evidently allied to one another, but not grouping closely with any of the known genera of Pleuroceridæ, may be tentatively placed in this Mexican group. Their true generic position remains to be established.

PACHYCHILUS TAYLORI (Gabb).

Melania Taylori, Gabb, 1866; *Melania* (*Goniobasis*?) *sculptis*, Meek, 1870, not of Lea, 1852; *M.* (*G.*?) *subsculptis*, Meek, 1870.

Shell of moderate size, slender-conical, whorls appressed and rather long, sutures somewhat impressed, periphery rounded, aperture elliptical, outer lip slightly sinuate; habitat apparently lacustrine, at least in part.

Eocene: Payette Lake beds, Idaho and Oregon; Truckee Lake beds, Nevada.

PACHYCHILUS LAWSONI, n.sp. Pl. VIII, Fig. 23.

Shell slender-conic, spire attenuate and regularly tapering, whorls very long and appressed, without a distinct periphery, normally smooth, but sculptured forms with several ridges of even magnitude crossed by plications, aperture but slightly sinuate and produced below; habitat apparently lacustrine, at least in part.

Length 27, breadth 10, altitude of body-whorl 12 mm.

Miocene: Contra Costa Lake beds, California.

Berkeley Hills, California; near Bald Peak (types) (H. Hannibal); same locality (D. A. C. Lawson, Dr. J. C. Merriam, *et al.*); Grizzley Peak (Dr. A. C. Lawson, Dr. J. C. Merriam, *et al.*); north flank of Ruin Peak (Dr. J. C. Merriam, *et al.*).

Named after Dr. A. C. Lawson, of the University of California.

PACHYCHILUS DRAKEI, Arnold & Hannibal, n.sp. Pl. VIII, Fig. 26.

Shell large, averaging about 45 mm. in altitude, elevated-conical, whorls long and slightly convex, sutures impressed, periphery rounded, aperture elliptical, outer lip sinuate; habitat apparently lacustrine, at least in part.

Altitude 45, breadth 14, altitude of body-whorl 12 mm.

Eocene: Tejon formation (local freshwater beds), Washington.

Little Falls, Washington; Bluffs along Olequa Creek at bend below town (H. Hannibal).

Only a single specimen, evidently syntonically deformed, is at hand. The sculpturing consists of about twelve rugose plications crossed by an equal number of spirals.

Named after Dr. N. F. Drake, of the Department of Geology, Stanford University.

Superfamily RISSOIDEÆ (H. & A. Adams), 1854.

Aside from the marine Rissoidæ, Rissoinidæ, Skeneidæ, and Hydrobiidæ, and the terrestrial Pomatiopsidæ, the Rissoids include two aquatic families—the Amnicolidæ, Tryon, 1862 (+Fluminicolinæ, Clessin, 1880, Lithoglyphinæ, Tryon, 1883, and Paludestrinidæ, Newton, 1891), and Bulimidæ, nom. nov.[1] (Bythiniinæ, Tryon, 1863).

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[1] Type genus *Bulimus*, Scopoli (*Bithynia*, Leach, *Bythinia* and *Bithinia* of authors). The name has not come into general use, but as may be seen from the following is necessarily applicable.

1757. Adanson, *Histoire Naturelle du Sénégal*, *Coquillages*, p. 5, pl. i, described and figured "Le Bulin, *Bulinus*", from the fresh waters of Africa. This is one of the physiform Planorbidæ.

1777. Scopoli, *Introductio ad Historiam Naturalium*, p. 392, proposed '*Bulimus*, Adanson' for the four aquatic and amphibious species of the Linnæan *Helix*, viz. *H. putris* (*Succinea putris*), *H. fragilis* (*Lymnæa stagnalis*), *H. stagnalis* (*Lymnæa stagnalis*), and *H. tentacula* (*Bythinia tentacula*). The diagnosis is not that of Adanson's *Bulinus*, which is not mentioned. No reference is given to where Adanson may have used *Bulimus*.

1781. Müller in *Der Naturforscher*, pp. 1–20, described the anatomy of "der Perlen-Blasen" (*Physa fontinalis*), and revived Adanson's *Bulinus*, ostensibly for the physiform section of his genus *Planorbis* of the preceding

Various authors have disagreed in regard to the limits of the Amnicolidæ; on the one hand it has been extended to include all the not strictly marine Rissoid genera, while on the other it has been subdivided on the most superficial characters. Doubtless when restricted to embrace only the freshwater Rissoideæ with horny sub-spiral opercula, it is a rather over-comprehensive group, but the anatomical studies necessary to segregate the genera into families and sub-families would require time all out of proportion to the results to be gained in the present discussion.

Family AMNICOLIDÆ, Tryon, 1862.

Shell small or minute, sub-solid, varying from globose to attenuate, imperforate or umbilicate, whorls more or less inflated, sutures impressed, aperture ovate and somewhat retracted below; animal oviparous, rostrum short and broad, tentacles cylindrical, blunt or tapering, foot short and broad, auriculated in front, rounded behind, and more or less constricted in the middle, operculum corneous and paucispiral, with a sub-central nucleus; habitat lacustrine and fluviatile.

Six more or less localized genera, *Amnicola*, *Paludestrina*, *Fluminicola*, *Pyrgulopsis*, *Cincinnatia*, and *Brannerillus*, occur in the present

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year. Adanson's species is included and given a binomial name. His group contains: (1) *Bulinus perla* (*Planorbis bulla*, Müll., *Bulla fontinalis*, L.) = *Physa fontinalis*; (2) *B. turritus* (*Planorbis turritus*, Müll., *Bulla hypnorum*, L.) = *Physa hypnorum*; (3) *B. gelatinus* (*Planorbis gelatinus*, Müll.) = ? *Physa fontinalis*; (4) *B. Senegalensis* (Le Bulin, *Bulinus*, Adanson).

1786. Scopoli, *Deliciæ Floræ et Faunæ Insubricæ*, i, p. 67, used *Bulimus* for a South American land shell belonging to *Borus*, Albers, 1850.

From these data we may draw the following conclusions.

Bulinus, Adanson, is not binomial and pre-Linnæan, hence can only be cited historically.

Bulimus, Scopoli, 1777, may be based on *Bulinus*, Adanson, 1757, or it may be based on some manuscript *Bulimus* of Adanson. No clue is given to where Adanson may have used the name, therefore there is no way of determining. If *Bulimus*, Adanson, was a manuscript name, it would have to be cited as of Scopoli, however, as its first use in print. If *Bulimus* is derived from *Bulinus*, Scopoli's attribution of the genus to Adanson explains the derivation of the word, but the fact that he altered the spelling and used the name for a group, in which Adanson's species was not included, places it on a distinct nomenclatural basis, hence it must be cited as of Scopoli in any event. *Helix tentacula*, L., has been named by Dall as a type by elimination, thus giving it priority over *Bithynia*, Leach, 1818.

Bulinus, Müller, is *Bulinus*, Adanson, adopted into binomial nomenclature. Adanson's species must go with it, in any event, since it is the type by autonomy and subsequent elimination.

Bulimus, Scopoli, 1786, makes it impossible to question *Bulimus*, 1777, as a lapsus for *Bulinus*. Its use for a land shell does not concern the applicability of the name for the species previously included. Scopoli may have thought his species was aquatic.

The similarity in orthography is undesirable, but does not affect the use of the names.

One species, *Bulimus tentaculus*, L., occurs as an introduced form in the drainage of the Great Lakes and adjacent waters of North America.

district. The shell characters offer only partial satisfaction in their discrimination.

Genus AMNICOLA, Gould & Haldeman.

Paludina (sp.), Say, 1819 (*P. limosa*, Say); *Amnicola*, Gould and Haldeman, in Haldeman, 1840, no species cited; in Gould, 1841 (*P. porata*, Say (= *P. limosa*, Say), first species, cited by H. & A. Adams, 1854).

Type, *Paludina limosa*, Say.

Shell of moderate size, averaging 4 mm. in altitude, conic-globose, sub-perforate, epidermis pale horn-coloured, whorls inflated, sutures impressed, spire regularly elevated, apex small and obtuse, aperture ovate, peritreme continuous; habitat quiet streams, lakes, and springs.

AMNICOLA LIMOSA (Say).

Paludina limosa, Say, 1817; *P. porata*, Say, 1821; *A. parva*, Lea, 1841.

Shell large for genus, globose-conic, sutures impressed, spire elevated; habitat quiet streams and lakes.

Boreal portions of American Province. Utah System.

Quaternary: Loess of eastern States; Bonneville Lake beds, Utah.

AMNICOLA MICROCOCCUS, Pilsbry.

Amnicola micrococcus, Pilsbry, in Stearns, 1902.

Shell minute, globose-conic, spire somewhat elevated, sutures barely impressed; habitat springs.

Mojave System.

Unrecognized: *Amnicola abavia*, Mayer, 1869. Miocene (?) of Alaska.

Genus PALUDESTRINA, d'Orbigny.

Bulimus (sp.), Poiret, 1801 (*B. viridis*, Poir.); *Turbo* (sp.), Vall, 1801 (*T. griseus*, Vall = *P. viridis*, Poir.); *Cyclostoma* (sp.), Draparnaud, 1801 (*C. vitreum*, Drap.); *Hydrobia* (sp.), Hartmann, 1821 (*C. vitreum*, Drap.); *Paludina* (sp.), Hartmann, 1821 (*B. viridis*, Poir.); *Leachia*, Risso, 1826 (*C. vitrea*, Drap.), not *Leachia*, Lesueur, 1821; *Paludestrina*, d'Orbigny, 1840 (*Paludina acuta*, Desh.); *Amnicola* (sp.), Haldeman, 1844 (*A. attenuata*, Hald. = *Paludina Nickliniana*, Lea); *Bithinia* (sp.), Dupuy, 1849 (*B. viridis*, Poir.); *Bythinella*, Moquin-Tandon, 1851 (*B. viridis*, Poir.); *Melania* (sp.), Conrad, 1855 (*M. exigua*, Conr. = *A. protea*, Gld.); *Heleobia*, Stimpson, 1865 (*Paludestrina culminea*, d'Orb.), preocc.; *Tryonia*, Stimpson, 1865 (*T. clathrata*, Stimp. = *A. protea*, Gld.); *Stimpsonia*, Clessin, 1878 (*Paludina Nickliniana*, Lea).

Type, *Paludina acuta*, Deshayes.

Shell small or minute, averaging 4 mm. in altitude, elongate-conic or attenuate, sub-perforate, whorls inflated, epidermis pale horn-coloured, spire regularly elevated, apex small and obtuse, aperture ovate, peritreme incomplete; habitat lakes, streams, and springs.

The writer entertains doubts that the American species are true

Paludestrinas. If not, *Tryonia* would become available for their reception. Of all the aquatic operculates this group is doubtless one of the most in need of severe critical revision.

PALUDESTRINA PROTEA (Gould).

Amnicola protea, Gould, 1855 (syntonic form); *Melania exigua*, Conrad, 1855 (syntonic form); *Hydrobia Seemani*, Frauenfeld, 1863; *Tryonia clathrata*, Stimpson, 1865 (syntonic form); *Bythinella Hemphilli*, Pilsbry, 1890; *P. Stokesi*, Arnold, 1903.

Shell usually of rather large size but variable in this respect, attenuate-conic, sub-perforate, sutures moderately impressed; habitat lakes and springs.

Mexican Province. Utah, Nevada, Columbia, Mojave, and Arizona Systems. Probably present in Klamath, Coast Range, Los Angeles, and Colorado Systems.

Quaternary: Le Conte Lake beds and San Pedro formation (specimens washed into marine terraces), California; Summer Lake beds, Oregon.

Pliocene: Kettleman Lake beds, California.

PALUDESTRINA LONGINQUA (Gould).

Amnicola longinqua, Gould, 1855; *Pomatiopsis intermedia*, Tryon, 1865; *Bythinella 'Binneyi*, Tryon', J. G. Cooper, 1888, in part; *P. Stearnsiana*, Pilsbry, 1899; *P. imitator*, Pilsbry, 1899; *P. curta*, Arnold, 1903; *P. Andersoni*, Arnold, 1910.

Shell small or of moderate size, elevated-conic, sub-perforate, sutures well impressed; habitat lakes, mountain streams, and springs, generally in organic mud with *Corneocyclas*.

Utah, Nevada, Columbia (locally), Coast Range, Mojave, Los Angeles, Arizona, and Colorado Systems.

Quaternary: Le Conte Lake beds, calcareous spring deposits of Santa Cruz Mountains, and San Pedro formation (specimens washed into marine terraces), California; Lahontan Lake beds, Nevada; Bonneville Lake beds, Utah. Pliocene: Santa Clara, Cache, and Kettleman Lake beds, California.

Genus FLUMINICOLA, Stimpson.

Paludina (sp.), Lea, 1838 (*P. virens*, Lea); *Amnicola* (sp.), Baird, 1863 (*A. Hindsii*, Baird = *P. virens*, Lea); *Fluminicola*, Stimpson, 1865 (*P. Nuttalliana*, Lea = *P. virens*, Lea).

Type, *Paludina virens*, Lea.

Sub-genus HEATHILLA, n.sub-gen.

Anculosa (sp.), Haldeman, 1841 (*A. fusca*, Hald.).

Type, *Paludina seminalis*, Hinds.

Named in honour of Dr. Harold Heath, under whose guidance a portion of the anatomical studies involved in these pages were made.

Sub-genus *Fluminicola*, s.s. Shell of moderate size, averaging 5 mm. in altitude, elevated-conic, spire decidedly elevated, early volutions slender but expanding rapidly before maturity is reached, whorls inflated, sloping downward and outward, sutures impressed; habitat streams and springs.

Sub-genus *Heathilla*. Shell similar to preceding but more nearly globose, sub-perforate, the spire but little elevated, early adolescent whorls slender, but the later ones expanding more rapidly than in *Fluminicola*, s.s., sutures shallow, *Fluminicola* stage carried back to mid-adolescence; habitat similar.

The bulk of the Fluminicolas belong to *Heathilla*, which may be readily distinguished by its globose form. Judging by the localized distribution of the representatives of this genus, additional species may be expected when the Great Basin and adjacent desert regions are explored more fully.

FLUMINICOLA VIRENS (Lea).

Paludina virens, Lea, 1838; *P. nuclea*, Lea, 1838; *P. Nuttalliana*, Lea, 1838; *Amnicola Hindsii*, Baird, 1863.

Shell large, elevated-conic, imperforate, epidermis dark green or tawny, spire elevated, sutures well impressed; habitat streams and springs.

Columbia and Fraser (locally) Systems.

FLUMINICOLA MODOCI, n.sp. Pl. VIII, Fig. 30.

Shell small, elevated-conic, imperforate, epidermis green-brown, spire decidedly elevated, sutures deeply impressed; habitat springs.

Altitude (estimated) 5·0, breadth 3·2, altitude of aperture 2·6 mm.

Nevada System (locally).

California: Fletcher's spring, south end of Goose Lake (type); Fritter's spring, head of Willow Creek, Honey Lake basin; Troxel's spring, Eagle Lake (H. Hannibal).

In the new edition of *West Coast Shells* this distinct little *Fluminicola* was figured as *Amnicola micrococcus*, to which it bears some resemblance, though that Rissoid is even more minute and sub-perforate. *F. Modoci* appears to be confined to the lava beds of North-Eastern California and the adjacent portions of Oregon and Nevada, once the home of the Modoc Indians, who, led by the intrepid Captain Jack, for a number of years successfully resisted the settlement of the country by the whites.

FLUMINICOLA (HEATHILLA) FUSCA (Haldeman).

Anculosa fusca, Haldeman, 1841; *Amnicola* '*turbiniformis*, Tryon', J. G. Cooper, 1871, *pars*.

Shell large, nearly globose, sub-perforate, epidermis dark silvery-brown, spire somewhat elevated, sutures impressed, whorls deep; habitat streams.

Utah System.

Quaternary: Bonneville Lake beds, Utah.

FLUMINICOLA (HEATHILLA) SEMINALIS (Hinds).

Paludina seminalis, Hinds, 1842; *P.* '*nuclea*, Lea', Hinds, 1844; *F.* '*Nuttalliana*, Lea', Binney, 1865, *pars*; *Amnicola turbiniformis*, Tryon, 1865; *F.* '*fusca*, Haldeman', Call, 1884, *pars*; *A. Dalli*, Call, 1884.

Shell large, globose, sub-perforate, epidermis green-brown, spire but little elevated, sutures not appreciably impressed, whorls deep; habitat streams and springs.

Klamath and Nevada Systems.

Varies much in size; specimens from springs are prevailingly dwarfed.

FLUMINICOLA (HEATHILLA) MERRIAMI, Pilsbry & Beecher.

F. Merriami, Pilsbry & Beecher, 1892.

Shell small, globose-turbinate, perforate, epidermis horn-coloured, sutures somewhat impressed, whorls rather deep; habitat springs.

Mojave System.

FLUMINICOLA (HEATHILLA) ERYTHROPOMA, Pilsbry.

F. fusca, var. *minor*, Stearns, 1893 (nude name, not used in a strictly varietal sense); *F. erythropoma*, Pilsbry, 1899.

Shell small, globose-turbinate, sub-perforate, epidermis silvery corneous, sutures somewhat impressed, whorls fairly deep, operculum with slowly increasing volutions and sub-central nucleus; habitat springs.

Mojave System.

FLUMINICOLA (HEATHILLA) COLUMBIANA, Pilsbry.

F. Columbiana, 'Hemphill MS.,' Pilsbry, 1899.

Shell of moderate size, sub-globose, barely perforate, epidermis dark purplish-black, spire moderately elevated, sutures well impressed, whorls not deep; habitat streams.

Columbia System (locally).

FLUMINICOLA (HEATHILLA) MINUTISSIMA, Pilsbry.

F. minutissima, Pilsbry, 1907.

Shell minute, broadly obliquely globose, perforate, epidermis olive-yellow, sutures impressed, whorls strongly inflated but not deep; habitat streams.

Columbia System (locally).

Genus PYRGULOPSIS, Call & Pilsbry.

Pyrgula (sp.), Wolf, 1869 (*P. scalariformis*, Wolf); *Pyrgulopsis*, Call & Pilsbry, 1886 (*Pyrgula Nevadensis*, Stearns).

Type, *Pyrgula Nevadensis*, Stearns.

Shell varying from small to large size, averaging 5 mm. in altitude, turreted-conic, imperforate or sub-umbilicate, epidermis pale horn-coloured, whorls somewhat inflated, rounded in adolescent stage, rounded, coronate, or peripherally carinate in adult, the carina frequently becoming obsolete in senile condition, sutures more or less impressed in rounded stages, apex usually small and obtuse, aperture ovate, peritreme continuous; habitat chiefly confined to lakes.

Pyrgulopsis is an interesting group on account of the pronounced shortening up of the sculptured stage; specimens in each species frequently pass directly from the juvenile to the senile round-whorled stage with but a barely appreciable development of the carina, and in no instance does it occupy a considerable period.

P. Nevadensis is the only living representative of the genus west of the Rocky Mountains. To this must be added, however, several additional forms particularly from the Pliocene lake deposits of California. Other undescribed Amnicolids from the extensive lacustrine beds of this period on the coast are probably congeneric, but the writer prefers to delay their description until the sculptured forms are discovered and their generic position positively established. The Pyrgulopses are characteristically localized in distribution, and the fossil forms were apparently rather short-lived, hence become valuable in horizon determination.

PYRGULOPSIS ANTIQUA (Gabb).

Lithasia antiqua, Gabb, 1866.

Shell large, sub-globose, spire elevated, whorls rounded and smooth, sutures somewhat impressed, aperture ovate, outer lip slightly sinuate, peritreme incomplete; habitat apparently lacustrine.

Eocene: Payette Lake beds, Idaho and Oregon.

The writer has seen specimens of this species, but has not had the opportunity to study the early whorls. While the large size and globose form suggest *Anculosa* somewhat, there is scarcely any likelihood that it belongs to that family. Its affinities are rather with the present group, though it is by no means certain that it is really congeneric with *P. Nevadensis.* The proper disposition of fossil Amnicolidæ into their respective genera is frequently rather embarrassing owing to the absence of well-marked shell characters.

PYRGULOPSIS NEVADENSIS (Stearns).

Pyrgula Nevadensis, Stearns, 1883.

Shell of moderate size, slender-conic, imperforate, spire decidedly elevated, sutures well impressed; habitat lakes.

Nevada System (locally).

Quaternary: Lahontan Lake beds, Nevada.

The prevailing form is peripherally carinate.

PYRGULOPSIS YATESIANA (J. G. Cooper).

Amnicola Yatesiana, J. G. Cooper, 1894.

Shell rather large, pupiform-globose, umbilicate, spire somewhat elevated, sutures not deeply impressed; habitat, apparently a lake species.

Pliocene: Santa Clara Lake beds, California.

The prevailing form is the rounded one, but peripherally carinate individuals are not rare at certain localities.

PYRGULOPSIS WILLIAMSI, n.sp. Pl. VIII, Fig. 29.

Amnicola 'turbiniformis, Tryon', J. G. Cooper, 1894.

Shell of very large size, broadly conic-globose, sub-perforate, spire somewhat elevated, sutures more or less impressed; habitat, apparently a lake species.

Type (a coronate individual): altitude 8·5, breadth 7, altitude of body-whorl 6 mm. Co-type (a peripherally carinate individual): altitude 7, breadth 6·3 mm. Co-type (a rounded individual): altitude 8·7, breadth 7 mm.

Pliocene: Kettleman Lake beds, California.

Hills bordering Tulare Valley on west, California; Martin and Dudley's oil-well, south-east quarter of section 32, township 26 south, range 21 east, Lost Hills (types) (W. Williams); east of Dudley–Lemoor road, south-west quarter of section 17, township 23 south, range 19 east, east border of Kettleman Hills (Ferguson); opposite Tulare Lake, west border of Kettleman Hills (W. L. Watts), *fide* Watts; well at depth of 1,058 feet, Lambertson's ranch near Tulare Lake (W. L. Watts), *fide* Watts.

P. Williamsi is the largest and most compact *Pyrgulopsis* yet described, though *Yatesiana* approaches it somewhat. The prevalent type in the Kettlemans appears to be the rounded form, and upon this it seems almost certain that Cooper founded his record of *Amnicola turbiniformis* (*Fluminicola seminalis*). This is the only species in these deposits which resembles a *Fluminicola* particularly, but, owing to the destruction in the San Francisco fire of the material on which Cooper based his report, which was among the California Academy collections, there has been no opportunity of verifying such a supposition. In the Lost Hills no exposures of these lake beds are known, but through the courtesy of Mr. W. Williams, chief geologist of the Associated Oil Company, the writer is indebted for some interesting material derived from an oil-well at a considerable depth. In this set, rounded, peripherally carinate, and coronate individuals are present, the latter prevailing. From one of these the type has been selected.

Genus Cincinnatia, Pilsbry.

Paludina (sp.), Anthony, 1840 (*P. Cinçinnatiensis*, Anth.); *Amnicola* (sp.), Anthony, 1843 (*P. Cincinnatiensis*, Anth.); *Cincinnatia*, Pilsbry, 1891 (*P. Cincinnatiensis*, Anth.).

Type, *Paludina Cincinnatiensis*, Anthony.

Shell of moderate size, averaging 5 mm. in altitude, elevated conic-globose, epidermis horn-coloured, whorls strongly inflated and umbilicate, sutures deep, spire elevated and sub-pupiform, apex bluntly obtuse, aperture sub-circular, peritreme complete; habitat lakes and sluggish streams.

The genus contains, so far as known, two species, *C. Cincinnatiensis*, which should not be confused with '*Cyclostoma*' *Cincinnatiensis*, Lea, a *Pomatiopsis*, and *C. Binneyana*, nom. nov.[1]

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[1] *Paludina obtusa*, Lea, 1841, not of Troschel, 1837. This has passed in the literature as *Paludina emarginata*, Küster. Whether or not Küster had this shell before him is of no consequence; he identifies his species with *Lymnæus emarginatus*, Say; hence the name is entirely inadmissible in this connexion. Lea's name is a homonym, therefore *C. Binneyana* may be substituted.

The two are almost wholely peculiar to the American Province, *C. Cincinnatiensis* alone extending west as far as the Great Basin.

Cincinnatia Cincinnatiensis (Anthony).

Paludina Cincinnatiensis, Anthony, 1840.

Shell large and ventricose, spire elevated-conic; habitat lakes and sluggish streams.

American Province. Utah System.

Quaternary: Loess of eastern States; Bonneville Lake beds, Utah.

Genus Brannerillus, n.gen.

Type, *Brannerillus physispira*, n.sp.

Shell of rather small size, averaging 2·5 mm. in altitude, conic-globose, whorls rounded or peripherally carinate, giving the shell the appearance of an *Astræa*, umbilicate, sutures impressed, spire elevated, but the apex conspicuously depressed below the plane of the succeeding whorl, aperture nearly circular in rounded forms, peritreme complete; habitat apparently lacustrine.

The present group is known to the writer only from a single fossil species, but the peculiar planorbiform apex immediately distinguishes it from the other Nearctic genera of Amnicolidæ, *Cincinnatia* approaching it most closely. In the development of a peripheral keel in some instances, it resembles *Pyrgulopsis*, but the outline is proportionately much narrower, and the apex merely obtuse in that genus.

Named after Dr. J. C. Branner, of the Department of Geology at Stanford University.

Brannerillus physispira, n.sp. Pl. VIII, Fig. 28.

? *Valvata* '*virens*, Tryon', J. G. Cooper, 1894 (juvenile).

Shell as in genus.

Altitude 2·5, breadth 3·3, altitude of aperture 1·7 mm.

Pliocene: Kettleman Lake beds, California.

Kettleman Hills near Coalinga, California; marl 'reefs' near mouth of gulch south of Medallion One Cañon, east flank of Kettleman Hills (types) (H. Hannibal); marl 'reefs' at head of gulch north of Huron – Big Tar Cañon road, near Lakeview oil-well, north flank of Kettleman Hills (Dr. J. C. Merriam) (H. Hannibal).

Section 28, township 30 south, range 22 east, Telephone Hills, near McKittrick, California (R. B. Moran).

The present species, an extremely abundant one at the type locality, where it locally composes to a considerable degree the marl 'reefs' (made up chiefly of *Paludestrina longinqua*) that form so prominent an element of the topography of the east flank of the Kettleman Hills, is prevailingly carinate at this point. Elsewhere the rounded form is the more common one. The large planorboid nucleus in young specimens may have been the basis of Cooper's record of *Valvata*, which has not been verified from these beds. The two have considerable superficial resemblance.

Superfamily VIVIPAROIDEÆ (Gray), 1857.

The Viviparoids, as at present understood, constitute two families—the Viviparidæ, a group common to both the old and new worlds, and the Lioplacidæ, at present confined to the American Province, but formerly ranging as far west as California. Several bizarre African genera customarily referred to the former group may be separable into another division upon more careful study.

Family VIVIPARIDÆ, Gray, 1857.

Shell large, averaging 25 mm. in altitude, conic-turbinate, subperforate or perforate, covered with a greenish, yellowish, or brownish epidermis, whorls inflated, aperture roundly ovate, and slightly retracted below, but not sinuate; animal large and viviparous, operculum annular, with a thickened margin and nuclear area, rostrum simple and pronounced, foot quadrate and not greatly produced in front of head, tentacles short and stout, the right clavate in male, branchial laminæ numerous, narrow or sub-linear, and diverging at tips to form several rows, cervical lappets large and forming trough-like ducts; habitat lakes, marshes, and quiet streams.

The Viviparidæ common to Western Europe and North America belong exclusively to *Viviparus* or its sub-genus *Callina*. No member of this genus occurs in the living state within the present district, although, like the succeeding family, fossil forms indicate a greater western extension during early Tertiary times. Two Viviparas introduced by the Oriental labourers from Japan as an article of food are, however, an established element of the fauna of the middle California lowlands.[1] While commonly classed in *Paludina*, *Vivipara*, or *Viviparus* as it is variously called, an examination of the early whorls will readily show that they are not congeneric with *Viviparus viviparus* (L.). Several years ago, in describing *Vivipara Henzadensis* from India, Pilsbry[2] commented on certain characters which peculiarized the operculum (these appear to the writer to be common to the entire family), and proposed the sub-genus *Idiopoma* to embrace certain species from South-Eastern Asia, of which, however, this is the only one mentioned. The species is unknown to the writer, but, judging by the figure and description, doubtless groups with *Bengalensis*, Lam., *quadrata*, Gray, and *Japonica*, v. Martens. The writer would therefore extend the name to embrace the entire genus. For the section represented by *malleata*, Reeve, and *Chinensis*, Gray, in which the adolescent carina is lost early, and the shell becomes decidedly globose in the adult condition, thus superficially recalling *Callina*, the name *Cipangopaludina* is proposed.

Genus Viviparus, Montfort.

Helix (sp.), Linné, 1758 (*H. vivipara*, L.); '*Cochlea vivipara fasciata*' (not binomial), Geoffroy, 1767; Martini's Transl., 1767; *Nerita* (sp.), Müller, 1774 (*N. fasciata*, Müll. = *H. vivipara*, L.);

[1] Hannibal, *Nautilus*, xxv, p. 31, 1911.
[2] Proc. Philad. Acad. Sci., 1901, p. 188.

Bulimus (sp.), Poiret, 1801 (*H. vivipara*, L.); *Cyclostoma* (sp.), Draparnaud, 1801 (*C. achatinum*, Drap. = *H. vivipara*, L.); *Natica* (sp.), Férussac (*H. vivipara*, L.); *Viviparus*, Montfort, 1810 (*V. fluviatorum*, Mont. = *H. vivipara*, L.); *Vivipara*, J. Sowerby, 1813 (emended form); *Viviparella*, Rafinesque, 1815 (emended form); *Paludina*, Lamarck, 1816 (*H. vivipara*, L.); *Tulotoma*, Haldeman, 1840 (nude name); in Binney, 1865 (*Paludina magnifica*, Conr. = *P. subpurpurea*, Say, syntonic form).

Type, *Helix vivipara*, Linné.

Sub-genus CALLINA, n.sub-gen.

Cochlea (sp.), Da Costa, 1778 (*Nerita vivipara*, Müll., *non* Linné = *Cyclostoma contectum*, Millet).

Type, *Paludina intertexta*, Say.

Named after Professor Robert Ellsworth Call, well known for his studies in this group.

Sub-genus *Callina*. Shell large, averaging 30 mm. in altitude, conic-turbinate, perforate, whorls inflated and rounded throughout development, sutures somewhat impressed, aperture rounded-ovate and slightly retracted below, outer lip not sinuate; habitat lakes, marshes, and sluggish streams.

Sub-genus *Viviparus*, s.s. Shell similar to *Callina* but smaller, averaging 25 mm. in altitude, elevated-conic, imperforate, whorls appressed and sub-carinate at the periphery in the adult, sutures not markedly impressed; *Callina* stage carried back to early adolescence; habitat lakes, marshes, and sluggish streams.

The nomenclatural vicissitudes of this genus have been discussed by authors of wider experience than the writer, and several divergent opinions have been reached. The best-known name, *Paludina*, published in the *Encyclopédie Méthodique*, and often credited to Bruguière, 1798, did not appear until the livraison of 1816 as a latinization of Lamarck's vernacular 'Paludine', 1812, hence is preceded by *Viviparus*, *Vivipara*, and *Viviparella*, all available. *Vivipara* is sometimes credited to Martini, who, in a German translation of Geoffroy's *Traité Som. Coq. Paris*, indexed '*Cochlea vivipara fasciata*' as *Vivipara fasciata*. Geoffroy did not formally accept the Linnæan nomenclature, and, as Martini's work claimed to be nothing more than a translation, it seems inconsistent to regard this accidental binomial as having the same status as the properly formed binomials of Linné, O. F. Müller, and other contemporaries, hence Sowerby must be considered the author. The absurdity of the earliest available name, *Viviparus*, needs no comment, but according to the present ruling of the International Congress there seems no sufficient excuse to avoid its use.

VIVIPARUS (CALLINA) TURNERI, n.sp. Pl. VIII, Fig. 31.

Shell large, similar in a general way to *V. contectus* of Europe, but more slender, whorls inflated and not deep, sutures well impressed, apex small and very obtuse; habitat apparently lacustrine.

Altitude 32, breadth 26, altitude of body-whorl 20 mm.

Eocene: Truckee Lake beds, Nevada.

Silver Peak Range, Nevada: Near coal-mine (type) (H. W. Turner); same locality (S. A. Knapp); 1 mile south-east of coal-mine (H. W. Turner); $1\frac{1}{2}$ miles south-east of coal-mine (H. W. Turner).

All the material of this species examined is rather distorted by crushing, but the series examined is sufficiently large to determine the specific characters. Named after Mr. H. W. Turner, formerly of the United States Geological Survey, who obtained most of the material while mapping the Silver Peak Range.

Viviparus Washingtonianus, Arnold & Hannibal, n.sp.
Pl. VIII, Fig. 32.

Shell small, seldom over 20 mm. in altitude, similar to *V. subpurpureus* of the Gulf States, but with a decidedly elevated spire, but slightly impressed sutures, and more slender nuclear whorls. Whorls appressed, decidedly sloping, and distinctly sub-carinate at the periphery; habitat apparently lacustrine.

Altitude 20, breadth 15, altitude of aperture 12 mm.

Eocene: Local freshwater beds in Tejon formation, Washington.

Little Falls, Washington: Bluffs along Olequa Creek above shoals 2 miles north of town (type); at shoals $1\frac{1}{2}$ miles north of town; bend a half-mile south of town (H. Hannibal).

Genus Idiopoma (Pilsbry).

Paludina (sp.), Lamarck, 1822 (*P. Bengalensis*, Lam.); *Vivipara* (*Idiopoma*) (sp.), Pilsbry, 1901 (*V.* (*I.*) *Henzadensis*, Pilsbry).

Type, *Vivipara* (*Idiopoma*) *Henzadensis*, Pilsbry.

Sub-genus Cipangopaludina, n.sub-gen.

Type, *Paludina malleata*, Reeve.

Sub-genus *Idiopoma*, s.s. Shell of moderate size, averaging 25 mm. in altitude, elevated-conic, sub-perforate, whorls appressed and tapering, peripherally carinate from early development stages, the carina becoming sub-obsolete on the body-whorl, apex elevated and prominent, aperture ovate and slightly retracted below; habitat lakes, streams, and marshes.

Sub-genus *Cipangopaludina*. Shell similar to *Idiopoma*, but conic-turbinate, perforate, early whorls appressed and peripherally carinate, later whorls ecarinate, and inflated with impressed sutures, aperture ovate; *Idiopoma* stage passed during adolescence; habitat similar.

Idiopoma Japonica (von Martens).

Paludina Japonica, von Martens, 1860.

Shell large, spire broad and strongly elevated, with a small prominent apex, sutures but little impressed, whorls deep and broadly appressed, marked by spiral striæ which have a tendency to be accentuated into carinations in forms from alkali waters, peripheral carina very pronounced in young stages, and becoming sub-obsolete only on the last half-whorl, axis sub-perforate, aperture higher than broad; habitat quiet streams and marshy situations.

Japan: introduced in Coast Range System.

IDIOPOMA (CIPANGOPALUDINA) MALLEATA (Reeve).

? *Paludina læta*, von Martens, 1860; *P. malleata*, Reeve, 1863; *P. 'Japonica*, Mart.', Wm. Wood, 1892; *Vivipara 'stelmaphora*, Bgt.', Stearns, 1901; *V. 'lecythoides*, Benson', Hannibal, 1908.

Shell large and very broad, spire elevated-conic, apex large and sub-prominent, sutures impressed, whorls inflated and fairly deep, marked by four revolving lines of punctures, two above, one at, and one below the periphery, an obtuse carina in early stages which is entirely lost before the adult condition is reached, axis perforate, aperture nearly as broad as high; habitat quiet streams and marshy situations.

Japan: introduced in Coast Range System.

Family LIOPLACIDÆ, Gill, 1871.

Shell large, averaging 25 mm. in altitude, elevated-conic, covered with a greenish or brownish epidermis, whorls more or less appressed and shouldered, aperture sinuate, operculum uniformly thin and horny, annular, but with a sub-spiral nucleus; animal small, foot large, quadrate, and produced in front of head, rostrum small, branchial laminæ elongate-triangular, of equal size, and arranged in a straight row, cervical lappets not forming tubular ducts; habitat streams, less frequently lakes.

This group, even to late years included in the Viviparidæ, from which it differs in numerous details, comprises two genera, *Lioplax* and *Campeloma*, Rafinesque (+*Ambloxis*, 'Rafinesque,' Binney, '*Melantho*, Bowditch,' Binney). The family appears to be a decadent one. While fossil species are fairly numerous and indicate a distribution as far west as California in early Tertiary times, at present *Lioplax* contains only the solitary species *L. subcarinata*, Say (+*cyclostomatiformis*, Lea), and *Campeloma* embraces but two, *decisa*, Say (+*coarctata*, Lea, *rufum*, Hald., *subsolidum*, Anthony, *Milesi*, Lea, etc.), and *crassula*, Raf. (+*ponderosa*, Say).

The presence of a sub-spiral nucleus to the operculum in these genera is interesting from the light it throws on the origin of concentric operculi in groups derived from sub-spirally operculate ancestors, the annular later growth appearing as an acquired character.

Genus LIOPLAX, Troschel.

Lymnæa (sp.), Say, 1817 (*L. subcarinata*, Say); *Paludina* (sp.), Say, 1819 (*L. subcarinata*, Say); *Helix* (sp.), Wood, 1828 (*H. decisa*, Wood = *L. subcarinata*, Say); *Lioplax*, Troschel, 1857 (*L. subcarinata*, Say); *Haldemania*, Tryon, 1862 (*L. subcarinata*, Say).

Type, *Lymnæa subcarinata*, Say.

Shell small, averaging 20 mm. in altitude, attenuate-conic, subperforate, whorls inflated and rounded, more or less shouldered at periphery, aperture sinuate and retracted below, peristome complete; habitat lakes and streams.

LIOPLAX ANDERSONIANA, n.sp. Pl. VIII, Fig. 33.

Shell of moderate size, similar to *L. subcarinata*, but more slender, regularly elevated-conic, sub-perforate, whorls not deep, strongly inflated, and indistinctly shouldered at periphery, aperture slightly sinuate; habitat apparently lacustrine.

Altitude 21, diameter 11, altitude of aperture 9 mm.

Eocene: local freshwater beds in Tejon formation, California.

Corral Hollow, near Tesla, California; cut along Western Pacific Railroad, one-quarter of a mile above Carnegie Pottery plant (types) (H. Hannibal); same locality (Stanford University Geological Survey, per W. H. Ochsner); mouth of long gulch from north, three-quarters of a mile above Carnegie Pottery plant (Stanford University Geological Survey, per J. R. Pemberton) (H. Hannibal).

Named after Mr. Robert Anderson, of the United States Geological Survey.

Superfamily VALVATOIDEÆ (Gray), 1840.

Family VALVATIDÆ, Gray, 1840.

Shell small or minute, planorbiform or turbinate, umbilicate, whorls normally round, sutures impressed, aperture circular not oblique, peristome complete, operculum corneus and multispiral; animal oviparous, muzzle produced, tentacles filiform, branchiæ plumose-pectinate and exposed on right side, foot sub-quadrate and bilobed in front; habitat lakes.

The family contains but the one widespread genus, *Valvata*, of which a single protean species inhabits North America.

Genus VALVATA, Müller.

Valvata, Müller, 1774 (*V. cristata*, Müll.); *Gyrorbis*, Fitzinger, 1833 (*V. cristata*, Müll.); *Planella*, Schlüter, 1838 (*V. cristata*, Müll.); *Planorbitina*, Betta, 1868 (*V. cristata*, Müll.).

Type, *Valvata cristata*, Müller.

Sub-genus TROPIDINA, H. & A. Adams.

Cyclostoma (sp.), Say, 1819 (*C. tricarinata*, Say); *Tropidina*, H. & A. Adams, 1854 (*C. tricarinata*, Say); *Cincinna*, Mörch, 1863 (*V. piscinalis*, Müll.); *Valvatinella*, Betta, 1868 (*V. piscinalis*, Müll.); *Ielskia*, Bourguignat, 1877 (*V. jelskii*, Crosse); *Jelskia*, Westerlund, 1886 (emended form), not *Jelskia*, Taczanovich, 1871.

Type, *Cyclostoma tricarinata*, Say.

Sub-genus *Valvata*, s.s. Shell minute, averaging 2 mm. in breadth, planorbiform, widely umbilicate, sutures moderately impressed; habitat lakes.

Sub-genus *Tropidina*. Shell prevailingly larger than *Valvata*, s.s., averaging 4 mm. in breadth, turbinate, narrowly or moderately umbilicate, sutures deeply impressed; *Valvata* stage carried back to early adolescence; habitat lakes.

VALVATA (TROPIDINA) TRICARINATA (Say).

Cyclostoma tricarinata, Say, 1819 (syntonic form); *V. sincera*, Say, 1824; *V. humeralis*, Say, 1829; *V. bicarinata*, Lea, 1841 (syntonic form); *V. striata*, Lewis, 1856, not *V. striata*, Phil., 1836; *V. virens*, Tryon, 1863; *V. Lewisi*, Currier, 1868; *V. sincera*, var. *Utahensis*, Call, 1884 (syntonic form); *V. mergella*, Westerlund, 1885; *V. Lewisi*, var. *helicoidea*, Dall, 1905; *V. humeralis Californica*, Pilsbry, 1908; *V. Calli*, Hannibal, 1910 (syntonic form); *V. Whitei*, Hannibal, 1910 (syntonic form).

Shell of moderate size for group, turbinate, moderately umbilicate, whorls small, sutures well impressed; habitat lakes and larger sluggish streams.

Sporadically throughout the Nearctic Region and Mexican Province.

Quaternary: Loess of eastern States; Bonneville Lake beds, Utah; Lahontan Lake beds, Nevada; Owens Lake beds, California; Summer Lake beds, Oregon; post-Glacial deposits of Vancouver Island. Pliocene: Santa Clara and Cache Lake beds, California.

The present species is readily susceptible to syntonic influences, and as a result varies more or less in the elevation of the spire and breadth of the umbilicus. Extreme forms frequently develop, in addition, one, two, three, or more spiral keels. Upon such a form the original *tricarinata* was based. *V. sincera* represents the normal aspect.

SUMMARY AND RANGE IN TIME OF THE CALIFORNIAN FAUNA.[1]

O, present; K, characteristic; R, recorded from elsewhere, but not from this Province.	Early Eocene.	Late Eocene, Oligocene.	Miocene.	Pliocene.	Quaternary.	Living.
UNIONOIDEÆ.						
Family MARGARITANIDÆ.						
Margaritana (*Pseudunio*) *Herrei*, n.sp. . . . Pl. vii, fig. 17.		K				
M. margaritifera (L.) . . . . W. Coast Shells, 1910, pl. i, fig. 4.			?	?	?	O
M. margaritifera falcata (Gould) . . . . . *Alasmodon falcata*, Gould, Wilkes Exp. Moll., figs. 545*a*, *b*.			?	?	O	O
Family UNIONIDÆ.						
Unio transpacifica, Arn. & Hann., n.sp. . . Pl. vii, fig. 18.		K				
Migranaja Condoni (White) . . . . *Unio Condoni*, White, Bull. 18 U.S.G.S., pl. ii.		K				
Anodonta cygnea impura (Say) . . . . . . Pl. v, figs. 1, 2.			O	O	O	O
A. cygnea (L.) . . . . Pl. v, figs. 3, 4.			?	O	O	O

[1] See note on p. 211.

O, present; K, characteristic; R, recorded from elsewhere, but not from this Province.	Early Eocene.	Late Eocene, Oligocene.	Miocene.	Pliocene.	Quaternary.	Living.
Anodonta cygnea Beringiana (Midd.) . . . . Pl. v, figs. 5, 6.				?	?	O
Gonidea (Limnobasilissa) angulata subangulata (J. G. Cooper) *Margaritana subangulata*, Cooper, Proc. Cal. Acad., iv, pl. xiv, figs. 1–4, 1894.				O	?	
G. angulata Haroldiana, Dall . . . . Pl. vi, fig. 10.					?	O
G. angulata (Lea) . . . . W. Coast Shells, 1910, fig. 289.					?	O
G. Hemphilli, n.sp. . . . . Pl. vii, fig. 19.				K		
Arnoldina dejecta (Lewis) . . . . Pl. vi, fig. 9.					O	O
CYRENOIDEÆ.						
Family SPHÆRIIDÆ.						
Sphærium corneum (L.) . . . . *S. rhomboideum*, Prime, Mon. Corbic., fig. 31.			?	?	R	O
S. tenue (Prime) . . . . Prime, Mon. Corbic., fig. 44.					R	O
S. patella (Gould) . . . . Prime, Mon. Corbic., fig. 36.					?	O
S. (*Amesoda*) *simile* (Say) . . . . *S. striatinum*, Prime, Mon. Corbic., fig. 29.				O	O	O
S. (*Amesoda*) *Idahoense*, Meek . . . . White, 3rd Ann. Rep. U.S.G.S., pl. xxxii, figs. 14, 15.	K					
S. (*Amesoda*) *Rogersi*, n.sp. . . . . Pl. vii, fig. 21.		K				
(? *S.* (*Amesoda*)) *Catherinæ*, n.sp. . . . . . Pl. vii, fig. 20.	K					
S. (*Amesoda*) *Andersonianum*, n.sp. . . . . Pl. vi, fig. 11.				K		
Musculium lacustre (Müll.) . . . . *M. Raymondi*, Hannibal, W. Coast Shells, pl. i, fig. 3.			?	?	O	O
M. partumeium (Say) . . . . W. Coast Shells, 1910, pl. i, fig. 5.			O	?	R	O
Family CORNEOCYCLADIDÆ.						
Corneocyclas (*Pisidium*) *pulchella abdita* (Hald.) *Pisidium abditum*, Prime, Mon. Corbic., fig. 72.			?	?	O	O
C. (*Pisidium*) *Meeki*, n.sp. . . . . Pl. vi, fig. 12.	K					
C. virginica (Gmel.) . . . . *P. virginicum*, Prime, Mon. Corbic., fig. 61.					O	O
C. pulchella (Jenyns) . . . . *P. pulchellum*, Gray, 1857 ed., Turton, pl. xii, fig. 151.			?	O	O	O

O, present; K, characteristic; R, recorded from elsewhere, but not from this Province.	Early Eocene.	Late Eocene, Oligocene.	Miocene.	Pliocene.	Quaternary.	Living.
Corneocyclas compressa (Prime)			O	O	O	O
P. compressum, Prime, Mon. Corbic., fig. 67.						
C. rotundata (Prime)					?	O
P. rotundatum, Prime, Mon. Corbic., fig. 81.						
C. æquilateralis (Prime)					O	O
P. æquilaterale, Prime, Mon. Corbic., fig. 66.						
C. Idahoensis (Roper)					?	O
Unfigured.						
C. Tremperi, n.sp.						O
Pl. vii, fig. 22.						
LYMNOIDEÆ.						
Family LYMNÆIDÆ.						
Lymnæa stagnalis (L.)			?	?	O	O
Binney, L. and Fw. Sh. N. Am., ii, fig. 28.						
L. auricularia (L.)			?	?	O	O
L. catascopium, Binney, loc. cit., fig. 81.						
L. palustris (Müll.)			?	?	O	O
Binney, loc. cit., fig. 66.						
L. contracosta, J. G. Cooper			K			
Not adequately figured.						
L. Stearnsi, Hann.			K			
L. maxima, Stearns, Bull. Geol. Univ. Calif., v, p. 70, fig. 1.						
L. Cooperi, n.sp.						O
Pl. vi, fig. 13.						
L. (*Galba*) *truncatula* (Müll.)			O	?	O	O
L. humilis, Binney, L. and Fw. Sh. N. Am., ii, fig. 99.						
L. (*Galba*) *obrussa* (Say)					O	O
Binney, loc. cit., fig. 69.						
L. (*Galba*) *solida*, Lea					O	O
Lea, Trans. Am. Phil. Soc., vi, pl. xxiii, fig. 91, 1838						
L. (*Galba*) *solida Cubensis* (Pfr.)					?	O
L. Cubensis, Hannibal, W. Coast Shells, 1910, pl. iii, fig. 4.						
Family ANCYLIDÆ.						
Gundlachia (*Kincaidilla*) *fragilis* (Tryon)						O
Ancylus fragilis, Hannibal, W. Coast Shells, 1910, pl. ii, fig. 2.						
Lanx (*Walkerola*) *Klamathensis*, n.sp.					O	O
Pl. viii, fig. 25.						
L. Nuttallii (Hald.)						O
A. Kootaniensis, Binney, L. and Fw. Sh. N. Am., ii, fig. 242.						
L. patelloides (Lea)						O
A. patelloides, Hannibal, W. Coast Shells, 1910, pl. ii, fig. 1.						

O, present; K, characteristic; R, recorded from elsewhere, but not from this Province.	Early Eocene.	Late Eocene, Oligocene.	Miocene.	Pliocene.	Quaternary.	Living.
Lanx subrotundatus (Tryon) Not adequately figured.						O
Lævapex (*Ferrisia*) *caurinus* (W. Cooper) *A. caurinus*, W. Cooper in Binney, L. and Fw. Sh. N. Am., ii, fig. 243.					?	O
(? *L.* (*Ferrissia*)) *undulatus* (Meek) *A. undulatus*, White, 3rd Ann. Rep. U.S.G.S., pl. xxxii, fig. 10.	K					
(? *Neoplanorbis* (*Amphigyra*)) *Dalli* (White) *Latia Dalli*, White, loc. cit., pl. xxxii, figs. 37–40.	K					
Fisherola lancides, n.sp. Pl. viii, fig. 35.						O
Zalophancylus Morani, n.sp. Pl. vi, fig. 15.				K		
Family Planorbidæ.						
Planorbis (*Gyraulus*) *albus*, Müll. Binney, L. and Fw. Sh. N. Am., ii, fig. 220.			?	?	R	O
P. (*Gyraulus*) *parvus*, Say W. Coast Shells, 1910, pl. ii, fig. 11.					O	O
P. (*Gyraulus*) *Liebmanni*, Dunker Binney, L. and Fw. Sh. N. Am., ii, figs. 182, 183.					O	O
P. (*Gyraulus*) *filocinctus*, P. & F. Pilsbry & Ferriss, Proc. Philad. Acad., 1906, pl. ix, figs. 1–3.						O
P. (*Segmentina*) *armigerus*, Say Gould, Invert. Mass., 1841, fig. 138.					?	O
P. (*Segmentina*) *Mojavensis*, n.sp. Pl. viii, fig. 24.			K			
P. (*Hippeutis*) *exacutus*, Say *P. exacutus*, Gould, Invert. Mass., 1841, fig. 137.					O	O
P. (*Hippeutis*) *dilatatus*, Gould *P.* var. *centervillensis*, Hannibal, W. Coast Shells, 1910, pl. ii, fig. 9.				O	O	O
Helisoma (*Planorbella*) *trivolvis* (Say) *Planorbis trivolvis*, Hannibal, loc. cit., figs. 292, 293.				O	O	O
H. antrosa (Conrad) *P. bicarinatus*, Binney, L. and Fw. Sh. N. Am., ii, fig. 205.					R	O
H. (*Perrinilla*) *pabloana* (J. G. Cooper) Not adequately figured.			K			
H. (*Perrinilla*) *Cordillerana*, n.sp. Pl. vi, fig. 16; pl. viii, fig. 34.	K					
Family Pompholigidæ.						
Pompholyx effusa, Lea W. Coast Shells, 1910, pl. ii, fig. 4.				O	O	O

O, present; K, characteristic; R, recorded from elsewhere, but not from this Province.	Early Eocene.	Late Eocene, Oligocene.	Miocene.	Pliocene.	Quaternary.	Living.
Pompholyx (*Carinifex*) *Newberryi* (Lea) . . *Carinifex Newberryi*, Binney, L. & Fw. Sh. N. Am., ii, fig. 120.					O	O
P. (*Carinifex*) *Binneyi* (Meek) . . . . . . *C. Binneyi*, White, 3rd Ann. Rep. U.S.G.S., pl. xxxii, figs. 5–9.	K					
P. (*Carinifex*) *sanctæclaræ* (Hann.) . . . . Pl. vi, fig. 14.				K		
Family PHYSIDÆ.						
Physa fontinalis (L.) . . . . *P. heterostropha*, Binney, L. and Fw. Sh. N. Am., ii, fig. 144.			?	?	O	O
P. fontinalis acuta (Drap.) . . . . *P. osculans*, Binney, loc. cit., fig. 146.			?	O	O	O
P. hypnorum (L.) . . . . *Aplexa hypnorum*, Hannibal, W. Coast Shells, 1910, fig. 296.			?	?	?	O
MELANOIDEÆ.						
Family PLEUROCERIDÆ.						
Ambloxus pliciferus (Lea) . . . . W. Coast Shells, 1910, pl. iii, fig. 10 (normal), fig. 9; text-fig. 297.				O	O	O
A. tenerus (Hall) . . . . (Eocene Goniobases), White, 3rd Ann. Rep. U.S.G.S., pl. xxxi, figs. 1–30.	K					
A. Olequaensis, Arn. & Hann., n.sp. . . . Pl. viii, fig. 27.		K				
Family MELANOPSIDÆ.						
(? *Pachychilus*) *Taylori* (Gabb) . . . . . . *Melania Taylori*, White, 3rd Ann. Rep. U.S.G.S., pl. xxxii, fig. 3.	K					
(? *P.*) *Lawsoni*, n.sp. . . . . Pl. viii, fig. 23.			K			
(? *P.*) *Drakei*, Arn. & Hann., n.sp. . . . . Pl. viii, fig. 26.		K				
RISSOIDEÆ.						
Family AMNICOLIDÆ.						
Amnicola limosa (Say) . . . . Binney, L. and Fw. Sh. N. Am., iii, fig. 166.					O	O
A. micrococcus, Pilsbry . . . . Stearns, Proc. U.S. Nat. Mus., xxiv, p. 286, fig. 4.						O
Paludestrina protea (Gould) . . . . Stearns, loc. cit., pls. xix–xxi.				O	O	O
P. longinqua (Gould) . . . . Stearns, loc. cit., p. 285, fig. 2.				O	O	O

O, present; K, characteristic; R, recorded from elsewhere, but not from this Province.	Early Eocene.	Late Eocene, Oligocene.	Miocene.	Pliocene.	Quaternary.	Living.
Fluminicola virens (Lea) . . . . W. Coast Shells, 1910, fig. 299.						O
F. Modoci, n.sp. . . . . Pl. viii, fig. 30.						O
F. (*Heathilla*) *fusca* (Hald.) . . . . . . W. Coast Shells, 1910, fig. 298.					O	O
F. (*Heathilla*) *seminalis* (Hinds) . . . . . Loc. cit., pl. iii, fig. 12.						O
F. (*Heathilla*) *Merriami*, Pils. & Beech . . . Stearns, Proc. U.S. Nat. Mus., xxiv, p. 286, fig. 5.						O
F. (*Heathilla*) *erythropoma*, Pils. . . . . . . Unfigured.						O
F. (*Heathilla*) *Columbiana*, Pils. . . . . . . Unfigured.						O
F. (*Heathilla*) *minutissima*, Pils. . . . . . . Unfigured.						O
(? *Pyrgulopsis*) *antiqua* (Gabb) . . . . . . *Lithasia antiqua*, White, 3rd Ann. Rep. U.S.G.S., pl. xxxii, fig. 4.	K					
P. Nevadensis (Stearns) . . . . Call & Pilsbry, Proc. Davenport Acad., v, 1886, pl. ii, figs. 1–10.					O	O
P. Yatesiana (J. G. Cooper) . . . . *Amnicola Yatesiana*, Cooper, Proc. Cal. Acad., iv, pl. xiv, fig. 10, 1894.				K		
P. Williamsi, n.sp. . . . . Pl. viii, fig. 29.				K		
Cincinnatia Cincinnatiensis (Anth.) . . . . *A. Cincinnatiensis*, Dall, Alaska, xiii, fig. 87.					O	O
Brannerillus physispira, n.sp. . . . . . . Pl. viii, fig. 28				K		
VIVIPAROIDEÆ.						
Family VIVIPARIDÆ.						
Viviparus (*Callina*) *Turneri*, n.sp. . . . . . Pl. viii, fig. 31.	K					
V. Washingtonianus, Arn. & Hann., n.sp. . . Pl. viii, fig. 32.		K				
Idiopoma Japonica (v. Mart.) . . . . *Viviparus Japonicus*, Pilsbry, Proc. Philad. Acad., 1902, pl. ix, fig. 1.						I
I. (*Cipangopaludina*) *malleata* (Reeve) . . . *Vivipara malleatus*, Hannibal, W. Coast Shells, 1910, pl. iii, fig. 8.						I
VALVATOIDEÆ.						
Family VALVATIDÆ.						
Valvata (*Tropidina*) *tricarinata* (Say) . . . *V. humeralis*, Hannibal, W. Coast Shells, 1910, pl. ii, fig. 6.				O	O	O

GEOGRAPHIC DISTRIBUTION OF THE LIVING CALIFORNIAN FAUNA.

O, regularly present; L, local; I, introduced; S, sporadic; X, extinct; K, characteristic.	Yukon.	Alaska.	Fraser.	Columbia.	Klamath.	Utah.	Nevada.	Coast Range.	Mojave.	Los Angeles.	Colorado.	Arizona.	American.	Extra-limital Provinces. Northern Europe.	Eastern Siberia.	Mexican.
UNIONOIDEÆ.																
Family MARGARITANIDÆ.																
largaritana margaritifera (L.)			S	S	S	S	S	S					O	O	O	
I. margaritifera falcata (Gld.)			O	O	O	O	O	L					L			
Family UNIONIDÆ.																
nodonta cygnea impura (Say)				S	S	O	O	O	O	O	O	O				O
. cygnea (L.)	S	S	O	O	O	S	S	S		I						
. cygnea Beringiana (Midd.)	O	O	O	S												
onidea angulata Haroldiana, Dall.			S	S	S			S		S						
. angulata (Lea)			O	O	O			O		O						
rnoldina dejecta (Lewis)												L				
CYRENOIDEÆ.																
Family SPHÆRIIDÆ.																
phærium corneum (L.)	S	?	S	S									S	S		
. tenue (Prime)	S	?	?	S		S							S			
. patella (Gld.)			S	S									S			
. (Amesoda) simile (Say)			O	O	O	O	O	O	O		O	O	O			
lusculium lacustre (Müll.)			S	S	S	?	?	S	S		?		S	S	S	
I. ovale (Fér.)											?		S	S		
I. partumeium (Say)				?	S	?	?	S					S			
Family CORNEOCYCLADIDÆ.																
orneocyclas (Pisidium) pulchella abdita (Hald.)	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
. Virginica (Gmel.)	S												S			
. pulchella (Jenyns)	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
. compressa (Prime)	S	?	S	S	S	?	S	S	?	L	S	S	S			
. rotundata (Prime)	S												S			
. æquilateralis (Prime)	S												S		S	
. Idahoensis (Roper)	S	?	S	S									S			
. Tremperi, n.sp.									K							
LYMNOIDEÆ.																
Family LYMNÆIDÆ.																
ymnæa stagnalis (L.)	O	O	O	O	O	O	O	L					O	O	O	
. auricularia (L.)	O	O	O	L		O							O	O	O	
. palustris (Müll.)	O	O	O	O	O	O	O	O	O		O		O	O	O	
. Cooperi, n.sp.								K								
. (Galba) truncatula (Müll.)	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	L
. (Galba) obrussa (Say)				O	O	O							O			
. (Galba) solida, Lea	O	O	O	O	O	O	O	O			S		L			
. (Galba) solida Cubensis (Pfr.)					S	S	O	O	O	O	O	O	O			O

O, regularly present; L, local; I, introduced; S, sporadic; X, extinct; K, characteristic.	Yukon.	Alaska.	Fraser.	Columbia.	Klamath.	Utah.	Nevada.	Coast Range.	Mojave.	Los Angeles.	Colorado.	Arizona.	American.	Extra-limi[tal] Provinces: Northern Europe.	Eastern Siberia.	
Family ANCYLIDÆ.																
Gundlachia (Kincaidilla) fragilis (Tryon)								K								
Lanx (Walkerola) Klamathensis, n.sp.					KL											
L. Nuttallii (Hald.)				KL												
L. patelloides (Lea)					KL											
L. subrotundatus (Tryon) . . .				KL												
Lævapex (Ferrissia) caurinus (W. Cooper)			O	O	O	O	O									
Fisherola lancides, n.sp. . . .				KL												
Family PLANORBIDÆ.																
Planorbis (Gyraulus) albus, Müll.	S	S	S	S	S	?		L					O	O	O	
P. (Gyraulus) parvus, Say . .	O	O	O	O	O	O	O	O	O	O	O	O	O	O		
P. (Gyraulus) Liebmanni, Dunker												S				
P. (Gyraulus) filocinctus, Pils. & Fér.												O				
P. (Segmentina) armigerus, Say	S												O			
P. (Hippeutis) exacutus, Say .	S	?	S	L									O			
P. (Hippeutis) dilatatus, Gould .	O	O	O	O	O	O	O	O	O	O		O	O	L		
Helisoma (Planorbella) trivolvis (Say)	O	O	O	O	O	O	O	O	O	O	O	O	O			
H. antrosa (Conrad)			S	S									O			
Family POMPHOLIGIDÆ.																
Pompholyx effusa, Lea				S	O	S	S	L	S							
P. (Carinifex) Newberryi (Lea) .					O		S	L	L							
Family PHYSIDÆ.																
Physa fontinalis (L.)	O	O	O	O	O	O	O	O	S		S		O	O	O	
P. fontinalis acuta (Drap.) . .					S	S	S	O	O	O	O	O	O	O		[illegible]
P. hypnorum (L.)	O			L		O							O	O	O	
MELANOIDEÆ.																
Family PLEUROCERIDÆ.																
Ambloxus pliciferus (Lea) . . .			L	O	O		L	L								
RISSOIDEÆ.																
Family AMNICOLIDÆ.																
Amnicola limosa (Say)						S							O			
A. micrococcus, Pils.									K							
Paludestrina protea (Gld.) . .				S	X	S	S	X	S	X	?	S				S
P. longinqua (Gld.)				L		O	O	O	O	O	?	O				[illegible]
Fluminicola virens (Lea) . . .			L	K												
F. Modoci, n.sp.							KL									
F. (Heathilla) fusca (Hald.) . .						K										
F. (Heathilla) seminalis (Hinds)					O		O									
F. (Heathilla) Merriami, Pils. & Bchr.									K							

O, regularly present; L, local; I, introduced; S, sporadic; X, extinct; K, characteristic.	Yukon.	Alaska.	Fraser.	Columbia.	Klamath.	Utah.	Nevada.	Coast Range.	Mojave.	Los Angeles.	Colorado.	Arizona.	American.	Extra-limital Provinces. Northern Europe.	Eastern Siberia.	Mexican.
luminicola (Heathilla) erythropoma, Pils.									K							
. *(Heathilla) Columbiana*, Pils.				KL												
. *(Heathilla) minutissima*, Pils.				KL												
yrgulopsis Nevadensis (Stearns)							K						O			
incinnatia Cincinnatiensis (Anth.)						S										
VIVIPAROIDEÆ.																
Family VIVIPARIDÆ.																
liopoma Japonica (v. Mart.) .								I								O
(Cipangopaludina) malleata (Reeve)								I								O
VALVATOIDEÆ.																
Family VALVATIDÆ.																
'alvata tricarinata (Say) . . .	S	S	S	S	S	S	S	S	S	?	S	?	S			S

Pelecypoda, 23; *Gastropoda*, 47; total, 70 species and sub-species.

CONCLUDING REMARKS.

While it has been held as brief that unnecessary confusion of the literature should be avoided by the introduction of as few innovations of nomenclature as possible, the fact has not been overlooked that unless some standard code be followed the endeavours of that corps of specialists whose work can only be compared with the wrecking-crew on one of our railroads would shortly render the bulk of the data in these pages wellnigh useless to the lay reader. The problem is less a matter of the retention of certain old names which have been more or less current in the literature, for both consistency and common sense prohibit their use where they have been rendered futile by the application of the genetic classification; rather it resolves itself into permitting the establishment of unfamiliar names for a species several times successively, or establishing one once and, let it be hoped, for all time.

Under the circumstances the writer has given as much care to the selection of the names to be used for the species as in determining their limits and relationships, and only lack of the necessary literature has prevented even more extensive revisions. The provisions and recommendations of the International Code have ordinarily been accepted in deciding upon the validity of names. The frequency that these do not cover the questions at issue has led to the adoption of several additional rules, the more important of which may be noted. The numbers apply to the sections of the Code affected.

IV. The name of a superfamily is formed by adding the ending *oideæ*[1] to the stem of the name of its type genus. Family, subfamily, and superfamily names are subject to the law of priority, and from a nomenclatural standpoint may be regarded as co-ordinate and interchangeable.

XXI. In the instance of a name published by one writer and attributed to another, and it is not clear from the context which author is responsible for the accompanying description, definition, or indication, the publishing author shall be held responsible for the name in all instances except (*a*) where it had been previously used as a *nomen nudum* by the author to whom it is attributed, or (*b*) it is subsequently claimed by the latter author in another publication.

XXV (*b*). Generic names, whether accompanied by a definition or not, under which no species or merely manuscript species are cited or indicated (excluding as a matter of course instances where the diagnosis of a species and genus are given as one), are not formed in accordance with the fundamentals of binomial nomenclature, and have no status under the Code. Such names take status only when reintroduced in the proper manner and from the time of reintroduction.[2]

XXX (iii). If a genus without a definitely designated type contains as an available species one which has been repeatedly mentioned as an illustration, example, or characteristic representative of the genus, said species shall be virtually regarded as type by subsequent designation.

Principal Literature.

Except in a few instances figures, references, or discussions of the species recognized in the preceding pages may be found in the following papers. It is the intention of the writer to supplement this article with detailed studies of each group, amply illustrated, as rapidly as possible.

General Papers.

Dall, W. H. *Land and Freshwater Mollusks of Alaska and adjoining Regions* (Harriman Alaska Expedition, xiii, 1905, pp. 171, 3 plates, and many text-cuts).

An indispensable handbook covering the district north of the 49th parallel. The treatment of the Lymnæidæ and other groups whose metropolis is essentially boreal is far superior to that of any other writer.

Hannibal, H. "Shells of Lakes and Streams," in Keep, *West Coast Shells* (revised edition), December, 1910, pp. 299–318, 3 plates, and several text-cuts.

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[1] T. Gill, Smith. Report for 1896, 1898, p. 480. The termination *oidea*, first suggested in this connexion, is preoccupied by its use as a generic ending, cf. *Cyrenoidea*. *Acea* has appeared in one or two papers, but was originally applied by the Adams as an ordinal termination, and must be suppressed for a group of different rank. There is no apparent reason why it should have been replaced by the current miscellany of names, which furnish a clue to the groups they embrace to the specialist only.

[2] The necessity of this rule in dealing with the Brünnichian and Rafinesquian genera (and some others) is obvious.

Figures and brief accounts of about forty of the more common or peculiar species inhabiting the United States west of the Rocky Mountains. It should be recalled that *Lymnæa obrussa* and *Amnicola micrococcus* as described and figured here are now referred to *L. Cooperi*, n.sp., and *Fluminicola Modoci*, n.sp., respectively.

UNIONOIDEÆ.

SIMPSON, C. T. "Synopsis of the Naiades, or pearly freshwater Mussels": Proc. U.S. Nat. Mus., xxii, No. 1205, pp. 501–1044, 1 plate, 1900.

CYRENOIDEÆ.

PRIME, T. *Monograph of American Corbiculadæ* (Smith. Misc. Coll., No. 145), 1865, pp. 80, many text-cuts.

Written many years ago, but still a standard.

DALL, W. H. [Sphæriidæ] in "Contributions to the Tertiary Fauna of Florida, etc.": Trans. Wagn. Inst., vol. iii (6), pp. 1455–64, 1903.

An excellent revision of the generic classification.

LYMNOIDEÆ.

BINNEY, W. G. *Land and Freshwater Shells of North America.* Part ii: Pulmonata, Limnophila, and Thalassophila (Smith. Misc. Coll., No. 143), 1865, pp. 120, many text-cuts.

A classical work.

MELANOIDEÆ.

TRYON, G. W. J. *Land and Freshwater Shells of North America.* Part iv: Strepomatidæ (Smith. Misc. Coll., No. 253), 1873, pp. 435, many text-figures.

PILSBRY, H. A. [Notes on the Pleuroceridæ] in Pilsbry & Rhodes, "Contributions to the Zoology of Tennessee," No. 4, Mollusks: Proc. Philad. Acad. Sci., 1896, pp. 495–7.

RISSOIDEÆ, VIVIPAROIDEÆ, AND VALVATOIDEÆ.

STIMPSON, W. M. *Researches upon the Hydrobiinæ and allied forms* (Smith. Misc. Coll., No. 201), 1865, pp. 59, and several text-figures.

An excellent account of the anatomical characters of the then known genera of Amnicolidæ.

BINNEY, W. G. *Land and Freshwater Shells of North America.* Part iii [Operculates except Melanoids] (Smith. Misc. Coll., No. 144), 1865, pp. 120, and many text-cuts.

As valuable as the preceding parts of this series by the same writer.

DALL, W. H. [Viviparidæ] in "Contributions to the Tertiary Fauna of Florida, etc.": Trans. Wagn. Inst., vol. iii (2), pp. 332–5, 1892.

PILSBRY, H. A. "Catalogue of the Amnicolidæ of the Western United States": *Nautilus*, xii, pp. 121–7, 1899.

Brief, but the best treatment of the local species of this difficult group extant.

PILSBRY, H. A. "Revision of Japanese Viviparidæ, etc.": Proc. Philad. Acad. Sci., 1902, pp. 115–21, pl. ix.

PALÆOMALACOLOGY.

WHITE, C. A. "Review of the Non-marine Fossil Mollusca of North America": 3rd Ann. Rep. U.S. Geol. Surv., 1883, pp. 403–550, 32 plates.

Contains notices and figures of all the species described to 1882.

CALL, R. E. "On the Quaternary and Recent Mollusca of the Great Basin, with descriptions of new forms": Bull. 11, U.S. Geol. Surv., pp. 66, 6 plates, 1884.

WHITE, C. A. "On marine Eocene, freshwater Miocene, and other Fossil Mollusca from Western North America": Bull. 18, U.S. Geol. Surv., pp. 26, 3 plates, 1885.

COOPER, J. G. "On some Pliocene Freshwater Fossils of California": Proc. Calif. Acad. Sci., ser. II, iv, pp. 164–72, pl. xiv, 1894.

STEARNS, R. E. C. "The Fossil Freshwater Shells of the Colorado Desert, their distribution, environment, and variation": Proc. U.S. Nat. Mus., xxiv, No. 1256, pp. 271–99, pls. xix–xxiv, 1902.

NEW GROUPS PROPOSED IN THIS PAPER.

Those preceded by a † are proposed on fossil forms.

UNIONOIDEÆ.

Quadrulidæ, sub-family Pleurobeminæ, n.sub-fam.
Lampsilidæ, sub-family Propterinæ, n.sub-fam.
Migranaja, n.gen. (*Unio littoralis*, Lam.).
Arnoldina, n.gen. (*Anodonta dejecta*, Lewis).
†*Gonidea*, sub-gen. *Limnobasilissa*, n.sub-gen. (*Margaritana subangulata*, J. G. Cooper).
†*Margaritana* (*Pseudunio*) *Herrei*, sp. nov.
†*Unio transpacifica*, Arnold & Hannibal, n.sp.
†*Gonidea Hemphilli*, n.sp.

CYRENOIDEÆ.

Corneocycladidæ, n.n. (Pisidiadæ, Gray, not available).
†*Sphærium* (*Amesoda*) *Rogersi*, n.sp.
†*S.* (*Amesoda*) *Andersonianum*, n.sp.
†*S.* (*Amesoda*) *Catherinæ*, n.sp.
†*Corneocyclas* (*Pisidium*) *Meeki*, n.sp.
C. Tremperi, n.sp.

LYMNOIDEÆ.

Lymnæidæ, sub-family Acellinæ, n.sub-fam.
Ancylidæ, sub-family Lævapecinæ, n.sub-fam.
Ancylidæ, sub-family Latiinæ, n.sub-fam.
Ancylidæ, sub-family Neoplanorbinæ, n.sub-fam.
Fisherola lancides, n.gen. et n.sp.
†*Zalophancylus Morani*, n.gen. et n.sp.
Lanx, sub-gen. *Walkerola*, n.sub-gen. (*L.* (*Walkerola*) *Klamathensis*, n.sp.).
Gundlachia, sub-gen. *Kincaidilla*, n.sub-gen. (*Ancylus fragilis*, Tryon).
†*Helisoma*, sub-gen. *Perrinilla*, n.sub-gen. (*H.* (*Perrinilla*) *Cordillerana*, n.sp.).
†*Planorbis* (*Segmentina*) *Mojavensis*, n.sp.
Lymnæa Cooperi, n.sp.

MELANOIDEÆ.

Ellipstomidæ, n.fam.
Pleuroceridæ, sub-family Gyrotominæ, n.sub-fam.
†*Ambloxus Olequaensis*, Arnold & Hannibal, n.sp.
†*Pachychilus Lawsoni*, n.sp.
†*P. Drakei*, Arnold & Hannibal, n.sp.

RISSOIDEÆ.

Bulimidæ, n.n. (Bythiniidæ, Tryon, not available).
†*Brannerillus physispirus*, n.gen. et n.sp.

Fluminicola, sub-gen. *Heathilla*, n.sub-gen. (*Paludina seminalis*, Hinds).
F. Modoci, n.sp.
†*Pyrgulopsis Williamsi*, n.sp.
Cincinnatia Binneyana, n.n. (*Paludina obtusa*, Lea, preoccupied).

VIVIPAROIDEÆ.

Viviparus, sub-gen. *Callina*, n.sub-gen. (*Paludina intertexta*, Say).
Idiopoma, sub-gen. *Cipangopaludina*, n.sub-gen. (*Paludina malleata*, Reeve).
†*Viviparus* (*Callina*) *Turneri*, n.sp.
†*V. Washingtonianus*, Arnold & Hannibal, n.sp.
†*Lioplax Andersoniana*, n.sp.

EXPLANATION OF PLATES V–VIII.

With the exception of the *Anodontas* and *Arnoldina* the species illustrated are new or figured for the first time. Characteristic figures of these four have been added owing to the prevailing uncertainty of their identity. Unless the contrary is stated, figures are approximately natural size.

Plates V and VI are reproduced from photographs taken by Mr. John Howard Paine, of Stanford University; Plates VII and VIII from photographs by the writer, through the courtesy of Professor Trevor Kincaid.

PLATE V.

(Issued in Part II.)

1. *Anodonta cygnea impura* (Say). Pond, Elysian Park, Los Angeles, California. p. 125.
2. *A. cygnea impura* (Say) (juvenile). Coyote River, Artesian Belt near San José, California. p. 125.
3. *A. cygnea* (L.). Dalles, Oregon. p. 125.
4. *A. cygnea* (L.) (juvenile). Umpqua River, Elkton, Oregon. p. 125. The individual is just past the *impura* stage at this side. *Cygnea* shows almost unlimited variation in this respect, however.
5. *A. cygnea Beringiana* (Midd.). Lake Hicaman, Alaska. p. 125.
6. *A. cygnea Beringiana* (Midd.) (juvenile). Narrows between Beaver and Alexander Lakes, Admiralty Islands, Alaska. p. 125. The specimen is barely past the *cygnea* stage.
7. *A. cygnea impura* (Say). $\times \frac{3}{2}$. Uvas River, Gilroy, California. p. 125. Collected in July, probably about three months from the glochidium. All three sub-species are ordinarily identical at this size.
8. *A. cygnea* (L.). Glochidium, length 0·35, altitude 0·35 mm. North-east shore of Rhett Lake, near California–Oregon boundary. p. 125.

PLATE VI.

(Issued in Part II.)

9. *Arnoldina dejecta* (Lewis). San Bernardino Rancho, Arizona–Mexico boundary. p. 129.
10. *Gonidea angulata Haroldiana*, Dall (cotype). Coyote Creek, between San José and San Francisco Bay, Artesian Belt, California. p. 127. Through a misunderstanding the original locality was given by Dall as the Guadeloupe Creek. The species formerly occurred there, but was destroyed by sewage about two or three years previous to the time collections sent to the National Museum were made. The variety is not always as large or finely developed as the figure would indicate, but exhibits more or less local variation in this respect.

11. *Sphærium Andersonianum*, n.sp. (type). Length 17·5, breadth 15 mm. Badlands Hills, 1 mile east of Sand Hollow, Oregon. Pliocene. p. 132.
12. *Corneocyclas Meeki*, n.sp. (type, a mould). Length 11, breadth 11 mm. Hill near Hawthorne, on Belmont stage road, Nevada. Early Eocene. p. 135.
13. *Lymnæa Cooperi*, n.sp. (*a*) Type, altitude 11, breadth 5 mm.; (*b*) cotype, altitude 7, breadth 3 mm.; (*c*) cotype, altitude 16, breadth 6 mm. Type and small cotype from spring, Wrights, Santa Cruz Mountains, California; large cotype from Adobe Creek, near Camino Real, Santa Cruz Mountains, California. p. 143.
14. *Pompholyx Sanctaclaræ*, Hannibal. (*a*) Type, altitude 5, breadth 8 mm.; near Los Gatos limestone quarry, Los Gatos, Santa Cruz Mountains, California. (*b*) Specimen from Telephone Hills, near McKittrick, California. Pliocene. p. 163.
15. *Zalophancylus Morani*, n.sp. (type). Max. diameter 9, min. diameter 7, altitude 3·5 mm. Badlands Hills, 1 mile east of Sand Hollow, Oregon. Pliocene. p. 152.
16. *Helisoma Cordillerana*, n.sp. (type, a mould, viewed from beneath). Diameter 22 mm. Hill near Hawthorne, on Belmont stage road, Nevada. Early Eocene. p. 161.

PLATE VII.

17. *Margaritana Herrei*, n.sp. (type, mould and partial cast in limonite of imperfect pair of valves). Length (estimated) 115, breadth 40 mm. One-quarter of a mile above Carnegie Pottery plant in cut along Western Pacific Railway, Corral Hollow, Tesla, California. Late Eocene. p. 121.
18. *Unio transpacifica*, Arn. & Hann., n.sp. (*a*) Type, length 58, breadth 30 mm.; (*b*) cotype, a slightly imperfect pair from which the shell matter has been cut away, exposing the impressions of the hinge-teeth, length 70, breadth 36 mm. Bluffs along Olequa Creek at shoals 1½ miles above Little Falls, Washington. Late Eocene. p. 123.
19. *Gonidea Hemphilli*, n.sp. (type). Length 31, breadth 14 mm. Water tunnel, head of Telegraph Cañon, Berkeley Hills, California. The specimen is the mould of one valve and a portion of another (not shown in figure) in coarse sandstone. Miocene. p. 128.
20. (? *Sphærium*) *Catherinæ*, n.sp. (type). Length 5, breadth 3·8 mm. Hill near Hawthorne, on Belmont stage road, Nevada. The specimen is the mould of both valves in marl. Early Eocene. p. 132.
21. *S. Rogersi*, n.sp. (type, a limonite cast). Length 20, breadth 14·5 mm. One-quarter of a mile above Carnegie Pottery plant in cut along Western Pacific Railway, Corral Hollow, Tesla, California. Late Eocene. p. 131.
22. *Corneocyclas Tremperi*, n.sp. (type). Length 1·4, breadth 1·3, depth of valve 1 mm. Bluff Lake Cienaga, San Bernardino Mountains, California. p. 137. The figure is greatly enlarged; the species is one of the smallest Corneocyclads.

PLATE VIII.

23. *Pachychilus Lawsoni*, n.sp. (type). Length 27, breadth 10 mm. Near Bald Peak, Berkeley Hills, California. Miocene. p. 183.
24. *Planorbis Mojavensis*, n.sp. (type). Diameter 9·5 mm. (*a*) View from above; (*b*) umbilical view, enlarged somewhat more than (*a*). Near Barstow, Mojave Desert, California. Miocene. p. 157.
25. *Lanx Klamathensis*, n.sp. (*a*) Type, max. diameter 11, min. diameter 7·5, altitude 3 mm.; (*b*) cotype, max. diameter 16, min. diameter 9·5, altitude 3·5 mm. Near Government Irrigation Dam, Upper Klamath Lake, Oregon. p. 149.

26. *Pachychilus Drakei*, Arn. & Hann., n.sp. (type). Altitude 45, breadth 14 mm. Bluffs along Olequa Creek at bend below Little Falls, Washington. Late Eocene. p. 183.
27. *Ambloxus Olequaensis*, Arn. & Hann., n.sp. (type). Altitude (estimated) 32, breadth 9·5 mm. Bluffs along Olequa Creek above shoals 2 miles north of Little Falls, Washington. Late Eocene. p. 178.
28. *Brannerillus physispira*, n.sp. (type). Altitude 2·6, breadth 3·3 mm. Marl 'reefs' near mouth of gulch, south of Medallion One Cañon. Kettleman Hills, near Coalinga, California. Pliocene. p. 191.
29. *Pyrgulopsis Williamsi*, n.sp. (*a*) Type, altitude 8·5, breadth 7 mm.; (*b*) cotype, altitude 7, breadth 6·3 mm.; (*c*) cotype, altitude 8·7, breadth 7 mm. Martin & Dudley's oil-well, Lost Hills, San Joaquin Valley, California. Pliocene. p. 189.
30. *Fluminicola Modoci*, n.sp. (type). Altitude (estimated) 5, breadth 3·2 mm. Fletcher's Spring, south end of Goose Lake, California. p. 187.
31. *Viviparus Turneri*, n.sp. (type, a mould in quartzite). Altitude 32, breadth 26 mm. Near coal-mine, Silver Peak Range, Nevada. Early Eocene. p. 193.
32. *V. Washingtonianus*, Arn. & Hann., n.sp. (type). Altitude 20, breadth 15 mm. Bluffs along Olequa Creek above shoals, 2 miles north of Little Falls, Washington. Late Eocene. p. 194.
33. *Lioplax Andersoniana*, n.sp. (type, a limonite cast). Altitude 21, breadth 11 mm. Cut along Western Pacific Railway, one-quarter of a mile above Carnegie Pottery plant, Corral Hollow, Tesla, California. Late Eocene. p. 196.
34. *Helisoma Cordillerana*, n.sp. (type, viewed from above). See pl. vi, fig. 16. p. 161.
35. *Fisherola lancides*, n.sp. (*a*) Type, max. diameter 6, min. diameter 3·8, altitude 1·2 mm., viewed from above; (*b*) cotype, max. diameter 5·5, min. diameter 4, altitude 1·2 mm., viewed from beneath. Snake River, Washington. p. 152.

Footnote to p. 197.

Since the first portion of this paper was written additional studies have shown that the fauna of the Columbia System is not homogeneous. That inhabiting the Columbia basin above the Dalles, characterized by *Sphærium corneum* and *tenue*, *Corneocyclas Idahoensis*, *Lymnæa auricularia* and *stagnalis*, *Lanx Nuttalli*, *Fisherola lancides*, *Planorbis exacutus*, *Pompholyx effusa*, *Physa hypnorum* (probably), *Fluminicola Columbiana* and *minutissima*, is more closely allied to the faunas of the other systems flanking the Rocky Mountains, while the fauna of the lower Columbia River and coast streams, peculiarized by *Lanx subrotundatus* and *Fluminicola virens*, groups better with the coastal systems.

The name Columbia System originally covered all territory north to Southern Alaska, but has been so restricted and warped as to have assumed an entirely different meaning, and for either of these divisions is hardly appropriate, so may be abandoned. The upper Columbia basin, known locally as the 'Inland Empire Country', may take the name *Inland Empire System*, and the coastal district the name *Willamette System*.

ORDINARY MEETING.

Friday, 10th May, 1912.

R. Bullen Newton, F.G.S., President, in the Chair.

Mr. W. R. B. Oliver was elected a member of the Society.

The following communications were read:—

1. "A Synopsis of the Recent and Tertiary Freshwater Mollusca of the Californian Province" (continuation). By Harold Hannibal.
2. "On *Dosinia lucinalis* (Lam.) and its synonyms." By A. J. Jukes-Browne, F.R.S., F.G.S.
3. "New Generic Names and New Species of Marine Mollusca." By Tom Iredale.

Mr. B. B. Woodward exhibited five species of *Baicalia* from Lake Baikal.

Mr. C. Hedley exhibited a species of *Cassidula* from Cooktown, Queensland, and suggested that it approached nearer to Martyn's figure of *C. nucleus* than do forms from New Caledonia and other localities which had hitherto been identified as that species. He pointed out that the genus being unknown in the Eastern Pacific, the habitat 'Otaheite' ascribed to it by Martyn was undoubtedly erroneous, and that if, like so many of Martyn's shells, it was collected by Captain Cook, it would not at all be improbable that it had been procured when the *Endeavour* was repaired on Cooktown Beach.

ORDINARY MEETING.

Friday, 14th June, 1912.

R. Bullen Newton, F.G.S., President, in the Chair.

Mr. Loftus St. George Byne and Dr. Stephen Gaal were elected members of the Society.

The following communications were read:—

1. "On a collection of Land and Freshwater Mollusca from Java." By M. M. Schepman.
2. "Descriptions of thirty-three New Species of Gastropoda from the Persian Gulf, Gulf of Oman, and North Arabian Sea." By J. C. Melvill, M.A., D.Sc.
3. "Note on the generic name *Pectunculus*." By Dr. W. H. Dall.
4. "Note on some Helicoids from New Guinea." By G. K. Gude, F.Z.S.
5. "Remarks on the Evolution of the Recent Marine Molluscan Fauna in the Newer Tertiary Rocks of India." By E. W. Vredenburg, F.G.S.

The late Rev. R. Ashington Bullen, B.A., F.L.S., exhibited the following specimens:—*Helicella Pisana* from the Lido, Venice, showing supposed hybrid characters; the animals when alive were dark in colour resembling *H. virgata*. *Clausilia bidens* from Torcello, Italy, with two mouths. *Otala vermiculata*, also from Italy, eaten by rodents, the epiphragm formed previous to hibernation having been partly removed. Dark banded and albino forms of the *Otala vermiculata* found living on the same food-plant. *Helix aspersa*, with unusually elevated spire, from Fiesoli.

ON *DOSINIA LUCINALIS* (LAMK.) AND ITS SYNONYMS.

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

Read 10th May, 1912.

This species was first described by Lamarck in 1818 (*Anim. sans Vert.*, vol. v, p. 572) under the name of *Cytherea lucinalis*, and it was figured by Delessert in 1841 (*Recueil Coquilles*, Lamk., pl. ix, figs. 2*a–c*). Still later a specimen, but apparently not the type as figured by Delessert, was represented in Chenu's *Illustrations Conchyliologiques* (vol. ii, pl. x, figs. 3–3*b*). None of the later writers, however, such as Hanley, Philippi, Sowerby, Reeve, or Römer, seem to have seen a specimen which they could identify with Lamarck's shell.

Hanley in his *Catalogue of Recent Bivalve Shells*, p. 101, published in 1843, gave a translation of Lamarck's description, with the additional statement that it was ornamented with "minute uninterrupted longitudinal lineoles". This he probably inferred from Delessert's figure, a copy of which he gave in his pl. xiii, fig. 30. Römer, writing in 1862, remarks that apart from these figures and the short description given by Lamarck "the species is quite unknown and seems only to exist in Lamarck's collection".

Meantime, however, G. B. Sowerby, in his *Thesaurus Conchyliorum* of 1852 (vol. ii, p. 673, pl. cxliv, figs. 71, 84), described a shell under the name of *Artemis striatissima*, which he believed to be a new species, and certainly he could hardly have identified it with *lucinalis*, because Lamarck said nothing about radiating striæ, and his type had a reddish tint on the umbonal region, whereas Sowerby's shell was white.

Recently a shell came into my possession which agreed so nearly with the description and figure given in Hanley's Catalogue that I thought it must be a specimen of *D. lucinalis*, in spite of its being white with only a yellowish tint on the disc. The only way to settle the matter was to have it compared with the type in the Geneva Museum of Natural History. Dr. E. F. Weber of that Museum having kindly consented to make the comparison, the shell was forwarded to him, and in returning it he writes: "c'est bien *Dosinia lucinalis* (Lamk.), cependant il est à remarquer que dans votre exemplaire le sinus palléal est plus large, plus obtus que dans le type, et que la coloration interne de l'individu de Lamarck est d'un brun foncé."

On reporting this result to Mr. E. A. Smith, he drew my attention to the fact that the white *D. striatissima* of Sowerby must be very similar to my specimen of *D. lucinalis*, since both have a sculpture of radiating striæ and a similar wing-like elevation of the escutcheon area. The shell was therefore sent to Mr. Smith for comparison with Sowerby's type in the British Museum, and he writes "your specimen is so exactly like the type of *D. striatissima* that if I got them mixed I should not be able to say which was which".

Moreover, Mr. Smith found that there was another shell in the Museum Collection which agreed in every essential respect with the *lucinalis* and *striatissima*; this was a shell in Cuming's collection which had been described by Römer under the name of *D. amethystina*.[1] There is a full description of this shell in Römer's monograph of *Dosinia* (*Novitates Conch.*, Abt. ii, Suppl., p. 80, Cassel, 1862), but he never figured it. The description might be one of *lucinalis* or *striatissima*, except that, instead of being white, it is described as "violascente albida, ad umbonum regionem amethystina", and also that the pallial sinus is rounded at the end. Mr. Smith, however, is of opinion that these are merely varietal characters, and that the shell described by Römer is undoubtedly a variety of *D. lucinalis*.

Thus the identification of my shell with the types of *lucinalis*, *striatissima*, and *amethystina* becomes a matter of some importance, because it not only establishes the identity of three species which were supposed to be different, but shows that Lamarck's shell was not the unique specimen that Römer imagined it to be, and also reveals the fact that it is a form which varies much in colour.

Under these circumstances it seems desirable to give a more complete description of *D. lucinalis* than has yet been published, and I think the following will be found to include all the characters which are of any real importance.

Dosinia lucinalis (Lamk.).

Testa solida, ad figuram fere circulari, alt. 24–8, lat. 24–8 mm., sub-convexa, inæquilaterali; umbonibus parvis, obtusis, incurvatis; lineis elevatis, tenuibus, confertis, subtiliter nodulatis, ex umbonibus radiantibus ornata, et liris concentricis, erectis, distantibus cincta; lunula lanceolata, valde impressa, in medio prominente; area posteriori lanceolata, marginibus angulatis limitata, medio in alæ formam labiis prominentibus surrecta, inter et subter quæ ligamentum vix conspicuum videtur.

Colore variabili, interdum omnino alba, interdum in parte vetustiori colore melino, vel amethystino, vel rubido tincta. Pagina interna alba, vel amethystina, vel rubida; sinu palliari profundo, ascendente, in extremitate anteriori rotundato vel obtuse angulari; lamina cardinali valida, latissima, dente laterali in valva dextra, papilliformi, rugoso; dente cardinali mediano crasso, rugoso; dentibus in valva sinistra normalibus. Valva dextra margine posteriori strige vel sulco angusto, brevi sed profundo, inciso.

Shell solid, nearly circular in outline, measuring from 24 to 28 mm. both in height and in width; moderately convex, inequilateral, with small, obtuse, incurved umbones; ornamented with numerous fine raised lines or riblets, which radiate from the umbones, and are crossed by less numerous concentric ridges or lamellæ, as well as by fine striæ, which give them a wavy or nodulated appearance. Lunule lanceolate, deeply impressed, with pouting lips; escutcheon rather narrow, defined by angular inflexions, and rising along the median

[1] Proc. Zool. Soc. Lond., 1860, p. 118.

line into an arched wing-like prominence above the ligament, which latter is just visible between its lips.

In colour the shell is variable, being sometimes entirely white, sometimes tinged with pale yellow, or pale violet or red on the older part of the shell. The internal surface is either white, violet, or reddish-brown, the hinge-plate strong, bearing on the right valve a roundish rugose anterior lateral, and the middle cardinal is also thick and rugose; the teeth of the left valve are normal. Pallial sinus deep, ascending, sometimes rounded, and sometimes bluntly angular at the anterior end. The right valve has a short but deep groove on the posterior margin.

This species is distinguished from all others by the fine longitudinal radiating riblets which cover its surface and are irregularly nodulated by very fine concentric incised lines or striæ. In size, shape, concentric sculpture, and dentition *D. lucinalis* much resembles *D. histrio*, but the escutcheon area is very different. The elevation of this area into a wing-like projection is not a character of more than specific importance. Other species show it in a less degree, such as *D. pubescens*, *D. Japonica*, and *D. prostrata*, and the degree of elevation varies even in the same species.

With respect to habitat, this also can now be established. The locality given by Lamarck is the island of St. Thomas, but this was probably a mistake. The locality of Sowerby's type of *D. striatissima* was unknown, but that of *amethystina* is given as Australia, and Mr. Smith informs me that the British Museum also possesses a specimen of *striatissima* (i.e. the white variety) from the Monte Bello Islands (West Australia), collected and presented by Mr. T. H. Haynes, so there can be no doubt what part of the world is the real home of this interesting species.

NEW GENERIC NAMES AND NEW SPECIES OF MARINE MOLLUSCA.

By Tom Iredale.

Read 10th May, 1912.

PLATE IX.

To this periodical I have already contributed papers originated through the study of a collection of shells made at the Kermadec Islands, and in this essay I describe a few of the novelties there obtained, and also propose some new generic names. The determination and description of new specific forms is a necessary evil, but the attempt to generically place even common shells seems to be an unnecessary evil to the majority of writers, and one which has been constantly neglected. I noted (this periodical, vol. ix, p. 70): "Furthermore I have found great difficulty in generically locating such well-known species as *Drupa*(?) *chaidea*, Duclos, and *Galeropsis*(?) *monodonta*, Quoy & Gaimard." Prolonged study has convinced me of the inaccuracy of the continued attachment of the preceding, with others, to genera with which they have little in common, and I later wrote (vol. ix, p. 320): "In recent years scarcely any scientific worker has described a new minute shell without carefully detailing the apical characters, and using them for classificatory purposes. Yet these same workers have been content to class larger well-known shells in an almost Linnean fashion."

In attempting to work through this collection I have been impressed with factors that have militated against the accurate and easy determination of the Indo-Pacific Marine Mollusca: firstly, the lack of series, showing variation, from almost any locality, and especially the almost entire absence of individuals showing the juvenile characters: this is most noticeable when it is realized that the majority of the common littoral Indo-Pacific molluscs are so abundant that long series of many forms could be easily obtained in a single day, covering most stages from the very young to adult. We are thus ignorant of the juvenile stages of very many of the commonest molluscs, and know the development only in rare cases, and until such are fully known all our higher groupings must be most imperfect, and in many cases also inaccurate. Secondly, it is no longer a possibility to correctly work out such a collection as mine without practically monographing each genus, more certainly as the monographs in the earlier volumes of Tryon's *Manual of Conchology* are useful only as works of reference to literature, the malacological matter being quite unreliable. I am convinced that all future workers, to produce any lasting results, must undertake monographic studies, and moreover must study series, note variation, also determine the sub-species from such series, and discriminate between species, sub-species, and varieties. I foresee the time when there will be more genera, fewer species, and more sub-species, with entire elimination of varieties. These latter may interest non-scientific workers, but serious students should never name such. Unfortunately, though I have, in the majority of cases, long series from the Kermadecs, the previously named molluscs with which comparisons have been instituted are represented by odd specimens only.

Since this note was written my views have received quite unexpected confirmation by the study of series of *Janthina*.

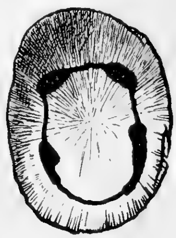
Roya, n.gen.

Roya Kermadecensis, n.sp. Pl. IX, Fig. 10.

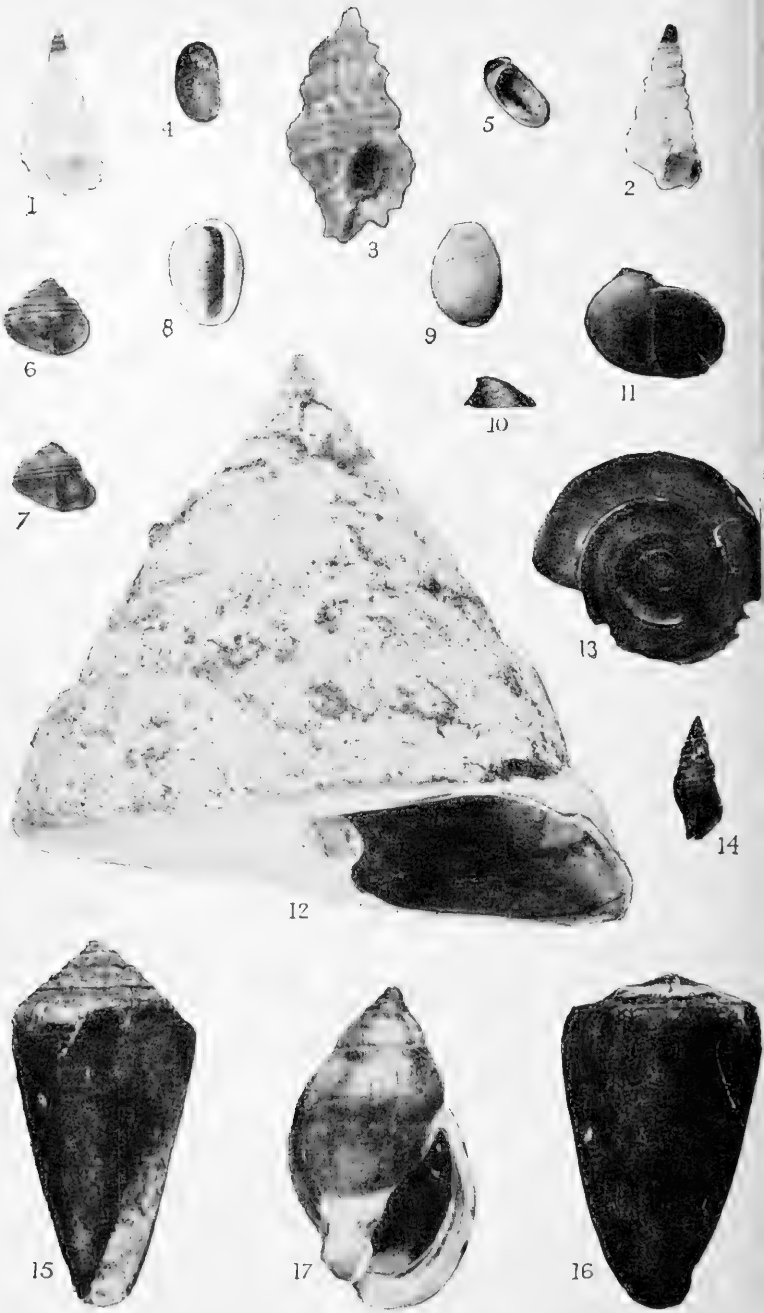
Shell thin, conical, bilaterally symmetrical, broadly ovate, anterior slope long, arched, posterior slope steep, scarcely concave. Apex at about four-fifths its length, nucleus anastrophic, almost immersed by last whorl. The muscular impression is horseshoe-shaped, symmetrical, but composed of two portions: a semicircular broad scar ending in an enlargement, and then on each side continued by a narrow line; these lines meet obliquely-set oval scars, which are connected by a narrow line. This muscular impression is invisible in dead shells, which are translucent. These are pale rufous, sometimes rayed with a darker colour; there is no apparent sculpture save growth-lines. The live shell is clothed with a fine green epidermis. Length about 5·5, breadth 3·5, height 3 mm.

Radula: Like that of *Gena* (Gwatkin).

Hab.—Sunday Island, Kermadec Group.



Externally this shell agrees very well with *Capulus nutatus*, Hedley (Proc. Linn. Soc. N.S.W., vol. xxxiii, p. 467, pl. ix, figs. 15–16, 1908). Upon comparison with the type of that species Mr. Hedley and I agreed it was inseparable as far as external conchological characters were observed. The muscle-impression of the shell, and the animal of *C. nutatus* are yet unknown. In the British Museum is the type of *Tectura radiata*, Pease (Proc. Zool. Soc. Lond., 1860, p. 437) from the Sandwich Islands. This seems to be another species of this genus. Yet this shell was at one time accepted as identical with *Williamia Gussoni*, Costa, by such an authority as Mr. E. A. Smith (Proc. Zool. Soc. Lond., 1890, p. 296), judging from conchological features alone. But *W. Gussoni*, Costa, belongs to the Siphonariidæ, whilst my shell does not. I am therefore doubtful of the correctness of merging specifically my shell with *Capulus nutatus*, Hedley, in view of the fact that animals of similar shells have proved



MOLLUSCA FROM THE KERMADEC ISLANDS.

so very different, and I have therefore taken the extreme course of differentiating the Kermadec shell, until the muscle-impressions of *C. nutatus* are made known. This, moreover, appears to be necessary, as my generic characters depend upon the animal and muscle-impressions, and I could not accurately name, as type, a shell in which they are *not* known to exist. Probably this is the shell recorded by Melvill & Standen (Journ. Conch., vol. viii, p. 414, 1897) from Lifu, as *Williamia radiata*, Pease, which they placed in the family Acmæidæ!!

This and the following genus are named in honour of my friend Mr. Roy Bell, whose aid in investigating the Kermadec Mollusca I wish to commemorate.

Royella, n.gen. Pl. IX, Figs. 1, 2.

I propose this generic name for the shell described as *Cerithium clathratum* by Sowerby in the *Thes. Conch.*, vol. ii, p. 883, pl. 185, fig. 258, 1855, from the Island of Bohol, and whose name was changed to *C. sinon* (Fig. 1) by Bayle in the Journ. de Conch., vol. xxviii, p. 243, 1880. When recorded from Lifu by Melvill & Standen (Journ. Conch., vol. viii, p. 116, 1895), it was transferred to *Cerithiopsis*. When I noted its history as above in these Proceedings, vol. ix, p. 320, I observed: "I don't know where to generically locate this shell, but it is certainly neither a *Cerithium* nor a *Cerithiopsis*." Further research has shown its distinctness from previously described generic forms, so I have been compelled to erect a genus for its reception. I might add I have seen other forms which appear to be congeneric. (Fig. 2, species undescribed.)

The shell is long, narrow, many-whorled, and tuberculate; apex long, sinusigeral, and pink, whilst the main shell is white; aperture circular, with a short distinct recurved canal. Operculum horny, multispiral; nucleus central.

The operculum of *Cerithiopsis* is said to be "paucispiral, somewhat concave, with three or four whorls, rather translucent and smooth outside" (Dall, Bull. Mus. Comp. Zool., vol. xviii, p. 252, 1889), whilst that of *Bittium* agrees better with this, but the shell characters at once separate *Royella* from *Bittium*. The shells usually assigned to *Cerithiopsis* and *Bittium* are of diverse generic types, and may be separated by means of the characters of their apices. I would recognize *Joculator*, Hedley, as fully worthy of generic rank, not accepting the conservative view taken by its author.

Brookula, n.gen.

In the Trans. New Zeal. Inst., vol. xl, p. 382, 1907 (1908), I recorded as recent a shell described from the Pliocene as *Scalaria corulum* by Hutton (op. cit., vol. xvii, p. 322, 1884 (1885)), and concluded: "Having carefully compared specimens, there is no doubt it is congeneric with *Cyclostrema angeli*, Ten.-Woods, and for the present the best location is in the genus *Cyclostrema*."

Since then I have examined quite a number of species which are congeneric; some were described as *Rissoa*, others as *Scala* or

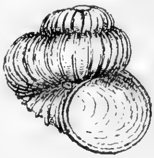
Scalaria, and most as *Cyclostrema*. The first two genera being generally abandoned, the last proves to be quite as unsuitable. Miss K. Bush, in the Trans. Conn. Acad., vol. x, pp. 97 et seq., 1897, published a Revision of the Cyclostrematids and allied genera, and, though she introduced several new genera, these species cannot be accurately placed in any. I therefore propose the genus *Brookula*, and name as type the following new species, *B. stibarochila*.

Brookula stibarochila, n.sp.

Shell minute, globosely turbinate, perforate, glassy, transparent. Whorls four. First whorl and a half unsculptured, the succeeding whorls bearing sloping axial laminæ, the interstices crossed with fine regular striæ. On the last whorl fifteen lamellæ are present, the last forming the outer edge of the aperture. Aperture circular, continuous. Umbilicus narrow and deep.

Measurement of type: Height 1·25, breadth 1 mm.

Hab.—Sunday Island, Kermadec Group.



To this genus I would refer *Cyclostrema conicum*, Watson (Chall. Reports, Zool., vol. xv, p. 122, pl. viii, figs. 9*a–c*); *angeli*, T.-Woods; *corulum*, Hutton; *crebrisculptum*, Tate; *denselaminatum*, Verco; *Nepeanensis*, Gatliff, etc.

The genus is named after Mr. W. R. Brook Oliver, my collecting companion for many years, and one of the members of the Kermadec Islands Expedition.

Jeannea, n.gen.

Shell fusiform, the spire equalling the aperture in length; aperture oval; columella smooth; outer lip thick, but not denticled; canal short, recurved. Protoconch turbinate, two-whorled, unsculptured. Operculum leaf-shaped, nucleus apical.

Type, *J. Hedleyi*, n.sp.

Jeannea Hedleyi, n.sp. Pl. IX, Fig. 14.

Shell small, fusiform, solid. Characters as above. Adult whorls five. Colour reddish-fawn with darker markings. Sculpture commences with longitudinal ribs, which are well marked on the first two whorls and fade away subsequently, not showing at all on the last whorl. Spiral threads commence at the same time, but these persist throughout, the last whorl showing two major ones above the aperture, and seven equally spaced can be counted on the outer lip. Between these are minor threads; on the last whorl three being seen between each major thread. In some shells these are faintly nodulous, and the higher two major threads are farther apart, and between them are five to eight minor threads.

Measurements of type: Length 12, breadth 5 mm.

Hab.—Sunday Island, Kermadec Group.

The animal examined alive was of a white colour; eyes sessile as black specks; propodium square, whilst the radular characters are such that it might be referable to *Cantharus* or *Pisania*.

Quoyula, n.gen.

This is introduced for the shell described by Quoy & Gaimard as *Purpura monodonta* (Voy. de l'Astrol. Zool., vol. ii, p. 561, pl. xxxvii, figs. 9, 10, 1833) from Tongatabu. I have given the history of its wanderings from *Coralliophila* through *Rhizochilus* and *Galeropsis* back to *Coralliophila* (these Proceedings, vol. ix, p. 76, 1910). I was inclined to let it stay in *Coralliophila* through the prejudice of the Sinusigera apex, but study of this shell with the other forms assigned to that genus has convinced me of the impropriety of so doing, and the only course open is to separate it.

Coralliophila was introduced by H. & A. Adams in the *Genera Recent Mollusca*, vol. i, p. 135, 1853, as a sub-genus of *Rhizochilus*, and, though sixteen species were named as members of the genus, no type was selected. Dall (Bull. Mus. Comp. Zool. Harv., vol. xviii, p. 217, 1889) noted this, and remarked that *C. madreporarum* could not be accepted as type, as it was not one of the original members of the sub-genus, but made no designation of type, adding "the true *Coralliophila* has been renamed *Pseudomurex*". Cossmann (Essais Paléoconch. comp., Livr. v, p. 83, 1903) has named as type "*Purpura neritoidea*, Lamk." In Adams' List is a "*neritoideus*, Chem.", so I would fix this as type. With this species I do not consider Quoy & Gaimard's *P. monodonta* congeneric, neither do I now accept *P. madreporarum*, Sowerby (*Gen. Rec. Fossil Shells*, vol. ii, pl. 237, fig. 12, 1834) as conspecific with the latter. When looking up this I noticed a footnote reading, "Since the above was written Mr. Gray has separated the last-mentioned shells from *Purpura*, under the generic appellation of *Pollia*." This refers to the sentence "*Triton undosus* of Lam.: we suggest the probability of its forming a well distinguished genus in union with several other cognate species". In the British Museum copy of Sowerby's work Mr. Edgar A. Smith has noted that *Pollia* was not published by Gray until 1839 in the Zoology of Beechey's Voyage; this latter has generally been quoted as the first entrance of *Pollia*, whereas Sowerby's note has five years priority. Moreover, the type (by monotypy) of *Pollia*, Sowerby, 1834, is *T. undosus*, Lam., so that *Tritonidea*, Swainson, 1840, would become an exact synonym, though probably both fall as equivalent to *Cantharus*, Bolten, 1798.

Heterorissoa, n.gen.

Shell minute, rissoid, smooth and shining, thin, glassy, transparent. Aperture broadly oval, peritreme thin, not continuous. Operculum semilunar, horny, concentric, with a lateral nucleus: inner edge thickened, with an internal rib from the nucleus, but no projecting rib.

Type, *Heterorissoa secunda*, Iredale.

This genus apparently takes the place of *Jeffreysia* in the Southern Hemisphere; in shell characters it agrees very closely with that

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genus, but the operculum differs in lacking the projecting rib. The shell recently described as *J. Wilfridi* (Gatliff & Gabriel, Proc. Roy. Soc. Vict., vol. xxiv, p. 188, pl. xlvi, fig. 3, 1911) I would consider to belong to my genus, also *J. Edwardiensis*, Watson (Chall. Rep. Zool., vol. xv, p. 584, pl. xliii, fig. 5, 1886), from Prince Edward Island.

Thais, Bolten.

In this Journal, vol. ix, p. 322, 1911, I indicated my interest in the generic treatment of the molluscs formerly classed under *Purpura*, Bruguière, but now known by the name of *Thais*, Bolten. At that time I was unaware that the group had been recently discussed by Dall (Dep. Int. U.S. Geol. Surv., Prof. Paper No. 59, 1909), and it was therefore with much interest that I studied his results. I hope to more fully deal with the conclusions there arrived at, but would here give expression to some points whereon I consider amendment possible. Before proceeding further I would express my deep gratitude for the great work which Dr. Dall is still doing; putting on record valuable synthetic papers, whereby analysis is made possible to those who are not skilled in the more difficult task of synthesis.

I have already definitely concluded that the juvenile stages of molluscs must be studied before generic groups can be considered stable. Though Dall has studied the animals, and found little variation, I do not find in his paper any notice having been taken of the earlier stages, and consequently in his treatment of the New Zealand and Australian Thaitids I find disagreement with my own studies.

Dall recognizes *Lepsia*, Hutton, proposed for *Purpura haustrum*, Martyn, as of sectional value, under the sub-genus *Thais*. The method of classing the Thaitids, as one genus only, I consider improper, and the four sub-genera seem absolutely artificial. The skeletal nature of Dall's system is most perplexing to the Austral student who finds no place for his most common friends. For instance, take the group

I mentioned (loc. cit., p. 321) as converging round *Thais succincta*, Lam. The only name I know of as being based on any of those there mentioned is *Agnewia*, Ten.-Woods, proposed for *Purpura tritoniformis*, Blainville. This is included in the general synonymy of *Thais* by Dall, but of what section or sub-genus he considers it a synonym in particular I am unable to say. Consequently I do not know where Dall would place any of our Australian Thaitids, save *T. haustrum*, Martyn, and *T. amygdala*, Kiener. Having carefully examined all the names noted by Dall as referable to these Thaitid molluscs, I propose *Lepsiella*, n.gen., with type *Purpura scobina*, Quoy & Gaimard, and *Neothias*, n.gen., with type *Purpura Smithi*, Brazier, and will fully discuss their relationships and status in another place.

Melarhaphe, Menke.

This would appear to be the generic name to be used for the Australian species grouped round *Littorina mauritiana*, Lamarck. In the Proc. Roy. Soc. Tasm., 1908 (1909), p. 56, W. L. May accepted *Litorina*, Menke, 1828, concluding that Férussac's introduction of *Littorina* was unrecognizable as being that of a nude name only. He acknowledged that this acceptation was due to Mr. Hedley's suggestion. My own interpretation of Férussac's proposal was that *Littorina* was legitimately introduced by that author, and, moreover, that the type of that genus was *L. obtusata*, Linné, as fixed by Rang (*Man. Mollusques*, 1829, p. 185) under the name *L. littoralis*. I am glad to note that Dall (Dept. Int. U.S. Geol. Surv., Prof. Paper No. 59, 1909, p. 79) had anticipated me in arriving at the same conclusion. The type of *Littorina* is quite unlike the Austro-Neozelanic shells known under that name, and the name to be used for those is *Melarhaphe*. Commonly quoted as of Mühlfeldt, this name was introduced into literature by Menke (Synops. meth. Moll., 1828, p. 23) thus: *Paludina glabrata*, Zgl. (*Turbo cærulescens*, Lam., *T. rupestris*, Chabr., *Melarhaphe glabrata*, Mhlfld.). The first reference is also to a manuscript name, as the only publication of Ziegler's name is by Pfeiffer in the Nat. Deutsch. Land u. Sudw. Moll., part iii. p. 46, pl. viii, figs. 9–10, 1828. This shell has been identified as *Littorina neritoides*, Linn., of which *Turbo cærulescens*, Lam., is also considered a synonym. When Quoy & Gaimard described their *Littorina Diemenensis* (Voy. de l'Astrol. Zool., vol. iii, p. 479, 1835) they compared it specifically with *L. cærulescens*, Lamarck, so that there need be no hesitation in using *Melarhaphe* for such shells.

Penion, Fischer.

The Austro-Neozelanic marine molluscan group commonly referred to as *Siphonalia* must bear this generic name.

Siphonalia was introduced by A. Adams (Ann. Mag. Nat. Hist., ser. III, vol. xi, p. 202, 1863) for a number of Japanese shells, of which *Buccinum cassidariæforme*, Reeve, is the first species, and should be taken as type; the others are mostly congeneric with this. This shell has little relationship with the New Zealand 'Fusoid' shells, and *Siphonalia* cannot be used for the latter.

Tryon (Man. Conch., vol. iii, p. 135, pl. liv, fig. 355, 1881) described an Australian shell as *Siphonalia maxima*. This was transferred to *Megalatractus* by Kesteven (Mem. Austr. Mus., vol. iv, pp. 419 et seq., 1904), but *Siphonalia maxima* is absolutely congeneric with *S. dilatata*, Quoy & Gaimard, and these should not be classed with *Megalatractus*. I will give full details confirming this conclusion in another place.

Kobelt introduced *Austrofusus* (Küster's *Conch. Cab.*, 1881, p. 127) for a number of Fusoid shells, including the Austro-Neozelanic '*Siphonalia*', but Fischer in the *Manuel de Conch.*, 1884, p. 625, cited as example of *Austrofusus* (which he made a sub-genus of *Siphonalia*), *S. alternata*, Philippi, which was the second of Kobelt's list, the first being indeterminable. At the same time Fischer proposed *Penion* for *Siphonalia dilatata*, Quoy & Gaimard. I would therefore fix *S. alternata*, Philippi, as type of *Austrofusus*, and this leaves *Penion* to be used for the Austro-Neozelanic forms, and I would here unhesitatingly place *Siphonalia maxima*, Tryon.

Bembicium, Philippi.

This name must be used for the genus of Australian molluscs known by the name of *Risella*. One species was for some time included in the New Zealand List, but was expunged by Suter (Trans. New Zeal. Inst., vol. xxxviii, p. 325, 1905 (1906)), who, however, concluded it must still be retained as occurring in the Pliocene in New Zealand.

Risella has been generally quoted as of Gray, 1840, but that reference is to the Synops. Brit. Mus., where it only occurs as a nude name. The earliest introduction legitimately made by Gray appears to be in the Proc. Zool. Soc. Lond., 1847, p. 150, where we read: "*Risella*, Gray, 1840, 1844. *Bembicium*, Philippi, 1846. *Trochus melanostomus*."

The 1844 reference to Gray seems to be only another case of Synops. Brit. Mus., so that *Bembicium*, Philippi, 1846, has clearly priority over *Risella*, Gray, 1847. In the Zeitschr. für Malak., September, 1846, p. 129, Philippi introduced this genus and monographed the species. Herrmannsen (*Ind. Gen. Malac.*, vol. i, p. 111, 1846) designated as type of *Bembicium*, *Trochus melanostomus*, so that *Risella*, Gray, becomes an absolute synonym. In his vol. ii, 1847, Herrmannsen included *Risella* as a name in the Synops. Brit. Mus., which he had not seen, and in his Supplement, p. 119, 1852, included it as published in the Proc. Zool. Soc. Lond., 1847, p. 150.

This correction has escaped the attention of Australian workers for two reasons: first, the inaccessibility of literature compels acceptance of many quotations without opportunity of verification, and the constant citation of Gray, Synops. Brit. Mus., 1840, by better situated workers, would arouse no suspicion that only the nude name there occurred; secondly, in the *Manual of Conchology*, vol. ix, where *Risella* is monographed, there is no mention of *Bembicium*, Philippi, to incite interest.

I might here point out that Cossman recently proposed a new genus, which he named *Risellopsis* (Havre Bull. Soc. Géol., vol. xxvii, p. 59, 1907 (1908)), but that name had been previously selected by Kesteven (Rec. Austr. Mus., vol. iv, p. 319, 1902) for a New Zealand marine molluscan genus.

LORA, Gistel.

In the Bull. Mus. Comp. Zool., vol. xliii, p. 259, 1908, Dall details the history of the generic names *Defrancia*, Millet, 1827, and *Clathurella*, Carpenter, 1856, selecting for type of Millet's genus *Defrancia pagoda*, Millet, and accepting that as type of *Clathurella*, Carpenter. It has apparently been overlooked that Gistel (Naturg. Thierr. hoh. Schulen, 1848, p. ix) had introduced *Lora* as a new name for *Defrancia*, Millet, noting *D. viridula*, O. Fabr., as a typical species.

PACHYCHEILUS.

In the *Penny Cyclopedia*, vol. xvii, p. 454, footnote, 1840, this name is introduced as a better name than *Pachylabra*, Swainson's substitute for *Pachystoma*, Guilding, preoccupied. This would seem to invalidate Lea's later *Pachychilus*.

TROCHUS ROYANUS, n.sp. Pl. IX, Fig. 12.

Shell pyramidal, large, massive, imperforate. Whorls more than twelve, subscalar, last whorl strongly keeled, base flat. Colour white. In adult specimens sculpture scarcely distinguishable, but on the last whorl can be noted a sculpture of nodules somewhat after the style of ornamentation seen on *T. pyramis*, Born, but much finer. Base smooth, save for growth-lines. Aperture quadrate, very oblique, the basal portion smooth inside; outer lip thin, and very fragile. Columella pearly, anteriorly terminating in a solid tubercle, and ascending with a semicircular sweep. Operculum thin, horny, multi-spiral, nucleus central; size 32×27 mm.

Measurements of type: Height 84, major diameter, 84 mm.

Hab.—Sunday Island, Kermadec Group.

The type of *Trochus*, Linné, Syst. Nat., 10th ed., 1758, p. 756, I now designate as *T. maculatus*, since *T. Niloticus* does not occur there.

CLANCULUS ATYPICUS, n.sp. Pl. IX, Fig. 7.

Shell small, depressedly globose, solid, umbilicate; periphery rounded, base flattened. Colour: dark greyish-brown, painted obliquely with yellow or fawn. Whorls six. Sculpture consists of fine spiral threads of varying strengths, about eighteen major ones on the last whorl. The preceding whorl shows six major threads only. The axial sculpture is represented by very fine close lines. Suture deep, channelled, bounded by a row of nodules. Aperture oblique, sub-quadrate, the outer lip slightly crenulate and recurved. Umbilicus deep, surrounded by a noduled callused rim, the callus extending to meet the outer lip. Columella obliquely inserted in the umbilicus, with a small nodule at each end. Operculum circular, horny, thin, multispiral, nucleus central.

Measurements of type: Height 8, major diameter 9 mm.

Hab.—Sunday Island, Kermadec Group.

Monilea incerta, n.sp. Pl. IX, Fig. 6.

Shell small, turbinate, thin, umbilicate; whorls convex, gradually increasing, slightly flattened below the suture, last whorl rounded at the periphery. Colour: generally blackish-grey irregularly rayed with white. Whorls six, the first one and a half minute, unsculptured; the sculpture consists of spiral threads increasing in number and strength, the penultimate whorl having three major ones, the last five above the periphery; between these run from one to three minor threads. The whole shell is overridden by very fine axial striæ. The base is sculptured with about twelve even-spaced ridges, similarly overridden. Umbilicus narrow, bounded by a thickened rib, only developed in the adult; inside white. Aperture sub-quadrate, outer lip thin. Columella ascending with a faint reflection, and higher again reflected, when a rib enters the umbilicus; connected with the outer lip by a slight callus. Operculum circular, multispiral, nucleus central, thin and horny.

Measurement of type: Height 10, major diameter 9 mm.

Hab.—Sunday Island, Kermadec Group.

Gena Oliveri, n.sp. Pl. IX, Figs. 4, 5.

Shell oblong ovate, small, thin, about twice as long as broad. Whorls four. Colour blackish-grey, more or less marbled with lighter grey and white. Sculpture consists of fine spiral grooves decussated by growth-lines, but the apex has two well-developed keels which are diagnostic. Columella arched.

Measurement of type: Height 9, length 11 mm.

Hab.—Sunday Island, Kermadec Group.

Vanikoro Wallacei, n.sp. Pl. IX, Fig. 11.

Shell globose, thin, perforate, last whorl increasing and descending rapidly. Whorls four. Colour white. The first whorl and a half are elevated, unsculptured, the succeeding whorls bearing fine closely set wavy threads, which are crossed by minute crowded striæ, these last predominate on the last whorl, but the whole sculpture is very fine. Columella obliquely set, straight; umbilicus wide and deep, bounded by a crenulate rib, inside crinkled parallel to the columella; aperture semicircular, outer lip thin. Operculum horny, paucispiral, thin, like that of a *Melarhaphe*. This does not agree with the description of the operculum of *Vanikoro* as given by H. & A. Adams.

Measurement of type: height 4, breadth 4·5 mm.

Hab.—Sunday Island, Kermadec Group.

Trivia desirabilis, n.sp. Pl. IX, Figs. 8, 9.

Shell small, sub-oval, extremities slightly produced; white, strongly sculptured. Sculpture consisting of about thirty major ridges, a few intercalatory ribs sometimes present; all are continuous, a very slight depression only being noticeable in the middle of the back. The interstices appear smooth. Aperture narrow; the teething agreeing with the ribbing present.

Length 7, breadth 5, height 4 mm.

Hab.—Sunday Island, Kermadec Group.

TROPHON SUBTROPICALIS, n.sp. Pl. IX, Fig. 3.

Shell very small, regularly trophonoid. Colour brownish. Protoconch two-whorled, elevated, smooth, white. Four adult whorls, regularly shouldered, with eight to ten longitudinal varices, which are crossed by spiral ribs, the first two adult whorls showing one, the third three, and the last five, three of which are prominent. In some shells the spirals overrule, but usually they are subordinate to the longitudinal varices. Aperture oval, denticled within the outer lip, which is heavily varicose. Canal short, recurved, open. Operculum typical.

Measurements of type: Length 3, breadth 1·5 mm.

Hab.—Sunday Island, Kermadec Group.

CONUS KERMADECENSIS, n.sp. Pl. IX, Figs. 15, 16.

Shell of medium size, quite smooth. Colour reddish-yellow, towards the middle of the shell a fainter band is usually seen when the shell is destitute of the thick red-brown epidermis, rarely persistent, save on the last quarter of a whorl. Number of whorls unknown. Spire slightly elevate; broad, conical, sutures impressed, periphery subangled. Anal notch distinct, outer lip thin. Pillar lip almost straight with a faint twist at anterior end; aperture widening anteriorly where there are a few wrinkles. Inside white, edge of outer lip tipped with brown. Operculum variable in size and shape.

Measurements: Height 55, 42, 31 mm.; breadth 29, 25, 18 mm.; height of spire 12, 8, 8 mm.

Hab.—Sunday Island, Kermadec Group.

CASSIDEA PERRYI, n.sp. Pl. IX, Fig. 17.

Shell small, ovate, smooth, aperture more than half the length of the shell, outer lip reflexed, scarcely variced, and bearing no denticles. Colour fawn with four darker transverse bands, only noticeable on the last whorl and clearly marked on the reflected lip as reddish-brown marks; sometimes the bands are broken and appear as oblong marks. Five adult whorls and the usual juvenile Cassoid apex, but varices are not apparent, save rarely on the last half-whorl. Aperture somewhat obliquely pyriform, the anterior canal short and recurved. Columella with an anterior groove, but otherwise smooth. Length 43, breadth 24, length of aperture 25 mm.

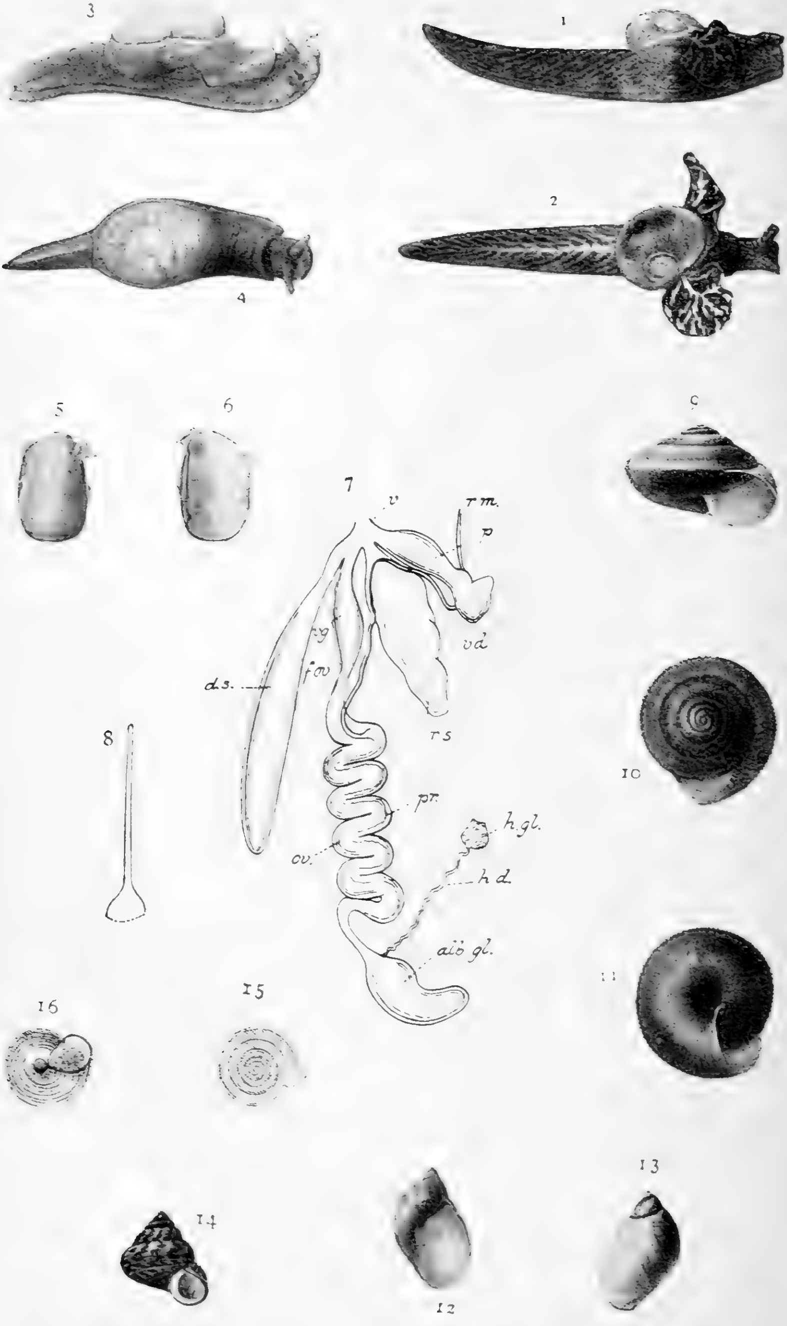
Hab.—Sunday Island, Kermadec Group.

Bearing a deceptive resemblance to *C. cernica*, Sowerby, but that species is a smooth relation to *C. vibex*, to which this form is not closely allied.

All the types of these new species will be presented to the Canterbury Museum, New Zealand, and paratypes are in the Australian Museum, Sydney.

EXPLANATION OF PLATE IX.

Fig.
1. *Royella sinon*, Bayle.
2. *Royella* sp. (undescribed).
3. *Trophon subtropicalis*, n.sp.
4, 5. *Gena Oliveri*, n.sp.
6. *Monilia incerta*, n.sp.
7. *Clanculus atypicus*, n.sp.
8, 9. *Trivia desirabilis*, n.sp.
10. *Roya Kermadecensis*, n.sp.
11. *Vanikoro Wallacei*, n.sp.
12. *Trochus Royanus*, n.sp.
13. ,, ,, operculum.
14. *Jeannea Hedleyi*, n.sp.
15, 16. *Conus Kermadecensis*, n.sp.
17. *Cassidea Perryi*, n.sp.



J. F. Obbes del.

LAND AND FRESHWATER MOLLUSCA FROM JAVA.

ON A COLLECTION OF LAND AND FRESHWATER MOLLUSCA FROM JAVA.

By M. M. Schepman.

Read 14th June, 1912.

PLATE X.

During his stay in Java Mr. E. Jacobson collected amongst other objects of Natural History some molluscs, the majority consisting of land and freshwater species, which he had the kindness to send to me for identification and description; amongst them I found a few forms which appear to be new to science, and as the accurate localities give a real importance, even to the more common and already known species, I now give a list of all of them.

1. Vitrinopsis Collingei, n.sp. Pl. X, Figs. 1, 2.

Animal of a light flesh-coloured tint, which on its upper surface is only clearly visible beneath the shell and on the foot-fringe, the neck of a rather dark slate colour, as well as the upper tentacles, the sides of the anterior part mottled with faint spots of black pigment, the dorsal face of the caudal part nearly quite blackish, mantle blackish, with two lobes; right mantle-lobe large, strongly black-spotted, leaving only an arborescent figure of whitish colour; left lobe narrower, of the same colour, but of simpler pattern, with only a few light-coloured branches; caudal part sharp, pointed behind, without mucous pore, with a median dorsal groove of lighter colour, and oblique furrows, running from the median groove towards the posterior end; foot-fringe bordered above by a double, impressed line. Foot-sole divided in a narrow median and two lateral planes, flesh-coloured, darker behind. Shell depressed, thin, corneous; whorls slightly convex, four in number, of which about two form a large nucleus, which is microscopically spirally striated, the striæ being pitted; third whorl still finer and more remote, spirally striated with plain striæ, but as well as last whorl smooth and shining; last whorl with fine growth-lines, which are partly fold-like and with a crenulate infrasutural margin, bordered by a groove. Peristome thin, aperture depressed.

Length of animal about 30, breadth of foot 2·5 mm.; largest diameter of shell 8·5, height about 5 mm.

Hab.—Nongkodjadjar, Tengger Mountains, January, 1911. One specimen, in my collection.

This species has much puzzled me; the animal agrees in every respect with Semper's description of his genus *Vitrinopsis*, but the shell with his genus *Vitrinoidea*. I have provisionally located it in *Vitrinopsis*, as the mantle, though damaged, evidently consisted of two separated lobes. I thought it not advisable to create a new genus on a single damaged specimen. Mr. Jacobson has given the following interesting account of the living animal: "The slug was found under the bark of a decayed tree. At its sides it has two peculiar, thin lobes, which, when the slug creeps undisturbed, are spread over each side of the shell, and cover a large part of it; if disturbed it partly retracts these lobes. If excited the slug is uncommonly active, writhing to the right and left, and violently moving the body like an earth-worm. I have never seen a slug which is so active in its movements. It cannot withdraw completely in the shell." As far as I know, this is the first species of the genus described from Java, though Strubell and Fruhstorfer may have found such.

2. Xesta Dwipana, Gude.

Gude, Proc. Mal. Soc., vol. v, p. 264, pl. vii, figs. 15–17, 1903; v. Martens, Ostas. Landschn., p. 254 (*Jenynsi*).

Hab.—Gunung Ungaran, September, 1910. Two specimens.

The specimens belong to the colour-variety, which has been named by Boettger v. *concolor*, without description, received from Fruhstorfer, from the Gunung Gedeh, as *Macrochlamys Jenynsi* v. *concolor*; it is characterized by its rather uniform yellowish-brown colour, without band. On comparison with Gude's descriptive table, I find Mr. Jacobson's specimens agree in every respect with the characters, and are quite different from *Martensia Jenynsi*, Pfr., of which species I could compare two East African specimens. In Journ. of Mal., vol. x, p. 53, 1903, Gude has recorded the species in his classified list of helicoid land shells of Asia as *Macrochlamys Dwipænsis*.

3. Hemiplecta patens, v. Martens.

V. Martens, Archiv f. Naturgesch., 1891, p. 27, pl. iii, fig. 1.

Hab.—Nongkodjadjar, January, 1911. One specimen.

The only specimen is young, as may be judged by its very thin, partly broken peristome; it agrees as well as can be desired with the description and figure of v. Martens, but it is not quite 40 mm. in its largest diameter, has about half a whorl less, and the aperture is still more rounded; these differences, however, would disappear if the shell were full grown. It is nearly from the same locality as the type of v. Martens. It agrees with specimens received from Fruhstorfer as *H. gemina*, v. d. B., but not with the description and figure of Philippi (Abbild. neuer Conch., vol. i, p. 9, pl. i, fig. 1), the umbilicus being nearly closed, the last whorl much broader, sculpture different, etc. Professor Thiele, who had the kindness to compare my specimens with the only type of v. Martens, affirms my suggestion that it is *H. patens*.

4. Hemiplecta Humphreysiana, Lea, var.

Lea, Trans. Phil. Soc. Philadelphia, vii, p. 463, pl. xii, fig. 16, 1841; v. Martens, Ostas. Landschn., p. 233, pl. x, figs. 3, 4, 6.

Hab.—Nusa Kambangan, March, 1911. One specimen.

The specimen is young; it does not exactly agree with any of the figures I could compare, nearest perhaps in shape with var. *complanata*,

v. Martens (loc. cit., p. 234, pl. x, fig. 3); in sculpture it agrees with other specimens from Java, but in colour it is peculiar by a narrow brown line, just above the light-coloured peripheral zone, which is, however, much narrower than that in v. Martens' fig. 6 of v. *bifasciata*, which is very different in size and shape.

5. Dyakia Rumphii, v. d. Busch.

v. d. Busch in Philippi; Abbild. neuer Conch., vol. i, p. 9, *Helix*, pl. i, fig. 2; Mousson, Moll. von Java, p. 18, pl. i, fig. 2; Reeve, Conch. Icon., *Helix*, fig. 480; v. Martens, Ostas. Landschn., p. 220; Pilsbry, Man. Conch., ser. II, vol. ii, p. 20, pl. iii, fig. 38.

Hab.—Gunung Gedeh, March, 1911, one specimen; Gunung Ungaran, September, 1910, two specimens.

The specimens are very young, but easily recognizable.

6. Dyakia clypeus, Mousson.

Mousson, Journ. de Conch., 1857, p. 156; v. Martens, Ostas. Landschn., p. 227; Pfeiffer, Nov. Conch., vol. iv, p. 27, pl. cxv, figs. 3–5; Pilsbry, Man. Conch., ser. II, vol. ii, p. 20, pl. iii, figs. 39, 40.

Hab.—Nongkodjadjar, January, 1911. Four specimens. The largest specimen is nearly quite flat above.

7. Helicarion Adolfi, Boettger.

Boettger, Bericht Senckenb. naturf. Gesellsch., p. 138, pl. v, fig. 1, 1890.

Hab.—Gunung Gedeh, March, 1911, one specimen; Gunung Ungaran, September, 1910, one specimen.

This species, which is characterized by excessively fine spiral striæ below the suture and at the base of shell, was found originally on the Gunung Salak by Strubell, and it seems to be rather common, at least Fruhstorfer has collected it at several other localities in Java.

8. Parmarion pupillaris, Humbert.

Humbert, Mém. Soc. phys. et Hist. nat. Génève, vol. xvii, 1863, p. 109, fig. 1; v. Martens, Ostas. Landschn., p. 179, pl. v, figs. 7, 8, pl. xii, fig. 3; Simroth, in Zool. Ergebn. einer Reise in Ost Indien, vol. iii, p. 106, pl. vii, figs. 3, 7, 10, pl. viii, figs. 16, 17.

Hab.—Gunung Ungaran, September, 1910. One specimen.

This specimen has a dark shell with the characteristic folds at its right side.

9. Parmarion (?) sp.

Hab.—Gunung Ungaran, September, 1910. Two specimens.

The largest of the two specimens has a length of scarcely 10 mm., and is too young for identification; the shell in situ seems to be white.

10. Microparmarion Jacobsoni, n.sp. Pl. X, Figs. 3–8.

Hab.—Nongkodjadjar, January, 1911. Three specimens.

Animal dark grey-brown, with a reddish tint, more predominating in the smaller specimens, in the adult the dorsal anterior part darker, with traces of a blackish longitudinal band on each side behind the tentacles, very conspicuous in young ones, and a blackish streak on each side of the tail; mantle of the same colour as body, with faint blackish spots, likewise conspicuous in the young; body and mantle rugose, but without warts; peripodial groove distinct, fringe with very faint dark lineoles at the anterior and posterior parts, particularly faint in the adult. Keel of intestinal sac rather sharp, with a few dark spots. Foot-sole with a median part, but little darker than the sides of body, lateral parts darker. Caudal keel sharp, of slightly lighter colour; caudal mucous pore an oblique slit. Length in alcohol about 40 mm.

Shell convex, oval, with bluntly rounded anterior margin, running with rounded angles in the lateral margins, covered by a brownish-yellow epidermis, projecting beyond the sides. No trace of spire. Of the generative organs the vestibule is small, the receptacular duct is short, only represented by a narrow part of the receptaculum seminis, which is a large oblong sac, attenuated at its distal part; the penis is swollen in its proximal part, contracted at its entrance in the vestibule, distally it is hooked on one side, with a blunt point at the other side, where the vas deferens ends it is rounded, below the hook-like top a rather long retractile muscle is inserted; the free oviduct is rather long, more distally with a swollen vaginal part, again attenuated towards the vestibule; the dart-sac is oblong, roundedly attenuated towards its distal, strongly attenuated towards its proximal end, no retractor muscle visible. Dart, unfortunately broken, consisting of a slender calcareous rod, with a broad base; the point is wanting.

Type-specimen in my collection, cotypes in the Leyden Museum.

As I could not identify this species with any of the described ones, I asked the advice of Mr. Collinge, who had the kindness not only to examine it for me, but to make a dissection and to send a sketch or drawing of the generative organs, adding that it was a new species of *Microparmarion* on account of its dart. The shell itself agrees more with that of *Parmarion*, as well as the rather sharp keel of the intestinal sac. In shell character it agrees with *M. Austeni*, Simr. ("Ueber einige *Parmarion* Arten," in Weber's Zool. Ergebnisse einer Reise in Niederl. Ost Indien, p. 109). Simroth says of the shell: "Die Schale ist beträchtlich stärker gewölbt, als bei den vorigen (*M Strubelli*), das Gewinde scheint völlig resorbiert zu sein."

Collinge writes that the new species is nearly allied to *M. Javanica*, Coll. (Ann. and Mag. Nat. Hist., ser. VII, vol. iv, p. 400, pl. viii, figs. 11–19, 1899). This concerns the generative organs, for in its external characters it is very different in many respects, especially by its relatively smooth surface, which is densely set with warts in *M. Javanica*, and the shell has a well-developed spire. As to the generative organs, the new species differs from *M. Javanica* by its small vestibule, which is large, triangularly rounded in *Javanica*; that species has a much smaller and pyriform receptaculum seminis, and the penis is quite different in shape, the vaginal part is not swollen, etc. Though the specimens vary in colour, the younger ones being more distinctly marked with black, they will, however, probably belong to one and the same species, the differences are certainly not stronger than those figured by Simroth (loc. cit., pl. vii, figs. 6*a*, 6*b*) as the adult and young of *Parmarion Weberi*.

11. Microcystina infans, Pfeiffer.

Pfeiffer, Proc. Zool. Soc. Lond., 1854, p. 290; id., Monogr. Heliceorum, vol. iv, p. 51; Reeve, Conch. Icon., vol. vii, *Helix*, fig. 1417; Martens, Ostas. Landschn., p. 243; Boettger, Bericht der Senckenb. naturf. Gesellsch., 1891, p. 257.

Hab.—Nongkodjadjar, January, 1911. One specimen.

The species seems to be somewhat variable, the whorls of the specimen are a trifle narrower than the majority of those I received from different sources from Java, but it agrees rather well with a not yet described var. *rufula*, Boettg., which is slightly smaller and darker than those denoted as typical.

12. Plectotropis Tenggerica, n.sp. Pl. X, Figs. 9–11.

Shell comparatively narrowly umbilicated, thin, fragile, yellowish-brown, depressed, spire conoidal, periphery with an obtuse angle or keel, obsolete near aperture, whorls $5\frac{1}{2}$, rather regularly increasing, last one slightly broader, moderately convex, with a shallow suture, slightly descending towards the aperture. Sculpture consisting of fine, rather irregular plicæ, the whole shell with short hairs. Aperture moderately oblique, broadly lunar, peristome regularly rounded (not quite developed), columellar margin reflected at and partly covering the umbilicus.

Diam. maj. 10, alt. 6·5 mm.; apert., alt. (diagonally) 4·5, lat. 4 mm.; diam. of umbilicus, 2 mm.

Hab.—Nongkodjadjar, January, 1911. Two specimens. Type in my collection, cotype in Leyden Museum.

Though these specimens are not quite developed, the peristome being still thin and fragile, I thought it fit to name them. The nearest ally is *P. Schepmani*, Mlldff. (Nachrichtsbl. d. D. Mal. Gesellsch., 1897, p. 68), by its narrow umbilicus; compared with a cotype presented by Professor Boettger, who originally named but did not describe it, the shell is higher, the keel more obtuse; that species is conspicuously spirally striated, and shows no traces of hairs or even scars. *P. Winteriana* and *Sumatrana* are still more remote.

13. Chloritis crassula, Philippi.

Philippi, Abbild. neuer Conch., vol. i, p. 152, *Helix*, pl. v, fig. 3; v. Martens, Ostas. Landschn., p. 276; Boettger, Bericht Senckenb. naturf. Gesellsch., 1890, p. 144, pl. v, fig. 7.

Hab.—Gunung Gedeh, March, 1911. One specimen.

The specimen, which is young, agrees very well with Philippi's figure of a young shell, but in such forms comparison with a rather obscure figure may always leave some doubt; Boettger has figured a very complete specimen from the Gunung Salak; I can see no difference in my other specimens from Java, as far as concerns shape and sculpture, but of course the characters of aperture remain undecided.

14. Amphidromus palaceus (v. d. Busch), Mousson.

Mousson, Land- u. Süssw. Moll. von Java, p. 28, pl. iii, fig. 1; v. Martens, Ostas. Landschn., p. 352; Pilsbry, Man. Conch., ser. II, vol. xiii, p. 134, pl. xlvii, figs. 1, 2, 4–6.

Hab.—Babakan, March, 1911. One specimen.

Agreeing in shape and rather coarse sculpture with the existing figures and with specimens I could compare, the only difference is that the specimen has in all five blackish streaks, one large preceded by a narrow one above the point of junction of the peristome, one on the back of the last whorl, and two narrow ones on the penultimate whorl; of these latter two I find no mention in literature. *A. perversus*, which is a many-streaked species, is much smoother. V. d. Busch has not described this species.

15. Amphidromus furcillatus, Mousson.

Mousson, Land- u. Süsswasser Moll. von Java, pp. 32, 115, pl. iii, fig. 3; v. Martens, Ostas. Landschn., p. 357, pl. xxi, fig. 3; Pilsbry, Man. Conch., ser. II, vol. xiii, p. 216, pl. lxvi, figs. 38–40.

Hab.—Nongkodjadjar, January, 1911. Two specimens.

A very variable species as regards colour-markings; the specimens under consideration belong to a variety with the flammules but rarely bifurcated.

16. Pseudopartula galericulum, Mousson.

Mousson, Land- u. Süsswasser Moll. von Java, p. 34, pl. iii, fig. 5; v. Martens, Ostas. Landschn., p. 324.

Hab.—Nusa Kambangan, March, 1911. One specimen.

A little larger than Mousson's type (19 instead of 17 mm.) and without the blackish top, but otherwise perfectly agreeing with his description. The species seems to be rather variable in shape and colour-markings. I possess several specimens with and without dark top, with and without the brownish band in the aperture, quite white and with a peripheral band, but all agree in their principal characters.

17. Vaginula Strubelli, Simroth.

Simroth, Sitzungsber. naturf. Gesellsch. Leipzig, 1891–2, pp. 58, 84; id., Abh. der Senckenb. naturf. Gesellsch., vol. xxiv, p. 137, pl. xiv, figs. 1–6, 9, 1897; v. Martens, in Weber, Zool. Ergebn. Reise Niederl. Ost Indien, vol. ii, p. 247.

Hab.—Samarang, November, 1909, June, July, 1910. Three specimens.

One of the specimens, taken in November, is young, and the hyponotum is but faintly spotted with blackish; the notum is likewise of a lighter colour than in the larger specimens.

18. Succinea javanica, n.sp. Pl. X, Figs. 12, 13.

Shell ovate, with short spire, pellucid, amber-coloured. Whorls about three, rather convex, but more flattened at their upper part. Sculpture consisting of numerous fine growth-lines, and at intervals stronger ones, which have the character of folds, especially on the dorsal side of last whorl, and more conspicuous below the suture; moreover, the shell has a fine sculpture, only visible under a strong lens or low power of the microscope, consisting of oblique protractive and retractive lines, which intercross and give a dull appearance to the shell; last whorl rather oblique. Aperture oval, with a moderately sharp angle above, peristome thin. Columella forming a blunt angle with body-whorl, with a sharp edge from body-whorl to regularly rounded basal margin; no trace of umbilicus, the columellar margin of body-whorl, with a narrow thin layer of enamel, more conspicuous and circumscribed in its lower half, until the point of junction with the basal margin.

Alt. 9, lat. 5·5 mm.; apert., alt. 6·5, lat. 3·5 mm.

Hab.—Tuntang River, October, 1910. One specimen in my collection.

This species seems to be very different from *S. obesa*, v. Martens (Ostas. Landschn., p. 387, pl. xxii, fig. 21), which is much more convex, less oblique, and has no peculiar sculpture. The only species from the archipelago of which I find a description of such sculpture is *S. solidula*, Pfr. (Proc. Zool. Soc. Lond., 1849, p. 134), afterwards described and figured by Smith (loc. cit., 1887, p. 518, fig. 1, woodcut, and Christmas Island Monograph, 1900, p. 56, pl. viii, figs. 8, 9), but in that species the whorls are more convex below the suture, accordingly the shell has a less elongated appearance, and the columellar side is less angular at the point of junction of upper part of columella and body-whorl. *S. gracilis*, Lea, which has been recorded from Java with doubt, is quite different according to Pfeiffer's description (Mon. Helic., vol. ii, p. 518), and *S. subrugata*, Pfr., which might have a secondary sculpture, according to Pfeiffer (loc. cit., vol. iii, p. 10), "vix nitidula, quasi pruinosa," is from Borneo, and differs in many respects.

19. Limnæa javanica, Mousson, var.

Mousson, Land- u. Süssw. Moll. von Java, p. 42, pl. v, fig. 1; v. Martens, Conch. Mitth., vol. i, p. 87, pl. xvi, figs. 1–10; id., Süss.- u. Brackwasser-Moll. des Ind. Archipels, p. 3, pl. i, figs. 3–7; pl. xii, figs. 2, 4.

Hab.—Tuntang River, October, 1910. Six specimens.

The specimens of this very variable species are young, and only one of them seems to be full-grown, but is unfortunately broken.

Of the quoted figures those of var. *intumescens*, v. Martens (Conch. Mitth., figs. 2–4), come nearest, but have the subangular shoulder still more pronounced.

20. Canidia Helena (Meder.), Philippi.

Philippi, Abbild. neuer Conch., vol. ii, p. 170, *Melania*, pl. iv, fig. 4; Mousson, Land- u. Süssw. Moll. von Java, p. 64, pl. x, fig. 2; v. Martens, Süss.- u. Brackw. Moll. des Ind. Archipels, p. 75.

Hab.—Tuntang River, October, 1910. Two specimens.

This species has not yet been recorded from Samarang. The western localities recorded by v. Martens are Batavia and Preanger Regencies; the most eastern one in Java is Surabaya; Fruhstorfer has collected it at Sukabumi. Though both specimens are only dead shells they are noteworthy, as they fill up a gap in the geographical distribution of the species.

21. Ampullaria scutata, Mousson.

Mousson, Land- u. Süssw. Moll. von Java, p. 60, pl. viii, fig. 2; Philippi, Martini-Chemn. Conch. Cab., 2nd ed., *Ampullaria*, p. 9, pl. i, figs. 4–6; v. Martens, Süss.- u. Brackw. Moll. des Ind. Archipels, p. 18.

Hab.—Djocja, February, 1911. Three specimens.

I have followed the views of v. Martens, who considers the name *conica*, Gray, in Wood's *Index Test.* too doubtful to apply it to this species from Java, which has been so clearly characterized by Mousson, though Gray's name should have priority. The operculum, which is one of the best characters distinguishing it from *A. ampullacea*, Linn., is very well represented by the quoted figure 6 of Philippi and by Mousson.

22. Melania testudinaria, v. d. Busch.

v. d. Busch in Philippi, Abbild. neuer Conch., vol. i, p. 3, pl. i, fig. 14; Mousson, Land- u. Süssw. Moll. von Java, p. 66, pl. xi, figs. 1–3; Brot, Martini-Chemn. Conch. Cab., 2nd ed., Melanidæ, p. 49, pl. vi, fig. 3; v. Martens, Süss.- u. Brackw. Moll. des Ind. Archipels, p. 31.

Hab.—Tuntang River, October, 1910. Fourteen specimens.

The specimens agree rather well with Mousson's fig. 3. The flammules are sufficiently conspicuous in well-preserved shells, but many of them are much eroded. One specimen is remarkable for the shape of its aperture. The shell evidently has been repeatedly broken and repaired by the animal, and consequently the base is quite flattened, and has a superficial resemblance with some forms of the American genus *Pleurocera*, e.g. *P. canaliculatum*, Say; but comparison with the other specimens from the same locality leaves no doubt about its true position.

23. Melania sp.

Hab.—Tuntang River, October, 1910. Three specimens.

The collection contains three ribbed specimens, one large one, which is too much eroded for identification and has the aperture broken, and two small specimens too young for determination.

24. Melania scabra, Müll., var. mutica, v. Martens.

v. Martens, Süss.- u. Brackw. Moll. des Ind. Archipels, p. 64, pl. iv, figs. 9–12; Brot, Martini-Chemn. Conch. Cab., 2nd ed., Melanidæ, p. 268, pl. xxvii, figs. 14*d–e*.

Hab.—Tuntang River, October, 1910. Three specimens.

These specimens differ from the type by the obsolete ribs of the upper whorls, which are entirely lacking on the last whorl, and in one shell even on the penultimate whorl; this latter specimen has dark spots below the suture and near the periphery, and agrees in this respect with Brot's fig. 15*a* of the same plate.

25. Leptopoma altum, Möllendorff.

Möllendorff, Nachrichtsbl. d. Deutschen Malak. Gesellsch., 1897, p. 90.

Hab.—Nusa Kambangan, March, 1911. One specimen.

This operculate land shell sufficiently agrees with v. Möllendorff's description, as far as concerns shape and sculpture; in colour it better agrees with one of the specimens received from Fruhstorfer, and identified by the author, the last whorl of the specimen under consideration being for a large part yellowish-brown, with exception of a narrow peripheral band, a larger basal zone, and a few narrow infrasutural zones which are whitish. The species seems to be rather variable in colour-markings.

26. Lagochilus trochiformis, n.sp. Pl. X, Figs. 14–16.

Shell narrowly umbilicated, umbilicus partly covered; shell subconical, with high spire, rather solid, sub-pellucid, yellowish, with purple-brown flames, reaching in last whorl from suture to the interior of umbilicus. Whorls 5½, convex, about two upper ones forming a smooth, shining, dark, corneous apex; suture deep. Sculpture consisting of fine spiral striæ and stronger spiral liræ, four in number on penultimate whorl, about eight on last whorl, and a few fainter ones; the whorls are crossed by conspicuous oblique growth-lines; rather short black hairs are visible on some parts of the liræ, and shorter ones on other parts, but they are mostly rubbed off. Aperture nearly circular, above with the characteristic incision, diagonal, partly double, the interior margin with a narrow, bluish-white, thickened rim, external one narrow, formed of several corneous layers. Interior of aperture flamed by the transparency of shell. Alt. 6·5, lat. 6 mm.; apert. alt. (diagonally) 2·75, lat. 2·5 mm.

Hab.—Gunung Ungaran, September, 1910. One specimen in my collection.

This species is the highest one known from Java. *L. convexum*, Mlldff. (Nachrichtsbl. D. Mal. Gesellsch., 1897, p. 91), according to description should come nearest in this respect, but my specimens, formerly examined by v. Möllendorff, as well as one I received for comparison from the Museum of Berlin, are larger and more depressed. It differs moreover by the larger number of keels, a less oblique, more circular aperture, a narrower umbilicus, and by colour. *L. obliquistriatus*, Bullen (Proc. Mal. Soc. Lond., vol vi, p. 110, pl. vi, figs. 4, 5), which is also a rather high shell, has a much larger (sixteen to eighteen) number of spiral liræ; in *L. trochulus*, v. Martens (Ostas. Landschn., p. 141), on the contrary, it is considerably smaller.

27. Nerita lineata, Chemnitz.

Chemnitz, Conch. Cab., vol. v, p. 297, pl. cxci, figs. 1958, 1959; Reeve, Conch. Icon., vol. ix, *Nerita*, fig. 13; v. Martens, Martini-Chemn., Conch. Cab., 2nd ed., *Nerita*, p. 15, pl. i, figs. 3, 4; pl. iv, figs. 12–15.

Hab.—Tjilatjap, March, 1911. Two specimens.

This is the only marine species. The specimens are quite typical. Native name Susuk daun.

28. Neritina (Clithon) brevispina, Lamarck.

Lamarck, Anim. sans Vert., 2nd ed., vol. viii, p. 572; Mousson, Land- u. Süssw. Moll. von Java, pp. 83, 118, pl. xii, fig. 12; pl. xx, fig. 11; pl. xxii, figs. 6, 7 (*Corona australis*); Reeve, Conch. Icon., vol. ix, *Neritina*, fig. 28; v. Martens, Martini-Chemn. Conch. Cab., 2nd ed., *Neritina*, p. 156, pl. xvii, figs. 1–4, 9; id., Süss.- u. Brackw. Moll. des Ind. Archipels, p. 79.

Hab.—Small river, Nusa Kambangan, March, 1911. Twenty-two specimens.

Rather small and variable in colour, but quite typical. Native name Keong batu.

29. Septaria suborbicularis, Sowerby.

Sowerby, Cat. Tankerville, p. 10; v. Martens, Martini-Chemn. Conch. Cab., 2nd ed., *Navicella*, p. 31, pl. vi, figs. 5–8, 14; id., Süss.- u. Brackw. Moll. des. Ind. Archipels, p. 84.

Hab.—Nusa Kambangan, March, 1911. Six specimens.

The specimens are marked with oblong lighter spots near the margin; some specimens come near to the sub-variety *furcato-radiata*, v. Martens, but they still belong to the type.

30. Corbicula ducalis, Prime.

Prime, Proc. Boston Soc. Nat. Hist., vol. viii, p. 274, 1862; Philippi, Abbild. neuer Conch., vol. ii, p. 76, *Cyrena*, pl. i, fig. 3 (*fluminea*); Mousson, Land- u. Süssw. Moll. von Java, p. 87, pl. xv, fig. 3 (*fluminea*); Clessin, Martini-Chemn. Conch. Cab., 2nd ed., Cycladeen, p. 184, pl. xxxii, figs. 5–6; v. Martens, Süss.- u. Brackw. Moll. des Ind. Archipels, p. 114.

Hab.—Tuntang River, October, 1910. Nine specimens.

This species, which I have also received from Sumatra, has been often named *C. fluminea*, Müll., which according to v. Martens is a species from China.

EXPLANATION OF PLATE X.

FIGS. 1, 2. *Vitrinopsis Collingei*, n.sp. × $1\frac{2}{3}$.
,, 3, 4. *Microparmarion Jacobsoni*, n.sp. Nat. size.
,, 5. Shell of same, upper side. Nat. size.
,, 6. Shell of same, inner side. Nat. size.
,, 7. Generative organs of same. × 2. *Alb.gl.* albumen gland; *d.s.* dart-sac; *f.ov.* free oviduct; *h.d.* hermaphrodite duct; *h.gl.* hermaphrodite gland; *ov.* oviduct; *p.* penis; *pr.* prostate; *r.m.* retractor muscle; *r.s.* receptaculum seminis; *v.* vestibule; *v.d.* vas deferens; *v.g.* vagina.
,, 8. Part of dart of same, enlarged.
,, 9–11. *Plectotropis Tenggerica*, n.sp. × 2.
,, 12, 13. *Succinea Javanica*, n.sp. × 2.
,, 14–16. *Lagochilus trochiformis*, n.sp. × 2.

DESCRIPTIONS OF THIRTY-THREE NEW SPECIES OF GASTROPODA FROM THE PERSIAN GULF, GULF OF OMAN, AND NORTH ARABIAN SEA.

By James Cosmo Melvill, M.A., D.Sc.

Read 14th June, 1912.

PLATES XI, XII.

In continuation of the last paper upon the subject,[1] I now beg to offer descriptions of some more interesting Mollusca, mostly culled from the almost inexhaustible supply forwarded by Mr. F. W. Townsend from time to time, one or two being added from Bombay, where they were obtained either by the same collector or Mr. Alexander Abercrombie. The opportunity has also been embraced of refiguring two or three species, e.g. *Ethalia diotrephes*, Melv. (*vide* Pl. XI, Figs. 17, 17*a*), which, till lately, was only known by the type, a poor and broken example. In this new delineation the elaborate sculpture and curious form of this little species are shown much more distinctly. *Argyropeza divina*, M. & St., too, is now figured from an adult example for comparison with *A. Schepmaniana*, described in this paper. And, thirdly, *Mangilia recta*, Smith, an interesting Persian Gulf species, has never till now been represented by any figure: this omission is now rectified.

Cocculina simplicior, n.sp. Pl. XII, Figs. 1, 1*a*.

C. testa parva, ovato-conica, compressa, lævi, albo-lactea, subpellucida, tenui, lateribus fere parallelis, utrinque rotundatis, planiusculis, superficie omni nitida, sub lente lineis obscuris incrementalibus concentrice prædita, apice acuminato, nucleo lævi, perinconspicuo, sub lente globoso, vitreo, postice arcuato-inclinante, antice convexiore, intus alba, perlævi. Long. 2·75, lat. 1, alt. 1·50 mm.

Hab.—Gulf of Oman. Lat. 24° 58′ N.; long. 56° 54′ E.; 156 fathoms, in shell-sand.

This is, curious to relate, the first *Cocculina* reported from these dredging results; and even this has occurred very rarely. All the examples seen are unfortunately dead, and consequently it has been impossible to examine the radula. It is a very minute, laterally parallely-compressed species, perfectly smooth save for very microscopic concentric incremental growth-lines, whole substance papyraceous and most fragile. It is to be noted that Dr. Schepman[2] treats of no less than seven new species of this genus, mostly dredged in live condition, in the account of the Prosobranchiata of the *Siboga* Expedition; and Dr. Dall,[3] the author of the genus, of three in the reports of the U.S. ss. *Albatross* cruise.

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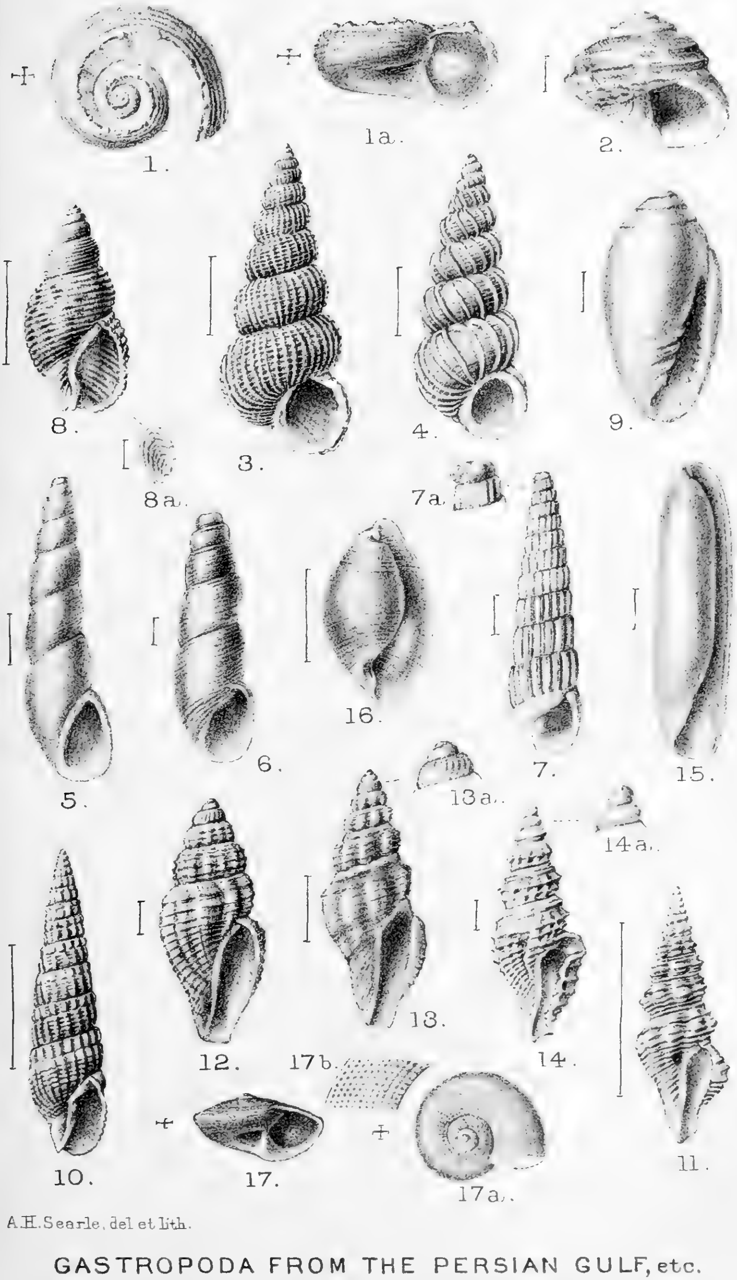
[1] Ann. Mag. Nat. Hist. (8), vol. vi, pp. 1–17, pls., 1910.
[2] Prosobr. Siboga Exped., pp. 17–22, pl. i, figs. 4–10; pl. viii, figs. 8–12, 1908.
[3] Mull. Mus. Comp. Zool. Harvard, xliii, pp. 340, 341, pl. xvi, figs. 3–7, 1908.



A. H. Searle, del et lith.

GASTROPODA FROM THE PERSIAN GULF, etc.

CYCLOSTREMA QUINQUESTRIATUM, n.sp. Pl. XII, Figs. 2, *2a*, *2b*.

C. testa depresso - conoidea, minuta, alba, subpellucida, laté umbilicata, spira paullulum conica, anfractibus 4, quorum apex ipse perparvus, nitidus, vitreus, cæteris ad suturas impressis, nitidis, undique lævissimis, ultimo ad peripheriam carinato, marginato, tenuissime spiraliter sub lente 5 striato, regione umbilicari haud profunda, apertura circulari, intus alba, margine columellari paullum calloso. Alt. 1, diam. 2 mm.

Hab.—Persian Gulf, Mussandam, at 55 fathoms.

A minute, smooth, glassy species, with certain Ethalioïd characteristics, such as the slight thickening of the umbilicar region, and consequent shallowness of the umbilicus itself. The body-whorl is keeled, five spiral striæ being here present on and about the periphery. Unlike any other *Cyclostrema* known to us in more than one way.

CYCLOSTREMA SPICULIGERUM, n.sp. Pl. XI, Figs. 1, *1a*.

C. testa parva, depresso-discoidali, alba, profunde umbilicata, subhyalina, anfractibus 4, apicalibus duobus inclusis, omnibus apud suturas multum impressis et laté canaliculatis, regione infrasuturali planata, aliter usque ad umbilicum spiraliter tenuiliratis, lira superiore anfractus ultimi spiculis brevibus æquidistantibus decorata, apertura rotunda, peristomate tenui, continuo. Alt. 2, diam. 3 mm.

Hab.—Persian Gulf, on the Telegraph cable.

A very elegant, though small species, remarkable for the coronal of equidistant, abbreviated spicules which denote the uppermost, and most strongly developed of the spiral liræ in the two lowest whorls.

GIBBULA ERYTHRACME, n.sp. Pl. XI, Fig. 2.

C. testa solidula, incrassata, angusté umbilicata, conica, brunnea, anfractibus 5, quorum apicales duo læves, detriti, cæteris ad suturas et peripherialiter obscure nodulosis, ultimo ad peripheriam obtuse bicarinato, superficie omni irregulariter spiraliter striata, brunnea, ad basim circa umbilicum hic illic obscure maculata, tribus supernis anfractibus clare puniceo-depictis, apertura oblique ovata, peristomate incrassato. Alt. 5, diam. 5·15 mm.

Hab.—Bombay (A. Abercrombie).

A somewhat solid, brown, rudely constructed *Gibbula*, brightened by the intensely carmine hue of the three uppermost whorls. Allied to *G. Danieli*, Ad.

SCALA ALIZONÆ, n.sp. Pl. XI, Fig. 3.

Sc. testa delicatissima, eleganter fusiformi, parum rimata, anfractibus 11, quorum apicales 3–4 læves, pernitidi, læte castanei, quatuor his proximis castaneo-suffusis, tribus ultimis solum puris, candidis, anfractibus omnibus rotundatis, apud suturas profunde impressis, læte et arctissime longitudinaliter fimbriato-costellatis, costis vel lamellis papyraceis, undique spiraliter decussatim liratis, interstitiis subquadratis, numero lamellarum ultimi anfractûs circiter 36, apertura rotunda, peristomate continuo, margine columellari lato, nitente. Alt. 11, diam. 4·75 mm.

Hab.—Persian Gulf, Mussandam, 55 fathoms.

A most exquisite shell, surpassing, we think, even the imposing *S. fimbriolata*, Melv., from the same seas, in elegant delicacy and intricate network pattern. Alliance may be noted with the coarser *S. thelateria*, M. & St., also from the same region, in the chestnut coloration of the upper whorls, and, to some extent, in the spiral liration. Several examples have occurred, by far the largest and finest being that taken as the type, and now figured. It is named in honour of Miss Alizon Townsend, daughter of its discoverer.

Scala aspicienda, n.sp. Pl. XII, Fig. 3.

Sc. testa oblongo-fusiformi, delicatissima, papyracea, anguste rimata, candida, anfractibus ad 11, inclusis apicalibus 3–4, parvis, nitidis, lævibus, pellucidis, cæteris ventricosulis, apud suturas impressis, undique densilamellatis, lamellis arctissimis præcipue anfractus apud supernos (numero antepenultimi anfractus circiter 50), spiraliter læte arcte liratulis, interstitiis sub lente longitudinaliter tenuissime striatis, apertura rotunda, labro in specimine unico effracto, imperfecto, paullum effuso, ad marginem columellarem triangulatim reflexo. Alt. 15, diam. 6·75 mm.

Hab.—Arabian Sea, 60 miles west of Bombay, at 40 fathoms.

One of the most delicately-formed of the genus: pure white, papyraceous in texture, very closely lamellate, lamellæ smooth, thin, spirally closely lirate, the interstices between the lirations microscopically finely striolate. Unfortunately the only two specimens are both broken at the mouth, reducing thus both their size and the power of describing the outer lip, which we should conjecture would be very like that of the nearest ally, *S. dubia*, Sowb., from the Moluccas and N. Australia. That species is much of the same form, outer lip roundly effuse, thin, but in the new form now described the lamellæ are far closer and more numerous on all the whorls, more especially the upper, the whorls also hardly being so tumid, and increasing less rapidly than in the older form.

Scala Idalia, n.sp. Pl. XII, Fig. 4.

S. testa parva, sed solidula, ovato-fusiformi, alba, anfractibus 8, quorum apicales 3 læves, vitrei, cæteris arcte lamellatis, lamellis lævibus, albis, crassis, numero anfractum apud ultimum 12, interstitiis spiraliter rudiliratis, apertura rotunda, peristomate continuo, percrasso, præcipue regionem apud columellarem fere calloso. Long. 4, diam. 1·55 mm.

Hab.—Persian Gulf, Mussandam, at 55 fathoms.

A small but decided species, both as regards form and appearance of being adult. The lamellæ are thick, proportionately speaking, and smooth, with the interstitial spaces rudely lirulate. Peristome continuous and extremely incrassate, particularly towards the base of the columellar region, where this thickening is very marked. Slightly allied to *S. thelcteria*, M. & St., which is, however, a more delicate species, or *S. deifica*, which is likewise more delicate, larger, and elongate.

(Idalia, one of the names of Aphrodite.)

SCALA PASIPHAËS, n.sp. Pl. XI, Fig. 4.

Sc. testa eleganter fusiformi, solidula, albo straminea, anfractibus ad 10, quorum apicales parvi, læves, cæteris rotundatis, ventricosulis, ad suturas impressis, regulariter lamellatis, lamellis crassiusculis, lævibus, infra suturas nequaquam angulatis, interstitiis æqualiter et spiraliter rudi-striatulis, striis distantibus, paucis, apertura rotunda, peristomate incrassato, continuo. Alt. 10, diam. 4·50 mm.

Hab.—Persian Gulf, Bushire.

An elegant species, of fairly normal appearance, proportionately solid, straw-coloured, with rounded tumid whorls, the lamellæ white, smooth, incrassate, not at all angular above, the interstices between the lamellæ coarsely spirally striate, striæ somewhat distant.

I am very grateful to M. de Boury for his kind opinion as to the distinctness of this species. I follow him in continuing to use the familiar word '*Scala*', despite the fact that the followers of the rigid rule of priority, including myself in a previous paper, have superseded it by the Boltenian name *Epitonium*. I venture also to express the just hope that this rule may, by common consensus, some day be to some extent so widened that names which have been in constant use, unchallenged till lately, for fifty to a hundred years or more, be allowed to stand.

(πασιφάης, glittering, conspicuous.)

TRICHOTROPIS CRASSICOSTATA, n.sp. Pl. XII, Fig. 5.

T. testa perparva, breviter fusiformi, imperforata, alba, in speciminibus omnibus visis epidermide denudata, anfractibus ad 4½, quorum apicales 2 magni, vitrei, globulares, lævissimi, ad apicem ipsum planati, cæteris longitudinaliter costulatis, costis percrassis, paucis, anfractûs ultimi ad 10, undique spiraliter rudiliratis, liris distantibus, paucis, interstitiis sub lente spiraliter striatulis, ad basim concentrice liratis, apertura ovato-quadratula, alba, peristomate tenui, canali brevissime rostrato, columella fere recta. Alt. 4, diam. 2 mm.

Hab.—Gulf of Oman. Lat. 24° 58′ N.; long. 56° 54′ E.; 156 fathoms, shell-sand.

This minute *Trichotrophis* occurred in bleached condition only in the dredging just recorded above, in company with *T. Townsendi*, M. & St.; this last, however, has been fortunately obtained in other localities in good condition. The two are somewhat similar, almost indeed identical in form and lip characters, but differing in the character of the longitudinal ribs, those of the species now before us being much fewer, more incrassate, and rudely formed. It is possible that it may be a local variety of *T. Townsendi*, but we hardly think this will prove to be the case. It has not yet been found to occur in any other of the recorded localities for the earlier described species.[1]

LIPPISTES TROPÆUM, n.sp. Pl. XII, Fig. 6.

L. testa parva, anguste umbilicata, ovato-fusiformi, delicata, alba, vel pallide straminea, anfractibus 6½, quorum 2½ apicales, nitidi,

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[1] Proc. Zool. Soc. Lond., June, 1901, p. 360, pl. xxii, fig. 7.

perlæves, apice ipso planato, secundo anfractu globulari, tumescente, candido, cæteris quatuor apud suturas multum impressis, supernis undique carinis duabus centralibus acutis præditis, simul ac tertia carinula supra, juxta suturas, ultimo ad medium tribus carinis ornato, quarta carina ad basim excavatam, circa umbilicum, apertura fere rotunda, labro tenui, tridentato, canali brevi, columella fere recta. Long. 6, lat. 3 mm.

Hab.—Persian Gulf, Mussandam, at 55 fathoms.

The type of this genus, formerly known as *Separatista*, Gray, is the *L. cornu*, Gmelin. It was established by Montfort in 1810, and has priority of thirty-seven years. Our new species is a beautiful and delicate shell, much impressed suturally, very acutely bi- or tricarinate spirally, with swollen and somewhat flattened polished white nucleus. Some superficial likeness to the genus *Mathilda*, Semper, is noticeable, but in this last genus the nuclear whorls are heterostrophe. The nearest ally to the *L. tropæum* is undoubtedly the smaller *L. zodiacus*, Hedley, from Mast Head Reef, North Queensland, where it was dredged at 17–20 fathoms off Mast Head.[1] There are about seven species of this genus known at the present time, of which four are found in Australian seas, and this is the third discovered to exist in the Persian Gulf region.

Rissoa (Amphithalamus) Alphesibœi, n.sp. Pl. XI, Fig. 5.

A. testa fusiformi, sæpe paullum incurva vel inæquali, albo-lactea, tenui, subpellucida, apice planato, lævigata, anfractibus, duobus inclusis apicalibus, ad 8, ventricosulis, apud suturas impressis, undique delicatissime spiraliter striatulis, apertura ovata, peristomate paullum incrassato, fere continuo, margine columellari simplice, obliqua. Alt. 5, diam. 2 mm.

Hab.—Persian Gulf, Henjam Island, and Arabian Sea, Karachi.

A species large for its genus, and sometimes incurved, white, slightly pellucent, beautifully spirally striolate, of which not very many examples have yet come to light. It is named after the 'Pastor Alphesibœus'—in fanciful allusion to his staff or crook, which this elongate, incurved species may be supposed to resemble in form.

Rissoa (Amphithalamus) Aristæi, n.sp. Pl. XI, Fig. 6.

A. testa minuta, alba, fusiformi, subpellucida, ad apicem late planata, vitrea, anfractibus, apicalibus 2 inclusis, ad 6, suturaliter multum impressis, undique spiraliter fortiter sulcato-striatis, striis regularibus, arctis, conspicuis, apertura ovata, peristomate fere continuo, haud multum incrassato, columella obliqua. Alt. 3·50, diam. 1 mm.

Hab.—Bombay (A. Abercrombie).

A very small, but well-defined species. Conspicuous for its regular, strong, and close sulco-striation, the whorls well impressed suturally, apex smooth, much and broadly flattened, swollen below, and vitreous. (Aristæus, a shepherd, cf. Virgil, G. iv, 317).

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[1] Hedley, Proc. Linn. Soc. N.S.W., vol. xxxii, p. 502, pl. xviii, fig. 30, 1907; also loc. cit., vol. xxvii, p. 23, 1902.

RISSOA (AMPHITHALAMUS) DENSILABRUM, n.sp. Pl. XII, Figs. 8, 8*a*.

R. testa parva, solidula, pallide straminea vel cinereo albescente, imperforata, anfractibus $5\frac{1}{2}$, quorum $2\frac{1}{2}$ apicales, apice ipso depresso, secundo anfractu vitreo, globoso, cæteris ad suturas paullum impressis, undique spiraliter arcte liratis, liris pro parte crassiusculis, interstitiis sub lente interdum planatis, interdum subalveolatis, apertura ovata regione labrali dorsaliter incrassata, labro fere continuo, columella obliqua, ad basim crassiore. Long. 2·75, lat. 1·25 mm.

Hab.—Karachi.

A small Rissoïd, which we refer to *Amphithalamus*, Carp. (= *Scrobs*, Wats.), though there are leanings towards the section *Onoba*, H. & A. Ad. The transverse liræ are close and coarse for the size of the shell, the region of the outer lip being, dorsally, considerably thickened and incrassate. The species occurs generally, but locally, along the Mekran Coast, but more particularly in the neighbourhood of Karachi, but I cannot find that it has been described previously.

RISSOINA TIBICEN, n.sp. Pl. XII, Fig. 9.

R. testa attenuato-fusiformi, apud basim latiore, nitida, solidula, lævi, alba, anfractibus 9, quorum apicales $2\frac{1}{2}$, perlæves, subpellucidi, bulbosi, cæteris longitudinaliter lævicostatis, costis anfractûs ultimi 9–10, usque ad basim ipsam extensis, superficie interstitiali sub lente undique spiraliter tenuissime striata, apertura rotundo-ovata, peristomate incrassato, albo, nitido, columella paullum excavata. Long. 5·75, lat. 1·75 mm.

Hab.—Persian Gulf, Mussandam, 55 fathoms.

This select, white, shining, somewhat pellucid *Rissoina*, belonging to the typical section of the genus, is somewhat isosceles-shaped, attenuately fusiform, neatly and smoothly ribbed, the interstitial spaces with a high power appearing uniformly spirally striolate. It may, perhaps, be compared in form with *R. terebra*, Garrett, from Fiji, but the character of the ribs, ornamentation, etc., is altogether diverse. Except for size this species is much like the type of the genus *Stiva*,[1] Hedley, but *S. ferruginea* is 18 mm. in length, from Wollongong, Australia.

(Tibicen, a piper.)

FOSSARUS APTUS, n.sp. Pl. XII, Fig. 7.

F. testa ovato-rotunda, conica, albo-straminea, delicata, anguste sed profunde umbilicata, anfractibus 5, quorum apicales 2 castanei, parvi, simplices, cæteris gradatulis, penultimo spiraliter tri-, ultimo quinque carinulato, interstitiis spiraliter tenuistriatis, apertura lunulata, intus pallide straminea, labro tenui; extus 6-denticulata, margine columellari margine fere recto. Alt. 3, diam. 3 mm.

Hab.—Persian Gulf, Mussandam, 55 fathoms.

A very small species, with elaborate sculpture, as above described, 5-keeled spirally on the body-whorl, with fine spiral intermediate

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[1] Proc. Linn. Soc. N.S. Wales, 1904, p. 192, pl. ix, figs. 23–5.

interstitial lines intervening. Umbilicus deep but narrow, outer lip thin, columellar margin fairly straight. We know no very near comparable species. It may have some Vanikoroïd characters about it; but I am convinced it is not of that alliance at all, the mouth and peristomatal characters are entirely that of *Fossarus*.

MATHILDA TELAMONIA, n.sp. Pl. XII, Fig. 12.

M. testa perelegaanter attenuato fusiformi, pallide straminea, delicata, anfractibus 15, quorum apicales duo heterostrophi, albi, rugosi, semialveolati, cæteris similaribus inter se, undique ad suturas impressis, 4 carinatis, carina principali et magis conspicua centrali, duabus inferioribus utrinque dispositis, quarta inferiore infra, juxta suturas: interstitiis bene alveolatis, alveis interdum profundis, ultimo infra peripheriam usque ad basim liris quinque spiralibus, interstitiis subalveatis, præditis, apertura fere rotunda, labro tenui, extus denticulato, columella recta. Long. 13, lat. 3 mm.

Hab.—Persian Gulf, Mussandam, at 55 fathoms.

Perhaps the most graceful *Mathilda* yet discovered; perfectly symmetrical and uniform in all its whorls. It comes near to *M. carystia*, Melv., but differs in the far greater prominence of its central keel.

(τελαμών, a belt, or zone.)

ARGYROPEZA SCHEPMANIANA, n.sp. Pl. XII, Fig. 11.

A. testa minuta, oblongo-fusiformi, nitida, albo-straminea, anfractibus ad 10, quorum 3½ apicales, apice ipso rufescente, parvo, lævi, duobus proximis spiraliter unicarinatis, cæteris apud suturas multum impressis, nitidis, tribus nodularum acutarum ordinibus spiraliter præditis, quorum prima infra, juxta suturas, minus conspicua, interstitiis pernitidis, lævibus, ultimo versus basim spiraliter conspicue carinulato, apertura ovata, labro tenui, subangulato, columella paullum excavata, ad basim crassiore, prolongatula. Long. 3, diam. 1 mm.

Hab.—Mekran Coast, Charbar, 40 fathoms.

This little species, the third of the genus now discovered, is very similar in actual appearance, form, coloration, and glazed aspect of whorls, to *A. divina*, M. & St.,[1] which has been found during the past few years to occur commonly in deep water, especially at the well-known station in the Gulf of Oman at 156 fathoms so often quoted. From this, however, the new form differs in the possession of three spiral rows of acute nodules or gemmæ around the whorls, instead of two only, and likewise by its uniformly smaller size. It is very uncommon, for we have not observed half a dozen examples, it usually occurring singly, while *A. divina* is gregarious. As this little species has only been delineated in young condition, we think the opportunity a good one for a figure of the adult shell (Pl. XII, Fig. 10). Its extension of range is much increased by the researches

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[1] Proc. Zool. Soc. Lond., June, 1901, p. 372, pl. xxi, fig. 3, sp. juv.

of the 'Siboga' Expedition,[1] when it was found both in the Molucca Passage and off the north coast of Sumbawa, in both instances in deep water. The operculum of this genus is found to be sub-oval, paucispiral, with central nucleus, according to the same author.

EULIMELLA EGERIA, n.sp. Pl. XII, Fig. 14.

E. testa minuta, attenuato-fusiformi, alba, delicata, tenuissima, anfractibus $9\frac{1}{2}$, quorum apicales $2\frac{1}{2}$ inverso-heterostrophi, pervitrei, nitidi, globulares, cæteris ad suturas impressis, ventricosulis, lævigatis, hic illic lineis longitudinaliter incrementalibus notandis, paullum nitidis, ultimo anfractu magnitudine penultimum et antepenultimum exæquante, obscure ad medium rufizonato, apertura ovata, labro tenui, columella obscurissime plicata. Long. 4, lat. 1 mm.

Hab.—Pasni, Persian Gulf, 40 fathoms.

A small, delicate, smooth, but not very shining shell, thin in texture, with inverse-heterostrophe vitreous apex of $2\frac{1}{2}$ whorls, the remainder being smoothish, the penultimate and body-whorls are obscurely rufous banded centrally, mouth oval, peristome thin, columella indistinctly uniplicate. The addition of this species raises the number of *Eulimella* found in the Persian Gulf region to eight. Of these one is *E. nitidissima* (Mont.), a European and British species, while the remainder are all endemic, so far as is at present known.

TURBONILLA (NISITURRIS) MATERNA, n.sp. Pl. XII, Fig. 13.

T. testa elegantissime attenuata, perlonga, læte vitreo-lactea, delicata, anfractibus ad 17, quorum apicales tres laterali-heterostrophi, pervitrei, cæteris apud suturas impressis, ventricosulis, arcte longitudinaliter costulatis, costis lævibus, interdum, sed raro, hic illic varicosis, interstitiis spiraliter sub lente striatis, striis distantibus, ultimo anfractu infra medium usque ad basim lævi, costis evanidis, apertura fere rotunda, labro interdum crassiusculo, interdum tenuiore, paullulum effuso, columella simplice, recta. Long. 8, lat. 1·15 mm., sp. maj.

Hab.—Persian Gulf, Mussandam, at 55 fathoms.

One of the most truly refined and beautiful of the many species of *Turbonilla* which have yet been discovered in this prolific region. The form is most graceful, attenuate, and lengthened; we have taken, indeed, as the type, a specimen possessing seventeen whorls; more usually examples occur with fourteen to fifteen. The nuclear whorls are laterally heterostrophe, so that we should place them in the section *Nisiturris*, Dall & Bartsch, the numerous body-whorls being uniformly ornamented with smooth, proportionately thickened smooth ribs, of which very occasionally one is varixed, while the interstices are spirally distantly striate. Mouth roundish, outer lip slightly effuse, sometimes thickened, columella straight. It was found locally frequent in shell-sand dredged at the depth and locality given above.

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[1] M. M. Schepman, *Prosobranchiata of the Siboga Expedition*, pp. 169, 170, pl. xv, fig. 11; pl. xii, fig. 1.

Turbonilla (Nisiturris) vallata, n.sp. Pl. XI, Fig. 7.

T. testa parva, attenuato-fusiformi, alba, delicata, haud nitente, anfractibus 13, quorum apicales tres omnino revoluti, heterostrophi, albo-vitrei, lævissimi, cæteris decem ad suturas impressis et vallatis, undique costatis, costis rectis, incrassatis, numero anfractum apud ultimum 17–18, interstitiis lævibus, ultimo ad basim fere recto, costis infra medium evanidis, apertura squarrose ovata, labro paullum incrassato, recto, columella subplicata. Long. 4·50, lat. 1·15 mm.

Hab.—Persian Gulf, Koweit, 10 fathoms.

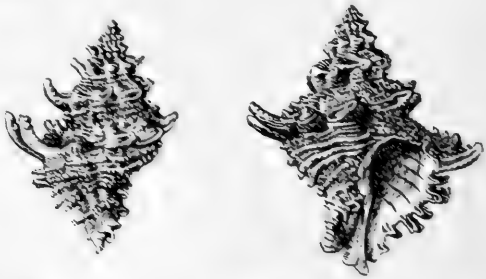
Resembling *T. recticostata*, Melv., from the same region in its straight longitudinal ribs, but differing in the gradate and flattened upper portion of each whorl.

(Vallatus, furnished with ramparts.)

Latiaxis princeps, n.sp. Pl. XII, Fig. 15.

L. testa oblongo-fusiformi, anguste perforata, alba vel straminea, interdum pallide hyacinthino-tincta, anfractibus 7–8, quorum apicales 2 minuti, vitrei, tribus his proximis spiraliter crassi-nodulosis, ad medium angulatis, duobus ultimis ad medium late et regulariter triangulatim spinosis, spinis recurvis, frondosis, squamatis, ultimo anfractûs omni superficie tenuistriata, et, infra peripheriam usque ad basim spiraliter septem squamarum ordinibus imbricatis ornata, apertura ovata, alba, labro tenui, extus multidentato, columella fere recta, canali paullum recurvo. Long. 37, lat. 25 mm.

Hab.—Persian Gulf, off the Telegraph cable at 50 fathoms, and near Mussandam, 55 fathoms.



Originally considered to be *L. diadema*, Sowb., this very elegant species differs in form of aperture and general contour considerably, being, indeed, nearer to the more recently described *L. armatus*, Sowb., which has much finer sculpture upon the body-whorl, the circlet of spines likewise being larger proportionately. I am indebted to Mr. Edgar Smith for pointing out these differences upon comparison with the actual types, and for his opinion thereupon. These three species *diadema*, *armatus*, and *princeps* may by some be considered forms of one protean species, but they seem constant to their types, and this fact points to the probability of their all being worthy of specific recognition.

I may add that *L. Sibogæ*, Schepm., a recently described [1] and very beautiful species from Pulu Kaniungan Reef, East Indies, bears some similarity to *L. princeps*, but in this species the spines are much longer and less triangular basally, and the canal is more produced.

Since writing the above description, several fine specimens have arrived, two of which are now reproduced, as they exhibit the spinal ornamentation very satisfactorily. Having also acquired a good specimen of *L. armatus*, I have been able to confirm my previously conceived opinion as to its distinctness from any form of *princeps*.

Bullia (Leiodomus) Townsendi, n.sp. Pl. XI, Figs. 8, 8*a*.

B. testa mediocri, ovato-fusiformi, solidula, rufo-purpurascente, anfractibus 7, quorum apicales $2\frac{1}{2}$ læves, vitrei, parvi, cæteris ventricosulis, supernis parvis, ultimo effuso, magno, undique spiraliter arcte liratis, liris crassiusculis, supernos ad anfractus plus minus simplicibus, ultimo liris granulis oblongis decoratis, et hic illic longitudinaliter sed irregulariter brunneo-sparso vel tessellato, apertura ovata, intus albi-striolata, labro subeffuso, extus crenulato, columella excavata, canali brevi, operculo rufocorneo, multi denticulato, nucleo laterali. Long. 18, lat. 6 mm.

Hab.—Mekran Coast, Gulf of Oman ; near Charbar.

A very interesting form, at first considered to be, perhaps, the young of some other species, but it is evidently distinct from *B. Kurrachensis*, Sowb., its nearest ally in these waters. Several specimens have now been obtained at different times, all much of the same size. The sculpture of the last whorl, as regards the spiral granulate lirulæ, is very characteristic, these granules being placed obliquely impinging upon each other, all oblong in shape, smooth, shining, and very regular. The coloration of the shell is peculiar, being purplish or greyish fuscous. The operculum is like that of *Nassa*, or *Bullia* proper, as opposed to *Dorsanum*, denticulate with lateral nucleus. We dedicate this species to Mr. F. W. Townsend, who has brought to light in these seas more Mollusca of the highest interest than any of his predecessors collectively.

Tritonidea castanea, n.sp. Pl. XII, Fig. 16.

T. testa mediocri, fusiformi, solida, castaneo-fulva, anfractibus ad 8, quorum apicales duo vitrei, globosi, cæteris ad suturas impressis, ventricosulis, undique longitudinaliter crassicostatis, et spiraliter crassiliratis, costis latis, subrotundatis, liris supra costas magis prominulis, interstitiis inter liras tenuissime spiraliter bi- vel tri-striatis, apertura ovata, intus alba, labro haud multum incrassato, columella fere recta, infra subnodosa, canali brevi. Long. 14, lat. 6 mm.

Hab.—Persian Gulf, Mussandam, at 55 fathoms.

The nearest ally seems to be *T. obliquicostata*, Reeve, from the Philippines, and of which I also possess a specimen from Rarotonga,

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[1] M. M. Schepman, *Prosobranchiata of the Siboga Expedition*, p. 359, pl. xxi, fig. 8, 1911.

formerly in the collection of Mr. C. P. Gloyne. The ribs are straight in the present species, and the whorls not so tumid.

Marginella (Gibberula) replicata, n.sp. Pl. XI, Fig. 9.

M. testa parva, crassa, ovato-elliptica, albescente, anfractibus 5, lævibus, quorum apicales duo minuti, ultimo cæteros multo magis quam decies superante, oblongo, apertura angusta, ad basim latiore, labro incrassato, intus multidenticulato, columella quatuor-plicata, plicis extensis. Long. 5·25, lat. 2·50 mm.

Hab.—Persian Gulf, on the Telegraph cable at 48 fathoms, 1906.

A *Marginella* of simple build, allied to other *Gibberulæ*, e.g. *mazagonica*, *Shoplandi*, etc., from the same seas, but differing in several points. Firstly in form, the present species being roundly oval elliptic; secondly in the strong plication, extended over the greater portion of the frontal surface in an oblique direction; thirdly in the multidenticulate inner edge of the outer lip. *M. replicata* is, so far, rare, but few examples having occurred, and these dead and pierced by carnivorous molluscs in every instance. The figure is taken from a combination of two or three examples, each perfect (or imperfect) in some particular.

Terebra ambrosia, n.sp. Pl. XI, Fig. 10.

T. testa attenuato-fusiformi, brunneo purpurascente, vel cinerea, solidula, rugosa, anfractibus 12–13, quorum apex ipse parvus, vitreus, globosus, cæteris infra suturas imprimis spiraliter nodulosis, nitidis, glabris, deinde unisulcatis, simul ac ad basim anfractuum longitudinaliter costoso-plicatis, plicis rudibus, spiraliter crassiliratis, anfractu ultimo bino spirali nodularum ordine contiguo, prædito, apertura ovata, labro tenui, columella obliqua. Long. 16, lat. 4·50 mm.

Hab.—Mekran Coast, Charbar, 5 fathoms, sand.

Near *T. cognata* of Smith, to whom I am indebted for calling my attention to this species. These two, with several others, belong to the alliance of *T. variegata*, which is of wide distribution in the Eastern tropics.

Drillia euchroës, n.sp. Pl. XI, Fig. 11.

D. testa eleganter fusiformi, attenuata, solidula, læte straminea, liris castaneis et ochro-nigrescentibus spiraliter alternatim decorata, anfractibus ad 11, quorum apicales tres læves, parvi, vitrei, apice ipso bulbuloso, cæteris ad suturas impressis, ad medium angulatis, undique longitudinaliter costatis, costis infra suturas evanidis, ultimo anfractu apud basim prolongato, regulariter infra peripheriam multilirato, apertura oblonga, labro tenui, sinu perobscuro, canali producto, margine columellari recto. Long. 22·75, lat. 7 mm.

Hab.—Persian Gulf, on the Telegraph cable, September 2, 1906.

A brightly coloured species, in shape attenuate-fusiform, eleven whorled, with apex small, vitreous, bulbous, the remainder suturally considerably impressed, straw-coloured with closely ranged spiral liræ of dark chestnut alternating with ochreous; in the centre of each whorl is a white spiral band, bringing into prominence the strongly noduled ribs of the angle of the whorl. The mouth is oblong, outer lip thin; perhaps neither specimen we have seen is full grown, as the sinus is so very obscurely marked. Of much the same form as *D. philotima*, Melv., from the same seas, but with more produced canal. It resembles a small *Latirus*, or even a *Fasciolaria* in miniature, but, of course, there is no columellar plication.

(*εὐχρόης*, well-coloured, goodly.)

Mangilia anarithma, n.sp. Pl. XI, Fig. 12.

M. testa parva, ovato-fusiformi, pallide straminea, nequâquam angulata, anfractibus ad 6, quorum duo apicales læves, globulosi, tertius arcte longitudinaliter liratulus, cæteris tribus longitudinaliter pauci-costatis, costis irregularibus, incrassatis, spiraliter rudiliratis, liris distantibus supra, versus basim magis numerosis, apertura oblonga, labro tenui, sinu fere evanido, canali brevi, lato. Alt. 4·25, lat. 1·50 mm.

Hab.—Mekran Coast, Charbar, 40 fathoms.

Of the same alliance as *M. phæa*, M. & St., which differs in its swarthy brown hue, and in its rarer spiral liræ, particularly on the body-whorl.

(*ἀναρίθμος*, numerous, from its local frequency.)

Mangilia recta, Smith. Pl. XI, Figs. 13, 13*a*.

Pleurotoma (*Mangilia*?) *recta*, E. A. Smith, Ann. Mag. Nat. Hist., October, 1888, p. 310.

Hab.—Mekran Coast, Charbar, 7 fathoms (Townsend); Persian Gulf (Colonel Pelly in Mus. Brit.).

A select species of a curious waxen grey or olive hue, thickly longitudinally ribbed, and obscurely but closely transversely striolate. The nuclear whorls, three in number, are glossy and smooth; the next beautifully longitudinally obliquely ribletted and decussate, in a similar way to *M. gracilenta*, Reeve, *Portia*, Smith, and others of a very closely allied confraternity. This species, however, *M. recta*, seems to possess peculiar characteristics in its facies, and to be a very good species.

Mangilia clarisculpta, n.sp. Pl. XI, Fig. 14.

M. testa parva, delicata, alba, fusiformi, rugosa, anfractibus ad 6, quorum apicales duo globosi, læves, tertius lævis, unicarinatus, cæteris ad mediam peripheriam angulatis, longitudinaliter nodosi-costatis, costis crassiusculis, infra suturas superficie planata, eleganter tornatula, ultimo versus basim multum attenuato, multilirato, apertura lata, sinu lato, labro incrassato, columella fere recta. Alt. 4, lat. 1·20 mm.

Hab.—Mekran Coast, Gulf of Oman, Charbar, 40 to 150 fathoms.

A conspicuously sculptured *Mangilia*, which would claim close kinship with *M. Smithii*, Nevill,[1] from Ceylon. It seems to differ in being slightly larger, with one or two tornate spiral keels just below

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[1] G. & H. Nevill, Journ. Asiatic Soc. Bengal, 1875, p. 88, pl. viii, fig. 13.

the sutures of each whorl, this space being quite plain and free from any sculpture in *M. Smithii*.

CLATHURELLA DITYLOTA, n.sp. Pl. XII, Fig. 17.

M. testa fusiformi, solidula, pallide albo-cinerea, vel carneola, anfractibus 9, apicalibus duobus globulosis subvitreis, lævissimis, inclusis, tertio et interdum quarto anfractu simpliciter spiraliter carinulatis, aliter lævibus, cæteris longitudinaliter crassicostatis, et spiraliter bicarinatis, ad juncturas costarum acutigemmatis, ultimo anfractu tricarinato, simul ac usque ad basim 8–10, spiraliter liratulo, numero costarum ultimum apud anfractum circa 9–10, undique apud suturas impressis, infra, juxta suturas rufo vel castaneo tinctis, simul ac versus basim, apertura ovata, labro paullum expanso, incrassato, sinu perlato, albo, rufimarginato, margine columellari biplicato vel bituberculato. Long. 7, lat. 2 mm.

Hab.—Persian Gulf, Koweit, 10 fathoms; Bunder Abbas, 10 fathoms (April 24, 1907); Henjam Island, 5–10 fathoms.

A well-known species, hitherto named *C. Polynesiensis*, Reeve, but it does not agree with the specimens so named from Polynesia, New Caledonia, Lifu, and other Eastern localities. Some examples exist in the British Museum (Nat. Hist.) labelled '*Borsonia*, sp.', the chief characteristic of this sub-genus being displayed in the typical fossil described in 1846 by Bellardi,[1] as *B. prima*, where midway on the columella two or more plications, superficial or otherwise, appeared, being probably a continuation, at right angles, or in an ascending line, of the spiral liræ round the base of the body-whorl. *B. nigro-cincta*, Mont., is a typical recent representative of this section, which seems to appertain on one hand to *Glyphostoma*, on the other to *Mangilia*. In the present state of uncertainty as to the limitations of these genera (or perhaps sections of one vast genus), we prefer considering the species now under discussion as a *Mangilia* for the present. We have received it also from Townsville, Queensland (A. U. Henn). Its principal allies appear to be *Clathurella rava*, Hinds (Conch. Icon., *Pleurotoma*, pl. xxviii, fig. 250); *Grayi*, Reeve (id., pl. xxvi, fig. 232); *vultuosa*, Reeve (id., pl. xxx, fig. 273); and, perhaps, *scalarina*, Desh. (Conch. I. Réunion, 1863, p. 109).

(δίς, τύλωτος, with two tubercles or plicæ.)

PLEUROTOMELLA EVADNE, n.sp. Pl. XII, Fig. 18.

Pl. testa parva, multum abbreviata, obesa, crassiuscula, alba, anfractibus ad 6, quorum apicales tres pulchre decussati sub lente, apice ipso lævi, globoso, cæteris tribus ad suturas impressis, tumidis, longitudinaliter obliqui-costatis, costis crassis, numero anfractum apud ultimum circa 18, spiraliter liratis, liris haud numerosis, rudibus, interstitiis squarrose alveolatis, ultimo a medio ad basim simpliciter transversim lirato, labro paullum expanso, apertura oblonga, intus alba, canali brevi. Long. 4, lat. 1·55 mm.

Hab.—Persian Gulf, Mussandam, at 55 fathoms.

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[1] Bull. Soc. Géol. France, vol. x, p. 30.

An infrequent little species, the sculpture much like that of *P. amphiblestrum*, Melv., from the Gulf of Oman, but the form is peculiar, being much abbreviate, and almost rotund, the nuclear whorls are beautifully microscopically decussate, outer lip slightly expanded, canal very short.

PLEUROTOMELLA HYPERMNESTRA, n.sp. Pl. XII, Fig. 19.

Pl. testa fusiformi, gracili, pallide albo-straminea, delicata, anfractibus ad 8, quorum apicales tres ochracei, parum nitidi, læves, quartus ochraceus, delicatissime decussatus, cæteris ad suturas impressis, infra, juxta suturas leniter declivibus, deinde fere rectis, longitudinaliter costulatis, costis haud numerosis, anfractûs ultimi circa 10, et spiraliter liratis, liris rudibus, interstitiis oblongo-squarrosis, apertura oblonga, labro incrassato, albo-stramineo, sinu lato, haud profundo, canali brevi, columella fere recta, simplice. Long. 6, lat. 2 mm.

Hab.—Persian Gulf, Mussandam, 55 fathoms.

A well-marked elegant form, neater and finer in sculpture than the allied *P. amphiblestrum*, Melv.,[1] from a neighbouring locality.[1] It seems to come in sequence next to this species, or *P. Alcestis*, also from the Gulf of Oman, described subsequently (1906).

CYLICHNA MECYNTEA, n.sp. Pl. XI, Fig. 15.

C. testa tenui, perangusta, famelica, nitida, alba, cylindrica, recta, apud extremitates ambas indistincte striolata, aliter perlævi, apertura angusta, ad basim latiore, columella ad medium recta, labro tenui, recta. Alt. 6, diam. 1·50 mm.

Hab.—Persian Gulf, Ormara, 1910.

A remarkable species, more perfectly narrowly cylindrical in form than any other of the genus with which we are cognizant, the aperture being equally narrow centrally, widening at either end, especially basally, and the whole surface quite smooth excepting for some obscure striolation at either extremity. Only one specimen has yet occurred.

(μηκύντεος, lengthened out.)

ATYS CHELIDON, n.sp. Pl. XI, Fig. 16.

A. testa ovata, delicatissima, albo-cinerea, pellucida, effusa, paullulum utrinque producta, antice simul ac postice spiraliter striata, striis sulcatulis, claris, decisis, utrinque circa 14, superficie centrali lævissima, apice uniplicato, labro paullum effuso, tenuissimo, apertura lunari, angusta, columella obscure uniplicata. Alt. 12, diam. 6·50 mm.

Hab.—Persian Gulf, Mussandam, at 55 fathoms, 1907

A very delicate, extremely pellucid *Atys*, whitish, vitreous, inflated, smooth centrally, and endowed with clearly cut spiral sulculose striæ

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[1] Proc. Mal. Soc. Lond., vol. vi, p. 58, pl. v, fig. 7, 1904; and loc. cit., vol. vii, p. 78, pl. viii, fig. 23, 1906.

at either extremity. Plaited at the apex and again, but slightly, on the columella, towards the base.

Allied to *A. tortuosa*, A. Ad., from the Philippines, and *A. flavovirens*,[1] M. & St., from Maskat, Persian Gulf.

EXPLANATION OF PLATES XI AND XII.

Plate XI.

Fig. 1, 1*a*. *Cyclostrema spiculigerum*, n.sp.
,, 2. *Gibbula erythracme*, n.sp.
,, 3. *Scala Alizonæ*, n.sp.
,, 4. *S. pasiphaës*, n.sp.
,, 5. *Rissoa* (*Amphithalamus*) *Alphesibœi*, n.sp.
,, 6. *R.* (*Amphithalamus*) *Aristæi*, n.sp.
,, 7, 7*a*. *Turbonilla vallata*, n.sp.
,, 8, 8*a*. *Bullia* (*Leiodomus*) *Townsendi*, n.sp.
,, 9. *Marginella* (*Gibberula*) *replicata*, n.sp.
,, 10. *Terebra ambrosia*, n.sp.
,, 11. *Drillia euchroës*, n.sp.
,, 12. *Mangilia anarithma*, n.sp.
,, 13, 13*a*. *M. recta*, Smith.
,, 14, 14*a*. *Clathurella clarisculpta*, n.sp.
,, 15. *Cylichna mecyntea*, n.sp.
,, 16. *Atys chelidon*, n.sp.
,, 17, 17*a*, *b*. *Ethalia diotrephes*, Melv.

Plate XII.

Fig. 1, 1*a*. *Cocculina simplicior*, n.sp.
,, 2, 2*a*, *b*. *Cyclostrema quinque-striatum*, n.sp.
,, 3. *Scala aspicienda*, n.sp.
,, 4. *S. Idalia*, n.sp.
,, 5. *Trichotropis crassicostata*, n.sp.
,, 6. *Lippistes tropæum*, n.sp.
,, 7. *Fossarus aptus*, n.sp.
,, 8, 8*a*. *Rissoa* (*Amphithalamus*) *densilabrum*, n.sp.
,, 9. *Rissoina tibicen*, n.sp.
,, 10. *Argyropeza divina*, M. & St.
,, 11. *A. Schepmaniana*, n.sp.
,, 12. *Mathilda telamonia*, n.sp.
,, 13. *Turbonilla materna*, n.sp.
,, 14. *Eulimella Egeria*, n.sp.
,, 15. *Latiaxis princeps*, n.sp.
,, 16. *Tritonidea castanea*, n.sp.
,, 17. *Clathurella ditylota*, n.sp.
,, 18, 18*a*. *Pleurotomella Evadne*, n.sp.
,, 19. *P. hypermnestra*, n.sp.

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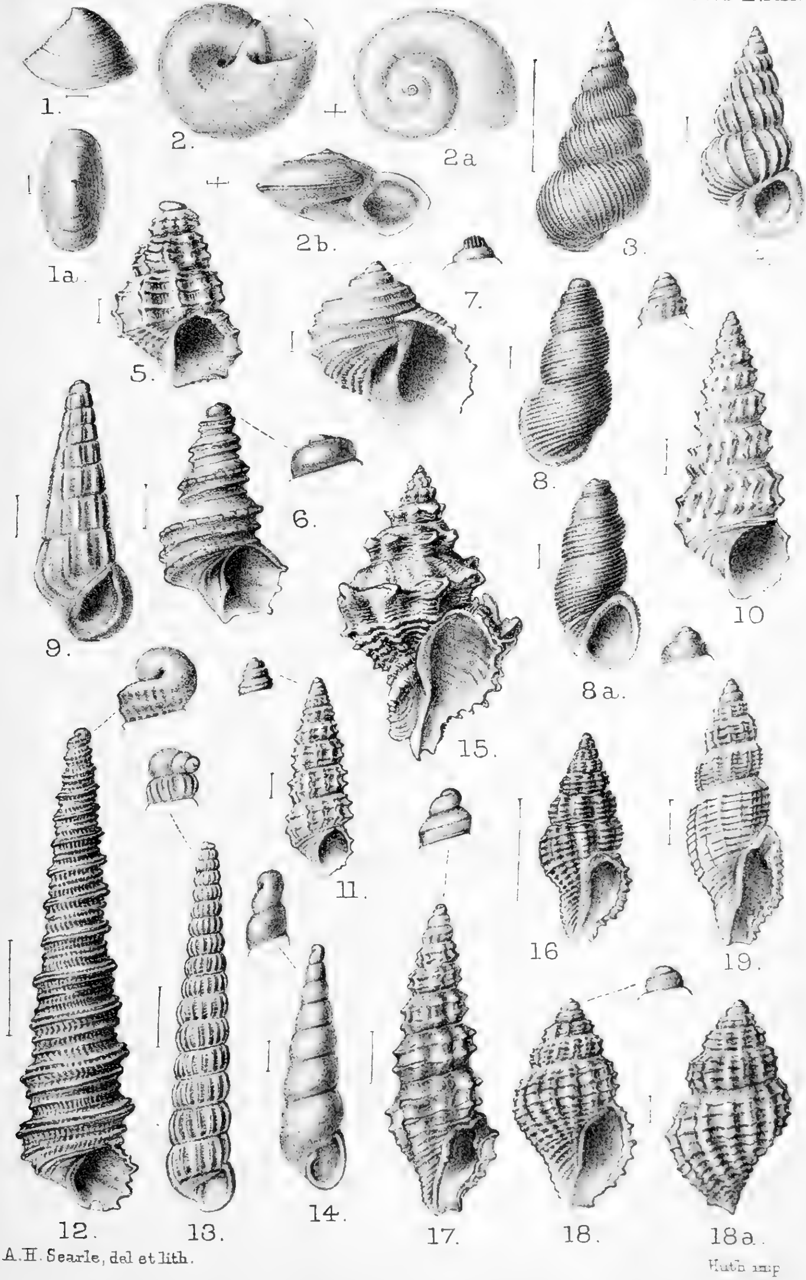
[1] Ann. Mag. Nat. Hist., ser. VII, vol. xii, p. 321, pl. xxiii, fig. 20, 1903.



A. H. Searle, del et lith.

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GASTROPODA FROM THE PERSIAN GULF, etc.

NOTE ON THE GENERIC NAME *PECTUNCULUS*.

By Dr. W. H. Dall.

Read 14th June, 1912.

In an excellent review of the Lamarckian genus *Pectunculus* in the *Journal de Conchyliologie* for February, 1912 (p. 84), M. Ed. Lamy has some remarks on the synonymy of this genus, which seem to call for examination and revision.

I have elsewhere shown that *Glycymeris*, Da Costa, 1778, is the first name which can be used for *Pectunculus*, Lamarck, in conformity with the international rules for nomenclature.

M. Lamy states that "ce terme de *Pectunculus* a été employé avec un valeur générique, in 1770 par G. Huddesford, dans le preface d'une édition postérieure de Lister, puis il a été repris en 1799, par Lamarck".

One would naturally suppose that by 'preface' M. Lamy refers to Huddesford's 'Præfatio' of a page and a quarter, in which no generic names of any kind are mentioned, but in a letter M. Lamy has kindly informed me that he regarded not only the 'Præfatio' but all the indices as prefatory.

Two facts may easily be verified by anyone having access to Huddesford's additions to Lister. First, he refers all the Lamarckian Pectunculi to *Arca* in his binomial index. Second, he uses the name *Pectunculus* in what may be claimed as a generic sense only once in the whole book, namely in the index to the anatomical plates, p. 5, tab. decima tertia, figure 1; and the species in connexion with which he uses it is *Cardium edule*, L. Consequently, if *Pectunculus*, Huddesford, has any standing in zoological nomenclature at all, it is a synonym of *Cardium*, Linné, and according to the rules of nomenclature cannot be used for any subsequently erected genus.

Pectunculus was used by Lister to cover nearly all the rounded and inflated bivalves, and not in particular for the Lamarckian Pectunculi.

I may add that the sole instance in which in his binomial index Huddesford introduces a name not previously in use by Linnæus is on p. 23, where he identifies *Ostrea ephippium*, L., with the genus *Pedalion*, Solander, which, if accepted, would preoccupy the later name *Melina* of Retzius (in Phillipsson), 1778.

Supplementary Note.

Since writing the preceding remarks I have had another note from M. Lamy, who acknowledges that his views on the validation of the name *Pectunculus*, Lister, rest on the situation found on p. 6 of the alphabetically arranged summary of Lister's classification of the mollusca, printed as Index i of Huddesford's supplement.

This is as follows: Lister's large groups being arranged alphabetically and the minor groups under them systematically, and nothing binomial in either.

"PECTUNCULI.
Fluviatiles . . . . tab. 157–60
Marines.
Paribus testis.
Polyleptoginglymi.
Margine longa seu ex altera Parte productiore tab. 229–38,"
etc.

If this may be taken as validating a generic name, *Pectunculus*, in the sense of binomial nomenclature, no one hereafter will dare mention a pre-Linnean name in any publication without a specific disclaimer. The above words, it must be remembered, are those of Lister and not of Huddesford.

NOTE ON SOME HELICOIDS FROM NEW GUINEA.

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

Read 14th June, 1912.

A small collection of Helicoids recently acquired by the British Museum was entrusted to me for examination by Mr. E. A. Smith, Assistant Keeper of Zoology. These shells were collected by Mr. A. S. Meek near the Setikwa River in Dutch New Guinea, and, although few in number, are of interest from the fact that none of the species represented have previously been recorded from the mainland of New Guinea, while the habitat of *Papuina rhombostoma* has hitherto remained unknown.

Planispira (Cristigibba) leptocheila, Tapp.-Canefri.

Helix leptocheila, Tapparone-Canefri, Ann. Mus. Civ. Genova, vol. xx, p. 150, pl. i, figs. 14–16, 1883.

Three specimens. Typically this species is white with one broad deep chestnut band above the periphery, and a rosy peristome; one of the specimens has this band, but it is pale brown in colour, while the shell itself is pale fawn; the second shell has in addition two very narrow bands, one above and one below the broad band, while the third specimen is similarly banded, but the median one is much reduced in width, and the peristome is blackish-brown, this colour being suffused beyond the gibbous portion. It was originally taken in the Moluccas. I possess specimens collected by Mr. Pratt in the Aru Islands.

Papuina rhombostoma, Pfeiffer.

Helix rhombostoma, Pfeiffer, Proc. Zool. Soc. Lond., 1845, p. 72; Reeve, Conch. Icon. Helix, 1854, pl. ccvi, fig. 1456.
Helix (*Papuina*) *rhombostoma*, Pilsbry, Man. Conch., ser. ii, vol. vii, p. 60, pl. xvi, figs. 14–15, 1891.

The single specimen received agrees fairly with the figure given by Reeve of *Helix rhombostoma*, a form which appears not to have been collected since it was described by Pfeiffer. It is intermediate between *P. Tayloriana*, Ad. & Reeve, and *P. Trobriandensis*, Hedley, having more flattened whorls than the latter, and a less developed beak at the aperture than the former. Its habitat was unknown, but Pilsbry shrewdly guessed that the species should be looked for in Southern New Guinea and its neighbouring islands.

Papuina Wallaceana, Sykes.

Journ. Malac., vol. x, p. 65, pl. vi, fig. 14, 1903.

This species was originally brought home from Waigiou. The type has six bands: one at the periphery, two above, and three below it. The three specimens collected are somewhat more elevated in the spire; one has only one faint band peripherally, the second has one above and two below the peripheral band, the third and fourth being fused in places; the third specimen has eight bands: four above and three below the peripheral band.

The species is related to *P. pseudolabium*, Pfeiffer, and *P. Kapaurensis*, Smith, but has a more depressed spire than the former, and is less solid than either.

Chloritis sulcosa, var. Meeki, n.var.

Helix sulcosa, Pfeiffer, Malak. Blatt., vol. i, p. 65, 1854; Novit. Conch., vol. i, p. 1, pl. i, figs. 1–3, 1854.

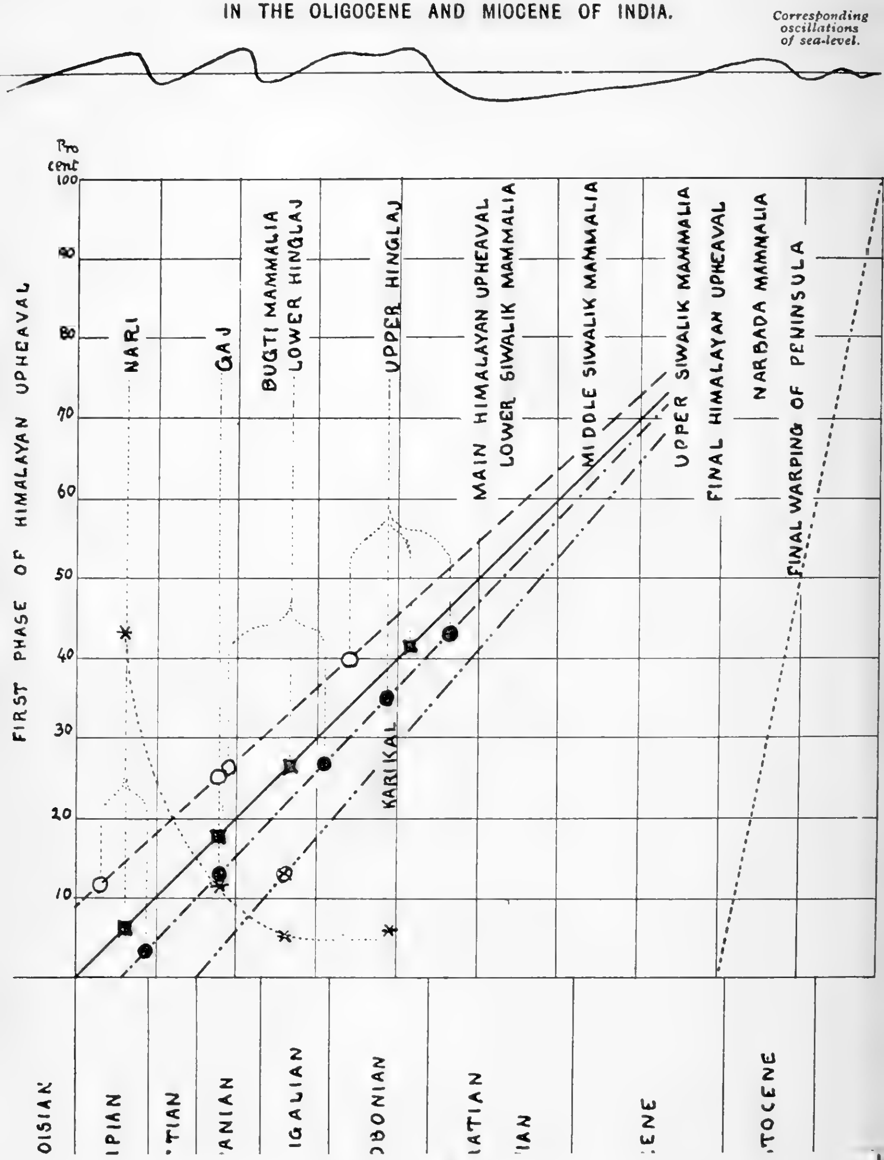
Hitherto only recorded from the Aru Islands. The new variety differs from the type in being darker—blackish-brown—and in having the peristome purplish-brown; it is also larger, and has a relatively higher axis.

Major diam. 53, minor 42·5 mm.; alt. 35 mm.

SCHEMATIC REPRESENTATION

OF THE EVOLUTION OF THE MODERN MARINE MOLLUSCAN FAUNA

IN THE OLIGOCENE AND MIOCENE OF INDIA.



REMARKS ON THE EVOLUTION OF THE RECENT MARINE MOLLUSCAN FAUNA IN THE NEWER TERTIARY ROCKS OF INDIA.

By E. W. Vredenburg, F.G.S.

Read 14th June, 1912.

PLATE XIII.

The diagram on Plate XIII illustrates the evolution of the modern marine molluscan fauna in the Oligocene and Miocene of India. The materials for the construction of the diagram were obtained from the researches upon which the author has latterly been engaged in connexion with his surveys in the Tertiary regions of North-Western India, which have yielded a series of marine fossils representing several successive stages of the post-Eocene. The formations represented are locally known under the names of Nari, Gáj, and Hingláj. Amongst the fossils which they contain there are a certain number of Foraminifera and Mollusca identical with well-known European forms, from which it has been ascertained that the age of the Nari fauna corresponds with that of the Stampian (Upper Oligocene) of Europe, that the Gáj corresponds essentially with the Aquitanian, being the Indian counterpart of the European Schio Beds, while the Hingláj is approximately astride of the boundary between Burdigalian and Vindobonian.

The proportions of Recent species occurring in the successive stages are as follows:—

	Gastropoda.			Lamellibranchiata.			Total Mollusca.		
	Number of species.	Number of Recent forms.	Percentage of Recent forms.	Number of species.	Number of Recent forms.	Percentage of Recent forms.	Number of species.	Number of Recent forms.	Percentage of Recent forms.
Nari	82	3	3·7	35	4	11·4	117	7	6·0
Upper and Lower Gáj	84	11	13·0	53	13	24·5	137	24	17·5
Lower Hingláj	44	12	27·2	28	7	25·0	72	19	26·3
Upper Hingláj	16	7	43·0	30	12	40·0	46	19	41·3

For the two older stages the proportion of recent Gastropoda is lower than that of Recent Lamellibranchiata. This difference is in harmony with the more rapid evolution of the Gastropoda as compared with the Lamellibranchiata. The proportion is reversed in the case of the Hingláj Beds, but the number of available forms is too small to expect closely accurate statistics.

Compared with the Tertiary faunas of European, both foraminiferal and molluscan, the correspondence is close enough to allow of no hesitation regarding the age of these beds, at least with regard to the two lowest stages, the Nari and Gáj, which respectively correspond with the Stampian and Aquitanian, and this correlation is also supported by the stratigraphical data. For stratigraphical reasons the newest age that can be assigned to the Hingláj is Vindobonian. It is evident, therefore, that the proportion of Recent species is much greater than in European strata of the same age. The Gáj, which is essentially Aquitanian, contains a proportion of living forms which is as great or greater than that met with in the uppermost Miocene of Italy, while the Hingláj, if judged by the European standard, would have to be regarded as Pliocene. Yet the Hingláj Beds are unconformably overlaid by the Siwalik formation, whose lower strata contain mammalian remains of Miocene age.

A similar divergence from the European standard had already been noticed in 1879 by Professor Karl Martin in his study of the fossil Miocene fauna of Java (*Tertiärschichten auf Java*, general part, p. 24). The figures arrived at by Martin are as follows (loc. cit., p. 28):—

	Number of species.	Number of Recent forms.	Percentage of Recent forms.
Gastropoda	160	47	29·0
Lamellibranchiata	74	28	38·0
Total Mollusca	235	75	31·9

Martin was under the impression that the Miocene fauna of Java corresponds essentially with the Gáj. Little is known of the stratigraphy of the deposits that have yielded the Javanese fauna, but from a comparison with the fauna of North-Western India, which contains a very large number of species identical with fossil Javanese forms, it is evident that the Java fossils were not derived all from one zone, but from several successive horizons. The greater number evidently were derived from strata situated on the same geological horizon as the Lower Hingláj, but there is a considerable admixture of typical Gáj and Upper Hingláj species, showing that both these horizons are also represented, though to a minor extent.

The explanation of this difference is to be sought in the chequered career of the European seas, both geographical and climatic, during later Tertiary times, as compared with the uneventful history of the Indian Ocean during the same period, which must have allowed therefore a much more gradual evolution of the marine fauna.

When we compare the Indian fossil faunas with European fossil faunas of the same zones, we observe a rapid decrease of the proportion of identical species in the stages following the Nari. The proportions are as follows:—

	European species.	Percentage of European species.
Nari	48	41·0
Lower and Upper Gáj	17	12·4
Lower Hingláj	4	5·4
Upper Hingláj	3	6·5

The fossil fauna of the Nari resembles the Oligocene fauna of Europe so closely as to constitute an eastern extension of the same zoological province, indicating great freedom of oceanic communication.

The connexion between the two regions was already much less direct in Aquitanian times, as indicated by the much smaller proportion of European species in the Gáj fauna, while in the successive faunas the contrast between the eastern and western faunas approximates the conditions observed at the present day. Several geologists, amongst whom I may mention Oppenheim and Rovereto, have already commented upon the similarity between the Indian Eocene and Oligocene faunas and those of Europe, as contrasted with the divergence between the Miocene faunas. It is satisfactory to find these conclusions confirmed by a closer study of the fossils than had been practicable hitherto. It is worth mentioning that the Egyptian Miocene marine fauna, so far as is known, contains a large admixture of Eastern forms, indicating that the land barrier between the two marine provinces must have extended across the Eastern Mediterranean further north than the present isthmus of Suez. I should also mention that the similarity between the Tertiary faunas is restricted to those of the Lutetian and Oligocene. The Lower Eocene molluscan fauna of India differs vastly from that of Europe, quite as much as the faunas from the Middle Miocene.

An attempt has been made at showing the above data in the form of a diagram upon which have also been inserted the relative position of the principal post-Eocene mammalian faunas of India, and also some of the main geological events such as the earth-movements of the Himalaya and of the Indian Peninsula, and the corresponding oscillations of the sea-level, so far as can be gathered from the information at present available.

In addition to the molluscan faunas from North-Western India, I have inserted the proportion of living forms in the Gastropod fauna of Karikal, another Upper Tertiary Indian fauna latterly monographed by Cossmann, and which, from the identity of several characteristic fossils, appears to be on a level with the Hingláj Beds, more especially the Upper Hingláj. I have thought it interesting, for the sake of comparison, also to illustrate diagrammatically the much more rapid evolution of the Echinoidea, and especially of the terrestrial mammalia.

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(Founded 27th February, 1893.)

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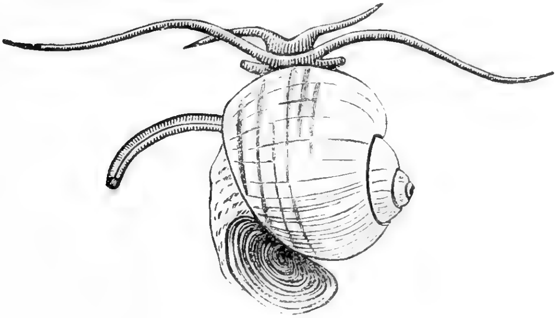

EDITED BY

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

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ORDINARY MEETING.

FRIDAY, 8TH NOVEMBER, 1912.

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

Professor Ralph Arnold was elected a member of the Society.

The following communications were read:—

1. "On *Tivela* and *Grateloupia*." By A. J. Jukes-Browne, F.R.S.

2. "On some remarkable Shell Monstrosities." By G. C. Robson, B.A.

3. "Descriptions of New Species of *Limicolaria* and *Krapfiella* from East Central Africa." By H. B. Preston, F.Z.S.

Mr. G. C. Robson exhibited two living specimens of *Glyptorhagada Silveri* (Angas).

ORDINARY MEETING.

FRIDAY, 13TH DECEMBER, 1912.

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

Keppel H. Barnard, Percival Ross Frames, and the Hon. Librarian of the Conchological Society of Great Britain and Ireland were elected members of the Society.

The following communications were read:—

1. "Note on *Cyprina islandica*." By W. H. Dall.

2. "Descriptions of two new Helicoids from British East Africa." By H. B. Preston, F.Z.S.

3. "Note on *Murex mancinella*, Linn." By E. A. Smith, I.S.O.

Mr. E. A. Smith exhibited a handsome specimen of *Murex ramosus*, Linn., presented to the British Museum by Mr. Henry Harvey, the shell having a black spiral band, a very unusual feature in the species. Mr. Smith further exhibited a sketch of a specimen of *Strombus gigas*, presented to the Museum by the same gentleman, and distinguished from the normal form by having a double row of spines.

ORDINARY MEETING.

FRIDAY, 10TH JANUARY, 1913.

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

M. Paul Jodot was elected a member of the Society.

The following communications were read:—

1. "On *Hygromia rufescens*, auct., in Ireland." By A. W. Stelfox.

2. "On some Preoccupied Molluscan Names (generic and specific)." By G. K. Gude, F.Z.S.

3. "A Collation of the Molluscan Parts of the Synopses of the Contents of the British Museum, 1838–45." By Tom Iredale.

Mr. E. A. Smith exhibited the type of *Helix rufescens* of Pennant, a young specimen of *Arianta arbustorum*, and pointed out that the shells described and figured by all subsequent authors under that name belonged to a different species. He suggested that the *rufescens*, auct., might take the name *montana* (Studer), C. Pfeiffer.[1]

[The meeting on 14th February approved of the auditing of the accounts by Dr. Henry Woodward and Mr. G. C. Robson.]

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[1] A note upon this subject has appeared in the Ann. Mag. Nat. Hist., 1913, vol. xi, p. 263.

NOTES.

Note on *Glyptorhagada Silveri* (Angas). (*Read 8th November, 1912.*)—Three living specimens of *Glyptorhagada Silveri* (Angas) from Oulnina, South Australia, (250 miles north-east of Adelaide), were presented to the British Museum by Mr. W. T. Bednall, a member of the Society. These specimens are interesting as affording satisfactory evidence on the colour of this species. The shell was described by G. F. Angas in 1868 (Proc. Zool. Soc., p. 257) as 'cretacea', and the colour of specimens presented by the author to the British Museum endorses this description. Thus matters have stood since 1868. It has, however, recently been discovered that the colour thus described is merely the result of exposure to natural bleaching agencies. Apparently it is only under very exceptional circumstances that Helicoids are discovered in their natural condition, as far as colour is concerned, in this part of Australia. They are usually found dead and bleached. If, however, after a long period of drought heavy rains come, the animals come out in countless numbers from the deep crannies of the rocks and from under the surface of the ground. A day or two is apparently sufficient for them to refresh themselves, and after that time they all disappear. On such a lucky occasion as this some specimens of *Glyptorhagada Silveri* were found, and we are now able, after this lapse of years, to publish a correct account of the colour. The latter consists of a brownish ochre ground-colour with three spiral dark-brown bands (one being practically sutural) upon the body-whorl. The upper two of these are continued with diminished definiteness on to the remaining whorls.

G. C. Robson.

ON *TIVELA* AND *GRATELOUPIA*.

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

Read 8th November, 1912.

As the dentition of these shells presents exceptional features and as I find that erroneous views regarding the structure of their hinges are largely current, a note on the subject, with the special object of fixing the taxonomial rank of the fossils known as *Grateloupia* and *Cytheriopsis*, seems to be required.

With respect to *Tivela*, no one seems to have fully and correctly described the positions of the cardinal teeth, nor their complete separation from the accessory dentiform ridges or rugosities. Most writers, indeed, such as S. P. Woodward, Deshayes, Adams, and Dall, have regarded all these dentiform ridges as cardinal teeth, and have stated that the teeth vary in number from 3 to 7 in each valve. Others, like Fischer and Cossmann, seem to have mistaken the first supplementary tooth or ridge for the normal posterior cardinal, and to have overlooked the small and slender anterior cardinal of the right valve.

Having examined the dentition of many species of *Tivela*, both in young and adult specimens, and having compared it with that of *Meretrix* and *Sunetta*, which are the most nearly allied genera, I can state with confidence that the *three* normal cardinal teeth of those genera are present in all species of *Tivela*, although their position varies, because they are more or less displaced by the growth of the supplementary teeth or ridges. This displacement is often carried to such a degree that the three real cardinal teeth are crowded into the anterior half of the hinge-plate, while the accessory teeth occupy the expanded posterior half.

These accessory teeth do not appear to be survivals of primitive embryonic ridges, for they are often less definitely developed in young shells than in adult specimens, and an examination of their number and position in many different species has convinced me that they are developed out of the original nymphal rugosities by the formation of parallel grooves and ridges on this plate.

1. Tivela.

The simplest form of hinge in *Tivela* is exemplified in that of *T. ponderosa*, Koch. In the right valve of this species the three ordinary divergent teeth of the Meretricine group are easily distinguishable, the anterior tooth being very narrow and slender and close to the lunular border, the median thick, solid, and triangular, and the posterior narrow and grooved at the top. Beyond this and below the ligament the nymphal plate is thickened and rugosely striated, but is not raised into any tooth-like projections. In the left valve the teeth are widely divergent and the posterior cardinal occupies its normal position, but its upper and outer side is rugose, as also is the nymph above it.

A distinctive character of the *Tivela* hinge is the forward position of the anterior cardinals in both valves, that of the left being in line with the long compressed anterior lateral, so that these two teeth have the appearance of being projections from one long continuous ridge; that of the right valve is always placed so close to the anterior margin and is moreover so low and slender that it may easily be overlooked, and in some species it does become obsolete in adult shells, though it is always discernible in young specimens.

In most species of *Tivela* the pallial sinus is short and small, but in *T. ponderosa* it is deep and wide, reaching horizontally about half-way across the shell and impinging on the pallial line below. The size and depth of the sinus vary much in different species, and it should not be described as always small.

T. damaoides, Gray, from Peru, has the same hinge-characters as *T. ponderosa*, and the specific differences are so small that it may be regarded as a mere variety of the latter. In the right valve of *damaoides*, however, the inner edge of the nymph is raised into a narrow tooth-like ridge (Fig. 1).

T. bicolor, Gray, from West Africa, has a similar hinge, the nymph of the right valve being nearly flat and only slightly rugose; so also are those of *T. tripla* (Linn.) and *T. dolabella* (Sow.); *T. polita* (Sow.) has a similar flat rugose nymph, and is remarkable for its deep pallial sinus, which extends more than half across the shell and obliterates part of the pallial line.

In *T. stultorum* (Mawe), which is better known as the *T. crassatelloides* of Conrad, there is a further development of this ridge, the whole thickness of the nymph in the right valve being produced or raised into a rugose dentiform ridge which forms a supplementary tooth, but is clearly only a thickened development of the nymph. This fits into a rugose trough or space between the posterior cardinal of the left valve and a narrow ridge or plate on the nymph above it.

T. natalensis (Dunker) is interesting because it shows what seems to be the first stage in the development of two nymphal teeth. The nymph is not thickened as in *crassatelloides*, being still low and flattish, but is grooved or channelled along the median line, and the left valve carries a narrow tooth-like ridge which fits into this groove. The hinge thus presents the appearance of having four cardinal teeth in each valve, for the grooved nymph might be mistaken for a bifid posterior tooth.

In this species also it is noticeable that there is a rather wider space between the nymph of the right valve and the true posterior cardinal, so that the latter is shorter and more central in position than is the corresponding tooth in the species previously mentioned; it is a straight, narrow, entire tooth, very different from the elongate grooved or bifid posterior of *Meretrix*, and it is united at the top, under the umbo, to the end of the lunular margin of the shell, as in *Meretrix* and other genera of Veneridæ.

In *T. compressa* (Sowerby) the nymphal plate is broader, and there are several parallel rugosities, the inner one of which becomes in old shells a rough irregular ridge. This inner ridge is still more prominent in *T. nitidula* (Sow., *non* Lam.).

T. intermedia (Sow.) furnishes a good example of the next stage in the development of accessory teeth, for in this species the nymph is much thickened and divided into two parts by a deep central groove, so that there are two distinct dentiform ridges. Moreover, the three

FIG. 1. *Tivela damaoides*, Gray.
,, 2. ,, *mactroides* (Born).
,, 3. ,, *argentina* (Sow.).
,, 4. ,, *gracilior* (Sow.).
,, 5. *Grateloupia irregularis*, Bast.

normal teeth are crowded into the anterior half of the cardinal plate; the anterior cardinal, though visible in young specimens, becomes obsolete with age, the median is narrowly triangular and directed forward, while the posterior is very narrow, short, straight, and almost vertically central.

In the left valve the posterior cardinal is also central, rather thick, and bifid when young; the nymphal area beyond it is thickened, very rugose, and roughly divided into two ridges by a longitudinal groove.

In *T. planulata* (Brod. & Sow.) and in *T. hians* (Phil.) the nymphal plate is very deep, and there are two ridges on the inner side of it in the right valve and two smaller ones on the left valve.

T. nubila (Gray), *T. mactroides* (Born), *T. trigonella*, and *T. lævigata* (Gray) have hinges like that of *T. intermedia*. In *mactroides* the rugose area of the right valve (Fig. 2) has a deep central groove and a second shallow one under the base of the ligament, so that there is an appearance of three parallel teeth. In the left valve there are two narrow ridges corresponding with these grooves, and the posterior cardinal is only united to the nymph at the top.

In *T. radiata* (Sow.) and *T. gracilior* (Sow.) we seem to have the ultimate phase of this line of development, for in these species, which are quite distinct from one another, the cardinal plate has the appearance of carrying six cardinal teeth. In *T. radiata* (right valve) the true posterior cardinal is actually nearer the anterior than the posterior end of the plate, while the first accessory tooth is a well-developed dentiform ridge separated from the next by a deep groove, except at the top, where it merges into the nymph; the second is also a long narrow ridge, and the third a shorter and less elevated one. The anterior cardinal is small but visible just inside a bulge of the lunular margin. In the left valve there are two well-developed accessory tooth-ridges behind the normal posterior cardinal, which is separated from them by a deep groove.

In *T. gracilior* the dentition is similar, but there is a wider space between the normal and the supplementary teeth of the right valve, so that the different origin of the two sets of teeth is very clearly seen. The interspace extends right up to the umbo, the posterior cardinal is united to the lunular margin, while the accessory teeth are obviously ridges on the nymphal plate, produced simply by the grooving or channelling of that plate. The hinge-plate is thus clearly divided into two parts, and there is a complete break or discontinuity between the anterior margin of the shell and the nymph or ligamental plate. In the left valve, however, this separation is not quite so complete, because the posterior cardinal of that valve is attached to the top of the nymph, springing, in fact, from the posterior and not from the anterior margin.

Finally, in *T. argentina* (Sow.) we have a rather different development, for in this species the nymph is not grooved longitudinally, but obliquely, and only on a portion of its surface (Fig. 3). Its anterior part is sculptured into four or five short oblique ridges, which are roughly but not very regularly parallel to one another, while the posterior part of the area is smooth. These oblique ridges, though less like teeth than the strongly developed ridges of *T. gracilior* (Fig. 4), are really more like those of *Grateloupia* than is the case in any other species of *Tivela*. All three of the normal teeth are clearly developed, and the right posterior is strongly united to the end of the anterior margin, but the left posterior is adherent to the thickened nymph of that valve.

2. Grateloupia.

This name was given by Desmoulins to certain shells of Miocene age which occur near Bordeaux in France, in Italy, and in Austria, but only two species have been described. The typical form is the *Donax irregularis* of Basterot (1825), which was more completely described and well figured by Desmoulins in 1828 [1] as the type of a new genus, to which he gave the name of *Grateloupia*. The following is that part of his description which relates to the hinge: "Dentes cardinales primarii (ut in *Cytherea*) divaricati, tres in utraque valva; quibus accedunt in valvis ambabus dentes cardini-seriales 3–6 lamellosi, paralleli, ad natem convergentes oblique rugosi, margineque denticulati, sub ligamento ad latus testæ posticum instructi. Dens lateralis unicus, anticus, sub ano (ut in *Cytherea*) in valva sinistra positus; fovea in valvâ dextrâ alterius valvæ dentem lateralem recipiente."

From this account (which is given also in French) it is quite clear that Desmoulins thoroughly understood the structure of the hinge, for he rightly credits it with three principal or primary teeth and several parallel accessory teeth, placed obliquely under the ligament, which he terms '*cardini-seriales*', not *cardinales*.

It is curious that although he was fully aware of the existence of a similar shell in the Miocene deposits of Bordeaux, namely the *Donax difficilis* of Basterot, yet he and Deshayes regarded this as belonging to *Cytherea*. Possibly this may have been due to his not possessing sufficiently good specimens, for the dentition is really the same, though the number of accessory ridges or teeth is less—only two or three in a more contracted space. It was, however, recognized as a *Grateloupia* by C. Mayer in 1858.[2]

Deshayes accepted the genus in 1848 (*Traité Élémentaire de Conchyliologie*), but S. P. Woodward considered it to be only of subgeneric rank; in the first edition of his *Manual* (1851) he placed it as a sub-genus of *Cytherea*, and in subsequent editions as a sub-genus of *Trigona*, which is the *Tivela* of Link. Most subsequent authors, d'Orbigny (1852), Sowerby (1852), Bronn (1854), Pictet (1855), and Hoernes (1862), accepted it as a genus; while Fischer, in his *Manuel de Conchyliologie* of 1887, not only described it as a genus, but separated it entirely from *Tivela*, which he placed as a sub-genus of *Meretrix*.

It seems to have been Fischer who first imagined that a posterior lateral tooth existed in the right valve of *Grateloupia*. He correctly stated that there are "trois dents cardinales divergentes" in each valve, and "plusieurs plis dentiformes, parallèles, placés en arrière de la dent cardinale postérieure", but he adds that there are two anterior lateral teeth and one posterior lateral in the right valve. No doubt this was the chief reason why he separated *Grateloupia* from *Tivela*.

His opinion has naturally influenced other French writers, and it has recently been adopted by Messrs. Cossmann & Peyrot,[3] who

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[1] Actes Soc. Lin. Bordeaux, ii, p. 243, pl. vi, figs. 1–5.
[2] Journ. de Conch., tom. vii, p. 88, 1858.
[3] "Conch. Neogen de l'Aquitaine": Actes de la Soc. Linn., Bordeaux tom. lxiii, 1909.

not only mention the existence of this supposed posterior lateral as a generic character, but show its position in their diagram of the hinge of *G. irregularis*. In their description of this species, however, they write of it as "très rudimentaire, la fossette opposée étant très indecisée", while under *G. difficilis* they remark that there is "pas d'apparence de lamelles postérieures, le bord supérieur est seulement un peu rainuré".

Thus these authors admit that the supposed posterior lateral does not exist in *G. difficilis*, and that it is very rudimentary in *G. irregularis*; hence it is impossible to regard it as a generic feature. Having examined good specimens of both species, which I owe to the kindness of Professor Peyrot, I can quite confirm their statements; I am not surprised that they regard the tooth as very rudimentary, even in *G. irregularis* (Fig. 5), for I feel sure that it has no real existence. The feature which has given rise to the idea of such a tooth is a slight inflection of the posterior margin of the valve beyond the end of the ligament, and a thickening of the inner border of the groove which exists in all species of *Tivela* and *Meretrix*. The extent of this thickening varies with the individual and with the age of the shell, and it has been exaggerated in some figures of the shell, notably in that given by Hoernes (op. cit., pl. xvi, fig. 56). Moreover, no one has claimed to recognize a corresponding tooth on the posterior border of the left valve; no elevation exists on that border, and its absence militates strongly against the existence of a lateral tooth in the right valve.

As, however, I did not wish to dissent from such authorities as Messrs. Fischer, Cossmann, and Peyrot without confirmation of my opinion, I sought that of Messrs. E. A. Smith and R. B. Newton, of the British Museum, who have kindly examined the specimens of *G. irregularis* in the National Collection, and have informed me that they agree in considering that "there is no posterior lateral tooth in *Grateloupia*".

This being so, there is really no essential generic difference between *Grateloupia* and *Tivela*; indeed, the differences are scarcely of subgeneric importance. The dentition of *Grateloupia* is similar to that of *Tivela argentina*, *T. radiata*, and *T. gracilior*. The two parts of the hinge-plate in the right valve are similarly separated by a deep groove or space, in front of which are three divergent cardinal teeth, while behind it are a set of oblique and parallel plaits or ridges, varying in number from three to ten. The true posterior cardinal is a straight, narrow tooth, placed vertically under the umbo, and connected at the top with the anterior margin of the valve. In some specimens it is, moreover, visibly bifid or grooved.

The pallial sinus in *G. irregularis* is large, deep, linguiform, and horizontal, extending to within a short distance of the anterior adductor scar, but in *G. difficilis* it is smaller and shorter, not reaching much more than half-way across the interior space. We have already seen (p. 267) that the depth of the sinus varies also much in *Tivela*, and it is certain that the form of the sinus cannot be taken as a character of generic or subgeneric importance.

There is nothing, in fact, about these two species of shells to mark them off as more than a section of *Tivela*, and they are actually associated with a third species which Messrs. Cossmann and Peyrot rightly regard as a typical *Tivela*; this is *T. triangularis* (Bast.), which closely resembles the recent *T. dolabella*. Messrs. Cossmann and Peyrot have retained *Grateloupia* as a genus, and have placed *Tivela* under it as a sub-genus, but this is contrary to the rule of generic priority, for Link's genus was proposed in 1807 and Desmoulins' in 1828, so that the proper arrangement is to make *Grateloupia* a section or sub-genus of *Tivela*.

Cytheriopsis (Conrad).

This supposed genus or sub-genus was founded on a fossil from the Eocene of Alabama (United States), but it is probably only a form of *Grateloupia*, and consequently of *Tivela*, for the distinction which Dr. Dall makes between them is a mistake, arising apparently from a miscomprehension of the dentition. He states that in *Grateloupia* "the posterior right cardinal is fused with the nymphal rugosities", and that in *Cytheriopsis* it is the left posterior cardinal which is so fused. As regards *Grateloupia* this statement is absolutely incorrect, for there is a deep space in the right valve between this tooth and the nymphal plate.

With respect to *Cytheriopsis*, which is the *Cytherea hydana* of Conrad (August, 1833) and the *Gratelupia Desmoulinsi* of Lea (December, 1833), the former gave no figure, but Lea gave a good one [1] showing the hinge of the left valve, and this is certainly that of *Grateloupia*, as there are three prominent cardinal teeth, and several oblique ridges on the nymph. Whether the posterior cardinal is fused with the first of these ridges, or whether there is a groove between them, is of small importance, seeing that in *Tivela argentina* it is so fused, and in *T. radiata* it is not. There is therefore no essential difference between *G. hydana* and the other species of *Grateloupia*, and consequently there is no necessity to perpetuate the name of *Cytheriopsis* or its substitute *Grateloupina* (Dall).

Conclusions.

From the preceding notes and observations it will be seen that I regard *Tivela* as a fairly compact genus, including the fossils which have been described under the names of *Grateloupia* and *Cytheriopsis*. Consequently I consider that the genus ranges from the Eocene to the present day.

I have shown that the so-called accessory teeth are entirely confined to the nymphal plates, that they are merely ridges developed out of the rugose sculpture of these plates, and that the hinge of *Grateloupia* closely resembles that of some recent species of *Tivela*; also that *Cytheriopsis* does not seem to differ from *Grateloupia* in any essential respect.

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[1] "Contributions to Geology," Philadelphia, 1833 (tract), pl. ii, fig. 33.

Further, I see no reason for retaining the *Pachydesma* of Conrad to include a few species which have a more vernicose periostracum than the rest, for the supposed existence of four cardinal teeth in these species is a mistake of Conrad's, repeated by Dall. The hinge of *Pachydesma* (i.e. *T. stultorum*) has been noticed on p. 267, and its dentition is merely one phase, among several, in the development of the nymphal ridges. It would be just as reasonable to separate those species which have two such ridges as to make a section out of those which have only one.

The only form, recent or fossil, which seems to have a character of subgeneric importance is *T. perplexa* (Stearns), in which the margins of the valves are crenulated, and for which Dall proposed the name of *Eutivela* in 1891.[1] I have referred to his description, which is accompanied by a woodcut of the left valve, and there can be no doubt that the shell is a *Tivela*. Judging from the figure the crenulations of the margin are distinct, though not in deep relief.

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[1] *The Nautilus*, vol. v, p. 26.

ON SOME REMARKABLE SHELL MONSTROSITIES.[1]

By G. C. Robson, B.A.

Read 8th November, 1912.

Most conchologists are familiar with the phenomenon of the formation of callous projections on the inner surface of the valves of Lamellibranchs as a reaction against foreign bodies introduced between shell and mantle. The following note deals with two growths apparently of this nature which are admitted by those who have examined them to be unique specimens of their kind. One of them is from the British Museum Collection, and the other from the Museum of the

Fig. 1. Natural size.

Royal College of Surgeons. The author is indebted to Mr. R. H. Burne, Assistant Conservator of the latter Institution, for the loan of the second specimen and for information concerning it.

These growths were in both instances imperfectly registered. It is thus impossible to refer them with absolute certainty to any particular form. The British Museum example (Fig. 1) was acquired over half a century ago, and was presented by someone who could give no

[1] Published by permission of the Trustees of the British Museum.

more certain information concerning its origin than "from a pearl?" The Royal College of Surgeons' specimen is "presumed" by the catalogue to come from a species of *Tridacna*. They have been examined by many competent authorities, who concur in referring them to *Tridacna*, though only at hazard. Indeed, if they are to be accepted as growths from a molluscan shell, there can hardly be any refuge from this opinion. No one of the many authorities who have seen the specimens has actually seen or heard of precisely similar growths, and recourse has been had to the literature of shell growth and teratology in vain.

It is hoped that the supposition that they are referable to *Tridacna* will be subsequently endorsed by some observer. But in any case the present note is rather a call for information than an assertion of fact.

The growths in question are irregular hollow masses of aragonite, with a slight internal lining of a dubious organic nature.

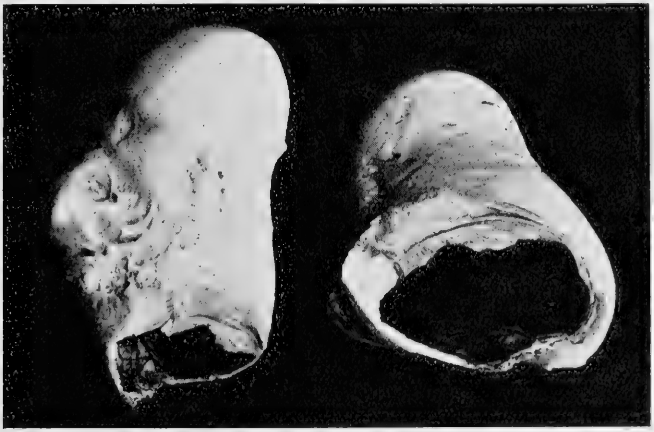


Fig. 2. Half natural size.

The specimen from the College of Surgeons' Museum (Fig. 2) measures 14×10 cm. and is rather heart-shaped. The obtuse end has had a portion sawn off it. The smaller specimen, measuring $8{\cdot}5 \times 5{\cdot}9$ cm., is flattish and roughly circular, and possesses a hollow stalk or narrow neck of an irregular shape, which looks as if it served to connect it to a surface of attachment.

The nearest analogy that suggests itself to the author is the occurrence of 'blisters' in the pearl oyster *Meleagrina margaritifera*. These 'blisters' are irregular excrescences of nacre on the inner surface of the valve of the oyster, and are of course very much smaller than these supposed *Tridacna* monstrosities. They are formed around bodies that have intruded themselves between the mantle and the shell, such as pearls developed in the mantle, and subsequently detached therefrom, or foreign bodies such as sand-grains or intruding animals.

The author is under the impression that they are also formed around parasites that invade the shell-forming area from outside by boring through the shell, as, for example, a boring sponge or mollusc.

Pearl blisters will be found to contain a true pearl, while the other kind of blister is usually hollow or contains some dried organic matter or sand.

The question suggests itself whether the large growths under discussion are similar in origin to the latter form of 'blister'. It must be admitted that in the largest hollow blister the author has examined the cavity was not very large proportionately to the size of the blister, and its walls were very thick, while the reverse is the case in the monstrous growths under consideration. Nor do the latter give the impression of having been formed round an intruding body. The stalk-like portion of the smaller growth is very curious, and suggests an organic connexion with some body or surface—a condition not found, of course, in the case of 'blisters'.

It must be admitted that examinations of sections of these monstrosities do not reveal a histological structure comparable to that of *Tridacna*, though, if these growths are pathological, one would not expect a close similarity to the normal histology of that genus.

Dr. Smith Woodward, F.R.S., and Dr. C. W. Andrews, F.R.S., have drawn the author's attention to the peculiar fact that the interior surface of the larger specimen is seamed with shallow meandering grooves, that give it the appearance of having been formed round or applied to some tumour-like growth covered with superficial blood-vessels.

To conclude, we may hazard the guess that these specimens are referable to *Tridacna*, and possibly comparable to 'blisters' of the pearl oyster, but qualify our identification with a desire for further information on this subject.

The author desires to express his indebtedness to Mr. F. Spencer, of Hatton Gardens, who was good enough to exhibit to him his excellent series of 'blisters' in *Meleagrina margaritifera*.

Postscript.—The author understands that a suggestion was developed at the meeting of the Society at which this paper was read (when he was unfortunately unable to be present) that these growths might be some form of Cetacean ear-bones. As the nature of these monstrosities is still *sub judice*, the author welcomes every suggestion that may be helpful, but the aragonite composition of the growths is sufficient, according to his view, to counterbalance a purely superficial resemblance to the ossicles in question.

DESCRIPTIONS OF NEW SPECIES OF *LIMICOLARIA* AND *KRAPFIELLA* FROM EAST CENTRAL AFRICA.

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

Read 8th November, 1912.

Limicolaria Featheri, n.sp.

Shell narrowly perforate, elongately ovately fusiform, cream-coloured, painted with transverse bands and flame-markings of red and reddish purple; whorls $7\frac{1}{2}$, moderately convex, the first $6\frac{1}{2}$ decussately sculptured, the last obsoletely so; suture impressed, very narrowly margined below with white, and irregularly crenellate; perforation very narrow, tubuliform owing to the narrow reflexion of the

columella; columella narrowly reflexed, vertically descending above, very slightly oblique below, a thin callus uniting it with the upper margin of the labrum; labrum acute, simple, slightly dilated below; aperture inversely auriform; interior of shell showing the transverse colour bands through the test. Alt. 46·5 mm.; diam. maj. 18·5, min. 18 mm. Aperture: alt. 19·75, diam. 8·75 mm.

Hab.—Voi, British East Africa (W. Feather).

Limicolaria Kivuensis, n.sp.

Shell allied to *L. Ponsonbyi*, Preston, from Uganda,[1] but differing from that species in its larger size and in having one whorl less; it also differs in its more obtuse apex, more convex whorls, and deeper suture, more obliquely sloping parietal wall, and in the sculpture, which is rather coarsely decussate throughout the whole shell.

[1] Proc. Malac. Soc. Lond., vol. vii, p. 89.

Alt. 65 mm.; diam. maj. 28·5, min. 25 mm. Aperture: alt. 27, diam. 23·75 mm.

Hab.—Lake Kivu (Robin Kemp).

LIMICOLARIA LAIKIPIAENSIS, n.sp.

Shell fusiform, very narrowly perforate, moderately solid, straw-coloured, transversely streaked, chiefly on the upper part of the

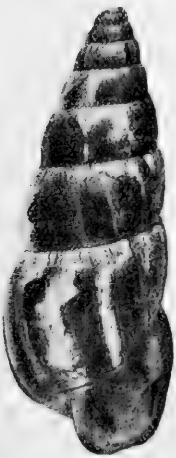
whorls, and banded, especially on their lower portions, with dark reddish chestnut; whorls 7½, not very convex, the earlier whorls sculptured with rather coarse, transverse wrinkles, crossed by spiral striæ, thus presenting a finely decussate appearance; the later whorls somewhat malleated and having the transverse wrinkles chiefly confined to the subsutural region; suture impressed, slightly crenellated by the terminations of the subsutural wrinkles; columella descending rather vertically, livid, very finely granulate, and reflexed over the very narrow perforation; labrum acute, simple, reddish chestnut; aperture inversely auriform; interior of shell whitish, showing the chestnut bands through the test. Alt. 57 mm.; diam. maj. 23·5, min. 21·5 mm. Aperture: alt. 23, diam. 11 mm.

Hab.—Rumruti, Laikipia Plateau, at an altitude of 7,000 feet, British East Africa (Robin Kemp).

The present species would appear to be identical with the specimen in the British Museum which was quoted by Dohrn[1] in his list of mollusca collected by the Speke Expedition as *L. tenebrica*, Reeve;[2] the present species, however, is totally unlike the type of that species, which is also in the British Museum, and I therefore take the present opportunity of describing it.

LIMICOLARIA PERCIVALI, n.sp.

Shell allied to *L. Smithi*, Preston,[3] but more elongate, and with one whorl more; the whorls are more convex, and the last slopes less at the base; the aperture is proportionately much shorter and rather broader; the columella descends almost vertically and is more widely



reflexed; moreover, the labrum is angled above and below, which is not the case with *L. Smithi*. Alt. 59·5, diam. maj. 22·5 mm. Aperture: alt. 27, diam. 9·25 mm.

Hab.—Rift Valley, British East Africa (A. Blayney Percival).

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[1] Proc. Zool. Soc. Lond., 1864, p. 116.
[2] Reeve, Conch. Icon. (*Bulimus*), pl. liii, fig. 347.
[3] Proc. Malac. Soc. Lond., vol. vii, pp. 89–90.

Limicolaria Kempi, n.sp.

Shell rimate, fusiform, moderately solid, the earlier whorls flesh-coloured, shading to yellow below, painted with rather closely set, transverse, zigzag, reddish purple flame-markings, and on the last whorl with two narrow, peripheral, spiral bands of the same colour; whorls $6\frac{1}{2}$, slightly convex, rather coarsely, decussately sculptured with closely set transverse riblets, crossed by spiral striæ, the sculpture becoming quite obsolete on the base of the shell; suture impressed, crenellated by the terminations of the transverse riblets; perforation very narrow, almost concealed by the outward expansion of the columella; columella pinkish flesh-colour, descending

obliquely, narrowly, outwardly expanded, and bulging inwards above, callously granulate, and extending above into an extremely thin parietal callus, which scarcely reaches the sutural margin within the aperture; labrum simple, receding below; aperture narrowly and somewhat curvedly, inversely auriform; interior of shell very pale bluish white. Alt. 39·75, diam. maj. 18 mm. Aperture: alt. 17, diam. 7·5 mm.

Hab.—The extreme south-western district of Uganda (Robin Kemp).

Also allied to *L. Smithi*, Preston, but separable from it chiefly by its decussate and much stronger sculpture.

Limicolaria radius, n.sp.

Shell rimate, ovately fusiform, moderately thin, pale yellowish, painted with transverse bands and flame-markings of reddish chestnut; whorls 7, flattish, the first very small and flattened above, the second large in proportion, the remainder regularly increasing, the last rather long, finely decussately sculptured on the upper whorls, the decussate sculpture becoming obsolete on the last; base of shell below the periphery polished, shining, marked only with faint, wavy, revolving striæ; suture impressed, whitish, irregularly crenellate; umbilicus very narrow, deep, partly concealed by the narrow, outward reflexion of the columella; columella whitish, pearly, minutely granulate, spreading above into an extremely thin callus which is also granulate; labrum simple; aperture elongately ovate; interior of shell bluish lilac, showing the flame-markings through the test. Alt. 40·5, diam. maj. 18 mm. Aperture: alt. 16·5, diam. 7·75 mm.

Hab.—Jombene Hills, British East Africa (A. Blayney Percival).

LIMICOLARIA SCABROSA, n.sp.

Shell fusiform, with dark flesh-coloured apical whorls, gradually changing to brownish yellow, and painted with transverse blotches, streaks, and flame-markings of dark blackish-purple; whorls $6\frac{1}{2}$, regularly increasing, the last rather large, coarsely, decussately sculptured throughout, thus presenting a somewhat scabrous appearance; suture impressed, crenellated by the decussate sculpture, and

narrowly margined below; columella whitish, descending in a gentle curve; labrum thin, acute; aperture somewhat dilated below, inversely auriform; interior of shell flesh-coloured, the transverse streaks and flame-markings being visible through the test. Alt. 61 mm.; diam. maj. 28·5, min. 25 mm. Aperture: alt. 30, diam. 16·5 mm.

Hab.—Between the Jombene Hills and Nyeri, British East Africa (Robin Kemp).

LIMICOLARIA PELLISLACERTÆ, n.sp.

Shell allied to *L. scabrosa*, but much larger and paler in colour, being, with the exception of the apical whorls, of a golden yellow colour throughout, occasionally transversely streaked with purple on the median whorls; the last whorl is proportionately much longer than in *L. scabrosa*, the columella is also much more curved, and the parietal wall does not bulge over the interior of the shell;

moreover, the aperture is much more oblique and dilated below than in that species; the interior of the shell is of a beautiful pinkish flesh-colour. Alt. 75·25 mm.; diam. maj. 34, min. 27 mm. Aperture: alt. 37, diam. 20·75 mm.

Hab.—Aberdare Range, Mount Kenangop, British East Africa (Robin Kemp).

LIMICOLARIA RADULA, n.sp.

Shell rimate, somewhat cylindrically fusiform with obtuse apex and a rather diaphanous appearance, the earlier whorls reddish brown, the later whorls pale reddish-yellow, painted with transverse bands and flame-markings of reddish purple; whorls $6\frac{1}{2}$, the first three rapidly increasing, the remainder regularly so, the last long, coarsely decussately sculptured, thus giving a granular appearance to the shell with the exception of the immediate umbilical region, which is devoid of granulation and only radiately puckered; suture impressed, crenellate, and narrowly margined below by a raised yellowish ridge; umbilicus narrow, deep, half-concealed by the narrow outward reflexion of the columella; columella lilac-coloured, finely granulate, narrowly outwardly reflexed, obliquely descending above, somewhat

curved below; labrum simple; aperture elongately ovate; interior of shell lilac-coloured shading to a bluish tinge in places. Alt. 44·5, diam. maj. 18·5 mm. Aperture: alt. 20·75, diam 9·5.

Hab.—Northern region of British East Africa (A. Blayney Percival).

KRAPFIELLA MAGNIFICA, n.sp.

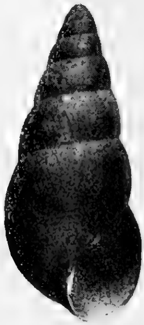
Shell turriculate-fusiform, moderately thin, brownish red, shading to yellowish red just behind the labrum, a broad, ill-defined band of the same tint encircling the umbilical region, which is of a reddish-purple colour, covered with a thin periostracum which gives to the otherwise polished surface a dull appearance, extreme apex slightly sunken;

whorls $7\frac{1}{2}$, the first $3\frac{1}{2}$ sculptured with somewhat fine, revolving, spiral liræ, the remainder marked only with rather oblique, transverse ridges; base of shell finely and closely spirally striate; suture impressed, somewhat puckered by the terminations of the transverse ridges; umbilicus ovate, moderately open, deep; columella descending in a slightly oblique and very gentle curve, outwardly expanded, but scarcely reflexed, diffused above into a thin, polished, clearly defined, and restricted parietal callus which reaches the interior sutural region just behind the upper margin of the labrum; labrum slightly reflexed below, simple above; aperture rather broadly inversely auriform; interior of shell pale lilac, shading to a darker tint of the same colour. Alt. 40·5 mm.; diam. maj. 20·25, min. 18 mm. Aperture: alt. 16·25, diam. 11·5 mm.

Hab.—Urguess, British East Africa (A. Blayney Percival).

KRAPFIELLA PRINCEPS, n.sp.

Shell fusiform with acute apex, moderately solid, uniformly reddish chestnut; whorls 8, the first very small, the remainder regularly increasing, somewhat convex, the earlier whorls coarsely spirally striate, the remainder closely and finely transversely costulate; suture impressed, finely crenellated by the terminations of the transverse costulæ; umbilicus very narrow, partly concealed by the outward expansion of the columella; columella rather



obliquely descending, diffused above into a very thin, shining, well-defined and somewhat restricted parietal callus which reaches the upper margin of the labrum; labrum thin, acute, slightly dilated below; aperture inversely auriform. Alt. 41·5 mm.; diam. maj. 32·25, min. 17·75 mm. Aperture: alt. 15·25, diam. 7·75 mm.

Hab.—Mt. Nyiro, to the south of Lake Rudolph, at an altitude of 8,300 feet (A. Blayney Percival); also collected by Mr. Percival on the Barta Steppes to the south of Mt. Nyiro, at an altitude of 4,000 feet.

DESCRIPTION OF TWO NEW HELICOIDS FROM BRITISH EAST AFRICA AND UGANDA.

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

Read 13th December, 1912.

Gudeella, n.gen. = *Thapsiella*, Gude, *non* Fischer.

The name *Thapsiella*, used for the group of African zonitoid land molluscs by Mr. G. K. Gude,[1] and which includes the two new species described below, being apparently preoccupied by Fischer in 1884 for a section of *Alvania*, Risso, it becomes necessary to substitute a new name for Mr. Gude's genus. I have, therefore, much pleasure in proposing the name *Gudeella* in its stead.

Genotype: *Gudeella Masukuensis*, Smith, from Central Africa.

Gudeella Kigeziensis, n.sp.

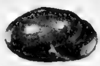
Shell rimate, depressedly suborbicular, moderately thin, reddish brown, polished, shining, base of shell spirally marked with lines of yellowish grey; whorls $4\frac{1}{2}$, regularly increasing, smooth but for transverse growth-markings; suture impressed, narrowly margined below; umbilicus narrow, deep; columella obliquely descending,

outwardly expanded above; labrum simple; aperture broadly and compressedly sublunate. Alt. 3·75 mm.; diam. maj. 7·75, min. 6·5 mm. Aperture: alt. 3·25, diam. 3·25 (nearly) mm.

Hab.—Kigezi, extreme South-West Uganda, at an altitude of 6,000 feet (Robin Kemp).

Gudeella Vernhouti, n.sp.

Shell depressedly turbinate, polished, shining, yellowish brown; whorls $4\frac{1}{2}$, regularly increasing, sculptured throughout with very fine and closely set silky spiral striæ; suture impressed, margined below; umbilicus narrow, deep; columella very narrowly outwardly



expanded above, very obliquely descending, not curved; labrum simple; aperture obliquely crescentic. Alt. 3·5 mm.; diam. maj. 6·25, min. 5·25 mm. Aperture: alt. 2·75, diam. 2·75 mm.

Hab.—Urguess, British East Africa (A. Blayney Percival).

[1] Proc. Malac. Soc. Lond., vol. ix, p. 272.

NOTE ON *CYPRINA ISLANDICA*.

By Dr. Wm. H. Dall.

Read 13th December, 1912.

On p. 105 of the Proceedings of the Malacological Society's current volume, Mr. E. A. Smith discusses the generic name of the *Venus islandica*, L., and incidentally points out that the species figured on pl. 301, figs. 1*a–b*, of the Encyclopédie Méthodique does not represent that species, as I had assumed, but was taken from a specimen of *Batissa*. A comparison shows that Mr. Smith is quite right in this identification, but I may perhaps be granted a few lines to show that I erred in good company.

The figure is sufficiently like *C. islandica* to deceive anyone whose attention is not especially called to the discrepancies, but apart from that, the circumstances which chiefly misled me are the facts that Lamarck himself in 1806 [1] and 1818,[2] Bory St. Vincent in 1827,[3] and Deshayes in 1835,[4] all unite in referring these figures to *Cyprina islandica*.

That Lamarck in 1799 selected another species as an example of the genus would not oblige us to take it as the type, since *Cyclas cornea* was not included in the species figured by Bruguière a year earlier under the name *Cyclas*, and consequently could not serve as the type, even if it had not had a generic name given to it by Scopoli many years before.

No one would be better pleased than I if the name *Cyprina* could be preserved, but I fear that the rules would have to be strained a little to do it. The name of the carp (*Cyprinus*) is doubtless derived from its popular allocation as the fish of Venus by the ancients. On the other hand, the binomiality of Moehring's bird-names [5] can hardly be maintained as against the properly proposed *Arctica* of Schumacher.

Again, since Link's use of the name *Cyclas* is inadmissible and the other forms figured by Bruguière had been pre-empted for new genera, it becomes a moot question whether *Batissa*, Gray, as the last-proposed name for any of the group, should not give way to *Cyclas*; since, if there was anything in the group available for a generic name after the elimination of *Sphærium*, *Cyrena*, and *Corbicula*, it would be entitled to hold the earlier name.

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[1] Ann. Mus. Nat. Hist. Paris, vol. vii, p. 420, 1806.

[2] Anim. sans Vert., vol. v, p. 557, 1818 (in synonymy).

[3] Tab. Encycl. Méth. Vers., 1827, p. 156.

[4] Anim. sans Vert., ed. Deshayes, vol. vi, p. 290, 1835 (in synonymy).

[5] Moehring's work, *Avium Genera*, was published in 1752, and therefore, being pre-Linnean, is not admissible in zoology. The Dutch translation, however, *with additions*, by Nozeman & Vosmaer, is dated 1758, the same year as the tenth edition of Linné's *Systema Naturæ*. Consequently the actual generic names proposed by Moehring may be considered as introduced into zoology at that date, and are therefore not again available for use in other branches of zoology, even if they are not adopted by ornithologists.—E. A. Smith.

NOTE ON *MUREX MANCINELLA*, LINN.

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

Read 13th December, 1912.

The Linnean collection, preserved in Burlington House, London, contains three shells labelled *Murex mancinella*. They were mounted upon wooden tablets by Mr. Hanley when he wrote his work *Ipsa Linnæi Conchylia*, and two of them are marked in Linné's handwriting with the number 544 of the twelfth edition of the *Systema Naturæ*.

One of the three specimens is the *Purpura mancinella* of Lamarck [1] and most other authors, and the other two are *Drupa cornus*, Bolten, of which *Purpura elata* of Blainville, and *Ricinula spectrum*, Reeve, are synonyms.

The *Purpura mancinella* of authors does not agree with Linné's description in the tenth edition of the *Systema*, for the columella is not "transversim striata", and nothing, moreover, is said as regards colour. The "apertura edentula" is fairly descriptive, for the red thread-like lines within the mouth could hardly be termed teeth, yet one would expect such a conspicuous feature to have been referred to if Linné had the shell before him *at the time*.

The *Murex mancinella* of the Museum Ulricæ published six years after the tenth edition of the *Systema* is certainly, in part, the *mancinella* auctorum, for this is shown by the "spinæ brevissimæ purpurascentes", which is a characteristic feature of that species. The "fauce lutea, transversim striata" also seems to indicate this species.

The description in the twelfth edition of the *Systema*, according to Hanley,[2] would apply to "an immature example of *Ricinula spectrum*", and he states that there are two adult examples of it in the Linnean cabinet, but he does not mention the existence of the specimen of *mancinella*, Lamk., which is there also. The quoted reversed figures in Rumphius,[3] however, in my opinion, hardly represents *Ricinula spectrum*, and cannot with certainty be referred to any species.[4] The figure in Argenville,[5] quoted by Linné in this edition of his work, is probably an enlarged but poor illustration of Lamarck's *Ricinula morus*.

From the above notes it will be seen that there is a curious complication, and it becomes a question whether either of the two shells, *mancinella* auctorum or *cornus*, Bolten (= *elata*, Blainville, and *spectrum*, Reeve), should be retained as the Linnean species. The *Murex mancinella* of the tenth and twelfth editions of the *Systema* and the Museum Ulricæ is certainly made up of at least three species, namely, *mancinella*, auct., *cornus*, Bolten, probably, and *morus*, Lamk.

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[1] Kiener, Coq. Viv., pl. xvi, fig. 46.
[2] *Ipsa Linn. Conch.*, p. 295.
[3] *Amboin. Rariteitkamer*, 1705, pl. xxiv, fig. 5.
[4] It is not unlike *Thais echinata* (Blainv.).
[5] *Hist. Nat. Lithol. Conch.*, 1742, pl. xx, fig. H.

The shell of the tenth edition of the *Systema*, as Hanley observes, may be an immature specimen of *Ricinula spectrum*, but there is no proof that it is, for the quoted figure of Rumphius hardly represents it, and there is no such shell in the Linnean cabinet. On the other hand, neither the description nor the quoted figure fits the *mancinella*, auct.

Considering the confusion surrounding Linné's *Murex mancinella* I am inclined to disregard it and to apply names to the shells which have been so designated, about which there is no doubt. Mr. C. Hedley has already come to the same conclusion.[1]

THAIS GEMMULATA (Lamarck).

1764. *Murex mancinella*, Linn. partim, Mus. Ulricæ, p. 636.
1780. *Murex mancinella*, Born partim, Mus. Vindob., p. 304, pl. ix, figs. 19–20.
1798. *Drupa mancinella*, Bolten partim, Mus. Bolten, p. 56.
1816. *Purpura gemmulata*, Lamarck, Tableau Encycl. Méthod. Vers, pl. 397, figs. *3a–b*; liste des planches, p. 2.
1822. *Purpura mancinella*, Lamarck, Anim. s. Vert., vol. vii, p. 239, excluding part of synonymy.
1846. *Purpura mancinella*, Reeve (Linn. partim), Conch. Icon., vol. iii, fig. 2.
1908. *Thais gemmulata* (Lamarck), Hedley, Proc. Linn. Soc. N.S.W., vol. xxxiii, p. 457.

Hab.—Aden (Rev. A. W. Baynham, Major Yerbury in Brit. Mus.); Seychelles I. (Sir A. Gordon in B.M.); Raine's Island, North Australia (J. B. Jukes in B.M.); North Borneo (J. Whitehead in B.M.); Seychelles, Amirantes, Madagascar, Mauritius (Martens); Loo Choo I. (Pilsbry); Bay of Muscat, Singapore, and Fiji I. (Tryon) are probably correct; Ceylon (Blainville); Darnley I., Torres Straits, Nickol Bay, North-West Australia, and Port Darwin, North Australia (Brazier).[2]

Thais ægrota (Reeve), united with this species by Tryon (Man. Conch., vol. ii, p. 164), is a very distinct form which occurs at Sharks Bay, Western Australia.

DRUPA CORNUS, Bolten.

1758. *Murex mancinella*, Linn.?? Syst. Nat., 10th ed., p. 751.
1798. *Drupa cornus*, Bolten, Mus. Bolten, p. 56.
1832. *Purpura elata*, Blainville, Nouv. Ann. Mus., vol. i, p. 207, pl. xi, fig. 1.
1839. *Purpura martiniana*, Anton, Verzeich. Conch., p. 88.
1846. *Purpura elata*, Reeve, Conch. Icon., vol. iii, fig. 27, dwarf form.
1846. *Ricinula spectrum*, Reeve, Conch. Icon., vol. iii, fig. 19.
1899. *Sistrum elatum*, Blainville; Melvill & Standen, Journ. Linn. Soc., vol. xxvii, p. 163.

Hab.—Aden (Capt. Shopland in Brit. Mus.); Australia (Blainville and Reeve); North Queensland (Melvill & Standen); Island of

[1] Trans. Linn. Soc. N.S.W., vol. xxxiii, p. 457, 1908.
[2] Journ. Conch., vol. ii, p. 187.

Capul, Philippines (Reeve, for *spectrum*); Seychelles, Amirantes, Mauritius, Bourbon (Martens).

The 'lumping' of this and several other species by Tryon with *Drupa ochrostoma* (Blainville) is too ridiculous for serious consideration.

Drupa cornus was founded by Bolten upon a figure in Martini's Conchylien Cabinet (vol. iii, fig. 971), which could not be referred to the present species with any certainty had it not been accompanied by the very good description given on p. 279. This is so complete in every detail that we are left in no uncertainty as to the species in question.

ON *HYGROMIA RUFESCENS*, AUCT.,[1] IN IRELAND.

By A. W. Stelfox.

Read 10th January, 1913.

During the last few years, at least some conchologists in this country have awakened to the fact that the inclusion of 'garden records' in tables ostensibly intended to show the geographical distribution of a species is liable to obscure rather than demonstrate its natural range.[2]

For many years, however, it has been the custom for certain English conchologists to 'fill up gaps' in the census by requesting gardeners of estates to forward molluscs for identification. Thus the accumulation of garden records has reached no mean proportions, and the apparent natural range of some of our Irish species has been affected thereby.

Among these, *Hygromia rufescens*, auct., may be taken as an example. This is a 'Central European' species, with its Britannic headquarters in the south-east of England, and thus it belongs to that element of our fauna which one might not expect to find in Ireland.

After some years investigation, I have grave doubts whether *H. rufescens* can be considered a native[3] of Ireland, although it has been 'found' in all the forty divisions of the island, and I am more and more inclined to agree with the opinion of my friend Mr. Welch that "it probably came to Ireland with the English". At the time of the publication of the "Irish List",[4] in 1911, I had not studied the problem sufficiently to give a decided opinion; but since that date I have accumulated much evidence, all of which tends to throw doubt upon the standing of this species in Ireland.

This evidence may be put in a tabulated form as follows:—

1. I know of no records for *H. rufescens* from uncultivated or undisturbed ground. It appears to be purely a 'hedgerow' and 'garden' inhabitant in Ireland, whereas in the South of England it occurs in woodlands on the Downs, associated with species unknown elsewhere in Britain, and is as unquestionably native as a species can be.

2. Records come mainly from the environs of towns and villages, and more especially from those where English settlers are known to have dwelt. In fact, its headquarters in Ireland lie within the boundaries of the Pale.[5]

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[1] Mr. E. A. Smith has shown that this is not the species described and figured by Pennant, Ann. Mag. Nat. Hist., 1913, vol. xi, p. 263.

[2] See L. E. Adams, Journ. Conch., vol. xiii, pp. 211–14, 1911.

[3] For a definition of a 'native' see S. T. Dunn, *Alien Flora of Britain*, pp. 9–10.

[4] Proc. Roy. Irish Acad., vol. xxix, sect. B, pt. iii, 1911.

[5] Nearly synonymous with the province of Leinster, but not so extended in area.

3. Its former absence from the Scotch settlements in the north-east is noteworthy, though it is now being rapidly disseminated over this area from nursery gardens.

4. Its extraordinary powers of adaptability render it extremely liable to accidental dispersal by man.

From many outlying districts which I have surveyed, in which this species had been unknown previously, I have been able to obtain a record by searching gardens, the precincts of a village rubbish-heap, or the ruins of some old castle or mansion. Thus I have records from the gardens of the castle on Lambay, co. Dublin; the gardens of the colony, Achill Island, West Mayo; in the villages on Inishmore, Aran Islands, Clare; in the village of Ventry, near the western extremity of the Dingle Peninsula, South Kerry; and in similar outlying districts in Ulster, in which it was unknown in the time of Thompson.

Writing in 1815, Captain Thomas Brown[1] says that it "is found in all dry places", but since practically all Brown's work was done within the Pale this bald statement throws but little light upon the subject.

William Thompson helps us more, but he was evidently unacquainted personally with the southern range of the species. He says[2] that "this species is common to the southern two-thirds of the island: as far north as Banbridge in the county of Down it has been found, and on old walls at Rostrevor [Co. Down also], 1848, by the Rev. G. Robinson". Thompson was a most accurate naturalist and a keen observer, and he could not have passed over this species had it then occurred in the gardens around Belfast, where it is now common. It is evident that he depended for his information relating to the southern counties mainly upon correspondents, and was thus led to believe in its universal range in those districts. Its distribution, however, is just as patchy in the south as in Ulster, and when cultivated ground has been left behind, *H. rufescens* vanishes also.

To my mind there is but one fact in connexion with *H. rufescens* in Ireland that is incompatible with the supposition that it was first introduced into this island by the English settlers. This fact, which I have kept until the last, is that in 1885 the late R. D. Darbishire recorded[3] it from the famous sandhill deposits at Dogs Bay, West Galway, and that Mr. Standen in 1895 repeats the statement[4] that the shell occurs there as a fossil.

Even should these records—the accuracy of which I have grave doubts—be proved to have been correct, the fact that *H. rufescens* owes its wide range in Ireland to its 'artificial' dispersal by man cannot be doubted for a moment.

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[1] "Account of the Irish Testacea": Mem. Wern. Nat. Hist. Soc., vol. ii, p. 525.

[2] *Natural History of Ireland*, vol. iv, p. 292, 1856.

[3] Journ. Conch., vol. iv, p. 317.

[4] *Irish Naturalist*, vol. iv, p. 270.

ON SOME PREOCCUPIED MOLLUSCAN NAMES (GENERIC AND SPECIFIC).

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

Read 10th January, 1913.

On some former occasions I have already pointed out that in several cases molluscan nomenclature required revision, and these Proceedings have been made the channel for publishing the results of my investigations.

In the course of my further work upon European Tertiary non-marine mollusca in the Collection of the British Museum I have recently come across some additional instances which it has been thought desirable to place on record.

The first case is that of *Diana*, a section of *Pyrgula*, proposed by Clessin in 1878,[1] the type being *Pyrgula Thiesseana*, Clessin,[2] from Greece.

The name *Diana* having already been employed on two previous occasions, i.e. by Risso, 1826, in Pisces, and by Lapparent and Gory, 1837, in Coleoptera, a new designation becomes necessary. While following Brusina[3] in according it generic rank, I propose to modify the name to *Dianella*, nom. mut.

The other cases referred to are specific names.

In 1838 Eichwald[4] described a shell from the Caspian Sea under the name of *Paludina pusilla*, which later[5] he figured. Some shells of this species having been acquired by the British Museum from a Miocene (Pontian) deposit in the Island of Tcheleken, Caspian Sea, I discovered, in looking up the literature of the species, that Basterot in 1825[6] referred a species from the Eocene (Bartonian), previously described by Brard[7] as *Bulimus pusillus*, to the genus *Paludina*, in which course he was followed by Deshayes.[8] Eichwald's name not being available for the Caspian form, especially since both this and the French shell are referable to *Paludestrina*, I propose to change the former to *Paludestrina Newtoni*, nom. mut. In associating with this species the name of our esteemed President, I desire to express my appreciation of the invariable courtesy I have received at his hands, and of the readiness, shown on so many occasions, with which he has placed his extensive knowledge, both stratigraphical and palæontological, at my disposal.

The next species to be dealt with is *Paludina ovata*, Dunker,[9]

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[1] Malak. Blätter, vol. xxv, p. 127.
[2] Loc. cit., p. 127, pl. v, fig. 8.
[3] Icon. Moll. foss. tert. Hungariæ, etc., 1902, expl. pl. vii, figs. 33–8.
[4] Bull. Soc. Imp. Naturw. Moscow, 1838, p. 153.
[5] *Faune Caspio-Caucasica*, 1841, p. 204, pl. xxxviii, figs. 12, 13.
[6] Mém. Soc. Hist. Nat. Paris, vol. ii, p. 31.
[7] Ann. Mus. Hist. Nat. Paris, vol. xv, p. 377, pl. xxiii, fig. 3, 1810.
[8] Descr. Coq. foss. Env. Paris, vol. ii, p. 134, pl. xvi, figs. 3, 4, 1825.
[9] Palæontogr., vol. i, p. 159, pl. xxi, figs. 10, 11, 1848.

occurring in the Miocene (Tortonian) strata of Bavaria. Bouillet[1] having twelve years previously published a *Paludina ovata* which he states forms beds several feet thick at Puy de Marman, Veyre, Department Puy de Dome, and occurs in a much older formation—Oligocene (Stampian), I would suggest for the more recent form the specific name *Dunkeri* in lieu. Sandberger[2] placed it in the genus *Bithynia*, a view coinciding with my own, and the shell will therefore bear the name *Bithynia Dunkeri*, nom. mut.

The last species to require renaming is *Cardium sulcatinum*, Deshayes,[3] 1838, not *Cardium sulcatinum*, Lamarck,[4] 1819. It is somewhat remarkable that Deshayes in applying this specific name overlooked the fact that it had already been used by Lamarck for another species, the more so since he himself edited a later edition of Lamarck's work, vol. vi (containing *C. sulcatinum*) being dated 1835. That the two forms are specifically distinct may at the outset be assumed from the fact that Deshayes makes no reference to Lamarck's specific name, an assumption which receives confirmation from Lamarck's note to the effect that his species is allied to *Cardium sulcatum*, Lam. = *C. oblongum*, Chemn.

Andrusov places the Crimean shell in the genus *Didacna*,[5] and I have much pleasure in coupling the name of the Russian savant with Deshayes' species: *Didacna Andrusovi*, nom. mut.

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[1] Cat. Esp. Moll. Auvergne, in Ann. Sci. Acad. Sci. Clermont-Ferrand, tom. viii, p. 145 (1835), 1836.
[2] Land und Süssw. Conch. Vorwelt, 1875, p. 560, pl. xxviii, fig. 17.
[3] Mém. Soc. géol. France, vol. iii, p. 53, pl. ii, figs. 3–5. Miocene (Sarmatian–Pontian): Kertch, Crimea.
[4] Anim. sans Vert., vol. vi, pt. i, p. 18.
[5] Mem. Acad. Imp. Sci., St. Petersburg, ser. VIII, vol. xxv, No. 8, p. 22, 1910.

A COLLATION OF THE MOLLUSCAN PARTS OF THE SYNOPSES OF THE CONTENTS OF THE BRITISH MUSEUM, 1838–1845.

By Tom Iredale.

Read 10th January, 1913.

I have had occasion in this periodical to point out that some of the generic names commonly cited as "Gray 1840", and a reference given to the "Synops. Brit. Mus.", could not be referred to that date, since apparently the new names there mentioned were *nomina nuda*. My friend Mr. Charles Hedley admitted that he had never seen the book, on account of its rarity. In a recent letter to me Dr. W.H. Dall wrote: "Much trouble would have been saved if we had only had a copy of Gray's 1840 Synopsis on this side of the water. I never got even a sight of it." Such information indicated the necessity of an endeavour to terminate the uncertainty surrounding this work. The best means of publicity seemed to be the reproduction in these Proceedings of the few pages dealing with Mollusca.

Upon investigation I found that Mr. C. Davies Sherborn had carefully noted all the new names as *nomina nuda*, and that these were catalogued and available to workers at the British Museum (Natural History). This paper, however, is written for the benefit of extra-London workers, for Mr. Sherborn's much-desired second volume will not be ready for publication for some time.

Under the title "Synopsis of the Contents of the British Museum" booklets were issued, apparently at irregular intervals, between the years 1808 and 1856, running into sixty-three editions. These covered the whole of the subjects in the British Museum, and their scope can be estimated by the warning given on the inside of the title-page. This reads: "The public are apprised that this Synopsis is merely intended for the use of persons who take a cursory view of the Museum." The result of this notice is seen in the fact that of the 1840 Synopsis I have only heard of the existence of two copies, one at the old British Museum, and the other at the Natural History branch at South Kensington.

In the thirty-sixth edition, dated 1838, the matter relating to molluscs reads in this style: "Cases 3 and 4 contain the shells of those Gasteropodous Mollusca that have the branchiæ similar to the former . . . They generally have a fringe on each side of their body, as the genera *Trochus*, *Monodonta*, and *Haliotis*." No new names are introduced, and the booklet has no interest to the systematist.

In the thirty-seventh edition, also dated 1838, the subject is more fully dealt with. Thus: "The Gasteropoda are divided into orders according to the form of their respiratory organs. The greater number of those furnished with shells have comb-like gills placed over the back of the neck. They are called *Cteno-branchiata* . . . Cases 5, 6, 7 contain the family of the *Strombidæ*, which are peculiar for having a sinus formed by the head of the animal, and placed on the side of the canal, as the true *Strombus*, *Pteroceras*, *Rostellaria*, *Aporrhais*, and *Struthiolaria*." This method is followed throughout, similar notes being given about the families admitted. I do not see any new names, however, but I noted a few misspellings as *Truneatella*, *Gasteroptera*, *Syphonaria*, and *Namnia* (? for *Nanina*). This account is signed by J. G. Children.

The thirty-eighth (1839), thirty-ninth (1839), and fortieth (1840) editions agree in detail, even the misspellings remaining unaltered.

It is obvious that these also have no systematic value.

In the forty-first edition there is no matter about shells, a note being given on p. 53 to the following effect:—

"TWELFTH AND THIRTEENTH ROOMS.

"The first of these Apartments, till lately, held the Collections of British Birds and British Shells, with a small assemblage of Birds' Eggs. These have been removed, and with the general collection of Birds and Shells, which filled the Thirteenth Room, are now in progress of rearrangement in the East Gallery."

The forty-second edition, dated 1840, is the important one, since the preliminary account, although after the manner of the preceding, is somewhat more fully rewritten, and contains a few new generic names with scant remarks diagnostic of them. Appended, however, is a general classification, which is here reprinted.

While engaged upon editing this paper, Mr. Edgar A. Smith consulted another copy of the "forty-second edition" dated "1840". This copy, preserved in the Library of the Zoological Department at the Natural History branch, differs from the one just noted in that in the preliminary account whole paragraphs concerning families not separated in the former are here inserted, whilst the classification following is much amplified, many additional genera occurring, but, as far as I can observe, only one new one, viz. *Livona*. Two obvious misprints were noted: p. 151, *Ringula* (= *Ringicula*), and p. 153, *Papa* (= *Pupa*). The pagination of course differs, the tables occupying pp. 150–6. The tables are signed at the end "John Edward Gray, Nov. 4, 1840". I propose to refer to this copy in the succeeding notes as 1840A.

"The following Tables exhibit the series of genera of Mollusca at one view":—

p. 146.

Sub-kingdom:
MOLLUSCA.

Class I:
GASTEROPODA.

Section I:
CTENOBRANCHIATA.

Order I: ZOOPHAGA.

Family 1: *Strombidæ*.

Strombus, 1.
Pteroceras, 2*a*–*b*.
Rostellaria, 2*b*.
Terebellum, 2*b*.

Family 2: *Muricidæ*.

a. Ranella, 3*a*.
Triton, 3*b*, 4.
Persona, 4.
Apollon, 4.
b. Murex, 4*c*.
Brontes, 4.
Chicoreus, 4*d*, 5.
Typhis, 6.
c. Pleurotoma, 7.
Clavatula, 7.
Conus, 7.
Fusus, 8.
Pyrula, 8.
Tritonium, 8.
Struthiolaria, 8.
Aporhaïs, 8.
d.*Lathirus.
Polygona.
Turbinellus.
Cynodonta.
Fasciolaria.
Cancellaria.

Family 3: *Buccinidæ*.

a. Cassis.
Cassidaria.

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Oniscia.
Dolium.
b. Harpa.
Purpura.
Monoceros.
Planaxis.
Quoyia.
Concholepas.
Ricinula.
Magilus.
Leptoconchus.
Buccinum.
Terebra.
Nassa.
Phos.
Bullia.
Cyllene.
Oliva.
Ancilla.
Eburna.

Family 4: *Volutidæ.*

Cymbium.
Voluta.
Mitra.
Volvaria.
Imbricaria.
Marginella.
Persicula.

Family 5: *Cypræadæ.*

Cypræa.
Cyprovula.
Trivia.
Erato.
Ovula.
Coriocella.

Order II: PHYTOPHAGA.

1. *Podophthalma.*

Family 1: *Turbinidæ.*

Turbo.
Batilla.
Imperator.
Trochiscus.
Phasianella.
*Thicolia.

Family 2: *Trochidæ.*

Pyramis.
*Cardinalia.
Trochus.
*Polyodon.
*Clangulus.
Phorcus.
*Ziziphinus.
Canthiridus.
*Thalotia.
Monodonta.
*Gibbium.
Gibbula.
Rotella.
*Talopia.
*Camitia.
Delphinula.

Family 3: *Stomatellidæ.*

Stomatella.
*Gena.

Family 4: *Haliotidæ.*

Stomatia.
Haliotis.
Padollus.
*Deriobranchus.
Scissurella.
Pleurotomaria.

Family 5: *Fissurellidæ.*

Parmophorus.
Emarginula.
Diodora.
Fissurella.
Macrochisma.
*Pupillia.
*Lucapina.
Fissurellidia.

Family 6: *Neritidæ.*

Nerita.
Pileolus.
*Culana.
Neritina.
Clithon.
*Dostia.
Velates.
Navicella.

Family 7: *Ampullariadæ.*

Ampullaria.
*Marisca.
Lanistes.
Asolene.
Ampulloidea.

Family 8: *Ianthinidæ.*

Ianthina.

Family 9: *Atlantidæ.*

Atlanta.
Helicoplegma.
*Helicophora.

2. *Eriophthalma.*

Family 1: *Naticidæ.*

Natica.
Neverita.
Nacca.
*Cepatia.
Mammilla.
*Cernina.
Globulus.
Naticina.
Cryptostoma.
Stylina?
*Radula?

Family 2: *Melaniadæ.*

Littorina.
Hydrobia.
*Amnicola.
Assiminea.
Lithoglyphus.
*Risella.
Nematura.
Paludestrina.
Lacuna.
*Medoria.
*Niomia.
Merria.
*Fossar.
Pagodus.
*Modulus.
Solarium?
*Torinia.
Bifrontia.
Turritella.
Haustator.
*Zaria.
*Mesalia.
*Eglisia.
Eulima.
*Nisso.
*Bacalia.
Rissoa.
*Nectia.
*Turbonella.

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Rissoina.
Chemnitzia.
*Tania.
Vibex.
Melania.
*Thaira.
Pachystoma.
*Lampania.
*Potamia.
Proto.
Pyrena.
Anculosa.
Io.
Melanopsis.
Potamides.
Tympanotomus.
Telescopium.
*Pyraze.
Vertagus.

Cerithium.
Ceriphasia ?
Acione.
Scalaria.
Clathrus.
*Cyclotrema.
Cornu ?

Family 3 : *Truncatellidæ.*
Truncatella.

Family 4 : *Paludinidæ.*
Paludina.
Meladomus.
Bithinia.

Family 5 : *Pyramidellidæ.*
Pyramidella.
Odostomia ?
Nerinea ?

Family 6 : *Tornatellidæ.*
Tornatella.
Solidula.
*Cinulia.
Monotygma.

Section II :
HETEROBRANCHIATA.

Order III :
PLEUROBRANCHIATA.

Family 1 : *Bullidæ.*
Bulla.
Bullæa.
Acera.
Doridium.
Gasteropteron.

Family 2 : *Aplysiadæ.*
Aplysia.
Dolabella.
Notarchus.

Family 3 : *Umbrellidæ.*
Umbrella.
Tylodina.

Family 4 : *Pleurobranchidæ.*
Pleurobranchus.
Berthella.
Pleurobranchia.

Family 5 : *Pterotracheidæ.*
Pterotrachea.
Firola.
Carinaria.

Argonauta.
Bellerophon.

Order IV :
GYMNOBRANCHIATA.

Family 1 : *Doridæ.*
Doris.
Hexabranchus.
Asteronotus.
Dendroris.
Glossodoris.
Actinodoris.
Pterodoris.
Actinocyclus.
Onchidoris.
*Brachychlamys.
Polycera.
Villiersia.
Plocamophorus.
*Cladophora.
Triopa.
Idalia.
Dimorpha.
Thecathera.

Family 2 : *Tritonidæ.*
a. Glaucus.
Laniogerus.
Eolida.
Eolidia.
*Styliger.
Phyllodesmium.
Flabellina.
Bursiris.
Cavolinia.
Calliopea.
*Liopa.
b. *Tethya.
*Malybe.
Melibæa.
Scyllæa.
Tritonia.
*Dota.
Eubranchus.
Montagua.
Duvaucelia ?
Tergipes.

Family 3 : *Placobranchidæ.*
Placobranchus.
Acteon.

Family 4 : *Phyllidiadæ.*
Phyllidia.
Diphyllidia.

Family 5 : *Patellidæ.*
Patella.
Patina.
Helcion.
Nacella.
*Lepeta.

Family 6 : *Chitonidæ.*
a. Chiton.
Acanthopleura.
*Tonichia.
b. *Acanthochetes.
Chitonellus.
Cryptoconchus.
*Amicula.

Order V :
PNEUMONOBRANCHIATA.

Family 1 : *Arionidæ.*
a. Arion.
Phosphorax.
b. Helicarion.
c. Nanina.

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Stenopus.
d. Zonites.

Family 2 : *Helicidæ.*
a. Limacellus.
Scutelligera.
Mehimatium.
b. Limax.
c. Parmacellus.
Cryptella.
*Pectella.
Vitrina.
Helicolimax.
Omalonyx.
d. Plectrophorus.
e. Testacellus.
f. Helix.
Streptaxis.
Anostoma.
Helicodonta.
Polydontes.
Pleurodonta.
Dentellaria.
Carocolla.
Iberus.
Chilotrema.
*Odontostylus.
Helicophanta.
Tapada.
Amphibulina.
*Epistylium.
Mesomphyx.
Proserpina.
Delomphalus.
Hyalina.
g. Bulimus.
Clausilia.

Siphonostoma.
Bulimulus.
Succinea.
h. Achatina.
Macrospira.
Achatinella.

Family 3 : *Veronicellidæ.*

Veronicella.

Family 4 : *Onchidiadæ.*

Onchidium.
Onchis.
Peronia.

Family 5 : *Auriculidæ.*

Auricula.
Melampus.
*Sidula.
*Tralia.
*Detracia.
Pedipes.
Marinula.
Ovatella.
*Leuconia.
Scarabus.
Chilina (*Ida).
Carychium.
Acme.

Family 6 : *Limnæadæ.*

Limnæa.
Amphipeplea.
Physa.
*Diastropha.
Aphlexus.
Planorbis.
Segmentina.
Ancylus.
*Velletia.

Family 7: *Amphibolidæ.*

Amphibola.

Family 8 : *Siphonariadæ.*

Siphonaria.

Family 9 : *Gadiniadæ.*

Gadinia.
Sormetus.

Family 10 : *Cyclostomidæ.*

a. Cyclostoma.
*Licina.
*Poteria.
*Leonia.
b. Annularia.
*Bolania.
Cyclotus.
Pterocyclos.
Strophostoma.
c. *Realia.
Megalomastoma.
d. *Callia.
e. Pupina.
Registoma.
f. Pomatias.

Family 11 : *Helicinidæ.*

Helicina.
Lucidella.
Alcadia.

Class II :

CONCHIFERA.

Order I : PHYLLOPODA.

Family 1 : *Veneridæ.*

a. Artemis.
b. Cytherea.
Meroe.
Gratelupia.
Trigona.
Chione.
Circe.
*Dorsina.
Mercenaria.
Anomalocardia.
Cyprina.
Tapes.
Venerupis.
*Clementia.

Family 2 : *Cyrenidæ.*

a. Cyrena.
*Geloina.
*Velorita.
b. Cyclas.
c. Pisidium.

Family 3 : *Cardiadæ.*

Cardium.
Hemicardium.
Conocardium.
Lichas ?

Family 4 : *Mactridæ.*

Mactra.
Schizodesma.
Spisula.
*Cypricia.
Lutraria.
Cryptodon.
Mulinia.
Gnathodon.

Family 5 : *Mesodesmidæ.*

Mesodesma.
Donacilla.
Anapa.

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Family 6 : *Tellinidæ.*

a. Psammobia.
Psammotea.
b. Tellina.
*Macroma.
Arcopagia.
*Strigella.
c. Ligula.
Semele.
Cumingia.
d. Petricola.
Clotho.
e. Mysia.
f. Donax.
Hecuba.
Cuneus.
Latona.
Iphigenia.
Capsa.
Galathea.

Order II : CLADOPODA.

Family 1 : *Pholadæ.*

Pholas.
*Barnia.
*Zirfæa.
*Mactresia.
*Talona.
Xylotrya.
*Guetera.
Iouannetia.
Teredina.
Teredo.
*Bankia.
*Kuphus.

Family 2 : *Gastrochænadæ.*

Aspergillum.
*Fœgia.
*Bryopa.
Clavagella.
Fistulana.
Gastrochæna.
Septaria ?

Family 3 : *Solenidæ.*

Solen.
Ensis.
*Pharus.
Cultellus.

Solecurtus.
Panopea.
Glycimeris.
*Ctenoconcha.

Family 4: *Anatinidæ.*

a. Auriscalpium.
Periploma.
Cochlodesma.
*Hemicyclostoma.
b. Thracia.
c. Lyonsia.
*Myodora.
d. Chamostrea.
Myochama.

Family 5: *Myadæ.*

Mya.
Platyodon.
Sphænia.

Family [6]: *Corbulidæ.*

Corbula.
*Azar.
Lentidium.
*Neara.

Family 7: *Pandoridæ.*

Pandora.

Family 8: *Solenomyadæ.*

Solenomya.

Family 9: *Galeommidæ.*

Galeomma.

Family 10: *Saxicavidæ.*

Saxicava.
Hiatella.

Order III: GONIOPODA.

Family 1: *Chamidæ.*

Chama.
Arcinella.
Diceras.
Caprina?

Family 2: *Etheriadæ.*

Etheria.
Mulleria?

Family 3: *Carditidæ.*

Cardita.
*Jesonia.
*Agaria.
Venericardia.
*Ophis.
Myoconcha.

Family 4: *Crassinidæ.*

Astarte.
Goodallia.
Nicania.
*Ginorga.

Family 5: *Crassatellidæ.*

Crassatella.

Family 6: *Isocardiadæ.*

Isocardia.

Family 7: *Lucinidæ.*

a. Lucina.
Semele.
Diplodonta.
Cyrenella.
Myrtea.
Corbis.
Mysia.
b Loripes.
Ungulina.
c. *Lenticularia.
*Verticordia.
Thetis.

Family 8: *Unionidæ.*

Anodon.
Margaritana.
Alasmodon.
*Damaris.
Unio.
*Heterodon.
Dipsas.
*Monocondyla.

Family 9: *Iridinidæ.*

Iridina.
*Leila.
Pleiodon.
Hyria.
Castalia.

Family 10: *Mycetopodidæ.*

Mycetopus.

Family 11: *Trigoniadæ.*

Trigonia.

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Family 12: *Arcadæ.*

a. Arca.
*Litbarea.
*Senilia.
b. Cucullæa.
Trisis.
*Barbatia.
c. *Noetia.
*Argina.
*Licarea.
Pectunculus.
Trigonocœlia.
*Cannabina.
d. *Limnopsis.
e. Nucula.
Leda.

Order IV: POGONOPODA.

Family 1: *Tridacnidæ.*

Tridacna.
Hippopus.

Family 2: *Dreissenidæ.*

Dreissena.
Congeria.
Mytilimeria.

Family 3: *Mytilidæ.*

Mytilus.
Modiola.

Family 4: *Crenellidæ.*

Crenella.
*Modiolarca.

Family 5: *Pinnidæ.*

Pinna.
*Atrina.

Family 6: *Aviculidæ.*

a. Malleus.
Vulsella (Reniella).
Avicula.
Margarita.
Pterynea.
Monotis.
*Wolfataria.
Posidonia.
b. Crenatula.
*Dalacia.
Inoceramus.
Catillus.
Pachymya.
Perna.
c. Gervillia.

Order V: MICROPODA.

Family 1: *Pectinidæ.*

a. Pecten.
Pallium.
Janira.
Amusium.
Neithæa.
*Pycnodonte.
b. Lima.
Plagiostoma.

*Limacula.
c. Pedum.

Family 2: *Spondylidæ.*
Spondylus.
Pachytos.
Podopsis.
Dianchora.
Plicatula.
Hinnites.
Harpax.

Family 3: *Ostreidæ.*
Ostrea.
Gryphæa.
Exogyra.
Alectryonia.
*Plectronia.
Carolia.
Mulleria.

Family 4: *Placunidæ.*
Placuna.

Family 5: *Anomiadæ.*
Anomia.
Placunanomia.
Pododesmus.

Class III:
BRACHIOPODA.

Family 1: *Lingulidæ.*
Lingula.

Family 2: *Terebratulidæ.*
a. Terebratula.
b. Spirifer.

Family 3: *Productidæ.*
Productus.
Calceola?

Family 4: *Thecideidæ.*
Thecidea.

Family 5: *Craniadæ.*
Crania.

Family 6: *Discinidæ.*
Discina.

Class IV:
PTEROPODA.

Order I: THECOSOMATA.

Family 1: *Cleodoridæ.*
a. Hyalæa.
*Diacria.
b. Cleodora.
Balantium.
Pleuropus.
Vaginella.
Creseis.
Brochus.
Psyche.
Euribia.

Family 2: *Limacinidæ.*
Limacina.

Family 3: *Cuvieridæ.*
Cuvieria.
*Tripteres.

Family 4: *Cymbuliadæ.*
Cymbulia.

Order 2:
GYMNOSOMATA.

Family 1: *Pneumodermidæ.*
Pneumodermon.
Spongobranchia.
Trichocyclus.

Family 2: *Cymodoceadæ.*
Cymodocea.

Family 3: *Clionidæ.*
Clio.

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Class V:
CEPHALOPODA.

Order I: SEPIOPHORA.

Family 1: *Octopodidæ.*
Ocythoe.
Octopus.
Eledona.
Philonexus.

Family 2: *Sepiadæ.*
Sepiola.
Onychoteuthis.
*Peratoptera.
Ommostrephes.
Loligopsis.
Cranchia.
Loligo.
Sepioteuthis.
Sepia.
Beloptera.

? Family 3: *Belemnitidæ.*
Belemnites.
Belemnosepia.

Family 4: *Spirulidæ.*
Spirula.

Family 5: *Ammonitidæ.*
Ammonites.
Planites.
Globites.
Crioceratites.
Cyrtoceras.
Clymene.
Scaphites.
Hamites.
Turrilites.
Baculites.

Order II:
NAUTILOPHORA.

Family 1: *Nautilidæ.*
Omphalia.
Nautilus.
Lituites.
*Orthostoma.
Gyroceratites.
Orthoceras.
Conoceras.
*Cyrtolites.
Actinoceras.

Family 2: *Goniatidæ.*
*Phragmolites.
Ceratites.
Goniatites.

JOHN EDWARD GRAY.

October 16, 1840.

The names which were new to science in the preceding list I have marked with an asterisk, but it will be obvious to every student that these cannot be treated otherwise than as *nomina nuda*, and must date from some later introduction.

In the forty-third edition, dated 1841, the same general account of the Mollusca is given as in 1840A, and a list follows, the note at the commencement reading: "The following List exhibits the series of genera of *Mollusca* at one view, and the numbers indicate the Table Cases in this Gallery, in which the genera in the collection are placed." The succeeding list extends from pp. 124–30, and almost exactly agrees with the 1840A list.

The forty-fourth edition, dated 1842, however, presents a troublesome complication. The general account is entirely rewritten, and diagnostic remarks are given of the genera, including most of those indicated as new in the forty-second edition, and an extended list follows. The remarks appear to me to be insufficient to establish the names, but in order that they may be fairly considered I reproduce them on pp. 302–9.

The forty-fifth edition was published in 1843, and on p. 10 the following note appears: "For an explanation of the method on which the Zoological Collection is arranged, and a list of the genera, see a small work called the 'Guide to the Zoological Collection', sold in the Hall, where may also be had a 'List of the Species of Mammalia', with the Synonymes."

Herein the matter relating to the "Shells of Molluscous Animals" is reduced to 4½ pages, and the list is omitted. The subject is rewritten very briefly in the following manner: "Table 17. The Top Shells (*Trochus*) and their allied genera, as the pyramid (*Pyramis*). The rosary (*Clangulus Pharaonicus*). The jujube berry (*Trochus Ziziphorus*). The iris or rainbow eardrop (*Cantherus Iris*), from New Zealand. The button shell (*Rotella lineolata*). The strawberry (*Monodonta*). The gold button (*Livona aurea*), which is peculiar for the light golden colour of the pearl. The dolphin (*Delphinula*)." This is exactly repeated in the forty-sixth edition (published in 1844), which contains none of the names credited by Gray himself to "1844". In the forty-fourth to the sixty-third (the last) editions there is nothing relating to the systematic study of Molluscs worthy of note.

It has now been shown that the forty-fourth edition, published in 1842, is the most important one, and needs careful consideration. It is also obvious that the diagnoses there given cannot be literally accepted, as most of them are merely comparative ones, and the fact must not be overlooked that Gray used many of the common generic names in a different sense to that hereafter assigned to them. Thus in the Proc. Zool. Soc. article we are told, for instance, that *Vermetus*, Gray, 1840, was not *Vermetus*, Adanson; *Entalis* not *Entalis*, Defrance; *Ovatilla* not *Ovatilla*, Bivon.; *Potamides* not *Potamides*, Brongn.; and *Clathrus* not *Clathrus*, Oken, 1815.

It is on account of such difficulties that I would advocate the rejection of the whole of the names used in this edition, and date them all from 1847; but, as this is simply an individual opinion, I am giving the whole of the diagnoses so that this matter may now be fully discussed, and a definite policy of rejection or acceptance adopted. There appear to be few alterations necessary through the adoption of the former policy, which seems to me to best favour accuracy.

In the Proc. Zool. Soc. (Lond.), 1847, p. 129 et seq., a paper was published entitled "A List of the Genera of Recent Mollusca, their Synonyma and Types by J. E. Gray". In the introduction is written: "I have been induced to send it in its present state, as I am constantly requested by both English and continental conchologists to supply them with copies of the Synopsis of the British Museum for 1838, 1840, 1842, and 1844, which contains a list of the genera of Mollusca, and which is now out of print, and also often to give them information with regard to the authorities for the several genera contained in that list, which shows that there is an evident want of some recent information on this subject. . . . The arrangement followed is that which was proposed in the Synopsis of the Contents of the British Museum for 1838, and which has been gradually modified in the different editions as I have become better acquainted with the animals of the different genera."

It is this list which brought into prominence the "Synopsis" names, these being there quoted as "Gray Syn. 1840", "Syn. B.M.", "S.B.M.", or simply "Gray 1840". I have therefore carefully gone through that list, and taken out all the names Gray there credited to himself as introduced in the Synopsis. As usual in all of Gray's work discrepancies are at once evident, names being given which do not appear in the Synopsis, and some I have noticed as new in the Synopsis are not included in the 1847 list. Further, Gray constantly quotes 1844, and generally after this a number. This shows great carelessness, since all these 1844 references, and there are many, should be 1842, where the number given agrees with the page on which the genus is diagnosed. It has been suggested that an alphabetical list would prove serviceable, and therefore I tabulate the names on that method and give after each its definition which appeared in 1840 or 1842, or the disposal of it in 1847, according to the Proc. Zool. Soc. article.

Acanthochetes, 1840. 1847. *Acanthochites*, Risso.

Agaria, 1840. In 1847 type is given as *Chama Agar*.

Alcadia, 1840, p. 130. 1840A, p. 134. "The *Helicinæ* have a simple mouth. *Alcadia* differs in having a slit in front of the mouth, into which is fitted the tooth-like process of the operculum."

Amathina, 1842. 1842, p. 63. "The *Amathina* differ from *Capulus* in having three or more strong longitudinal ridges in front."

Amicula, 1840, p. 123. 1840A, p. 127. "*Acanthochetes* is peculiar for having a bundle of bristles placed on each side of the valves; and *Chitonellus* and *Amicula* only differ in having the valves nearly hidden in the mantle of the animals."

Amnicola, 1840. 1847. *Amnicola* sp., Anthony.

Anapa, 1840. In 1847 quoted as *Anapa*, Gray, 1844, and type given as *Erycina petitiana*.

Argina, 1840. 1842, p. 81. ". . . and *Argina* are ovate, subcordate, convex shells with a crenated margin, and the front group of teeth small and roundish: the hinge teeth are all equally transverse."

Atrina, 1840. 1842, p. 83. "The *Pinna* have an elongated shell with a longitudinal crack filled with a cartilage in the middle of each valve, and *Atrina* are shorter shells without any such crack."

Azar, 1840. In the Proc. Zool. Soc. 1847, on p. 186, *Azor*, Leach, MSS. 1819, is included with type *Solen vespertinus*. On p. 189, *Azor*, Leach, MSS. 1819, is again included with type *Solen antiquatus*. Its usage in connexion with the latter species needs investigation.

Bacalia, 1840. Does not seem to be further mentioned by Gray, either in 1842 or 1847. H. & A. Adams (Gen. Rec. Moll., vol. i, p. 312, 1854) quote it as a synonym of *Littorina*, a conclusion which its position in the previous tables (between *Nisso*, = *Niso*, and *Rissoa*) would not have suggested.

Bankia, 1840. 1842, p. 76. "In *Bankia* they [the pallets of *Teredo*] are elongated, and formed of small cones one within the other, looking somewhat like a quill."

Barbatia, 1840. 1842, p. 81. "The *Barbatia* are elongated shells, covered with a hairy periostraca; the teeth on the middle of the line are small, of the ends large and oblique."

Barnia, 1840. 1842, p. 76. "*Pholas* has an elongated shell with three pieces on the back. The *Barnia* has only one piece, and the *Zirfæa* are short shells with very large gapes at each end, and no distinct dorsal pieces. The *Martesia*, when the animal arrives at full size, closes up the gape in front of the shell with a shelly plate, and the dorsal ligament is covered with a large shield-like convex plate. The *Talona* differ from the latter in being longer, and in the back margin being reflected, and only furnished with two small back pieces."

Bolania, 1840. Not further mentioned, either in 1842 or 1847.

Brachychlamys, 1840. 1847. *Brachychlanis*, Ehr.

Bryopa, 1840. 1842, p. 77. "The *Bryopæ*, which are only known in a fossil state, appear to have lived in sand like the *Aspergillum*, for the tubes are of a regular club shape with a fringe of small tubes round the disk."

Callia, 1840, p. 129. 1840A, p. 133. "The *Calliæ* have a peculiarly polished shell very like the former [*Pupina*], but they want the groove."

Camitia, 1840. 1842, p. 57. "The *Talopia* are like the *Rotella*; the shell is striated and umbilicated, the umbilicus being edged with a striated callus edge, which in *Camitia* is so large as nearly to hide it."

Cannabina, 1840. 1847. ? *Cannabina*, Gray, 1840. No type or further information given.

Cardinalia, 1840. 1842, p. 56. "In *Pyramis* the front of the inner lip has a slight canal, and in *Cardinalia* it appears notched."

Cepatia, 1840. 1842, p. 60. "The operculum of *Natica* is simply horny; *Cepatia* differs in the axis being covered with a large callosity. *Mammilla* chiefly differs from the latter in the axis of the shell being covered with a large callosity, and *Naticaria* in having a thin oblong shell with a large oblong mouth and a thin inner lip. *Cernina* is imperforated with a large mouth, and the inner lip callous."

In 1847 Gray informs us that *Mammilla*, Gray, 1840 = *Polinices*, Montf., 1810; and *Naticaria*, Gray, 1840 = *Mammilla*, Schum., 1817.

Cernina, 1840. See preceding note.

Cinulia, 1840. 1842, p. 62. "The *Cinulia* are like the *Tornatella* with two plaits, and the outer lip is thickened externally."

Cladophora, 1840. In 1847 given as a synonym of *Triopa*, Johnst., 1838; and *Liopa*, Gray, 1840, quoted as a misprint for this name, though the two names are given in different families.

Clangulus, 1840. 1847. *Clanculus*, Montf.

Clementia, 1840. 1842, p. 75. "The *Tapes* and *Venerupes* have oblong shells with very compressed teeth, and the *Clementia* are like the latter, but are very thin, and have a cavity in the margin before and behind the teeth."

Ctenoconcha, 1840, p. 135. 1840A, p. 139. "*Ctenoconcha*, which has many characters in common with the Solens, has the teeth like *Nucula*, but it has an external cartilage."

Culana, 1840. 1842, p. 58. "The *Pileoli* are [fossil] shells of a conical form with a circular base; the inner lip is expanded as far back as the hinder edge of the whorls, forming an edge to the base. The *Culanæ* differ in being oblong and rather convex beneath."

Cyclotrema, 1840. 1847. *Cyclostrema*.

Cypricia, 1840. In 1847 given as of Gray 1837, but I have not found any reference of that date. The type is given as *M. anatina*, and *Labiosa*, Schmidt MSS., Moller, 1832, cited as coequal.

Dalacia, 1840. 1842, p. 83. "The *Dalacia* are like the *Crenatula*, but have the umbo some distance from the front of the hinge margin instead of quite at the angle."

Damaris, 1840, p. 38. 1840A, p. 142. "In *Unio*, *Damaris*, etc., it has lateral teeth of different degrees of development and form, so that they sometimes resemble cardinal ones."

Deriobranchus, 1840. 1847. *Deridobranchus*, Ehr.

Detracia, 1840. In 1847 type is given as *Vol. bullæoides*.

Diacria, 1840. 1842, p. 86. "In some [*Cleodoridæ*] there are lateral slits in the sides of the shell which are interrupted in front in the globular shells of the *Hyalææ*, and continued to the mouth in the elongate *Diacriæ*."

Diastropha, 1840. In 1847 quoted as *Diastrophia*, Guild., Gray, and type given as *Ph. Guildingii*.

Dorsina, 1840. 1847. *Dosinia*.

Dostia, 1840. 1842, p. 58. "The *Dostiæ* differ [from *Clithon*] in having a nearly symmetrical shell with only the rudiment of a spire, and the inner lip, like *Neritina*, is only denticulated."

Dota, 1840. 1847. *Doto*, Oken, 1815.

Eglisia, 1840. 1842, p. 60. "The *Turritellæ* are turreted and marine; the mouth of the shell is squarish and the operculum orbicular, many whorled. The *Haustators* chiefly differ in the outer lip being marked with a deep notch leaving a groove on the whorls. The *Zaria* has an ovate mouth rather produced in front [p. 61]. *Mesalia* is very like the former, but the mouth is round and produced into a slight canal in front, and the front of the inner lip is slightly twisted. *Eglisia* has a round mouth with the outer lip rather thickened internally." In the Proc. Zool. Soc., 1847, Gray introduced a new name *Torcula* for *Haustator*, Gray, 1840, not Montfort, 1810.

Epistylium, 1840, p. 125. 1840A, p. 129. "The true *Helices*, *Helicodonta*, etc., have the peristoma of the shell thickened, while the *Helicophanta*, *Epistylium*, and *Proserpina* have it thin and sharp."

Fœgia, 1840. 1842, p. 77. (Compared with *Aspergillum*.) "In *Fœgia* the lower end is irregular, with scattered tubes, and destitute of any fringe."

Fossar, 1840. In 1847 *Forsar* is printed, but corrected in the errata. Type given, *Helix ambigua*, Linn. (= *Natica* (*fosar*), Adans., 1757).

Gasterosiphone, 1842. 1842, p. 88. "In some of them [*Belemnitidæ*], as *Gastrosiphone*, the syphon is in the front."

Geloina, 1840. 1842, p. 75. "The *Cyrenæ* have three teeth in each valve, and the compressed lateral teeth striated across. The *Geloina* differ in the lateral teeth being smooth, and the *Velorita* has a short thick anterior lateral tooth close to the large cardinal ones."

Gena, 1840. 1842, p. 51. "The *Genæ* are thin, oblong, ear-shaped shells, with a very large animal and no operculum."

Gibbium, 1840. 1842, p. 57. "The *Gibbium* have a depressed top-shaped shell with perforated axes."

Ginorga, 1840. Not further mentioned, either in 1842 or 1847.

Guetera, 1840. In 1847 the type is given as *Fist. corniformis*.

Harlea, 1842. 1842, p. 78. "The *Harlea* are oblong, subquadrate, thin shells, with a sharp keel from the umbo and conical hinge teeth."

Hatina, 1842. 1842, p. 62. "The *Bivinæ* have an orbicular spiral operculum with an oblong lateral scar, like the *Trochi*. The *Vermilia* has the mouth of the tube surrounded by three spines, and the *Hatina* has no operculum."

Helicophora, 1840. 1842, p. 59. "The *Helicophoræ* always have oblong spiral unkeeled shells with an entire mouth."

Hemicyclostoma, 1840. 1847 = *Hemicyclonosta*.

Heterodon, 1840. Not mentioned in 1842 notes or in 1847.

Ida, 1840. This name, bracketed after *Chilina*, is not again mentioned in 1842 or in 1847.

Jesonia, 1840. In 1847 this is placed in the synonymy of *Mytilicardia*, Blainv., 1825.

Kuphus, 1840. 1842, p. 76. "The *Kuphus* has ovate pellets toothed at the tip; the tubular case of this genus is club-shaped, contorted, opaque, and closed at the end."

Lampania, 1840. Type given in 1847 as *Cerithium zonale*, Lam., and *Batillaria*, Benson, 1842, cited as a synonym.

Lathirus, 1840. 1847. *Latyrus*, Montf.

Leila, 1840, p. 138. 1840A, p. 142. "In *Iridina* and *Leila* the hinge edge is smooth, like *Anodon*, and the latter has a sharp syphonal inflection."

Lenticularia, 1840. 1842, p. 80. "The *Lenticularia* are solid shells, like the *Lucina*, but with the cartilages partly internal; they have a conical anterior lateral tooth."

Leonia, 1840. In 1847 still a nude name, neither the type being designated nor the name placed in synonymy.

Lepeta, 1840. 1842, p. 67. "In *Patella* the gills form a complete series round the edge of the mantle. In *Helicon* [*sic*] the series is interrupted over the head, and *Lepetæ* differ from both in the animal being destitute of any eyes."

Leuconia, 1840. In 1847 typified by *Voluta alba*.

Licarea, 1840. Not again mentioned, either in 1842 or in 1847.

Licina, 1840. In 1847 given as of Brown, 1756, with type *Turbo labea*.

Limacula, 1840. 1847. ? *Limatula*.

Limnopsis, 1840. 1847. *Limopsis*.

Liopa, 1840. 1847. *Triopa*.

Liotia, 1842. 1842, p. 57. "The Dolphin shells (*Delphinula*) differ from all the rest in being thick turbo-like umbilicated spinose shells with a round mouth, and the *Liotia* differs from *Delphinula* in having a regular margined mouth to the shell."

Litharea, 1840. 1842, p. 81. "The *Litharcæ* are elongate, truncated behind, and live in holes in stones and rocks; the hinge teeth are all equally transverse."

Livona, 1840. 1842, p. 57. "The *Livonæ* are solid conical shells with a rounded mouth and a callosity partly covering the umbilicus."

Lucapina, 1840, p. 114. 1840A, p. 117. "In *Lucapina* the mantle covers the cancellated shell."

Lunarca, 1842. 1842, p. 81. "The *Lunarca* differ from the former [*Argina*] in the front group of teeth being replaced by an elevated ridge."

Macroma, 1840. 1847. ? *Macoma*.

Mactresia, 1840. 1847. *Martesia*.

Malybe, 1840. 1847. *Melibe*, Rang, 1829.

Marisca, 1840. 1847. ? *Marisa*.

Medoria, 1840. 1842, p. 60. "The *Medoria* are like the *Lacuna*, but more solid, and covered with a rough periostracum."

Mesalia, 1840. 1842, p. 60. See note under *Eglisia*.

Modiolarca, 1840. 1842, p. 82. "The *Crenellæ* are suborbicular, and the *Modiolariæ* ovate elongated shells."—Note: *Modiolarca*, 1840, is thus a misprint for *Modiolaria*.

Modulus, 1840. 1842, p. 60. "The *Moduli* only differ from them [*Pagodus*] in the shell being more depressed and the inner lip having a distinct notch forming a tooth; they have been confounded with the *Monodonta*."

Monocondyla, 1840. 1847. *Monocondylea.*

Myodora, 1840, p. 136. 1840A, p. 140. "In the *Lyonsiæ* and *Myadoræ*, the cartilage pit is sunk into the hinge margin of each valve, and covered by a large flat hinge-piece; the shell of the former is thin and of the latter thick, with very unequal valves, the left one being flat."

Mysia, 1840. Appears twice on the same page (150), once in the Tellinidæ, and afterwards in the Lucinidæ.

Neara, 1840. 1842, p. 78. "The *Neara* have a thin nearly equivalve shell produced into a beak behind and with small hinge teeth."

Nectia, 1840. Not again mentioned, either in 1842 or in 1847.

Niomia, 1840. 1842, p. 60. "*Nioma* has a white spirally striated shell with a deeply perforated axis." 1847. Given as a synonym, with *Merria*, of *Vanikoro.*

Nisso, 1840. 1847. *Niso*, Risso.

Nœtia, 1840. Not again mentioned, either in 1842 or in 1847.

Notosiphone, 1842. 1842, p. 88. "And in another [*Belemnitidæ*], the *Notosiphone*, [the syphon is] in the dorsal part of the septa of the alveolus. The alveolus is sometimes obliterated."

Odontostylus, 1840. Not again mentioned, either in 1842 or in 1847.

Ophis, 1840. 1847. *Opis*, Defrance, 1825.

Orthostoma, 1840. In 1847 fossil genera are not included, hence nothing further is given concerning this name.

Pectella, 1840. In 1847 included with a ? in front, and neither placed in synonymy nor type designated.

Peratoptera, 1840. Not again mentioned, either in 1842 or in 1847.

Pharus, 1840, p. 135. 1840A, p. 139. "In *Solen* and *Ensis* the foot is club-shaped, and the tubes are short and united. In *Pharus* the foot is long with a dilated end, and the syphons are elongate and separate."

Phragmolites, 1840. In 1847 nothing is mentioned of this, as the fossil genera are not included.

Plectronia, 1840. In 1847 nothing further is offered, whilst the name itself is accompanied by a ?.

Polyodon, 1840. 1847. ? *Polydonta*, Montf.

Potamia, 1840. 1847. ? *Potamis.*

Poteria, 1840. In 1847 neither type designated, nor placed in synonymy. See 185

Pupillia, 1840, p. 114. 1840A, p. 117. "In *Pupillia* the shell is surrounded by a sharp white edge."

Pycnodonte, 1840. 1847. ? *Pycnodonta.*

Pyraze, 1840. 1847. *Pyrazus.*

Radula, 1840. 1842, p. 60. "The genus *Radula* is referred here provisionally until its animal is known; the shell is solid and Nerite-like, with a rounded inner lip, having a deep notch in its centre; the throat is somewhat striated."

Raleta, 1840. 1842, p. 78. "The *Tomala* are like the *Corbulæ*, but have a triangular projecting plate with a ridge on each side in the left valve, and two triangular teeth in the other, and

Raleta differs from the latter only in having a narrow central pit, its right valve with a strong conical tooth falling into the large pit before the tooth in the left valve."

Realia, 1840. In 1841 the type cited as "*R* —— ? n.s."; therefore still a *nomen nudum* at that date.

Risella, 1840. 1842, p. 60. "*Risella* is like *Littorina*, but the shell is top-shaped, the whorls keeled, and the mouth rather square."

Scaphura, 1840. 1847. *Scaphula*.

Senilia, 1840. 1842, p. 81. "The *Senilia* have very thick shells, covered with a smooth olive periostraca; the hinge teeth are all equally transverse."

Sidula, 1840. 1842, p. 70. "The *Scarabus*, like *Ranella*, forms half a whorl between each period of rest, the thickened and reflexed parts of the lips forming an edge to each side of the shell. The *Sidulæ* have a sharp internal ridge to the outer lip."

Strigella, 1840. 1847. *Strigilla*.

Styliger, 1840. 1847. *Stylifer*.

Talonia, 1840. 1842, p. 76. See note under *Barnia*.

Talopia, 1840. 1842, p. 57. See note under *Camitia*.

Tania, 1840. 1842, p. 60. "The genera *Tania*, *Anculosa* ,and *Io* have the mouth of the shell truncated in front of the axis, as in *Achatina*, the former having a turreted, the second an ovate short, and the latter a fusiform shell with a large mouth."

Tapada, 1840. In 1847 given as a synonym of *Cantareus*, Risso, 1826.

Tethya, 1840. 1847. *Tethys*.

Thaira, 1840. 1847. *Tiara*.

Thalotia, 1840. 1842, p. 57. "In *Ziziphinus*, *Cantharidus*, and *Thalotia* the mouth is oblong and simple and the axis of the shell is covered by the inner lip; the former is top-shaped, the *Cantharidi* are ovate and green within."

Thecathera, 1840. 1847. *Thecacera*.

Thicolia, 1840. 1842, p. 56. "The *Thicoliæ* chiefly differ from the latter [*Phasianella*] in the animal being less ornamented with beards." In the Proc. Zool. Soc., 1847, Gray spells this name *Thicolea*, and cites it as intended for *Tricolea*, Risso.

Tomala, 1842. 1842, p. 78. See note under *Raleta*.

Tonichia, 1840, p. 123. 1840A, p. 126. "The *Tonichia* has the upper surface of the mantle bald and cartilaginous, and the under covered with a very hard striated skin."

Torinia, 1840. 1842, p. 60. "*Torinia* differs [from *Solarium*] in having a nearly orbicular operculum, which is very convex and marked with a spiral ridge looking like a pagoda."

Tralia, 1840. In 1847 the type given as *V. pusilla*.

Tripteres, 1840. 1847. *Triptere*.

Tugonia, 1842. 1842, p. 78. "The *Tagonia* have the same kind of process, but the shell is ovate, ventricose, with a large gape on its short hinder slope."

Turbonella, 1840. 1847. ? *Turbonilla*.

Velletia, 1840, p. 128. 1840A, p. 132. "The *Velletiæ* differ in the animal and shell being reversed, like the *Physæ*."

Velorita, 1840. 1842, p. 75. See note under *Geloina*.
Vermilia, 1842. 1842, p. 62. See note under *Hatina*.
Verticordia, 1840. 1842, p. 80. "The *Verticordiæ* are fossil shells, allied to the latter [*Cryptodon*]."
Wolfataria, 1840. Not again mentioned, either in 1842 or 1847.
Zaria, 1840. 1842, p. 60. See note under *Eglisia*.
Zirfæa, 1840. 1842, p. 76. See note under *Barnia*.
Ziziphinus, 1840. 1842, p. 57. See note under *Thalotia*.

In the Proc. Zool. Soc., 1847, I find the following quoted as Gray, 1840, which I have not found in the Synopsis either of 1840 or 1842: *Ersina*, *Isthmia*, *Lauria*, *Philippia*, and *Sarmaticus*.

It should be noted that Gray probably distributed shells between the years 1840 and 1847 under these new generic names, and that some of these may have been correctly introduced into literature by other authors.

I have observed that Philippi, in the Enum. Moll. Sic., vol. ii, p. 90, 1844, recorded that *Lucapina elegans*, Gray = *Fissurella cancellata*, Sow., and that *Pupillæa aperta*, Gray = *F. hiantula*, Lamarck. This was only noticed through the misspelling of *Pupillia* attracting the writer's attention.

A name that seems to need rejection is *Livona*. In 1840 it is a *nomen nudum*; in 1842 it is indeterminable; in 1843 it is associated with a shell which is certainly not the one selected as the type in 1847.

In February, 1847, Philippi (Zeitschr. Malak., Jahr. iv, p. 21) introduced *Cittarium* for *Turbo pica*, and in November, 1847, that shell appeared as type of *Livona*, Gray. Unless *Livona* can be traced to an earlier legitimate introduction than the Proc. Zool. Soc., 1847, *Citt arium* must replace it.

Algoa and *Musica*. Although neither of these names appears in the tables in any edition of the Synopses the following notes are given:—

Musica, 1840, p. 112. 1840A, p. 114. "In general the shell is covered with a distinct periostraca as *Mitra*, *Voluta*, and *Musica*."
Algoa, 1840, p. 113. 1840A, p. 115. "In *Cypræa*, *Algoa*, and *Ovula* the outer coat of the shell is polished." *Algoa* is never afterwards mentioned, but in the 1847 list Gray quotes *Musica* as of 1840.

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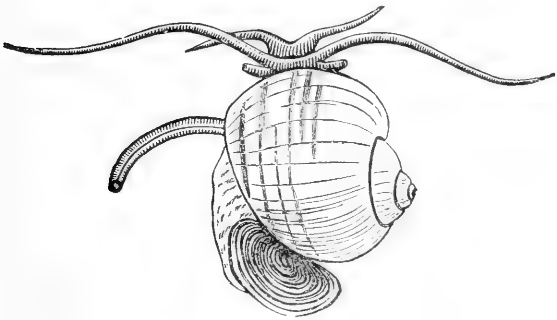

EDITED BY
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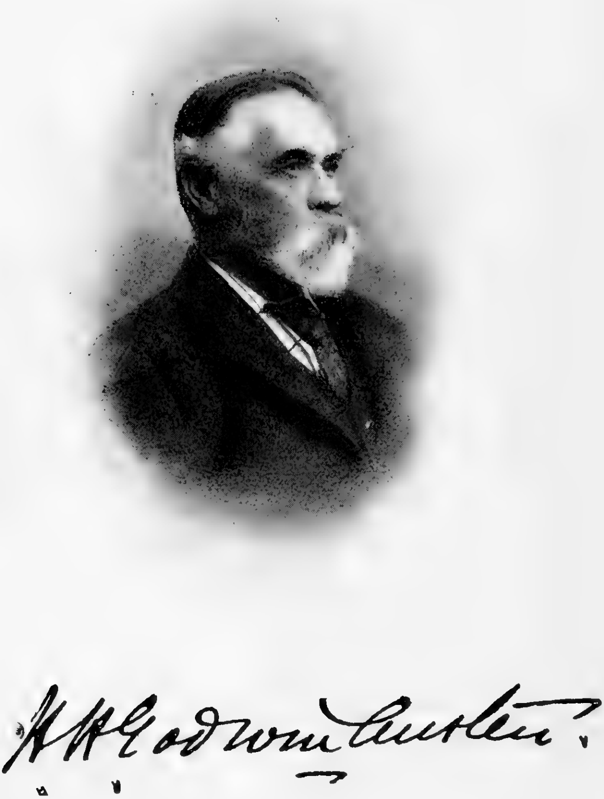

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To Balance from last year	£12	7	0	To Balance in hand January, 1913	£12	7	0

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

John H. Ponsonby, Hon. Treasurer.
January 22, 1913.

HENRY WOODWARD
GUY C. ROBSON } Auditors.

ANNUAL GENERAL MEETING.

Friday, 14th February, 1913.

R. Bullen Newton, F.G.S., President, in the Chair.

Mr. H. C. Fulton and Mr. A. W. Oke, LL.M., F.L.S., were appointed scrutineers.

The Secretary announced that at the last Ordinary Meeting, through an oversight on his part, no Auditors had been appointed, and that in the interval he had consulted the members of the Council, who decided that the two members who acted in that capacity the previous year, viz. Dr. Henry Woodward, F.R.S., and Mr. G. C. Robson, B.A., should again be asked to officiate, and that the Annual Meeting should be asked to confirm this course. This was carried unanimously.

The following report was read :—

"Your Council, in presenting their twentieth Annual Report, find it a source of great satisfaction to be able to refer to the useful—and in some cases voluminous—papers published through the usual channel of the Society's 'Proceedings', details of which will be found below.

"It is with deep regret that they have to record the loss by death of two prominent members, the Rev. R. Ashington Bullen and Dr. J. C. Cox, and also of two others, Mr. D. D. Baldwin and Mons. A. Bonnet, while resignation and other causes are responsible for the removal from the roll of five more names.

"During the year eleven new members have been elected, so that the membership of the Society on December 31st, 1912, stood as follows :—

Ordinary members	71
Corresponding members	91
Total . .	162

"The financial condition of the Society is essentially the same as last year. The current account shows a balance of £4 10*s.* 11*d.* The special fund has still £12 7*s.* standing to its credit, while the Society still holds the sum of £50 invested in Metropolitan 2½ per cent stock. For its improved financial condition the Society is indebted to some members who made generous contributions to its funds.

"During the year 1912 three parts of the 'Proceedings' have been published as usual, forming the first half of Vol. X. They comprise 261 pages, 13 plates, and 36 text-figures.

"The following gentlemen have very kindly contributed towards the cost of illustrations or have supplied drawings or photographs for the plates or text-figures: Dr. R. Arnold, H. H. Bloomer, H. Hannibal, J. C. Melvill, R. B. Newton, H. B. Preston, M. M. Schepman, E. A. Smith, G. B. Sowerby, A. W. Stelfox, and E. W. Vredenburg. Without such liberal help it would not be possible so fully to illustrate the 'Proceedings'.

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

On the motion of Mr. H. C. Fulton, seconded by Mr. A. W. Oke, LL.M., F.L.S., the above was adopted as the Annual Report of the Society.

The following were elected as Officers and Council for 1913:—

President.—Rev. A. H. Cooke, M.A., F.Z.S.

Vice-Presidents.—G. C. Crick, F.G.S.; R. Bullen Newton, F.G.S.; H. B. Preston, F.Z.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., 22 Heathfield Road, Acton, London, W.

Other Members of Council.—Rev. E. W. Bowell, M.A.; C. Oldham; G. C. Robson, B A.; H. O. N. Shaw, F.Z.S.; J. R. Le B. Tomlin, M.A., F.E.S.

On the motion of Mr. A. S. Kennard, F.G.S., seconded by Mr. J. E. Cooper, a vote of thanks was passed to the Retiring Officers and Members of the Council and to the Auditors and Scrutineers.

ORDINARY MEETING.

Friday, 14th February, 1913.

The Rev. A. H. Cooke, M.A., F.Z.S., President, in the Chair.

The following specimens were exhibited:—

By the Rev. A. H. Cooke, M.A., F.Z.S.: A series of *Purpura lapillus* (Linn.), from many localities in Great Britain, France, the Faroe Islands, Norway, and Iceland; and in drawing attention to the wide range of variation shown by this species he made some remarks upon the possible causes of variation in certain cases.

By Mr. J. E. Cooper: Specimens of *P. lapillus* (Linn.), including a very large form from crab-pots, Swanage; a very small form from exposed rocks, Lynmouth; imbricated examples from oyster-beds, Burnham-on-Crouch; and fossil forms from the Red Crag, Norwich; also Dr. Gwyn Jeffreys' copy of Wood's *Index Testaceologicus*, with his book-plate and autograph.

By Mr. L. St. G. Byne, M.Sc.: A fine series of *Cypræa Mauritiana*, from the Andaman Islands.

By Mr. G. B. Sowerby, F.L.S.: A specimen of *Edentellina typica*, Gatliff & Gabriel, upon which a discussion arose as to whether it is a Lamellibranch or a Tectibranch; also a fine group of *Tenagodus australis* from Victoria, Australia.

By Mr. E. A. Smith, I.S.O.: Some of the types of Mollusca described by Pennant in his *Zoology*, 1777, together with other specimens figured in the same work, all of which had recently been presented to the National Collection by Lord Denbigh.

ORDINARY MEETING.

FRIDAY, 14TH MARCH, 1913.

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

Mr. G. C. Leman, Mr. H. McClelland, and Mr. F. H. Sikes, M.A., F.L.S., were elected members of the Society.

The following communications were read :—

1. "Note on the identity of *Torinia densegranosa*, Pilsbry, and *T. Enoshimensis*, Melv." By J. C. Melvill, M.A., D.Sc.

2. "Note on *Cypræa tigris*, L." By L. St. G. Byne, M.Sc.

3. "Note on a Holocene deposit at Boveney, Buckinghamshire." By J. E. Cooper.

ORDINARY MEETING.

FRIDAY, 11TH APRIL, 1913.

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

Mr. J. Vernhout was elected a member of the Society.

Mr. F. H. Sikes, M.A., F.L.S., exhibited a series of land and freshwater mollusca collected by him in Iceland, together with three pictures in oil painted by himself showing the habitats of some of the Mollusca.

Mr. E. A. Smith, I.S.O., exhibited the three largest known living species of *Lima*, viz. *L. Goliath*, Sow., from Japan; *L. excavata*, Gmel., from Norway; and *L. Dalli*, Bartsch, from the Philippines.

The following communications were read :—

1. "Description of a new species of *Cryptoplax*." By the Rev. A. H. Cooke, M.A., F.Z.S.

2. "Characters of a new sub-genus and species of *Choanopoma* from Cuba." By H. B. Preston, F.Z.S.

3. "The Helicoid Land Shells of the Fiji Islands, with definitions of three new genera and descriptions of four new species." By G. K. Gude, F.Z.S.

OBITUARY NOTICES.

We regret very much to have to record the loss by death of another member of the Society. The Rev. R. Ashington Bullen, who joined it in 1897, died suddenly in his 63rd year whilst journeying abroad on August 14th, 1912. He often attended the meetings of the Society, which on several occasions was much indebted to him for financial assistance.

It was not until 1894 that he commenced to write upon conchological subjects, and he was not a prolific author, but fifteen papers from his pen appear in the Society's "Proceedings". The majority of these treat upon the land and freshwater Mollusca occurring in Holocene and Pleistocene deposits in various parts of England and a few foreign localities, but four of them are descriptive of non-marine forms from the Philippine Islands, the Island of Gisser, Sumatra, Java, and New South Wales.

In the *Geological Magazine* (dec. v, vol. ix, No. xi, pp. 525–8) an obituary notice, accompanied by his portrait, furnishes many interesting details regarding Mr. Bullen's career. He was possessed of a most charming personality, which much endeared him to all the many friends who had the pleasure of his acquaintance.

The following is a complete list of Mr. Bullen's writings treating exclusively, or in part, upon fossil and recent Mollusca:—

1894. "Shells from Portland Rubble Drift."[1]
1898. "Note on Non-marine Mollusca obtained from Holocene and Pleistocene Deposits at Buckland, Dover."[2]
1899. "Notes on Land-shells from a Holocene Deposit at the Horse-shoe Pit, Colley Hill, Reigate."[2]
"Notes on Mollusca": Science Gossip, vol. v.
1900. "Shells from Portland Rubble Drift."[1]
1901. Harlyn Bay and the Discoveries of its Prehistoric Remains. 3 editions, 1901, 1902, 1912.
"Pleistocene Mollusca from the Raised Beach Deposits of Perim Island."[2]
"Note on a Well-section at Dallinghoo, Suffolk": Quart. Journ. Geol. Soc., vol. lvii.
"On two apparently new species of *Corbicula*."[2]
"Notes on *Helicella Cantiana* as food for the Turdidæ": Journ. Conch., x, 27.
1902. "Notes on Holocene Mollusca from North Cornwall."[2]
1903. "Notes on the Pleistocene Non-marine Mollusca at Portland Bill; and on Holocene Non-marine Mollusca from (1) West Harnham, Wilts; (2) Harlton, Cambridgeshire; (3) The Down above Durdle Barn Door, Dorset; and (4) Folkestone."[2]
1904. "Descriptions of new species of Non-marine Shells from Java, and a new species of *Corbicula* from New South Wales."[2]
1905. "On a new variety of *Planispira zebra*, Pfr., from the Island of Gisser, and a new species of *Chloritis* from Java."[2]
"Notes on Land and Freshwater Shells from the Alhambra Ditch, Granada, Andalusia, Spain; on recent Land Shells from various localities near Carmona, Province of Sevilla; and on Land, Freshwater, and Marine Shells from Holocene Deposits, Carmona."[2]
"Notes on Pleistocene and Recent Shells from Crete."[2]
1906. "Notes on some Microzoa and Mollusca from East Crete."[1]
"Notes on a Holocene Deposit at Harlton, Cambs."[2]

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[1] *Geological Magazine.* [2] Proc. Malac. Soc.

1906. "On some Land and Freshwater Mollusca from Sumatra."[1]
1907. "Notes on Land and Freshwater Mollusca observed in the neighbourhood of St. Albans": Trans. Herts Nat. Hist. Soc., vol. xiii.
1908. "Kitchen Middens in North Cornwall."[2]
1909. "Holocene and Recent Non-marine Mollusca from the neighbourhood of Perranzabuloe."[1]
1910. "Notes on the Æolian Deposits on the Coast at Étel, Morbihan."[2] Parts I and II.
"Notes on (1) Pleistocene, (2) Holocene, (3) Recent Non-marine Shells from Mallorca; (4) Marine Shells associated with the Holocene Deposits; (5) Marine Shells from Alcudia, Mallorca; (6) Non-marine Shells from Manresa, Cataluña."[1]
1911. "Some Notes on the Geology of the Bermuda Islands."[2]

E. A. Smith.

With much regret we also have to record the death, at a good old age, of Dr. James C. Cox, of Sydney, New South Wales, which occurred on September 29th of last year. He became a member of the Society in 1893, and contributed one paper, the last from his pen, to our Society's "Proceedings".

Dr. Cox was a leading member of the medical profession in Sydney, where he had resided for many years. His writings have chiefly been upon the Pulmonata of Australia, and altogether he was the author of thirty-seven different papers, practically restricted to the description of the Australian fauna.

His most important work is the *Monograph of Australian Land Shells*, published at Sydney in 1868, consisting of 111 pages and illustrated with 20 coloured plates. The nomenclature in this book is of course quite out of date, but the distribution of the then known species is recorded, and the illustrations are very useful. Fourteen of his papers are descriptive of marine forms, especially the genera *Cypræa* and *Voluta*, but he also wrote upon the Oysters and Octopodidæ of Australia, and other genera of which he described new species are *Haliotis*, *Recluzia*, *Chiton*, and *Cytherea*.

The principal journals in which his writings occur are the Proceedings of the Zoological Society of London for 1864, 1865, 1866, 1867, 1869, 1870, 1871, 1872, 1873; the *Annals and Magazine of Natural History*, 1864; Proceedings of the Linnean Society of New South Wales, 1880, 1882, 1883, 1888, 1889, 1890, 1894, 1895, 1899. Two papers were published in the *Journal de Conchyliologie*, 1866 and 1871.

He possessed a very extensive collection of shells chiefly from the Australian continent and the Pacific islands. This was sold in London in 1903–5, and the British Museum was fortunate in obtaining many of the types of the species described by him. Among the rarities comprised in the collection were *Cypræa Valentia*, *Thatcheri*, and *venusta*, *Voluta Wisemani*, *Bednalli*, *Brazieri*, *Tissotiana*, *canaliculata*, and *coniformis*, *Mitra Rossiæ*, and *Conus gloria-maris*. These valuable shells are now distributed in the J. J. MacAndrew, Dautzenberg, Melvill, Prince Salm Salm, and British Museum collections

E. A. Smith.

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[1] Proc. Malac. Soc. [2] *Geological Magazine*.

NOTE ON THE IDENTITY OF *TORINIA DENSEGRANOSA*, PILSBRY, AND *T. ENOSHIMENSIS*, MELVILL.

By James Cosmo Melvill, M.A., D.Sc.

Read 14th March, 1913.

I have lately received specimens of *T. densegranosa*, Pilsbry, 1905, and am satisfied it is only the adult state of the smaller *Enoshimensis* described by me fourteen years earlier, in October, 1891. I am confirmed in this view by Mr. Edgar Smith, who with me also compared the types of the latter with *densegranosa* at the British Museum (Natural History) a few months ago. I repeat my original description.

Solarium (*Torinia*) *Enoshimense*, sp. nov.

"S. testa depresso-discoidea, solida, profunde umbilicata, fusco-castanea, anfractibus quatuor, spiraliter sulcatis, papillis moniliformibus, regulariter transversim decoratis, apud suturas depressis, ultimo anfractu rapide accrescente, ad peripheriam tribus costis crenulato-carinatis, ad umbilicum pulchre crenulato, apertura circulari, labro simplice. Long.: 2·50 mm. speciei majoris. Lat.: 5 mm.

"*Hab.*—Enoshima, Japonia.

"Shell flattened, pale-brown chestnut, moderately and deeply umbilicate, whorls four, the last very rapidly increasing, with spiral channels of unequal breadth covering the whole surface, and forming regular rows of moniliform papillæ. At the periphery these spiral channels have a very boldly defined semblance of angularity; the concentric spaces below the sutures are double the width of the three intervening spaces between them and the periphery. At the base, the crenulations round the umbilicus are boldly defined, and the next concentric space is twice the breadth of those, in their turn, intervening between this and the angle of the periphery, four in all.

"Of this small species, obtained in a native box of Japanese shells forwarded direct, and which contained several novelties, I have two specimens precisely similar, and in one of the drawers of the National Collection at the Natural History Museum, South Kensington, have found two or three others, unnamed, labelled 'From Japan'."

There is really nothing to add to this description, but I may utter a word of apology for the somewhat crudely drawn magnified original figure. Reference to this is given below.

The synonymy will therefore be as follows:—

Heliacus Enoshimensis (Melvill).

Solarium (*Torinia*) *Enoshimense*, Melv., Journ. Conch., vol. x, p. 411, pl. ii, fig. 12 (October, 1891).

Torinia densegranosa, Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, p. 106, fig. (1905).

NOTE ON A HOLOCENE DEPOSIT AT BOVENEY, BUCKINGHAMSHIRE.

By J. E. Cooper.

Read 14th March, 1913.

The Holocene deposits of the Thames Valley have received considerable attention, especially from Messrs. Kennard & Woodward. Full lists of fossil Mollusca from these beds have been published for Wallingford,[1] two separate localities near Staines,[2] and Clifton Hampden,[3] besides several less complete lists for other places in this area.

Last year there was an excellent section in the north bank of the Thames at Boveney, Bucks, which appears to be worth notice. This exposure consisted of a thick bed of brickearth (alluvium), with a maximum depth of about 5 feet, resting upon a thin sandy bed some 2 inches in thickness, which was crowded with shells. The shell-bed was just above water when the river was low, and corresponded to a similar deposit at Staines. The fossils in the brickearth were chiefly land shells, and the specimens were scattered about in the clay like currants in a pudding. As usual *Hygromia hispida* was the commonest Helicoid, and *Helix nemoralis* was also abundant.

1. From this alluvium the following species were obtained:—

Vitrea cellaria (Müll.).	*Jaminia muscorum* (L.).
V. nitidula (Drap.).	*Succinea putris* (L.).
Pyramidula rotundata (Müll.).	*S. elegans*, Risso.
Hygromia hispida (L.).	*Limnæa peregra* (Müll.).
Vallonia excentrica, Sterki.	*L. palustris* (Müll.).
Helicigona lapicida (L.).	*Planorbis umbilicatus*, Müll.
H. arbustorum (L.).	*P. Strœmi*, Westd.
Helix nemoralis, L.	*Bithynia tentaculata* (L.).
H. hortensis, Müll.	*Valvata piscinalis* (Müll.).
Cochlicopa lubrica (Müll.).	*Neritina fluviatilis* (L.).

Planorbis Strœmi was only noticed quite at the base of this bed; it was probably derived from the sandy bed below.

2. The narrow sandy bed, characterized by the abundance of *P. Strœmi*, consisted chiefly of freshwater shells, with a few land species here and there. The list comprised—

Vitrea crystallina (Müll.).	*Vallonia costata* (Müll.).
V. nitidula (Drap.).	*V. excentrica*, Sterki.
Zonitoides nitidus (Müll.).	*Helicigona arbustorum* (L.).
Punctum pygmæum (Drap.).	*Helix nemoralis*, L.
Euconulus fulvus (Müll.).	*Cochlicopa lubrica* (Müll.).
Pyramidula rupestris (Drap.).	*Jaminia muscorum* (L.).
P. rotundata (Müll.).	*Vertigo pygmæa* (Drap.).
Hygromia hispida (L.).	*V. pusilla*, Müll.

[1] Proc. Malac. Soc., vol. viii, p. 93.
[2] Proc. Geol. Assoc., vol. xix, p. 252; Proc. Malac. Soc., vol. vii, p. 310.
[3] Proc. Cotteswold Club, vol. xiv, p. 198.

Clausilia laminata (Mont.).
Succinea putris (L.).
S. elegans, Risso.
Carychium minimum, Müll.
Ancylus fluviatilis, Müll.
Acroloxus lacustris (L.).
Limnæa auricularia (L.).
L. peregra (Müll.).
L. palustris (Müll.).
L. truncatula (Müll.).
L. stagnalis (L.).
Planorbis corneus (L.).
P. albus, Müll.
P. Stræmi, Westd.
P. crista (L.).
P. carinatus, Müll.
P. umbilicatus, Müll.
P. vortex (L.).
P. spirorbis (L.).
P. contortus (L.).
P. fontanus, Lightfoot.
Physa fontinalis (L.).
Bithynia tentaculata (L.).
B. Leachi (Shepp.).
Valvata piscinalis (Müll.).
V. cristata (Müll.).
Neritina fluviatilis (L.).
Sphærium corneum (L.).
Pisidium amnicum (Müll.).
P. supinum, A. Sch.
P. Henslowanum, Malm.
P. pulchellum, Jenyns.
P. Casertanum, Poli.
P. pusillum (Gmel.).
P. nitidum, Jenyns.
P. obtusale, Pfr.
P. milium, Held.
P. subtruncatum, Malm.

Pyramidula rupestris and *Vertigo pusilla* were the most interesting finds; the latter species still lives at Burnham Beeches, a few miles away.

Mr. B. B. Woodward, F.L.S., has kindly identified some of the *Pisidia* quoted above. I am also indebted to Mr. A. S. Kennard, F.G.S., for naming two immature forms of other shells.

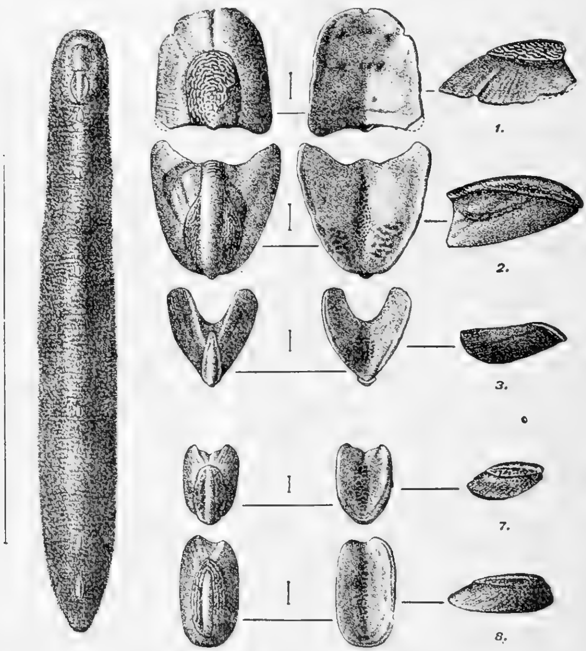
DESCRIPTION OF A NEW SPECIES OF *CRYPTOPLAX*.

By the Rev. A. H. Cooke, M.A., F.Z.S.

Read 11th April, 1913.

Cryptoplax evanescens, n.sp.

Animal narrowly cylindrical, much elongated, foot exceedingly narrow; *body* thick and leathery, covered with short deciduous spines or fine scales, spines yellow or reddish-yellow; *body colour* variable, grey, yellow, or reddish, and blotched with red underneath the spines; *gill-rows* rather large, but occupying only about one-fifth of the entire length of the animal; *valves* very small, in a fresh specimen the



fourth, fifth, and sixth are scarcely visible; as the animal contracts in spirit they become more noticeable; the two front valves are the largest, third valve considerably smaller (these three valves are close together); fourth valve remote from the third, very small, hardly visible, buried deeply in the muscular integument of the back; fifth valve remote from the fourth, hardly visible; sixth valve remote from the fifth, just visible; seventh valve remote from the sixth, more conspicuous; posterior valve conspicuous, much nearer to the seventh than the seventh is to the sixth.

The *articulamentum* is relatively large in proportion to the *tegmentum*, especially in the more buried valves; the angle of the articulamentum is very deeply cut, especially in valve 3.

The *sculpture* of the external portion of the valves is rude, and consists mainly of a central ridge, which slightly projects forward, forming a sort of blunt beak; this ridge in valve 1 is broadly oval, and lies on the hinder portion of the shell; in valve 2 it is prominent, and runs the whole length of the valve, with two small, longitudinally striated, lateral areas, but in valves 3, 4, and 5 it consists of a beak only; this beak area increases in size, and becomes more prominent, in the posterior valves.

Radula normal (Professor H. M. Gwatkin).

Length of full-grown specimen, 4½ inches.

Hab.—Funafuti, South Central Pacific (Mr. J. S. Gardiner).

The nearest ally of this species appears to be *Cr. Burrowi*, E. A. Smith, from which it differs markedly in (1) its narrower form, (2) the smaller size of the valves, (3) the relative position of the valves, and (4) length of the gill-rows, which in *Burrowi* are longer in proportion to the whole length of the animal.

I am not able to say whether *pores* are present, but there is no sign of lateral tufts on the integument. The usual three slits in the anterior valve are present, but are very rude and undeveloped. Measurements of the valves are subjoined (in tenths of an inch):—

	Length.	Breadth.
Front valve	·125	·125
Second ,,	·125	·15
Third ,,	·083	·083
Fourth ,,	·07	·05
Fifth ,,	·07	·05
Sixth ,,	·05	·045
Seventh ,,	·083	·05
Posterior ,,	·1	·06

The whole animal is thus thirty-six times as long as its longest valve, and ninety times as long as its shortest.

This species may be regarded as forming, so far as our present knowledge extends, a sort of last term in the series of Chitons which exhibit gradual degradation of the valves.[1] So far as I am aware, it is the only species yet described in which, while all the valves are reduced in size, some are so far embedded in the integument that in fresh specimens they are scarcely visible.

If we may take it for granted that the original object of a molluscan shell was the protection of some vital part or parts of the organism, it is plain that in the present case, as compared with the form of shell normal in the Polyplacophora, this particular function of the shell has practically ceased to exist. But, since the vital organs may be taken to exist as before, and to be in equal need of some sort of protection—except in so far as it is afforded by increased safety of habitat—it may be safely assumed that the degradation of the valves has been accompanied by a parallel thickening or extension of the dorsal integument, so that the protection once afforded by one portion of the animal has been transferred to another.

[1] See Haddon, *Challenger* Expedition, Report on the Polyplacophora.

It is interesting to note the analogy presented by other limaciform Mollusca, in which the shell, once probably external and substantial, has become overlapped by developments of the dorsal area and has gradually disappeared from view, ultimately either vanishing altogether or becoming disintegrated, or else, as in the case of *Testacella*, completely shifting its position or becoming redeveloped in a position where a special necessity had to be provided for. In all these cases it will be found that the modification of the size or shape of the shell was, as it were, compensated for by a corresponding modification of the integument, which took its place and did its work.

It is possible that future discovery may bring to light a form or forms of Chiton in which the process of degradation has proceeded further still, and in which all the valves are markedly embedded, or in which some have even become non-existent. On a consideration of the present species and its nearest allies, one would expect the sixth, fifth, and fourth valves to disappear first, since in their case the reduction of size has proceeded furthest, while one might hazard a conjecture that the limit valves at either end would maintain their existence longest.

Mr. C. Hedley records [1] no Polyplacophora from the atoll, with the exception of a single mutilated median valve of a species of *Tonicia*, dredged at 150 fathoms. He remarks that Pease only knew of six species of Polyplacophora from the Central Pacific, a fact remarkable when it is considered how abundantly the group is represented on the west coast of South America, Australia, and New Zealand.

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[1] "The Mollusca of Funafuti," Supplement: Mem. Austr. Museum, iii, pt. ix, p. 550, 1899.

CHARACTERS OF A NEW SUB-GENUS AND SPECIES OF *CHOANOPOMA* FROM CUBA.

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

Read 11th April, 1913.

Ramsdenia, n.subgen.

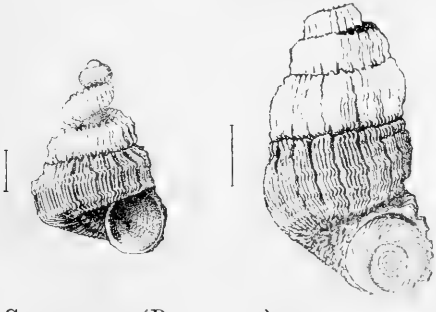
Shell perforate, cylindrical, the first two whorls mamillary, contiguous, the third widely disjunct, the fourth, fifth, and sixth contiguous except towards the aperture where the last is slightly disjunct, transversely, laminately sculptured; operculum calcareous, with central, depressed nucleus, the outer margin costulate, the inner or depressed portion bearing a raised spiral ridge.

Genotype: *R. mirifica*, n.sp.

The adult shell is generally decollate, and lacks the first three whorls; thus only immature specimens, as a rule, show the upper distinguishing characters.

There seems little doubt but that *Ramsdenia* should be classed as a sub-genus of *Choanopoma*,[1] Pfr., and would in some respects appear to be intermediate between *Choanopoma*, *sensu stricto*, and its sub-genera *Blæsospira*[2] and *Xenopoma*,[3] both of Crosse.

It is with great pleasure that I associate the name of my friend Mr. Charles T. Ramsden, the collector, with the above sub-genus.



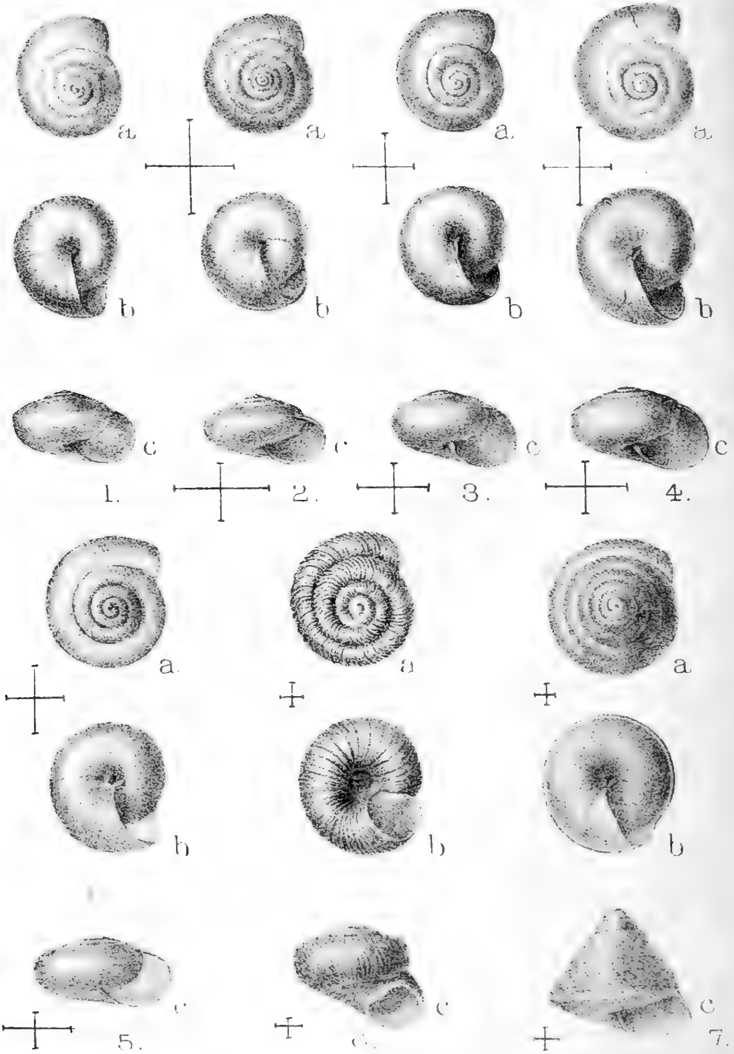
Choanopoma (Ramsdenia) mirifica, n.sp.

Shell dextral, cylindrically fusiform, cream-coloured; whorls 6, the first two smooth except in the sutural region, where they are strongly and serratedly crenellate, the third whorl loosely disjunct, sculptured only with erect, fine, slightly distant, transverse costulæ, the fourth, fifth, and sixth volutions joined except just behind the aperture, angled at the periphery, sculptured with spiral liræ crossed by very wavy, erect, fine, frill-like, transverse costulæ arranged in groups of two or three on the fourth whorl, three to four on the fifth, and four to five or six on the last whorl, the interstices being occupied with fine, wavy, scratch-like, spiral striæ; suture deeply incised, coarsely

[1] Zeitsch. f. Malak., 1847, pp. 47, 107.
[2] Journn. de Conch., Paris, vol. xxxviii, pp. 280–2, 1890.
[3] Tom. cit., pp. 282–3.

crenellated and serrated by the termination of the groups of frill-like costulæ; perforation very narrow, spinously costulate; peristome continuous, subcircular, outwardly frilled by the termination of the spiral liræ except in the immediate contra-parietal region; operculum calcareous, sinistral, white, deeply depressed in the centre, having four volutions, the two outer whorls closely, obliquely, arcuately costulate, the two inner bearing an erect, serrated, spiral ridge. Alt. (allowing for apical whorls), 8·75 (about), diam. maj. 4 mm.; aperture, alt. 1·75, diam. 1·75 mm.

Hab.—Bayate, near Concepcioncita, 30 miles north-west of Guantanamo, "a totally unexplored locality" (C. T. Ramsden). Young specimens of this extraordinary form are widely umbilicate and bear a marginal, a sub-marginal, and an interior spiral liration.



A.H. Searle del. et lith. Huth imp.

LAND SHELLS FROM FIJI ISLANDS.

THE HELICOID LAND SHELLS OF THE FIJI ISLANDS, WITH DEFINITIONS OF THREE NEW GENERA AND DESCRIPTIONS OF FOUR NEW SPECIES.

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

Read 11th April, 1913.

(PLATE XIV.)

An interesting little collection of Helicoids from the Fiji Islands has been kindly placed in my hands for identification by Mr. John Ponsonby. They were collected by his son, Mr. Richard Ponsonby, during a temporary residence in that group of islands, and although there appears to be only one undescribed form among them, several of the older species, which have hitherto remained rare in collections, have now fortunately been rediscovered. It is also of interest having to record the presence in those islands of two Oriental species—doubtless introduced with living plants—viz. *Hemiplecta striata* (Gray), a native of the Malay Peninsula, and *Eulota similaris* (Fér.), believed to be indigenous in China, but at present found in many parts, not only of the old, but also of the new world. It is believed to owe its present wide distribution to the fact that it has been carried with the soil attached to coffee plants. My own records cover the following localities: Asia—China and Formosa, Japan, Siam, Cochin-China, Penang, Perak, Singapore, Java, Celebes, Philippine Islands, India, Burma, Ceylon; Australia—New South Wales; Pacific—Sandwich Islands; Africa—Natal, the Seychelles, Comoros, and the islands of Rodriguez, Mauritius, Bourbon, Madagascar, and Ascension; America—Bermuda, Cuba, Barbados, Brazil, and Argentina.

In comparing Mr. Ponsonby's shells with those in the Natural History Museum, I came across a considerable quantity of unnamed material collected in the Fiji Islands by the officers of H.M.S. *Herald* (MacGillivray, Rayner, and McDonald) between 1854 and 1857, and presented to the Museum by the Admiralty. Mr. E. A. Smith, the Assistant-Keeper of Zoology, having with his unvarying courtesy placed these at my disposal, I have considered this a fitting opportunity of working out these shells at the same time. This collection yielded four undescribed species—one of them co-specific with the one found by Mr. Richard Ponsonby—three of which I refer to the genus *Fretum*, while the fourth does not appear to be referable to any known genus, and I am therefore obliged to create a new genus for its reception.

Fijia, nov. gen.

Shell discoid, umbilicated, thin, pellucid; the later whorls costulate, decussated by spiral sulci.

Type: *F. Macgillivrayi*, Gude.

Three other species (*Clayi*, *Barkasi*, and *Samoensis*) do not appear to assimilate with any other Zonitoids, and for these I propose—

Liardetia, nov. gen.

Shell small, trochoid, thin, finely but distinctly costulate, periphery carinated.

Type: *Nanina Clayi*, Liardet.

Three further species (*Nouleti*, *Pfeifferi*, and *Otaræ*) I am likewise unable to classify with any other Pacific shells. One of these, *Pfeifferi*, has indeed been referred by von Martens to the genus *Eurypus* of Semper[1]—*Eurypus* being preoccupied, Mr. Sykes has substituted *Fretum* for Semper's name—but I am unable to concur in this view, seeing that this species and its allies are widely different from *Casca*, the type of that genus. More recently Mr. Sykes[2] has placed some Norfolk Island species in *Fretum*, which, however, likewise bear no resemblance to its type, and may in fact constitute another new genus, but these will, I hope, be dealt with on another occasion. For the reception of the three before-mentioned species I now propose—

Irenella,[3] nov. gen.

Shell imperforate, turbinate or depressed conoid, solid, livid purplish, shining, smooth or striated and decussated with spirals.

Type: *Helix Nouleti*, Le Guillou.

Fretum lepidum, n.sp. Pl. XIV, Figs. 3*a–c*.

Shell perforate, turbinate, shining, dark fuscous above, milky white below, or entirely milky white; spire depressed, apex obtuse, suture channelled; whorls 4, rounded, very finely striated transversely and spirally, the striæ being perceptible only with a strong lens; aperture rotundate, margins acute, regularly curved; columellar margin reflected, practically covering the narrow perforation of the umbilicus, and furnished inside with a slightly entering callous fold, not equally developed in all specimens. Diam. maj. 9, min. 8 mm.; alt. 5·5 mm.

Hab.—Island of Ngau, under dead leaves and logs. October, 1855. (J. MacGillivray.) Six specimens.

Type in the British Museum.

Allied to *nodulata*, Mouss., but, while possessing only four whorls, it is nearly twice as large as that species, which has six whorls.

Fretum placitum, n.sp. Pl. XIV, Figs. 4*a–c*.

Shell narrowly perforate, conoid; spire depressed, apex obtuse, suture channelled; whorls 4, increasing rapidly, last more than twice as wide as the penultimate, slightly dilated towards the aperture, a little rounded above, angulated above the periphery, the angle disappearing towards the aperture, inflated below; smooth, shining, finely striated; aperture oblique, crescent-shaped, margins acute, regularly curved; columellar margin reflected and almost covering the narrow perforation of the umbilicus. Type whitish

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[1] Monatsber. Berlin Akad., 1877, p. 268.

[2] Proc. Malac. Soc. Lond., vol. iv, p. 140, 1900.

[3] εἰρηνη, 'peace,' to convey the idea of the locality: Pacific Ocean.

corneous, slightly suffused with pale fuscous. Diam. maj. 10, min. 8·75 mm.; alt. 6 mm.

Hab.—Island of Ngau. September, 1854. (MacGillivray.) Five specimens.

Type in the British Museum.

One specimen is fuscous in colour, and measures, diam. maj. 10·5, min. 9 mm.; alt. 6 mm.

Allied to the preceding species, but larger, the last whorl is more tumid below towards the aperture, the umbilicus is narrower, the aperture less dilated transversely and the angulation above the periphery is much less, while the microscopic spirals of *Fretum lepidum* are absent in the present species.

FRETUM RICHARDI, n.sp. Pl. XIV, Figs. 1*a–c*.

Shell narrowly umbilicated, depressed, conoid, pellucid, clouded at the umbilical region, corneous, shining, smooth, faintly and irregularly striated; apex acute, suture shallow, margined; whorls 5, increasing rapidly, the last twice as wide as the penultimate; flattened above, rather acutely angulated above the periphery, inflated below; aperture diagonal; margins acute, upper and outer nearly straight, lower regularly curved, columellar obliquely descending, slightly reflected and overhanging the narrow umbilicus. Diam. maj. 15·5, min. 13·5 mm.; alt. 9 mm.

Hab.—Viti Levu, under dead leaves. September, 1856. (Rayner and McDonald.) Two specimens.

Allied to *Fretum Hoyti*, Garr., but more depressed than that species and with more conical spire; the angulation of the whorls is more pronounced, the whorls increase more rapidly, the aperture is more dilated transversely, and the shell is of a thinner texture. The second specimen measures, diam. maj. 14·25, min. 13 mm.; alt. 9 mm.

Var. *atrofusca*, n.var.

Differs from the type in being dark fuscous. Diam. maj. 15·5, min. 13·5 mm.; alt. 9·5 mm.

Hab.—Suva Harbour. (Mr. Richard Ponsonby.) Two specimens.

FIJIA MACGILLIVRAYI, n.sp. Pl. XIV, Figs. 2*a–c*.

Shell narrowly umbilicated, conoid, pale corneous; spire depressed, apex obtuse, suture deep; whorls $5\frac{1}{2}$, tumid, increasing slowly and regularly, apical whorl almost smooth, the next regularly and strongly costulate above, the costulæ becoming more crowded and finer on the last portion of the last whorl; costulæ strongly decussated by spiral sulci; last whorl angular above periphery, costulæ and spiral sulci descending below the periphery where they terminate abruptly, below which the shell is finely striated transversely, shining, with some distant, irregular, shallow spiral grooves; aperture oblong-ovate; margins acute, regularly curved, columellar shortly dilated, reflected and overhanging the moderate umbilicus. Diam. maj. 12, min. 11 mm.; alt. 7 mm.

Hab.—Matuku, under dead leaves. August, 1855. (MacGillivray.) Seven specimens.

As regards sculpture and shape of shell the present species somewhat resembles a miniature *Hemitrichia.* I do not know any species with which to compare it.

As a quarter of a century has elapsed since any new species of Helicoids from this group of islands were described,[1] the present would appear to be a suitable occasion to tabulate all the known forms from that region.

In the subjoined classified list the species represented in the *Herald* collection are indicated by the letter H, while those brought home by Mr. Richard Ponsonby are distinguished by R.P. A few species sent to the British Museum by Liardet are marked with the letter L. In each case the localities are appended.

Genus Parmella, H. Ad.

planata, H. Ad.

Genus Liardetia, Gude.

Clayi (Liardet). Vatou, Ngau; H. Taviuni; L.
Barkasi (Liardet). Ngau, Vatou; H.

Genus Sitala, H. Ad.

Pinnocki (Liardet). Taviuni; L.
sansita (Cox). Pl. XIV, Figs. 7*a–c*. Totoya; H. Island in Suva Harbour; R.P.
microconus (Mouss.). Also found in the Samoa and Friendly Islands.

Genus Philonesia, Sykes.

sororia (Cox).
Vitiensis (Mouss.). Viti Levu, Moalu, Totoya; H. Island in Suva Harbour; R.P.
perpolita (Mouss.). Also found in the Samoa and Friendly Islands.
Upolensis (Mouss.). Totoya; H. Also found in the Samoa Islands.
= *Samoensis* (Baird, *non* Mouss.).

Genus Lamprocystis, Pfeff.

excrescens (Mouss.). Viti Levu; H. Island in Suva Harbour; R.P. Also found in the Cook Islands, the Friendly Islands, and the New Hebrides.
firmostyla (Mouss.). Also found in the Samoa and Friendly Islands.
Kiaoensis (Garr.).
= *Kiraensis*, Garr. (err. typ.).
= *Kivaensis*, Tryon.
Stearnsiana (Garr.).
Taviuniensis, Garr.
unisulcata (Mouss.). Also found in the Samoa Islands.
= *laqueata* (Baird).

Genus Fretum, Sykes.

casca (Gould).
= *calva* (Gould, *non* Lowe).
= *Vitiensis* (Pfr., *non* Mouss.).

[1] The last paper is by Garrett, Proc. Zool. Soc., 1887, p. 164.

similis (Semp.).
tenellum (Garr.).
nodulatum (Mouss.).
placitum, Gude. Ngau; H.
lepidum, Gude. Ngau; H.
Ramsayi (Liardet).
vitrininum (Liardet). Taviuni; L.
Schmeltzianum (Garr.). Pl. XIV, Figs. 5*a–c*.
Richardi, Gude. Viti Levu; H.
  var. *atrofusca*, Gude. Suva; R.P.
Assavaense (Garr.).
fragillimum (Mouss.). Viti Levu, Ovalau, Ngau; H. Viti Levu; R.P.
Hoyti (Garr.). Viti Levu, Ovalau; H.
Godeffroyanum (Garr.).

Genus Orpiella, Gray.

scorpio (Gould).

Genus Irenella, Gude.

Nouleti (Le G.). R.P.
  = *rubricata* (Gould).
polita (Mouss.).
Pfeifferi (Phil.).
  = *lurida* (Gould).
Otareæ (Garr.). Vanna Levu, Viti Levu; H.

Genus Fijia, Gude.

plicostriata (Mouss.). Viti Levu; H.
Macgillivrayi, Gude. Matuku; H.

Genus Trochomorpha, Albers.

abrochroa (Crosse). Viti Levu; H. Island in Suva Harbour; R.P.
  var. *pseudoplanorbis*, Mouss.
accurata, Mouss.
corallina, Mouss.
fessonia (Angas).
Kantavuensis, Garr.
latimarginata (Smith).
Lüdersi (Pfr.). Ngau; H. Also found in the Society and Friendly Islands.
Merzianoides (Garr.).
planoconus (Mouss.), Garr.
subtrochiformis, Mouss. Also found in the Samoa Islands.
Swainsoni (Pfr.). Also found in the Society Islands.
Taviuniensis (Garr.).
themis, Garr.
transarata (Mouss.).
  var. *depressostriata*, Mouss.
tumulus (Gould).

Genus Endodonta, Albers.

Section *Thaumatodon*, Pilsbry.

Maupiensis (Garr.). Also found in the Society Islands.
  = *Maupitiensis*, Pfr.
subdædalea (Mouss.).

Genus Charopa, Albers.

adposita (Mouss.).
inermis (Mouss.). Vatou; H.
monstrosa (Ancey). Pl. XIV, Figs. 6*a–c*.
  = *irregularis* (Mouss., *non* Semp.).
Princei (Liardet). Taviuni; L.

Introduced Species.

Hemiplecta striata (Gray). Suva; R.P.
Eulota similaris (Fér.). R.P.

Doubtful or Spurious Records.

Trochomorpha planorbis (Less.), var.
Planispira (*Trachiopsis*) *leucolena* (Crosse).
  = *Delessertiana*, var.
Cochlostyla (*Callicochlias*) *semirufa* (Albers).

From the foregoing list it appears that the total number of Helicoids known from Fiji amounts to fifty-eight, by far the greatest number being confined to those islands, since only ten of them have been recorded from other groups, of which seven occur in the three immediately surrounding archipelagoes, viz. the Samoa or Navigator Islands, the Tonga or Friendly Islands, and the New Hebrides, while four are shared with the farther outlying groups (the Society Islands and the Cook or Hervey Islands). As regards the genera, four are as far as can at present be ascertained endemic (*Liardetia*, *Orpiella*, *Irenella*, and *Fijia*), the others being generally distributed over all the Pacific Island groups, some of them, viz. *Sitala*, *Lamprocystis*, and *Trochomorpha*, having in fact a much wider distribution, occurring on the continent and most of the islands of Asia, while *Endodonta* even reaches South Africa and St. Helena, and *Charopa* extends to Australasia.

Two previously described species, viz. *Sitala sansita* (Cox) and *Fretum Schmeltzianum* (Garr.), the latter from my own collection, are now figured for the first time.

EXPLANATION OF PLATE XIV.

Figs.
1*a–c*. *Fretum Richardi*, n.sp.
2*a–c*. *Fijia Macgillivrayi*, n.sp.
3*a–c*. *Fretum lepidum*, n.sp.
4*a–c*. *F. placitum*, n.sp.
5*a–c*. *F. Schmeltzianum* (Garr.).
6*a–c*. *Charopa monstrosa* (Ancey).
7*a–c*. *Sitala sansita* (Cox).

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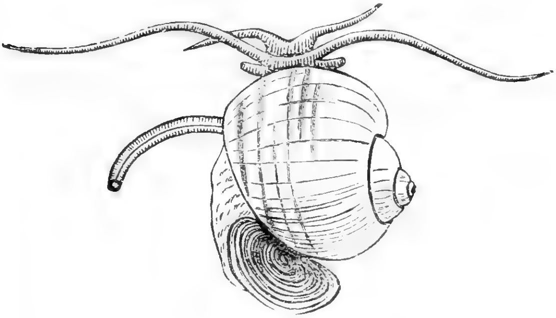

EDITED BY

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

Under the direction of the Publication Committee.

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ORDINARY MEETING.

Friday, 9th May, 1913.

The Rev. A. H. Cooke, M.A., F.Z.S., President, in the Chair.

Dr. Augusto Nobre was elected a member of the Society.

The following communications were read:—

1. "Descriptions of three new species of Land Shells from New Zealand." By H. Suter.
2. "On *Callista*, *Amiantis*, and *Pitaria*." By A. J. Jukes-Browne, F.R.S., F.G.S.
3. "Descriptions of new species of Land Shells from Africa." By Cæsar R Boettger.
4. "On a collection of Land and Freshwater Shells from the Upper Nile Region." By Cæsar R. Boettger and Fritz Haas.

Mr. B. B. Woodward, F.L.S., exhibited a number of glass tubes which were found after a time to be covered with condensed moisture on the inner surface, although the aperture had not been sealed or closed with cork, but only with cotton wool. He believed this to be due to an inherent defect in the glass itself, but he was taking steps to find out the cause, and promised to communicate the result.

Mr. R. B. Newton exhibited specimens of *Ampullaria ovata*, with opercula of that species, and *Lanistes carinatus* from a Miocene deposit near the Victoria Nyanza, both species occurring in that region in the recent state.

ORDINARY MEETING.

Friday, 13th June, 1913.

The Rev. A. H. Cooke, M.A., F.Z.S., President, in the Chair.

The following communications were read:—

1. "Note on the genus *Pseudomalaxis*, Fischer, and descriptions of a new species and sub-genus." By the Marquis de Monterosato.
2. "Non-marine Mollusca from the Old Bed of the Thames at Barn Elms with *Margaritana* (*Pseudunio*) *auricularius* (Speng.)." By A. S. Kennard, F.G.S., and B. B. Woodward, F.L.S.
3. "The Land Mollusca of the Kermadec Islands." By Tom Iredale.
4. "Definitions of further new genera of Zonitidæ." By G. K. Gude, F.Z.S.

Mr. Tom Iredale exhibited a two-mouthed specimen of a *Pupa* taken by him in Hungary.

Mr. C. N. Bromehead, B.A., exhibited *Unio tumidus* and *Anodonta cygnea*, var., dredged from the River Thames off Battersea.

NOTES.

Non-marine Mollusca from the Old Bed of the Thames at Barn Elms with *Margaritana* (*Pseudunio*) *auricularius* (Speng.). (*Read 13th June*, 1913.)—We received from Mr. Lawrence some small masses of iron-cemented grit containing shells that had come from the same deposit as the race-covered *Unio auricularius*, Speng., and *U. tumidus*, Retz. From these masses we extracted the following species :—

Ancylus fluviatilis, Müll.
Limnæa pereger (Müll.).
Planorbis albus, Müll.
P. crista (Linn.).
P. contortus (Linn.).
Bithynia tentaculata (Linn.).
B. Leachii (Shepp.).
Valvata piscinalis, Müll.
Valvata cristata, Müll.
Theodoxus fluviatilis (Linn.).
Sphærium corneum (Linn.).
Pisidium Henslowanum (Shepp.).
P. supinum, A. Schm.
P. nitidum, Jenyns.
P. pusillum (Gmel.), Jenyns.

The *Sphærium corneum* resembles in form the variety *mænanum* met with at Crayford and Erith, so that this form must have lingered on, or the Barn Elms deposit is older than one would have been led to believe.

A. S. Kennard & B. B. Woodward.

DESCRIPTIONS OF THREE NEW SPECIES OF LAND SHELLS FROM NEW ZEALAND.

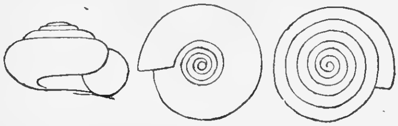
By Henry Suter.

Read 9th May, 1913.

Some New Zealand land shells, collected by Mrs. G. B. Longstaff, and also a number found by Mr. G. W. Howes, of Dunedin, were sent to me by the former for identification. Amongst them I found the three new species which are now described and figured.

Endodonta (Charopa) Longstaffi, n.sp.

Shell very small, sub-discoidal, the whorls very narrow, umbilicate, with close radiate riblets, uniformly light brown. *Sculpture* of the post-embryonic whorls consisting of very fine and close radiate riblets, 28 to 30 per millimetre, slightly flexuous above and upon the periphery, straight on the base, with exceedingly faint microscopic dense spiral striation, the interstices with a few fine incremental



lines. *Colour* light brown, without any colour-markings. *Spire* slightly raised, broadly convex, flat in the centre. *Protoconch* of $1\frac{1}{2}$ smooth flattish volutions. *Whorls* $6\frac{1}{4}$, narrowly coiled up, very slowly increasing, convex, periphery regularly rounded. *Suture* well impressed. *Aperture* oblique, rotundly lunate. *Peristome* simple, acute, margins converging. *Columella* short, arcuate, vertical. *Umbilicus* wide and deep, perspective, about one-third of the greatest diameter. Height 1·5, diam. 2·8 mm.

Dentition unknown.

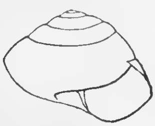
Type in my collection.

Hab.—Orepuki, Southland (Mrs. G. B. Longstaff), type; Woodhaugh, Otago (Mr. G. W. Howes).

Named in honour of Mrs. G. B. Longstaff, F.L.S., who discovered the species when visiting New Zealand in 1910.

Thalassohelix pygmæa, n.sp.

Shell very small, trochiform, narrowly umbilicated, smooth, pellucid and thin, periphery distinctly angled. *Sculpture* consisting of fine



oblique growth-lines and fine microscopic spiral striation, base with spiral line more prominent than the others at some distance from the umbilicus. *Colour* pale horny, with faint rufous radial streaks of different width, extending over the base. *Epidermis* thin, slightly shining. *Spire* conoidal, convex, of about the same height as the aperture. *Protoconch* of 1½ smooth whorls, obtuse. *Whorls* 5, regularly increasing, lightly convex, periphery angled; base convex. *Suture* not much impressed. *Aperture* slightly oblique, sub-quadrangular. *Peristome* simple, acute. *Columella* short, sub-vertical, a little reflexed. *Umbilicus* narrow, open, one-eighth of the greatest diameter. Height 2·8, diam. 4 mm.

Dentition unknown.

Type in my collection.

Hab.—Woodhaugh, Otago (Mr. G. W. Howes). One specimen.

LAOMA (PHRIXGNATHUS) GRACILIS, n.sp.

Shell minute, depressed globose, umbilicated, almost smooth, thin, somewhat shining, pellucid, uniformly horn-colour. *Sculpture* consisting of fine irregular growth-lines and very fine microscopic spiral striæ, the last whorl being faintly and somewhat irregularly radially plicated. *Colour* greenish horn-colour. *Spire* conoidal, the height slightly more than that of the aperture. *Protoconch* obtuse, smooth,

of 1½ volutions. *Whorls* 4½, the last large in proportion, convex; base rounded. *Suture* well impressed. *Aperture* somewhat oblique, broadly lunate. *Peristome* acute, thin, the margins faintly converging. *Columella* short, oblique, nearly straight, slightly reflexed. *Umbilicus* moderate, open, deep, about one-seventh of the greatest diameter. Height 1·5, diam. 2·3 mm.

Dentition unknown.

Type in my collection.

Hab.—Woodhaugh, Otago (Mr. G. W. Howes). One specimen.

This species stands nearest to *L. viridula*, Suter, which, however, is imperforate.

ON CALLISTA, AMIANTIS, AND PITARIA.

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

Read 9th May, 1913.

The large group of shells which was called *Callista* by Mörch (1853) and by the Adams Bros. (1857), and *Dione* by Gray (1847), was divided by Römer into three sections (1857 and 1862), which were really genera, for he regarded them as co-ordinate with *Tivela, Meretrix*, and *Circe*.[1] His divisions were *Callista* for the *Venus chione* group, *Caryatis* for the *C. tumens* group, which he had called *Pitar* in 1847, and *Dione*, which he restricted to the *Venus dione* group, but included *D. nobilis*, which is the *Cytherea callosa* of Conrad, and for which Carpenter proposed the sub-genus *Amiantis*.

A little later (1876) the whole group was briefly reviewed by Meek, who thought all these divisions might be reunited into one genus under the name *Callista* (Poli & Adams). Of this genus he made six sections or sub-genera, including Römer's three groups, and adding to them a sub-genus *Macrocallista*, and the fossils *Aphrodina* (Conrad) and *Dosiniopsis* (Conrad).

More recently (1902) Dr. Dall published a "Synopsis of the Veneridæ",[2] in which he regarded most of these groups as separate genera, discarded the name *Callista*, and made a still further subdivision of them so that his genera and sub-genera are as follows:—

1. *Macrocallista*, Meek, with sub-genus *Chionella*, Cossmann.
2. *Amiantis*, Carpenter, with section *Eucallista*, Dall.
3. *Callocardia*, Adams, with sub-genus *Agriopoma*, Dall.
4. *Pitaria*, Römer, em., with sub-genus *Hysteroconcha*.
5. *Aphrodina* (as sub-genus of his *Cytherea*, Bolten).

A comparison of this arrangement with those of Römer and Meek has convinced me that Römer's is much more natural and satisfactory than either of the others. I propose to give my reasons for this opinion and to bring under review some other small groups of shells which are closely allied, viz. the *Tivelina* of Cossmann, the *Lepidocardia* and *Transenella* of Dall, and that for which I proposed the name of *Calpitaria* in 1908.

If it be argued that all these groups are so closely allied that they form no more than one genus, there is little fault to be found with Meek's arrangement, for we need then only exclude *Dosiniopsis*, which indeed he included with some doubt. It may be admitted that the groups above mentioned are linked together by species which combine the characters of two or more of them. At the same time there is no reason why we should not accept the existence of links between groups which it is otherwise convenient to regard as separate genera.

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[1] Krit. Untersuchung der Arten des Moll. *Venus*, Cassel, 1857; and Malakozool. Blätter, Bd. viii, 1862.

[2] Proc. U.S. Nat. Mus., vol. xxvi, p. 335, 1902.

A genus is not a definite creation, but a result of evolution, and the establishment of genera is therefore largely a matter of convenience. Thus, when we are dealing with a large group of shells it is convenient to divide it into several genera, if these can be usefully defined, while, if this very group had not developed so many species, it might have been more convenient to make one genus with several sub-genera. It is not necessary that a genus should be an absolutely isolated group; a genus may be isolated from other recent genera by the extinction of links, though some of these links may occur in fossil faunas; on the other hand, in some cases links between two generic groups may have survived to the present time, and for convenience may have to be included in one of the two genera.

The *Cytherea* or *Callista* group is a large one, and consequently it seems convenient to divide it into a limited number of genera, provided that these can be defined so that they are easily distinguishable from one another. Both Römer and Dall have essayed to do this, and Römer's three divisions seem to me much more natural and convenient than Dall's. Thus I see no reason for separating what Dr. Dall calls '*Agriopoma*' from *Pitaria*, the shells having substantially the same dentition; while the typical *Dione* group agrees much more closely with *Amiantis* than with *Pitaria*. Finally, *Aphrodina* is essentially a *Callista*, as I have previously shown, and has so little in common with the *Venus puerpura* group that I am sure few will follow Dr. Dall's lead in that direction.

An independent examination of a large number of species belonging to these groups led me to the conclusion that they might conveniently be arranged in three sets which could well be regarded as genera. Subsequent reference to Römer's lists of species showed me that my grouping was substantially the same as his, though I can certainly indicate the critical differences between them more briefly and clearly than he did.

These three genera have been widely known by the names of *Callista*, *Dione*, and *Caryatis*, but here we are brought up against that thorny and almost insuperable obstacle of nomenclature. *Callista* cannot be used as if it had been properly established by Poli, because he applied it solely to the animal, or rather to the animals of several Linnæan genera, and did not intend it to be used as a name for any shells belonging to the Linnæan genus *Venus*. Again, if the strict rule of priority is enforced *Callista* cannot be derived from Mörch or Adams because Gray unfortunately published Leach's use of it in 1852, though so used it becomes merely a synonym of *Clausina* (Brown).

The rule of priority, however, is breaking down from the shear weight of the absurdities and inconveniences with which it is burdened, and of these *Callista* is a striking instance. If discarded it would have to be replaced by the name *Macrocallista*, which presupposes the existence of a *Callista* and was actually proposed by Meek for a mere section of *Callista*. The larger and typical group has then to be included under the name *Chionella*, which was proposed by Cossmann so late as 1887 for a small group of

Eocene fossils. This is surely a *reductio ad absurdum*! For the prevention of such cases as this it seems to me that a relaxation of the rule is required, and that authority should be given for deriving the name from the first subsequent author who used it for the same group to which the current type belongs. This would enable us to pass over Leach and to derive the name *Callista* either from Mörch, whose first species was *C. erycina*, or from H. & A. Adams, whose typical example was *C. chione*. I shall therefore retain the name *Callista* in the hope that the International Zoological Congress will eventually adopt this course.

The name *Dione*, however, cannot stand because it was preoccupied by Hubner in 1816 (Lepidoptera), nor can it be replaced by *Hysteroconcha* as Dr. Dall proposed, for this name is not Fischer's as he supposed. Fischer in his Manuel (1887) used *Dione*, and only mentioned *Hysteroconcha* of "Lang, 1722" in brackets as a synonym, the date showing this name to be pre-Linnæan. I shall demonstrate in the sequel that the *Dione* group is more closely connected with the *Amiantis* of Carpenter than with the *Pitaria* group. Consequently, I agree with Römer in regarding the two former as members of one genus, the name of which will be *Amiantis*.

With regard to the name *Caryatis*, this was also preoccupied by Hubner in 1816; moreover, Römer had himself previously proposed the name *Pitar* for the group, and this, as amended by Dr. Dall and converted into *Pitaria*, should certainly be accepted.

The criteria on which I mainly rely for the establishment of these three genera, *Callista*, *Amiantis*, and *Pitaria*, are (1) the existence in the two latter of a channel leading from the pit between the anterior laterals of the right valve below the anterior cardinal into the first interdental socket, (2) the position and shape of the left posterior cardinal, (3) the form and direction of the pallial sinus. Neither the characters of the external surface nor the bridge-connexion of the anterior and posterior cardinals in the right valve are to be depended upon, though of course they are useful points in diagnosis. So also is the existence of a definite escutcheon in *Amiantis*.

Relying on the characters of the dentition only, the three generic groups may be distinguished as follows:—

In *Callista* there is no connecting channel; the left posterior cardinal is short, high in the middle, and confluent with the nymph.

In *Amiantis* there is a channel under the right anterior cardinal; the left posterior cardinal is long, highest at the end, and confluent with the nymph (as in *Callista*).

In *Pitaria* there is a channel as in *Amiantis*, but the left posterior cardinal is generally more or less separate and slightly curved, so as to extend across the hinge-plate to its inner margin.

There are, however, some exceptions to these rules or generalizations. Thus, *Callista aurantiaca*, Sow., has the fosse and channel of an *Amiantis*, though in all other respects it is a *Callista*. It may, therefore, be regarded as to some extent a link between the two genera, but I do not propose to give it a sectional name, as that would be magnifying the importance of a single structural character.

Another exceptional shell is *Callista vulnerata*, Brod., a rather rare form from the Pacific coast of America. This has the external aspect of a *Callista*, and was so classed by Römer, but inside it presents the dentition of *Pitaria*, and was properly referred to that genus by Dr. Dall in 1902.[1] Moreover, as pointed out by the latter, it is remarkable for having its inner margins irregularly crenulated, a feature not found in any other member of either genus. On account of these peculiarities I propose to separate it as a sub-genus of *Pitaria* under the name of *Callizona*, from its purple marginal band of colour, which is often reduplicated as a zone along the lines of growth.

A more important and inconvenient exception to the discrimination of *Amiantis* and *Pitaria*, as above formulated, is that of *Pitaria tumens*, the very type of the latter genus; for in this shell the left posterior cardinal resembles that of *Amiantis* in being confluent with the nymph along its whole course, and in this respect differs from most other species of *Pitaria*. There is also another point of difference between *P. tumens* and its congeners, this being the form of the pallial sinus, which is long, horizontal, linguiform, and pointed at the anterior end, like that of *Amiantis callosa* and *A. dione*.

Pitaria tumens therefore combines some of the features of *Amiantis* with some of those which are distinctly characteristic of most other *Pitaria*, but it must remain the type of the latter because it is the original '*Pitar*' of Adanson. We are therefore in this predicament, that the majority of the species composing the genus *Pitaria* differ from the genotype in two important particulars, i.e. in the position of the left posterior cardinal and in the possession of a short rounded or bluntly angular sinus; while the genotype only differs from a typical *Amiantis* in certain external characters, such as its finer surface sculpture, the exsert lunule, and absence of escutcheon.

Some may think that the best plan would be to unite the *Pitaria* and *Amiantis* groups, and to make only one genus of them, but this would obscure the fact that there are two essentially distinct groups linked together by a few intermediate forms. Moreover, I regard the complete separation of the left posterior cardinal and its extension across the hinge-plate as a character of much importance, because it links *Pitaria* with *Dosinia*, and suggests that the latter has been evolved from the former.

There is also another point of difference between the typical *Pitaria tumens* and the numerous species which have a free right posterior cardinal; for in the former the cardinals of the right valve are separate from one another, like those of *Callista*, while in the latter the anterior and posterior cardinals are more or less united at the top to form an arch over the median tooth. This is markedly the case in the species *citrina*, *pellucida*, and *subpellucida*, the arch in these being really as complete as it is in the shells which Dr. Dall separated in 1902 under the name of *Agriopoma*. In the species *læta*, *obliquata*, and *inflata*, the connecting bridge is lower and slighter, and

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[1] Proc. U.S. Nat. Museum, vol. xxvi, p. 388.

in some specimens it is either absent or was so slight as to have been broken and detached; the same is the case with the West Indian *fulminata* (Menke). There is, in fact, every gradation between a complete arch and an incomplete one, proving that the character is of little value as a basis of generic or sub-generic distinction.

Dr. Dall based his *Agriopoma* group on three characters: (1) a continuous cardinal arch in the right valve, (2) a chalky shell without coloration, (3) an angular pallial sinus; and he placed it as a sub-genus of *Callocardia*, taking *Texasiana*, Dall, as the type and excluding *P. fulminata.* It is clear, therefore, that his small group of American shells is not the large group which I distinguish by another set of characters, and for which I now propose the name *Pitarina,* indicating *P. citrina* as the type. This I regard as a section of *Pitaria*, distinguished by a free oblique posterior cardinal in the right valve and a short pallial sinus; the valves are frequently coloured with brown markings, and there is often a complete cardinal arch in the right valve.

So far as I can ascertain, there are only five other reputed species of *Pitaria* which agree with the type. One of these is *P. cor*, Römer (*non* Hanley), which only differs from *tumens* in being more trigonal in shape, and may be regarded as a mere variety; another is *P. rufescens*, which seems only to differ in colour, but is said to come from the Philippine Islands, while *tumens* is a native of West Africa. The third is *P. virgo*, which also comes from West Africa and differs very little from *tumens*, but in which the posterior cardinal is not quite so completely confluent with the nymph. The other two species are *P. manillæ*, Sow., and *P. tumida*, Sow., both of which are trigonal and concentrically ribbed. It is therefore these five species or varieties which, with *P. tumens*, will form *Pitaria*, *sensu stricto.* The true *Cytherea cor* (Hanley) is a very different shell from that above-mentioned.

We cannot leave the *Pitaria* group without taking notice of the shell described by A. Adams under the name of *Callocardia*, and of certain other shells which have been associated with it. *Callocardia* was founded in 1864 on a single left valve, and Adams thought that it did not possess an anterior lateral tooth, for he distinctly wrote "dentibus lateralibus nullis".[1] In 1883 (Challenger Reports, Mollusca) Mr. E. A. Smith doubtfully referred three new species of shells to *Callocardia*, but in the following year Dr. Dall proposed the genus *Vesicomya* for these and another new form (*V. venusta*, Dall).[2] In 1888 Mr. G. B. Sowerby, having obtained perfect examples of the original species *Callocardia guttata*, pointed out that its dentition agreed more closely with that of *Caryatis* than with that of *Miocardia*, near which it had been placed by Adams. In 1900 Mr. Smith confirmed Sowerby's view,[3] and figured the hinges of both valves of *C. guttata*; indeed, he went farther and

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[1] Ann. Mag. Nat. Hist., vol. xiii, p. 307, 1864.
[2] Bull. Mus. Comp. Zool., vol. xii, p. 272.
[3] Proc. Malac. Soc., vol. iv, p. 81.

declared that so far as the hinge is concerned there is no essential difference between *Callocardia* and *Caryatis*. He also figured the hinge of *Vesicomya lepta* for comparison, but did not discuss the generic affinities of the latter, thus leaving us under the impression that it was akin to *Callocardia*. It is noticeable, however, that he writes of *Vesicomya* as a genus, and that his list of species which probably belong to it comprises all the forms which had been described by Dr. Dall and himself under the names of *Callocardia*, *Vesicomya*, and *Callogonia*.

The figure of the *Callocardia* hinge is not very good, and does not clearly bring out the existence of the anterior lateral in the left valve, but Mr. Smith informs me that it is there—"an erect acute tooth arising from the margin of the hinge-plate." He further tells me that he does regard *C. guttata* as merely a species of *Pitaria*, the fact of the united cardinals in the right valve not reaching the dorsal margin in some species being in his opinion of no great importance. On this point I agree with Mr. Smith, and differ from Dr. Dall, who makes *Callocardia* a genus with a sub-genus *Agriopoma* on the strength of it. I think, however, that the hinge of *Callocardia* has some features which are more than specific, and if it really has an entire pallial line it may remain as a sub-genus of *Pitaria*.

The only other shell which can be placed with *Callocardia guttata* is that described by Dr. Dall in 1889 as *Veneriglossa vesica*, but afterwards regarded by him as a species of *Callocardia*.[1] It was described as having a hinge like *Cytherea*, but with an entire pallial line.

The shell described by Mr. H. B. Preston in 1905 under the name of *Callista* (*Callocardia*) *Birtsi* only resembles *Callocardia* in being a thin white shell with some resemblance to *Pitaria*. Its dentition is like that of *Lamelliconcha* and *Pitaria tumens*; the hinge-plate is deeply excavated and attenuated posteriorly, but all the teeth are very short, tall, and narrow, except the left posterior cardinal, which is a short low inconspicuous lamina under the umbo, and confluent with the nymph. The pallial sinus is obscure, but is rather short and rounded. The lunule is superficial, not impressed, and there is no escutcheon.

There are several shells which are similar to *C. Birtsi*, namely *Caryatis Deshayesi*, Pfr., *C. Hungerfordi*, Sow., *C. pudicissima*, Smith, a fine shell which may be a variety of *Deshayesi* in Mr. MacAndrew's collection, and another unnamed species from the Persian Gulf in Mr. J. C. Melvill's collection. All these are thin, white, oval shells, concentrically striated, and slightly angulated on the posterior slope. For this small group I propose the name of *Leucothea* with *L. Birtsi* as the type, and would place it as a sub-genus of *Pitaria*, as a link between the typical section and *Callocardia*.

The fossil shells described by M. Cossmann in 1886 under the generic name of *Atopodonta* are closely allied to *Callocardia*. When referring to them in 1908 I omitted to notice that P. Fischer had

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[1] See Bull. U.S. Nat. Mus., vol. xxvi, p. 353, 1902.

interpreted their dentition in the same manner as Dr. Dall and myself;[1] but as the true construction of the *Callocardia* hinge was unknown to him, he retained the latter in the Cyprinidæ and placed *Atopodonta* with a (?) in the Veneridæ. As I have pointed out, the arrangement and form of the teeth in *Atopodonta* are not quite the same as in *Callocardia*; the former must therefore be regarded as a section of the latter, though no doubt it is really the ancestor of *Callocardia*, and is at present only known to occur in the Eocene of the Paris Basin.

There only remains the genus *Vesicomya* to be considered, and by the kindness of Mr. MacAndrew I have been able to examine a good specimen of *V. lepta*. This has convinced me that *Vesicomya* cannot be placed in the same genus as *Callocardia*, nor even in the same sub-family, for it does not possess any lateral teeth. The hinge-plate is long and narrow, extending beyond the teeth at each end, and turned up slightly on the anterior side of both valves, but this is clearly due to the attachment of the pedal muscle. There are only three teeth in each valve, and these are laterally elongated, pulled out as it were, the united median and anterior of the left valve being both directed forward, while the right anterior is high up near the lunular margin, and the median is placed below it and projects a little beyond it. The right posterior is a double tooth consisting of two separate laminæ, of which one is united to the anterior tooth. This arrangement of teeth differs from that of any other genus, but comes nearest to what is found in the fossils *Cyprimeria* and *Cyclorisma*. There is an additional point of similarity in the fact that some species of *Vesicomya* (like *V. lepta*) have no pallial sinus, while others (like *Leeana*, Dall) have a fairly deep one, and for the latter Dall proposed the name *Callogonia*.

Having satisfied myself of the existence and convenience of these generic groups so far as recent shells are concerned, I thought it desirable to re-examine some of the Eocene fossils which were dealt with in a former paper,[2] in order to see how they could be classified by the hinge characters above indicated.

It will be remembered that a certain number of these Eocene fossils seemed to combine some of the characters of *Pitaria* with some of *Callista*, and that for these I proposed to create a section under the name of *Calpitaria*, with *P. sulcataria*, Desh., as the type. I now find that this estimate of their taxonomic position is curiously confirmed by the form of the left posterior cardinal, which in these species is closely appressed to the nymph for part of its length, but is slightly curved at the end so as to disengage itself and extend across the hinge-plate. It thus occupies a position which is intermediate between that of the same tooth in *Callista* and that in *Pitarina*.

From specimens which I owe to the kindness of M. Cossmann, I find that this is the case with *P. sulcataria* and its var. *Suettonensis*,

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[1] Manuel de Conchyliologie, 1887, p. 1088.
[2] Proc. Malac. Soc., vol. viii, p. 148, 1908.

with *P. ambigua* and with *P. obliqua*, while in the more typical *Pitaria Parisiensis* this tooth is completely, though very narrowly, separated from the nymph. The last-mentioned may therefore be classed as a *Pitarina*, but probably most of the other species referred to *Pitaria* by M. Cossmann in his *Iconographie Complète* of 1907 have an elongate partially free posterior cardinal like *sulcataria*; from his photographic figures this certainly seems to be the case with *P. avia*, *P. Lamberti*, and *P. fastidiosa*.

Furthermore, I find that a few recent species agree with *P. sulcataria* in having a similar left posterior cardinal which is only partially free from the nymph, the upper portion being closely appressed to it. This is the case with *P. rudis*, Poli, *P. Simpsoni*, Dall, *P. indecora*, Phil., *P. varians*, Hanley, *P. hebræa*, Lam., and *P. munda*. Under these circumstances I now regard *Calpitaria* as more closely allied to *Pitaria* than to *Callista*, and consider that this group may be placed as a section of the genus *Pitaria*; and that it includes the recent species above-mentioned.

Another small group of Eocene shells which I found difficult to allocate to any recognized genus was that to which M. Cossmann gave the name of *Tivelina*. The affinities of this little group are undoubtedly with *Callista* and *Amiantis*, and not with *Tivela* as the name implies, and in this opinion I am glad to say that M. Cossmann now agrees with me.

A fresh study of the specimens with which M. Cossmann previously supplied me, and of two others which he has recently sent me, only confirms my previous observations, but shows that the group might be divided into two sections by the dentition of the right valve. One of these would include the type, and agrees with *Amiantis* in having an undercut anterior cardinal and a channel leading from the anterior lateral pit; while the dentition of the other set differs little from that of *Callista*. The first section includes *T. tellinaria*, *T. Dixoni*, *T. rustica*, *T. humerosa*, and *T. gibbosula*; the second would comprise *T. analoga*, *T. subanaloga*, *T. sphenarium*, and *T. distans*.

One common species, however (*T. striatula*), occupies an intermediate position in this respect, the anterior cardinal being deeply undercut, but there is no continuous channel in front of it. Further, there is no association of other specific differences to warrant such a division into sections; on the contrary, they all agree in having a short left posterior cardinal confluent with the nymph, as in *Callista*, a short narrow and nearly entire right posterior tooth, and a short rounded ascending pallial sinus.

These fresh observations only confirm my previous statement that "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* and in some it makes a near approach to that of *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". I am still able to agree with M. Cossmann in regarding the group as one which is united by a common set of characters, and I am still of opinion that, "on the whole, *Tivelina* is more nearly allied to *Callista* than to any other genus."

When drawing up the tabular view of genera and sub-genera for my paper on Cretaceous and Tertiary Veneridæ in 1908, I placed *Tivelina* as an independent genus, but I now incline to regard it as merely a sub-genus of *Callista*. Moreover, I think the species *Baudoni*, *elegans*, and *elegantula* should be separated from it and referred to *Callista* itself, from which they do not differ in any essential respect; and in this view I understand that M. Cossmann concurs. On the other hand, I regard *T. capsuloides* as a small *Pitaria* belonging to the *Calpitaria* section; for there is nothing in the dentition or the pallial sinus or the shape of the shell to dissociate it from such species as *P. sulcataria* and *P. Parisiensis*. *Meretrissa* (*depressa* and *dubia*) must also be separated and placed under the genus *Meretrix*.

While comparing the shells of *Tivelina* with the smallest species of *Callista*, I came across the very small shells which have been separated by Dr. Dall as a distinct genus under the name of *Transenella*,[1] and I noticed that the dentition of *Tr. Conradina* (his type) is very like that of some species of *Tivelina*, i.e. those which most resemble *Callista*. The chief differences are that in *Transenella* the left posterior cardinal is rather longer and is partially free from the nymph, and that the valve-margins are finely and tangentially grooved, whereas in *Tivelina* they are smooth. It appears to be this marginal grooving which has induced Dr. Dall to regard *Transenella* as a genus, but I do not agree in considering this character to be of generic importance. Such striation has probably less embryological and structural value than crenulation of the margins, and yet both smooth and crenulated margins are found in the genera *Circe* and *Sunetta* as well as in *Astarte*. Moreover, I have discovered that similar tangential grooving occurs in *Callista pannosa*, Sow., and in *C. puella*, Carp., shells from the Pacific coast of Central and South America, which Dr. Dall has not hesitated to class as '*Macrocallista*' (*Chionella*), which is his equivalent for *Callista*. In the shells which I believe to be *puella* the grooves are clearer than they are on the thicker shells of *C. pannosa*, but probably they are equally distinct on the young of the latter. I also find them to be well developed in *Callista angulifera*, Sow., with specimens of which I have been furnished by Mr. G. B. Sowerby, but unfortunately the locality of this species is unknown. As all the other species which possess this peculiar striation have their home in American waters, it is probable that *C. angulifera* is also an American shell. Dr. Dall has described four species from the Caribbean Sea, and one (the '*Psephis*' *tantilla*, Gould) from the Pacific coast; the three species above mentioned raise the number to eight, and they certainly form a small group, section, or sub-genus of *Callista*, which may well be recognized under the name of *Transenella*.

Another shell which certainly belongs to the *Callista* group and

[1] Proc. U.S. Nat. Mus., vol. vi, p. 340, 1883; vol. xxvi, p. 348, 1902.

bears much external resemblance to *Tivelina* is the *Venus Africana* of Philippi (= *Chione floridella*, Gray). This species was separated by Dr. Dall in 1902[1] under the name of *Lepidocardia*, and was placed for some inscrutable reason as a sub-genus of his *Cytherea* (Bolten). I cannot see any kind of connexion between *C. Africana* and *Venus puerpura* or *V. plicata*, with which it seems positively absurd to place it. In its small size, faint striation, compressed form, and posterior attenuation it resembles *Tivelina*, but the hinge differs in the close approximation of the anterior laterals to the cardinal teeth; the pallial sinus again agrees in form and direction with that of typical *Callista*. The hinge-plate is very short and the cardinal teeth are more equally divergent in both valves, the median occupying a more central position than in *Callista* or *Tivelina*. It certainly has characters of its own which are not found in any other species, and which entitle it to sectional or sub-generic rank in the genus *Callista*.

Summary.

The conclusions arrived at in the preceding pages may be summarized in the form of a descriptive synopsis of the genera, thus:—

Genus Callista (Poli), H. & A. Adams, 1857.

Type. *Venus chione*, Linn.

Synonyms: *Chione*, Gray (not Megerle, 1811); *Dione*, Gray, 1847 (not Hubner, 1816); *Chionella*, Cossmann, 1887.

Shell oval, rarely trigonal, smooth or concentrically grooved, with minute discontinuous ingrained radial striæ beneath a glossy vernicose periostracum. Lunule circumscribed, but escutcheon not defined. Hinge of left valve with a strong anterior lateral and three cardinal teeth, of which the two anterior are united to form a Λ, and the posterior is confluent with the nymph; in the right valve there are two anterior laterals with a pit between them and three separate cardinals, the median being nearer the anterior than the posterior, and the latter is superficially grooved (only bifid in *Aphrodina*). Pallial sinus generally wide, horizontal, and pointed in front. Margins of valves smooth (except in *Transenella*). Anterior left and posterior right dorsal margins grooved to receive bevelled edges of opposite valve.

Section *Macrocallista*, Meek, 1876. Type, *Venus nimbosa*, Solander (= *V. gigantea*, Gmel.). Shell much elongated, pallial sinus short.

Section *Callistina*, J.-Br., 1908. Type, *Cytherea plana*, Sow., Cretaceous fossil. Left posterior cardinal long and not confluent with the nymph. Left anterior lateral elongate, narrow, corrugated; right laterals obsolete. Pallial sinus ascending.

Sub-genera.

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

Shell like *Callista*, but finely striated, and without trace of radial striation. Left posterior cardinal partially free, and anterior cardinal

[1] Proc. U.S. Nat. Mus., vol. xxvi, p. 356.

curving forward. Right anterior cardinal pointing to lower anterior lateral, posterior broadly bifid. Pallial sinus deep, ascending. This group is Cretaceous and Eocene, including *C. nitidula*, Lam., *C. nitida*, Desh., *C. tranquilla*, Desh., and *C. corbulina*, Desh.

Lepidocardia, Dall, 1902. Type, *Venus Africana*, Phil. (=*floridella*, Gray).

Shell ovate, compressed, posteriorly attenuated, nearly smooth, but showing radial striæ. Hinge-plate short, with crowded teeth, the left anterior lateral long and reaching nearly to top of anterior cardinal. Pallial sinus horizontal, pointed. No other species known.

Transenella, Dall, 1883. Type, *T. Conradina*, Dall.

Shell oval or sub-trigonal, smooth or striate. In left valve three divergent cardinals, the median being thick and triangular; in right valve the anterior is short and undercut, the posterior narrow and often entire. Pallial sinus rounded. Valve-margins tangentially grooved. This includes *C. pannosa*, Sow., *C. puella*, Carp., and *C. angulifera*, Sow., besides the species mentioned by Dr. Dall, and there are also some species of Miocene age.

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

Shell small, oval, compressed and posteriorly attenuated; surface smooth or finely striate; hinge-plate strong in front, but curtailed behind; cardinal teeth all short; left valve with a strong anterior lateral and three divergent cardinals, of which the median is triangular and the posterior narrow and confluent with nymph; in the right valve the pit of the anterior lateral is sometimes isolated, sometimes continued into a channel which undercuts the anterior cardinal. Pallial sinus small, rounded, and ascending.

Genus Amiantis, Carpenter, 1863.

Type, *Cytherea callosa*, Conrad (= *Dione nobilis*, Sow.).

Synonyms: *Dione* (in part), Gray; *Dione*, Römer; *Hysteroconcha*, Lang (in Fischer), pre-Linnæan.

Shell oval, more or less angulated on the posterior slope; surface sculpture of concentric ridges; lunule impressed and circumscribed, escutcheon defined, but very narrow, with raised ligamental margins; ligament long, open, and conspicuous; hinge similar to that of *Callista*, but in the left valve the pit between the anterior laterals is continued into a channel which passes under the anterior cardinal; left median thick and triangular, right median semilunar; nymphs rugose or longitudinally grooved; pallial sinus deep and horizontal.

In *Amiantis* (s.s.) the shell is thick, oval, glossy, and strongly ribbed; the interior is irregularly thickened; the hinge is thick, the right posterior cardinal grooved, the left one long and prominent; nymphs rugose; pallial sinus linguiform and pointed. Only two recent species are yet known, *A. callosa*, Conr., and *A. purpurata*, Lam., but it is represented in the Miocene of Aquitaine by *Cytherea undata*, Bast.

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

Shell oval, striated or ridged; hinge-plate excavated and attenuated posteriorly; teeth as in *Amiantis*, but left posterior cardinal deeply grooved; nymphs longitudinally ribbed; pallial sinus linguiform, rounded, or obtusely angular.

This section corresponds with the *Dione* group of Römer, but must, I think, also include one species which has been referred to *Pitaria*, viz. the *Cytherea cor* of Hanley.

Section *Agriopoma*, Dall, 1902. Type, *Cyth. Texasiana*, Dall.

Outer surface dull and chalky; nymphs smooth, median and anterior cardinals of right valve forming a complete arch; left posterior long and partly free, left median narrow. Pallial sinus sharply angular.

Genus Pitaria, Römer, 1857, em.

Synonyms: *Caryatis*, Römer, 1862; *Dione*, Gray (in part).

Shell oval or sub-trigonal, smooth or finely striate; lunule superficial; escutcheon not defined; ligament short and deeply sunk; teeth in left valve like those of *Amiantis*, but posterior cardinal generally more or less separate from the nymph; in the right valve the anterior and posterior cardinals are often united to form an arch over the median; pallial sinus generally short and rounded, often ascending.

Pitaria (s.s.). Type, *Venus tumens*, Gmelin.

Nymphs longitudinally ridged; left posterior cardinal long and confluent; left median triangular; right cardinals separate; pallial sinus deep and pointed. This small group is a link with *Amiantis*.

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

Left posterior cardinal partly free and oblique; median triangular; right cardinals separate; pallial sinus short and rounded.

Section *Pitarina*, nov. sect. Type, *C. citrina*, Lam.

Nymphs smooth; left posterior cardinal free and crossing the hinge-plate obliquely; pallial sinus short, rounded, ascending; two outer cardinals of right valve forming a complete arch.

Sub-genera.

Callizona, n.subgen. Type, *Callista vulnerata*, Brod.

Shell thick, sub-orbicular, glossy; valve-margins irregularly crenulated; nymphs smooth; hinge strong; left posterior cardinal long and partly free as in *Calpitaria*; right posterior cardinal short and entire, rugose; pallial sinus short and rounded. Only the one species known.

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

Shell very thin; hinge-plate narrow and excavated between the teeth; the united cardinals in each valve forming complete arches which are regularly curved and not angular; left posterior tooth long and free, but parallel to nymph; right posterior cardinal formed of two plates, one of which is continuous with the anterior tooth; pallial line obscure, but believed to be entire.

Leucothea, n.subgen. Type, *Callocardia Birtsi*, Preston.

Shell very thin, dull white, concentrically striated; hinge-plate short, deeply excavated, and narrowed posteriorly; nymphs narrow, with a single groove; teeth thin and weak; left posterior cardinal short and marginal, under umbo; cardinal arch in right valve complete, and the hinder part of posterior cardinal rising into a sharp peak; pallial sinus short and rounded.

In conclusion, I desire to express my gratitude to Dr. J. C. Melvill and Mr. J. J. MacAndrew for the loan of many specimens from their respective collections, for without this kind assistance I should not have been able to examine so many different species of these genera. I have also to thank Dr. Melvill for reading this paper in MS. and for testing the practical applicability of the descriptions and definition herein set forth.

DESCRIPTIONS OF NEW SPECIES OF LAND SHELLS FROM AFRICA.

By Cæsar R. Boettger.

Read 9th May, 1913.

PLATES XV–XVII.

I have lately received the following new species and sub-speci among a large number of well-known African land shells. Most them were collected in German East Africa, two in Togo, one Southern Cameroons, and one in Southern Abyssinia. I receiv them through the kindness of Mr. P. Hesse, Venice (No. 6), Mr. Naegele, Waltersweier, near Offenburg (Nos. 3, 4, 5, 8, 9, 10, 12, 1 Mr. H. Rolle, Berlin (No. 7), and Mr. M. Stahlberg, Schwe (Nos. 1, 2, 11). I have to thank Dr. L. Germain, of Paris, fo having kindly examined Nos. 1, 2, 6, 9, 11; also Mr. E. A. Smit who informed me that No. 1 was not in the British Museum. T types are in my collection, excepting that of *Ligatella Letourneu* Bourg., var. *intermedia*, nov. var., which has been presented to the Senckenberg Museum, Frankfurt (M.).

1. Trochonanina Germaini, n.sp. Pl. XV, Figs. 1–3.

Testa perforata, applanata, distinctissime carinata, linea impressa indistinctissima supra et distincta sub carinam, supra corneo-fusca, infra cornea et nitens, supra sericea, propter costulas angustas, basim versus evanescentes. Anfractus 6½, plani, regulariter accrescentes, sutura plana separati; ultimus non descendens. Apertura angulato-ovata, obliqua; peristoma simplex, acutum, marginibus callo tenui junctis. Alt. 10 mm.; diam. maj. 24·5, min. 22 mm.; apertura, alt. 12, lat. 9 mm.

Hab.—Harrar, Southern Abyssinia.

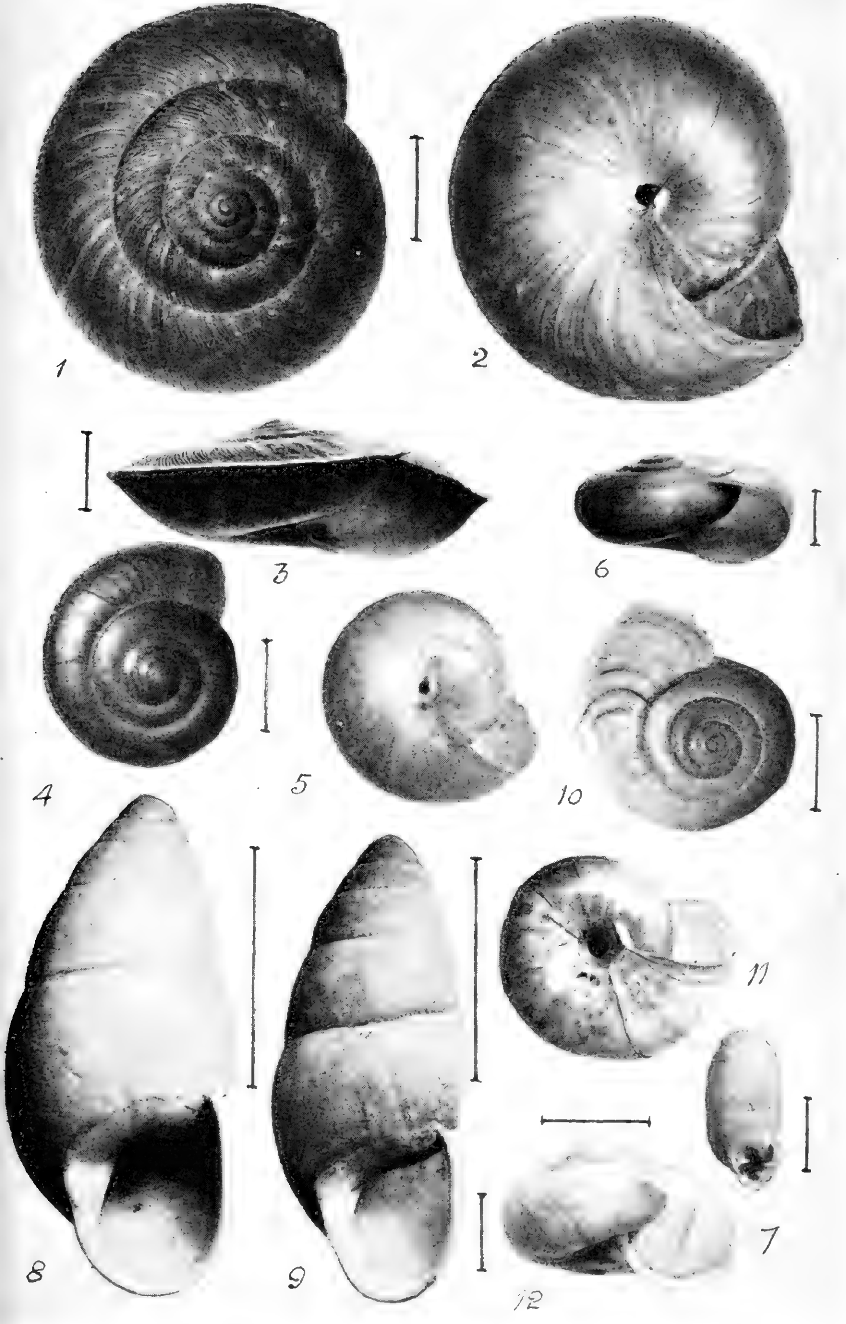
Shell perforate, flattened, very sharply keeled, the keel bordered above by a very indistinct line, and below by a distinct impressed line; corneous brown above and corneous below, glossy below, above with a silky lustre, caused by narrow, fine riblets, which become very indistinct on the underside. Whorls 6½, flat, regularly increasing in size, separated by a flat suture; the last whorl not descending in front; aperture angulate-ovate, oblique; peristome simple, acute, the margins united by a very thin callus.

This pretty new *Trochonanina* is related to *T. Nyassana*, E. A. Smith, but is easily distinguished by its flatter shape. I received this species from Mr. M. Stahlberg, Schwerin. I have the honour of connecting with it the name of Dr. L. Germain, Assistant of the Muséum d'Histoire naturelle at Paris.

2. Thapsia calamichroa, Jon., var. depressa, n.var.
Pl. XV, Figs. 4–6.

Differt a typo spira depressa. Alt. 7 mm.; diam. maj. 14, min. 12 mm.; apertura, alt. 8, lat. 6 mm.

Hab.—Atakpame, Central Togo.



LAND SHELLS FROM AFRICA.

This new sub-species of the widely distributed *Thapsia calamichroa*, Jon., differs from the type in having a more depressed spire and being therefore flatter. I received this fine shell from Mr. M. Stahlberg, Schwerin.

3. Ennea (Gulella) quinquedentata, n.sp. Pl. XV, Fig. 7.

Testa rimata, pupiformis, lævis, non costata; apex obtusus. Anfractus 8, convexiusculi, regulariter et leniter accrescentes, sutura subplana, prope aperturam ascendente, separati; ultimus circa $\frac{2}{5}$ longitudinis totius æquans. Apertura subverticalis, pyriformis, quinquedentata; dente uno lamelliforme parietali, uno columellari, uno ad basim marginis columellaris, duobus ad marginem basalem; peristoma tenue, reflexum, marginibus callo tenuissimo junctis. Long. 10, diam. 5 mm.; apertura, alt. 3, lat. 2·5 mm.

Hab.—Kipatimu, German East Africa.

Shell rimate, pupiform, smooth, without ribs; apex obtuse; whorls 8, moderately convex, regularly and slowly increasing in size, separated by an almost flat suture, which somewhat ascends near the aperture, the last whorl measuring about $\frac{2}{5}$ of the length of the shell; aperture nearly vertical, pyriform, with 5 teeth; one lamelliform on the parietal margin, one on the columellar margin, one at the base of the columellar lip, and two on the basal margin; peristome thin, reflexed, the margins united by a very thin callus. I received this new *Ennea* from Mr. G. Naegele.

4. Edentulina affinis, n.sp. Pl. XV, Fig. 8.

Testa perforata, oblonga, oviformis, obtusa, albescens, nitens. Anfractus 7, moderate convexi, sutura subplana, prope aperturam ascendenti, infra linea impressa sculpta, separati; ultimus circiter $\frac{1}{3}$ longitudinis totius æquans. Apertura ovata, intus alba; peristoma crassum, reflexum, marginibus callo distincto junctis. Long. 31·5, diam. 15 mm.; apertura, alt. 13, lat. 10 mm.

Hab.—Kipatimu, German East Africa.

Shell perforate, oblong, oviform, obtuse above, whitish, glossy. Whorls 7, very moderately convex, separated by an almost flat suture, which ascends near the aperture and is bordered below by an impressed line; the last whorl measuring about one-third the length of the shell. Aperture ovate, white within; peristome thickened, reflexed, the margins united by a distinct callus.

Var. gracilis. Pl. XV, Fig. 9.

Differt a typo testa graciliore. Long. 30, diam. 12·5 mm.; apertura, alt. 12, lat. 7·5 mm.

Hab.—Kipatimu, German East Africa.

This new variety differs from the type by its slender shape.

Edentula affinis is most closely related to the variable *Edentulina ovoidea*, Brug., but can easily be distinguished from that species by its smaller size and flatter whorls. It is also rather more perforate, and has a flatter suture which does not ascend so much at the aperture. This new species and the var. *gracilis* are due to the zeal of Mr. G. Naegele.

5. Gonaxis helicoides, n.sp. Pl. XV, Figs. 10–12.

Testa perforata, subsolida, luride lactea, supra anguste costulato-striata, infra lævis, nitens. Anfractus 7, convexiusculi, sutura plana separati; ultimus celeriter accrescens, antice non descendens, supra sulco superficiale impressus. Apertura ovata, obliqua, margine superiore in lobum producto; peristoma moderate incrassatum, subreflexum, marginibus callo tenuissimo junctis. Alt. 10 mm.; diam. maj. 14·5, min. 12 mm.; apertura, alt. 8, lat. 7 mm.

Hab.—Kipatimu, German East Africa.

Shell perforate, not very thick, but solid, dirty milky white, closely costulately striated on the upper sides, smooth and shining below. Whorls 7, moderately convex, separated by a flat suture; the last whorl rapidly increasing in size, not descending in front, furnished on the upper side with a very low furrow. Aperture ovate, oblique, its upper margin produced; peristome somewhat thickened, moderately reflexed, the margins united by a very thin callus.

Mr. G. Naegele has kindly sent me this characteristic new *Gonaxis*.

6. Achatina Hessei, n.sp. Pl. XVII, Fig. 1.

Testa imperforata, fusiforme ovata, brunnea; anfractus superiores flammulis brunneis indistinctis, in anfractu ultimo evanescentibus, ornati; anfractus ultimus praecedentibus saturatius coloratus; apex albescens. Superficies subnitens, granulis distinctissimis, sulcis spiralibus longitudinalibusque valde incisis induta. Anfractus 8, moderate convexi, regulariter accrescentes, sutura subplana separati; ultimus subconvexus, $\frac{1}{2}$ longitudinis totius æquans. Apertura ovata, intus alba, colore externo translucente; peristoma simplex, acutum; margo columellaris albescens, cum basali angulum formans. Long. 128, diam. 64 mm.; apertura, alt. 71, lat. 37 mm.

Hab.—Yaunde, Southern Cameroons.

Shell imperforate, fusiform-ovate, of a chestnut colour; the upper whorls painted with very indistinct darker chestnut stripes, which disappear on the last whorl, which is somewhat darker-coloured than the preceding; apex whitish. Surface nearly lustreless, furnished with strong granules, produced by deeply-cut spiral and longitudinal furrows. Whorls 8, very moderately convex, regularly increasing in size, separated by an almost flat suture; the last whorl somewhat convex, measuring about one-half of the shell. Aperture ovate, white within, displaying the external colour; peristome simple, acute; the margin of the whitish columella forming an angle with the basal margin.

This pretty *Achatina* is related to *A. balteata*, Rve., but is distinctly separated from that species by its very different sculpture, which recalls the granulation of *A. reticulata*, Pfr. *A. Hessei* is named in honour of Mr. P. Hesse, from whom I received this new species.

LAND SHELLS FROM AFRICA.

7. Achatina Kilimæ, Dautz., var. Rollei, n.var. Pl. XVI, Fig. 1.

Differt a typo colore et pictura. Testa flava, flammulis nigro-brunneis ornata; flammulæ in medio anfractuum interdum zigzag-formes, confluentesque. Anfractus superiores subtiliter rosaceæ. Testa indistincte granulata, subnitens, solida. Long. 88, diam. 43 mm.; apertura, alt. 47·5, lat. 25·5 mm.

Hab.—Bulwa, Usambara, German East Africa.

This new variety differs from the typical *Achatina Kilimæ* in colour and painting. The shell is straw-yellow, ornamented with blackish chestnut stripes, which in the median zone of the whorls sometimes become zigzag, flammulate, and confluent. The upper whorls are pale roseate, but are never so intensely coloured as in *A. Zanzibarica*, Bourg., and its allies. The granulation of the shell is not so distinct as in that species, and the shell has more lustre and is heavier. I have also a specimen before me which is rather more elongated, but does not justify a new sub-specific name. This pretty *Achatina* is named in honour of Mr. H. Rolle, from whom I received it.

8. Achatina Zanzibarica, Bourg., var. Naegelei, n.var. Pl. XVI, Fig. 4.

Differt a typo figura minore et graciliore et anfractibus rapidius accrescentibus; testa flava, flammulis brunneis ornata. Long. 78, diam. 38 mm.; apertura, alt. 39, lat. 20 mm.

Hab.—Kwiro, post-office Mahonge, German East Africa.

This variety differs from the type in being smaller and more slender, even than var. *Lhotellerii*, Bourg.; the whorls increase more rapidly than in the type. The shell is straw-yellow, ornamented with chestnut stripes. The shape of the new form is quite different from that of the type of *A. Zanzibarica*, Bourg., and nobody, seeing only these two forms, would suppose that they belonged to the same species. The variety *Lhotellerii*, Bourg., however, is intermediate between them. We now see that *A. Zanzibarica* is a species, the shape of which varies from tumid ovate to slender ovate. All forms clearly show that they belong to one species by their upper whorls being intensely roseate, by being not very heavy, and by other features mentioned in Bourguignat's diagnosis (*Description de diverses espèces terrestres et fluviatiles de différents genres de mollusques de l'Égypte, de l'Abyssinie, de Zanzibar, du Sénégal, et du centre de l'Afrique*, Paris, 1879, pp. 5–6). *A. Usambarensis*, Rolle (Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft, 1895, p. 100) is a synonym of *A. Zanzibarica*. I figure (Pl. XVI, Fig. 2) a typical specimen of *A. Zanzibarica* (a cotype of *A. Usambarensis* preserved in the Senckenberg Museum), also (Pl. XVI, Fig. 3) a specimen of var. *Lhotellerii*, neither of which has ever been figured, and the type of var. *Naegelei*, showing the considerable variation in form which occurs in this very variable species. The new variety (var. *Naegelei*) was received from Mr. G. Naegele, with whose name I have associated it.

9. Pseudoglessula Leroyi, Bourg., var. obtusa, n.var.
Pl. XVII, Fig. 2.

Differt a typo spira obtusa. Long. 32, diam. 15·5 mm.; apertura, alt. 13, lat. 8·5 mm.

Hab.—Pugu, 19 km. from Daressalam, German East Africa.

This new variety is less elongated than the typical form of the species, but shows in all other respects a close relationship. I received this form from Mr. G. Naegele.

10. Pseudoglessula Naegelei, n.sp. Pl. XVI, Fig. 5.

Testa perforata, elongata, anguste striata, nitens, non solida, cornea. Anfractus 8, convexiusculi, sutura subimpressa separati; ultimus ⅓ longitudinis paulo minor; apertura ovata; peristoma tenue, reflexum; margo columellaris reflexus, cum basali angulum indistinctissimum formans; margines callo tenue juncti. Long. 17·5, diam. 7·5 mm.; apertura, alt. 6, lat. 4 mm.

Hab.—Kipatimu, German East Africa.

Shell perforate, elongate, finely striate, shining, not heavy, corneous; whorls 8, somewhat convex, separated by a not very impressed suture, the last measuring less than one-third of the length of the shell; aperture ovate; peristome thin, reflexed; the margin of the columella reflexed and forming a very indistinct angle with the basal margin; the margins united by a thin callus.

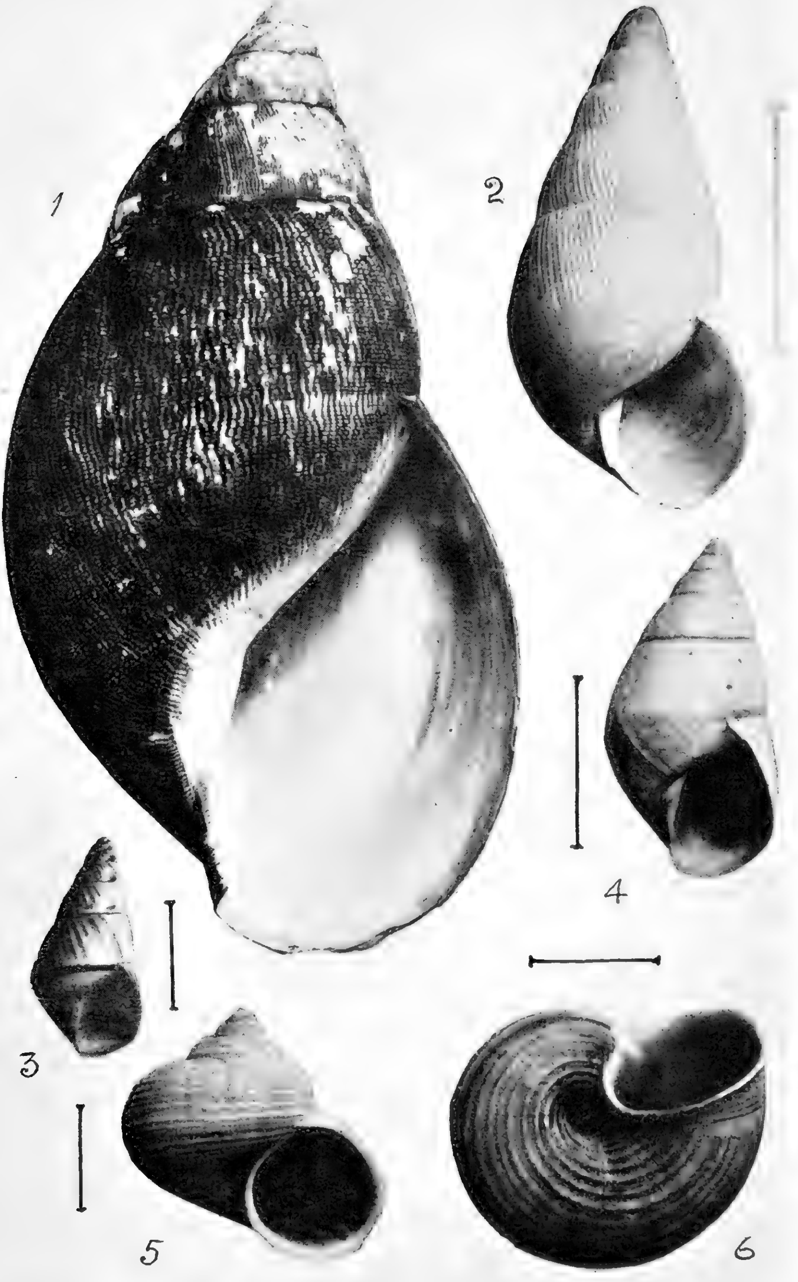
This species is allied to *Pseudoglessula introversa*, E. A. Smith, but is easily separable, being more slender and somewhat larger. The perforation in *P. Naegelei* is also larger, and the shell is corneous, not greenish corneous as in *P. introversa*. The whorls also increase more gradually, and the aperture is smaller. For comparison, a specimen of *P. introversa* from the same locality is figured (Pl. XVI, Fig. 6). I have the pleasure to connect with the new species the name of Mr. G. Naegele, from whom I received it.

11. Rhachis Stahlbergi, n.sp. Pl. XVII, Fig. 3.

Testa rimata, elongata, conica, subcarinata, anfractibus superioribus rubris, inferioribus albescentibus, supra carinam striis carneis longitudinalibus, sub carinam deficientibus ornata; carina linea nigrescenti-fusca comittata, supra quam anfractus mediani guttis ejusdem coloris ornati; anfractus 7, superiores subconvexi, sequentes plani, regulariter accrescentes, sutura planissima separati; ultimus circa ⅖ longitudinis totius æquans. Apertura oblongo-ovata, obliqua, linea externa translucente; peristoma simplex, acutum; margo columellaris albescens, cum basali angulum indistinctum formans. Long. 14, diam. 7 mm.; apertura, alt. 6·5, lat. 4 mm.

Hab.—Atakpame, Central Togo.

Shell rimate, elongated, regularly conical, slightly carinated, upper whorls red, elsewhere whitish, above the carina ornamented with fine flesh-coloured longitudinal stripes, which are wanting below the carina; carina provided with a dark blackish-brown band, which on the middle whorls is bordered above with dots of the same colour; whorls 7, upper whorls moderately convex, the others flat, regularly



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increasing in size, separated by a very flat suture, the last whorl measuring about $\frac{2}{5}$ the length of the shell; aperture oblong-ovate, oblique, displaying the external band; peristome simple, acute; the margin of the whitish columella forming a very indistinct angle with the basal margin.

This beautiful little shell can easily be recognized by its regular conical shape and its pretty markings. I received it from Mr. M. Stahlberg, in honour of whom it is named.

12. Rhachis obeliscus, n.sp. Pl. XVII, Fig. 4.

Testa rimata, elongata, conica, fere ecarinata, flavo-albescens, guttis parvis nigro-cæruleis irregulariter picta, ad carinam linea fusco-purpurascente ornata; apex niger; anfractus 7½, superiores subconvexi, sequentes plani, sutura plana separati; ultimus circa $\frac{2}{5}$ longitudinis totius æquans; apertura oblongo-ovata, obliqua, fusco-purpurascens, linea externa translucente; peristoma simplex, acutum; margo columellaris purpurascens, cum basali angulum indistinctissimum formans. Long. 22·5, diam. 11·5 mm.; apertura, alt. 11·5, lat. 7 mm.

Hab.—Kipatimu, German East Africa.

Shell rimate, elongate, conical, very faintly keeled, yellowish white, irregularly dotted with small dark-blue spots; at the keel ornamented with a purplish-brown band; apex black; whorls 7½, upper whorls moderately convex, the others flat, regularly increasing in size, separated by a flat suture, the last whorl measuring about $\frac{2}{5}$ the length of the shell; aperture oblong-ovate, oblique, purplish brown, displaying the external band; peristome simple, acute; the margin of the purple columella forming a very indistinct angle with the basal margin.

This new species was received from Mr. G. Naegele.

13. Ligatella Letourneuxi, Bourg., var. intermedia, n.var. Pl. XVII, Figs. 5–6.

Differt a typo figura majore. Testa linea brunnea lata et alia angustiore superiore ornata. Alt. 16·5 mm.; diam. mag. 17, min. 14 mm.; apertura, alt. 9·5, lat. 8·5 mm.

Hab.—Kipatimu, German East Africa.

This new sub-species differs from the typical form in being constantly larger, but never so large as var. *Stuhlmanni*, v. Mart. The shell is ornamented with a dark-brown band and a paler one above it. I received this fine new form from Mr. G. Naegele.

EXPLANATION OF PLATES XV–XVII.

Plate XV.

Figs. 1–3. *Trochonanina Germaini*, n.sp.
,, 4–6. *Thapsia calamichroa*, Jon., var. *depressa*, n.var.
,, 7. *Ennea (Gulella) quinquedentata*, n.sp.
,, 8. *Edentulina affinis*, n.sp.
,, 9. *E. affinis*, var. *gracilis*.
,, 10–12. *Gonaxis helicoides*, n.sp.

Plate XVI.

Fig. 1. *Achatina Kilimæ*, Dautz., var. *Rollei*, n.var.
,, 2. *A. Zanzibarica*, Bourg.
,, 3. *A. Zanzibarica*, var. *Lhotellerii*, Bourg.
,, 4. *A. Zanzibarica*, var. *Naegelei*, n.var.
,, 5. *Pseudoglessula Naegelei*, n.sp.
,, 6. *P. introversa*, Smith.

Plate XVII.

Fig. 1. *Achatina Hessei*, n.sp.
,, 2. *Pseudoglessula Leroyi*, Bourg., var. *obtusa*, n.var.
,, 3. *Rhachis Stahlbergi*, n.sp.
,, 4. *R. obeliscus*, n.sp.
,, 5–6. *Ligatella Letourneuxi*, Bourg., var. *intermedia*, n.var.

ON A COLLECTION OF LAND AND FRESHWATER SHELLS FROM THE UPPER NILE REGION.

By Cæsar R. Boettger and Fritz Haas.

Read 9th May, 1913.

The land and freshwater shells here enumerated were collected in 1910 by Dr. Otto le Roi, of Bonn, during Prof. Dr. Al. Koenig's expedition to the Upper Nile region. It is quite natural that in a collection from Central Africa the species of the genus *Limicolaria* largely predominate, both as regards the number of species and specimens. The collection forms part of Dr. Koenig's museum at Bonn, but duplicates have been kindly presented by the collector to the Senckenberg Museum, and duplicates of the Pulmonates to C. R. Boettger. The Gastropods are treated by C. R. Boettger, and the Bivalves by F. Haas.

Burtoa nilotica (Pfr.).

There are two specimens of this form which is found especially in the lake district and near the sources of the White Nile. They were collected near Gemesa, Bahr el Djebel (March 20, 1910).

Limicolaria Kambeul (Brug.), var. turris, Pfr.

In 1860 L. Pfeiffer (Proceedings of the Zoological Society of London, 1861, p. 25, pl. ii, fig. 3) described a new species, *Limicolaria turris*, based on specimens from the source of the White Nile (leg. Petherick). The species was mentioned again by L. Pfeiffer (*Novitates conchologicæ*, Bd. ii, p. 162, pl. xliv, figs. 1–3, Cassel, 1860–6) and by E. von Martens (Malak. Blätt., 1865, p. 197). E. von Martens (Malak. Blätt., 1870, p. 33, and 1873, pp. 38–9) found *L. turris* in the collection of G. Schweinfurth from the Djur and Rek forests, south of the Meshra of the Bahr el Ghazal. E. von Martens first recognized the similarity between *L. turris* and the West African *L. Adansoni*, Pfr. The first author who united the two species was C. J. Jickeli (*Fauna der Land- und Süsswasser-Mollusken Nord-Ost-Afrika's*, Dresden, 1874, pp. 154–7, pl. ii, figs. 3, 4). A complete list of the forms of this group, of which *L. Kambeul* was first described and ought to be the typical sub-species, was given by Pilsbry (Man. Conch., ser. ii, vol. xii, pp. 251–3, Philadelphia, 1904). We now see that *L. Kambeul* is a species which ranges in the form of several varieties from Senegal to the sources of the Nile. Dr. le Roi brought home four specimens of *L. Kambeul*, var. *turris*, one from Redjaf, Bahr el Djebel (March 14, 1910), two from Kiro, Bahr el Djebel (March 17, 1910), and one from Gemesa, Bahr el Djebel (March 18, 1910).

Limicolaria flammata (Caill.).

This species is the most common shell in North-East Africa, and is one of the most variable. There is a fine series in Dr. le Roi's collection: one specimen from the junction of the Bahr el Ghazal and the Bahr el Arab (March 1, 1910), one from Bor, Bahr el Djebel, and one from Malek, Bahr el Djebel (March 8, 1910), two northward at Mongalla, Bahr el Djebel (March 17, 1910), three from Lado, Bahr el Djebel (March 11, 1910), two from Gondokoro, Bahr el Djebel (March 12, 1910), three northward from Lado, Bahr el Djebel (March 15, 1910), four from Gemesa, Bahr el Djebel (March 18, 1910), one from Kaka, Bahr el Abiad (February 20, 1910), one from Abu Doleb, Bahr el Abiad (March 30, 1910), four from Renk, Bahr el Abiad (February 19, 1910), and three from Djebel Achmed Aga, Bahr el Abiad (April 3, 1910).

Limicolaria Koenigi, n.sp.

Testa rimata, longissima, procera, corneo-albida, flammulis tenuibus castaneis ornata, maxime supra suturam; apex albus; anfractus 9, subconvexi, regulariter accrescentes, sutura plana separati; ultimus

paulum convexiusculus, fere $\frac{1}{3}$ longitudinis totius æquans; apertura alba, pictura translucente, angusta; peristoma simplex, acutum; columella alba; margo columellaris valde reflexus, cum margine basali angulum formans. Long. 57·5, diam. 18 mm.; apertura, alt. 20·5, lat. 8·5 mm.

Hab.—Kaka, Bahr el Abiad (leg. Otto le Roi, February 20, 1910; Museum Al. Koenig).

Shell rimate, very long and slender, corneous white, ornamented with fine chestnut stripes, especially above the suture; apex white; whorls 9, very moderately convex, regularly increasing in size, separated by an almost flat suture; the last whorl somewhat convex, measuring about one-third of the length of the shell; aperture white, displaying the external striping, narrow; peristome simple, acute; the margin of the white columella widely reflexed, forming an angle with the basal margin.

This species is most nearly related to *Limicolaria longa*, Pils. (Man. Conch., ser. II, vol. xvi, p. 284, pl. xxxii, figs. 18, 19). Like that species it belongs to the group of *L. flammata* (Caill.). From *L. longa* it is distinguished by being smaller and more delicate. The unique type-specimen was collected at Kaka, Bahr el Abiad (February 27, 1910). We have named the species in honour of Professor Dr. Al. Koenig, to whose scientific energy the whole expedition was due.

Limicolaria candidissima, Shuttl.

We have before us four specimens of this rare *Limicolaria*, which is found especially in Kordofan. There are three from the Bahr el Ghazal (February 27, March 2, and March 1, 1910, the last near the mouth of the Bahr el Arab), and one from Abu Doleb, Bahr el Abiad (March 30, 1910). Only the specimen from Abu Doleb was obtained with animal. The four shells have no markings at all. The one from Abu Doleb has a pale corneous epidermis, darker than in *L. flammata*. It is uniformly coloured, except the columella, which is dull purplish. *L. candidissima* is certainly specifically distinct from *L. flammata*, though it belongs to the same group as that shell.

Limicolaria Rohlfsi, Kob.

The well-marked *Limicolaria Rohlfsi*, Kob., was described by Kobelt at the request of E. von Martens (Kobelt, Die Genera *Livinhacia*, *Pseudachatina*, *Perideris*, *Limicolaria*, und *Homorus*, in Martini und Chemnitz: Syst. Conch. Cab., 1895, p. 72, pl. xxiii, figs. 5–6; Martens, *Beschalte Weichtiere Deutsch-Ost-Afrikas*, Berlin, 1897, p. 107, pl. v, fig. 36). The type (leg. G. Rohlfs) came from the Ngadda River (north-west of the junction of the Benue and the Niger). Some more specimens were obtained by O. Neumann (February, 1894) at Mhugu, north-east side of the Victoria Nyanza, south of Ngowe Bay, and at Kavirondo, and by Stuhlmann in the grassy steppe in Vitshumbi, at the south-west end of Albert Edward Nyanza (May, 1891), and in a banana plantation in Buginda at Chef Oransi, district of Andetei, west of the Semliki-Issango (December 18, 1891). This species is easily recognized by its peculiar coloration. It is furnished with a row of dark-brown spots close below the suture and a broad dark-brown band around the umbilicus, while the space between is uniformly straw-yellow. The columella is usually dull purplish. Dr. le Roi obtained a magnificent set of twenty-seven examples at Thombe, Bahr el Djebel (March 20, 1910), and a single specimen at Gemesa, Bahr el Djebel (March 18, 1910). While G. Rohlf's specimen, according to Kobelt, measures only 38 mm., O. Neumann's specimens had a length of 60 to 65 mm. (Stuhlmann's examples were young). Dr. le Roi's specimens vary from 38 to 50 mm.; they, therefore, nearly approach Rohlf's shell.

Limicolaria connectens, v. Mart.

This species was described by E. von Martens from a specimen obtained by O. Neumann (Nachrichtsblatt Deutsch. Malakozool. Gesell., 1895, p. 183; Martens, *Beschalte Weichtiere Deutsch-Ost-Afrikas*, Berlin, 1897, p. 112, pl. v, figs. 5–6). The following localities are enumerated by von Martens: Mhugu, on the north-east shore of Victoria Nyanza (O. Neumann, February, 1894), Karevia, western foot of Runssoro (Stuhlmann, February 16, 1891), and Bundeko, 0° 55′ (Stuhlmann, July 4, 1891). Eighty specimens of this rare *Limicolaria* were taken by Dr. le Roi at Thombe, Bahr el Djebel (March 20, 1910), and two specimens at the Bahr el Ghazal (February 27, 1910). They fully agree with E. von Martens' description and figures, and are easily distinguished from *L. rectistrigata*, E. A. Smith, by their browner colour and stronger granulation. In many specimens the stripes of the last whorl possess a forwardly pointed emargination in the line which continues the suture. E. von Martens has already mentioned this.

Limicolaria Leroii, n.sp.

Testa perforata, solida, oblongo-turrita, superne cæruleo-albida, infra flavo-albida, fusco-nigrescens flammulata; apex albus. Anfractus 8, plani, regulariter accrescentes, sutura plana separati, sub sutura tenue plicati, in anfractu ultimo et præcedentibus linea impressa marginata; ultimus paulum convexiusculus, fere $\frac{2}{5}$ longitudinis totius æquans. Apertura cæruleo-albida, pictura translucente, angusta, verticalis; peristoma simplex, acutum; columella cærulea; margo columellaris reflexus, cum margine basali angulum formans. Long. 37·5, diam. 16 mm.; apertura, alt. 16, lat. 7 mm.

Hab.—Bahr el Ghazal (Otto le Roi, February 23, 1910; Museum Al. Koenig).

Shell perforate, solid, oblong turreted, upper whorls bluish white, lower whorls yellowish white, flammulated with dark blackish brown; apex white. Whorls 8, rather flat, regularly increasing in size, separated by an almost flat suture, beneath which a fine plication is to be seen, bordered by an impressed line upon the last and preceding volutions; the last whorl somewhat convex, measuring about $\frac{2}{5}$ the length of the shell. Aperture bluish within, displaying the external striping, narrow, vertical; peristome simple, acute, the margin of the blue columella reflexed, forming an angle with the basal margin.

This species somewhat resembles the shell described by Preston (Proc. Malac. Soc. London, vol. vii, pp. 89–90, 1907) as *Limicolaria Smithi*,[1] from Uganda, but is distinguished by its flatter whorls, by more distinct markings, and by the impressed line, which borders the fine plication beneath the suture. It also somewhat resembles *L. Martensiana*, E. A. Smith, but is distinguished from it by its rich

dark blackish-brown markings, which are more intense. The angle which the margin of the columella forms with the basal margin is better marked in *L. Leroii* than in *L. Martensiana*. We have pleasure in connecting with this handsome species the name of its collector, Dr. Otto le Roi. Unfortunately only one specimen is at hand, which was found at the Bahr el Ghazal (February 23, 1910).

Limicolaria Heuglini, v. Mart.

This species was based by von Martens on two shells, collected by J. Heuglin in Southern Abyssinia (Malak. Blätt., 1866, pp. 94–5). Since that time specimens of this shell have been brought to Europe rather frequently, and a number of sub-species in North-East Africa have been distinguished. Four specimens were taken by Dr. le Roi, one at the Bahr el Ghazal (February 27, 1910), one northward of Bor,

[1] *Limicolaria Smithi*, Preston, named in honour of E. A. Smith, is preoccupied by *L. Smithi*, Pils., named after A. Donaldson Smith, which is a sub-species of *L. flammata*, Caill. (Man. Conch., ser. II, vol. xvi, p. 283, Philadelphia, 1904). Therefore, we propose the name *Limicolaria Prestoni*, nom. nov.

Bahr el Djebel (March 8, 1910), and two at Gemesa, Bahr el Djebel (March 9, 1910).

Physopsis Africana, Krauss.

Physopsis Africana ranges from South Africa through Mozambique and Zanzibar to the Nile. Dr. le Roi obtained one specimen in the Bahr el Ghazal (February 25, 1910).

Physopsis Didieri, Rochebr. & Germ.

This rare species was described by Rochebrune & Germain (Bull. Mus. hist. nat., 1904, p. 142). It was collected by the members of the mission of Bourg de Bozas at Donfile, White Nile. Dr. le Roi obtained a fine living specimen in the Bahr el Ghazal (February 25, 1910). It is quite distinct from the preceding species, although found together.

Planorbis Sudanicus, v. Mart.

In Dr. le Roi's material there are eight specimens, which represent different ages. They agree well with von Martens' description (Malak. Blätt., 1870, p. 35). The first figure of the shell is to be found in Pfeiffer's *Novitates Conchologicæ*, vol. iv, pp. 23–4, pl. cxiv, figs. 6–9. Dr. le Roi's specimens are from the Bahr el Ghazal (February 28, 1910).

Segmentina angusta, Jick.

One specimen of this rare *Segmentina* was collected by le Roi in the Bahr el Ghazal (February 28, 1910). It agrees well with Jickeli's description and figure (Jickeli, *Fauna der Land- und Süsswasser-Mollusken Nord-Ost-Afrika's*, Dresden, 1874, p. 220, pl. vii, fig. 24).

Cleopatra bulimoides (Oliv).

Dr. le Roi collected one specimen of this common species at Dakke, Nubia (February 7, 1910).

Pachylabra ovata (Oliv), var. Kordofana, Parr.

Three specimens of this variety of the widely distributed *Pachylabra ovata*, which is common in Kordofan, were taken by le Roi in the Bahr el Abiad.

Pachylabra Wernei (Phil.).

Five magnificent specimens were collected by le Roi in the Bahr el Abiad together with the preceding species.

Lanistes Boltenianus (Chemn.).

Six specimens of this *Lanistes*, which is common in the Nile Valley, were obtained by le Roi, one in the Bahr el Ghazal (February 24, 1910), one in the Bahr el Djebel at Kiro (March 17, 1910), one in the Bahr el Abiad at Abu Doleb (March 30, 1910), and three in the Bahr el Zeraf (March 24–8, 1910).

Lanistes (Meladomus) ovum (Peters).

A magnificent set of six specimens of this *Lanistes*, which has a wide range in Africa, was obtained by le Roi. Three were collected in the Bahr el Ghazal (February 24, 1910), and three in the Bahr el Djebel near Malek (March 8, 1910).

Corbicula consobrina (Caill.).

One specimen and a single valve of this *Corbicula* were obtained by le Roi in the Bahr el Abiad near the island of Lakadavia (February 17, 1910).

Corbicula radiata (Phil.).

Dr. le Roi collected a single specimen of this species at Abu Simbel, Nubia (February 9, 1910).

Cælatura nilotica (Caill.), var. Sennaariensis, Küst.

One specimen of this beautiful little shell was found by le Roi in the Bahr el Abiad near the Djebel Achmed Aga (April 3, 1910).

Mutela nilotica, Sow.

We have before us one specimen of this *Mutela* which was taken by le Roi in the Bahr el Abiad near the island of Lakadavia (February 17, 1910).

Spatha Marnoi, Jick.

Dr. le Roi obtained a fine specimen of this bivalve, the type of which was collected by Jickeli (Jickeli, *Fauna der Land- und Süsswasser-Mollusken Nord-Ost-Afrika's*, p. 264, pl. viii, fig. 3, Dresden, 1874) in the Bahr el Seraf (Marno) in the country of the Nuîr, where Dr. le Roi also found his specimen (March 24–8, 1910).

Ætheria Caillaudi, Fér.

One perfect specimen and a single valve were taken by le Roi in the Bahr el Abiad near the island of Lakadavia (February 17, 1910).

NOTE ON THE GENUS *PSEUDOMALAXIS*, FISCHER, AND DESCRIPTIONS OF A NEW SPECIES AND SUB-GENUS.

By the Marquis de MONTEROSATO.

Read 13th June, 1913.

CAREFUL attention to Dr. Fischer's diagnosis of his sub-genus *Pseudomalaxis* indicates that he did not appreciate the differences separating his selected type (*Bifrontia zanclea*, Phil.—a fossil) from the species which is found living at Madeira. The latter is characterized by the complete detachment of the whorls, a fact not mentioned by Fischer, who united the two forms. I propose, therefore, to raise *Pseudomalaxis* to generic rank (for it has no connexion with *Bifrontia*, fossil species from the Paris Basin [1]), and to constitute a new sub-genus, *Spirolaxis*, for the Madeiran shell.

The European species (for I have no knowledge of the extra-European forms) will stand as follows:—

PSEUDOMALAXIS, Fischer.

Man. de Conch., 1885, p. 714.

Type, *Bifrontia zanclæa*, Phil.

1. PSEUDOMALAXIS ZANCLÆA (Philippi).

Bifrontia (?) *zanclæa*, Phil. Enum. Moll. Sicil., vol. ii, p. 225, pl. xxviii, fig. 11.

Fossil in the Messina district; unknown in a living state.

2. PSEUDOMALAXIS ALDROVANDI (Foresti).

Solarium Aldrovandi, Foresti, Mem. Accad. Sci. Inst. Bologna, ser. II, vol. vii, pl. 625, pl. ii, figs. 17–20, 1868.

Discohelix (*Pseudomalaxis*) *Aldovrandi* [sic] (For.); Sacco, Moll. Terz. Piemonte e Liguria, pt. xii, p. 75, 1892.

Var. *Ligustica*, Sacco, l.c., pl. ii, fig. 65.

Fossil of Orciano and Zinola; extinct.

3. PSEUDOMALAXIS ACTONI, n.sp.

Pseudomalaxis, *Omalaxis*, and *Bifrontia zanclæa*, auct.

Hab.—Living in the coralline zone at Naples, Palermo, Algeria, and Sardinia (coll. Monterosato).

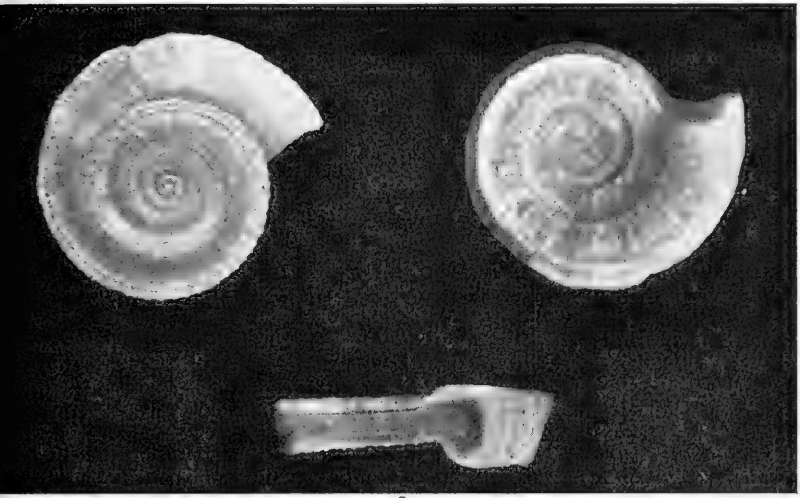
The largest species of the genus, measuring lat. 15, alt. 3 mm. Very dilated, umbilicus widely open, surface roughened, ornamented at the periphery with minute denticulations. Named in honour of Admiral G. Acton, one of the oldest conchologists, who was the first to discover it.

[1] *Bifrontia bifrons*, Deshayes.

Sub-genus SPIROLAXIS, n.subgen.

Shell discoidal; whorls quadrangular, detached, solute.

The operculum is characterized by Fischer in his description of



Pseudomalaxis zanclæa, of which species, occurring only in the fossil state, it is unknown.

4. PSEUDOMALAXIS (SPIROLAXIS) CENTRIFUGA (Monterosato).

Pseudomalaxis centrifuga, Monterosato, Nat. Sicil., Ann. ix, num. 7, p. 161, 1890; Boll. Soc. Mal. Ital., vol. xvii, p. 12, 1892.

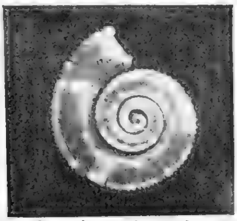
Mention is made in the Nat. Sicil. of the quadrangular solute whorls and of the Madeiran habitat.

Omalaxis zanclea (*non* Phil.), H. & A. Adams, Gen. Rec. Moll., vol. i, p. 244, pl. xxv, fig. 9 (Madeira).

A good figure showing the characteristic separation of the whorls.

Bifrontia zanclea (*non* Phil.), Watson, Journ. Linn. Soc., vol. xxvi, p. 275, 1897.

Pseudomalaxis Macandrewi, Iredale, Proc. Malac. Soc., vol. ix, p. 254, 1911 (Madeira).



This species is much smaller than the others, measuring only diam. 4, alt. 1·5 mm., and the surface is almost smooth; but under a good lens fine spiral striæ are distinctly visible in well-preserved specimens.

THE LAND MOLLUSCA OF THE KERMADEC ISLANDS.

By Tom Iredale.

Read 13th June, 1913.

PLATE XVIII.

I propose to deal with the Land Molluscs collected on Sunday Island, Kermadec Group, under four headings, viz., Historical Notes, Ecological Notes, Systematic Account, and General Conclusions.

1. Historical Notes.

In 1854 H.M.S. *Herald* surveyed Sunday Island, and although Macgillivray collected five species of land shells which were presented to the British Museum, they were never reported upon. In 1856 Pfeiffer described two species collected by Lieutenant Chimmo: I presume Lieutenant Chimmo was one of the officers of the *Herald.*

Nothing more was heard from the Kermadecs until 1873, when Mousson recorded one of Pfeiffer's species, and added three new ones from a collection made by Dr. Graeffe. The same year E. A. Smith described a *Vitrina* received from Sunday Island via Auckland: this was one of Mousson's new species, and Smith's name has priority by a few days.

In 1892, when Hedley and Suter made up the Reference List of the Land and Freshwater Mollusca of New Zealand, they included four species only from the Kermadecs, one of Pfeiffer's species being omitted. Mr. Hedley has since pointed out to me that Pfeiffer had recorded in 1863 *Tornatellina Novoseelandica*, Pfr., from Sunday Island.

The Land Molluscan fauna of Sunday Island therefore stood at the end of 1907 thus—

Helicarion Kermadecensis (Smith) = *ultima*, Mousson.
Medyla exposita (Mousson).
Macrochlamys Kermadeci (Pfeiffer).
Endodonta modicella vicinalis (Mousson).
Helix Chimmoi, Pfeiffer.
Tornatellina Novoseelandica, Pfeiffer.

2. Ecological Notes.

Sunday Island is the summit of an immense volcano, the crater being about one mile and a quarter in diameter. To the north-west and south-west run two long spurs which are cut into innumerable deep short gullies. The crater ridge averages about 1,000 feet, the highest point being over 1,700 feet, the lowest about 200 feet. The two spurs are each over 1,000 feet practically their whole length. The only flat land on the island was a small piece on the west coast and another on the east coast, though on the north coast a series of terraces about 80 feet above sea-level existed. The crater was similarly provided with minor ridges, the level being calculated as 40 feet above sea-level. From a theoretical point of view the island seemed favourable for the finding of localized races due to isolation. It is densely bush-covered, has a heavy rainfall, 70 inches being registered in ten months, and an equable climate, the minimum thermometric record being 50° F., the maximum just under 90° F. in the shade. Such conditions would suggest a veritable paradise for land molluscs, especially as there seems to be little bird life to molest them. However, all the animals found were very minute, and well distributed. Before proceeding to the island I looked up the literature regarding New Zealand Land Molluscs, but found little was recorded of the habitats of the species published. I therefore made a simple rule of "search everywhere". One result was the finding of some snails in most unlikely places, and as I have always been interested in the habits of the animals as well as in the shells I now offer my observations.

The bush consisted of various kinds of trees, nikau palms, and tree-ferns; the undergrowth was chiefly fern. The most abundant tree, the poutukava of Polynesia, was disliked by all molluscs, only very rarely the commonest species being found thereon. On account of the pumiceous nature of the soil it did not hold water, and therefore the wet quickly disappeared after rain. In the crater there were three lakes, two of large size; these were, however, of a mineral character; the third, of very small size, was fresh. In the west bay was a large freshwater swamp, and there were besides two very small permanent springs. I did not, however, find any freshwater molluscs, though I constantly searched for them. I also noticed that the wettest portions of the bush did not yield anything out of the common, but rather that molluscs generally were scarcer in such places. Immediately upon landing a snail was found, which is the one recorded by Pfeiffer as *Tornatellina Novoseelandica.* This lived on the flat under pumice-stones and rotten logs; I was much surprised to find a snail under dry pumice-stones, yet this species was there commonly living and with it a mollusc which I have called *Paralaoma Raoulensis.* It was noted in the case of the latter that the pumice-stones which harboured it were generally moss-covered on the top, and in wet weather it was observed near or among the wet moss. When the rain stopped it retreated, and was then only discovered very snugly hidden away in the crevices, whereas the former was not so particular. *P. Raoulensis* was later found throughout the island under rotten wood and stones and decaying leaves. It was collected all over the heights as well as on the level, though it was more common on the latter. My next find, also on the flat, was a few specimens of *Kieconcha Kermadeci* (Pfr.). These were taken on the underside of a piece of rotten wood, and diligent search in the locality revealed no more. It was later sparingly found distributed all over the island, the favourite location being under well-decayed nikau leaves on the ground, but it was a solitary creature, rarely more than one or two being sheltered by the same leaf, and many leaves would be turned without disclosing any.

Trochonanina exposita, Mousson, was next collected, and its habits were, to me, very curious. It was never met with on the level, but only on the crater ridge. It would there be noted very numerous for a short distance, and then absolutely none could be found, the patch being exactly limited. No reason whatever could be discovered for this extreme localization, only about half a dozen patches being observed, though every effort was made to find more. The species had gregarious habits, living under rotten nikau leaves on the ground, and hundreds could be collected from one of these patches in a few hours. Neither height nor dampness was accountable for the patches, one of the most vigorous patches being in a relatively dry position on the sides of the cliffs only about 500–600 feet high. Upon the highest point, over 1,700 feet, a few were obtained. These lived principally under rotten logs and were of a grey colour, whereas all the rest were uniformly brown. Little variability in size, shape, or colour was apparent, though thousands were critically examined. This is more remarkable in view of the extreme variability of the close ally of the species, the Norfolk Island *T. insculpta* (Pfeiffer).

On the sides of the cliff, while cutting a path, I obtained a few specimens of another Charopoid shell from under a wet moss-covered stone. Upon examination it showed a fully armoured mouth, and was consequently classed under *Ptychodon*. It was afterwards commonly obtained all over the cliffs, and also rarely on the level, its most frequent habitat being under dead nikau leaves, but it did not despise rotten wood, and also sometimes hid itself under wet stones. It was never found under dry stones like the first two species mentioned. This shell I call *Ptychodon pseutes*. The preceding five were the only snails found during the first eighteen weeks, whilst our time was engaged fixing up living places, making food arrangements, etc., so that it will be understood that the snails were not obtrusive.

Having cleared up the aforesaid matters vigorous search was prosecuted throughout the island, with most delightful results. The only way to establish the presence or absence of molluscs was to thoroughly search the island section by section. It had been proved to me by this time that the only feasible method was to search while it was raining, when the snails were moving. After a couple of days' search on the flat at one end, with no result, the other and untouched bush-covered end was investigated. The bush, however, was so dense that it was quite impossible to see these minute molluscs, and my only chance was when a break came, which was rarely. However, a piece of black bark was turned over whereon glistened two minute cream Charopoids, which I feel justified in naming *Charopa exquisita*. This species was afterwards found on the undersides of moss-covered stones deeply embedded in earth on the side of the cliff. A few were found under dead nikau leaves on the ridge, and some more were discovered under loose dry pumice-stones in the crater. Only two or three were found at a time, and it is the scarcest shell I obtained, the majority of the specimens being not fully grown. The next day in the same place, searching among dead leaves, I came across a dead shell which I call *Pronesopupa senex*. Search as I would I could gather no more specimens that day, the minute size and dark coloration effectually prohibiting its discovery in the darkness of the dense bush.

At the same time a new shell was brought to me that had been obtained on the cliffs. It was a very close ally of *Ptychodon pseutes*, and I have called it *P. amanda* on account of its beauty. This discovery made me forsake the flat and commence the investigation of the heights at once. I had noted in literature that snails from different altitudes differed specifically, and sometimes generically, from those living on the low level. The first day revealed a new shell in numbers under stones, dead nikau leaves, and rotten wood, well stowed away at about 1,200 feet. It was a cream Charopoid, which was at first thought to be the same as the one found on the level, but comparison showed them to be absolutely different. I have named this *Charopa Macgillivrayana* in honour of the first naturalist to exploit Sunday Island, and whose collections received no recognition. I find, in the British Museum, that he obtained all the species known at the end of 1907, though none were described from his collection. This shell was well distributed, in some places being almost numerous, but the small size prevented rapid collecting, each specimen having to be taken from its hiding-place by means of a pen nib reversed in a pen-holder. I offer this suggestion to collectors who have to get minute shells out of crevices of wood. Associated with it, under nikau leaves, were found *Ptychodon pseutes* and *amanda*, the latter rarely occurring. The last named was later found all over the heights, but it was a somewhat solitary animal, usually confining itself to its favourite rotten nikau leaves. This successful foray encouraged to further search, and as it rained all the night I set out for the same place the next morning to collect more specimens and perhaps add another new species. A great surprise was, however, in store, as approaching the hunting-ground my friend Mr. Roy Bell, one of the settlers of the island and who generally accompanied me on my excursions after these minute animals, noted a new larger snail climbing on a moss-covered tree-trunk. Immediately every idea was given up to the very careful inspection of all the tree-trunks in the immediate vicinity, with the result that they were found to have a peculiar and interesting snail fauna of their own. Previously tree-trunks had been casually examined, but with no result save rarely a *Tornatellina*, which I confused with the ground-living *T. Novoseelandica*. Furthermore, it had been mainly dry weather when such searching had been undertaken. I might point out that hunting for these tree-living minute snails was not a delightful occupation, as they only fed while it was raining or immediately afterwards. It needed all the zeal of the enthusiast to walk out in the pouring rain, climb 1,000 feet cliffs up slippery and dangerous goat-tracks, becoming wet and bedraggled at every footstep, wade through dripping ferns knee-deep, all to be done before the happy hunting-ground was reached, then to stoop low down round tree-trunks while the rain trickled down the neck, only stopping to wipe the wet out of one's eyes, already strained to a hurtful point to distinguish these dark-coloured atoms from the deep-green background. Two or three hours was quite sufficient at a time, as no rest could be taken owing to the dripping state of everything, including ourselves. It was not the least use looking for these snails in the dry weather, as they hid themselves away in the moss, and were quite erratic in their choice of trees. From one tree-trunk a dozen might be procured, while careful examination of the adjoining half a dozen trees might not disclose an additional specimen. Further, this discrimination referred even to individuals as well as species. It was early observed that particular kinds of trees were never frequented by snails, but it was later absolutely proved that, even among the favoured species of trees, a further particularization was carried out to individuals, sometimes even to parts of one tree. I well remember one tree consisting of four separate limbs; from the first I obtained twenty odd specimens, and anticipating a fine haul commenced on the other three, with a total result of *one* specimen. Yet an investigation carefully carried out provided no solution. In addition localities differed; no place afterwards gave such results either as to species or individuals as the occasion now referred to, yet these tree-dwellers were afterwards recognized all over the island on the highlands. A few were obtained as stragglers on the flat, and it may be they were as common on the level, but the bush was there so dense that it was difficult to see even in dry weather, and an absolute impossibility in dull wet weather. However, to particularize the tree snails found on this eventful field-day. Four species were obtained associated together; the first one found and the largest of the four as well as the largest Charopoid was a *Ptychodon*, with which I have associated the name of Mr. Roy Bell, as an appreciation of his help and comradeship in the discovery of these forms. The specific name *Royanus* will always distinguish this. The next largest was a most beautiful shell which I refer to *Calymna*, and specifically call *arboricola*. It was much scarcer than the preceding. The third was a delightful *Charopa* with a resemblance to Reeve's *anguicula*, so I have termed it *pseudanguicula*. A very minute brownish shell completed that day's surprise list, and I propose to designate it *Flammulina miserabilis*. It is a wretched-looking little shell, and it was a miserable job keeping the eyes focussed to pounce upon it.

Such a fine haul urged to further efforts, and despite the continued and uninviting rain, a day later the trees in the same neighbourhood were again undergoing critical investigation with interesting results. On the cliffs, almost at the top, the *Pronesopupa*, previously represented by one dead shell from the level, was found numerously on tree-trunks, which were not moss-covered and unassociated with any of the previous day's finds. It appeared to have hidden away in crevices in the bark, and only came out after a deal of rain. Higher up, just on the ridge, an entirely different *Tornatellina* was noted on the moss-covered tree-trunks along with the *Tornatellina* I had confused with *T. Novoseelandica*, Pfr. In this case again the Charopoid forms were not found living with these, and this *Tornatellina* was always a very scarce shell. Considered criticism of the preceding results induced the idea of new forms, perhaps existing due to localization. Excursions to different parts of the island destroyed this, no new forms being obtained, but the known ones were proved to be well distributed. However, on the flat a new *Tornatellina* was found upon a patch of Kawa Kawa or Pepper plant. When raining it was seen crawling up the stems and under the leaves in fair numbers. Nowhere else was it found save on this one small plot; I could not discover where it hid itself in the dry weather, though every wet day it was noted. It appeared quite an aberrant style of *Tornatellina*, the animal being quite unlike those previously examined, so that it was quite a pleasure to find that Pilsbry had created a new genus for either it or a very close ally. This species was immediately recognized as *T. inconspicua*, Brazier, from Lord Howe Island, when I showed it to Mr. Hedley at Sydney. I concluded that many prior names have been bestowed upon it, but I will note these in the systematic portion later. Upon the other side of the island another species of *Tornatellina* was observed. It was, however, noted all over the higher portions of the island under dead leaves, stones, rotten wood, etc.

By this time it seemed that the snail fauna must be pretty well known, yet the largest and most noticeable species had escaped our search. I allude to *Helicarion Kermadecensis* (Smith), which was simultaneously described by Mousson, who received it from Dr. Graeffe, who had stated it to be "numerous". Such was certainly not the case at this time, and therefore it was thought advisable to investigate the problem. It was considered probable that, as it was undoubtedly not "numerous" anywhere we had searched, its last refuge might be the highest point of the island, known as Moumoukai. It was therefore at once decided to be necessary to thoroughly search that locality as a forlorn hope. Much to my delight the first excursion provided one specimen living under a fallen nikau leaf, and among dead fern-leaves a couple of broken dead shells were noted. My second and third trips were unsuccessful, but on the fourth a second live specimen was obtained from under a fallen nikau palm leaf. It was now concluded that a beautiful clean animal like this *Helicarion* would not live among dirty leaves, but should be a tree-liver. Following up this line of investigation did not solve the problem. Two other members of our party, however, proved this theory correct, and to them belong the credit of the rediscovery of this beautiful animal. Messrs. W. R. Brook Oliver, now a member of this Society, and W. L. Wallace, while making a trip over Moumoukai, camped overnight on the top, and in the dew of the early morning a *Helicarion* was observed crawling on the bulbous head of the nikau palm. Upon climbing up the palm the underside of the leaves was found to be the station of the missing *Helicarion*. Hearing this, Mr. Roy Bell and I immediately visited the place, and, camping there, were well rewarded. It was found that only a very small colony existed, that its limits could be exactly defined, and that only a few trees were selected. Having fixed their station, search was renewed all over the island, but without success. No other colony was discovered at any altitude, so that it seems that this species has become almost exterminated in a space of forty years without visible enemies. If this colony be the only existing remnant of this species, to what can it owe its extinction? As before quoted, Dr. Graeffe termed it "numerous", and I find Macgillivray collected it. There is not the least probability that either of these obtained it from the colony I have denoted, which was the south-west aspect of the highest peak of the island.

In the spring of the year, under stones on the level, another *Paralaoma* was obtained, to which I attach the designation *ambigua.* Fair numbers were collected, and it gave rise to much disquietude on my part. After nine months searching, to note a new shell on the well-looked over level was unexpected, while the discovery that *Helicarion Kermadecensis* was confined to a very small patch, and *Tornatellina inconspicua* to an even more restricted area, caused me much misgiving. I had anticipated I should be able to confidently state I had collected all the land molluscs of Sunday Island, but such facts as these destroyed my complacency. Renewed efforts were made, and other parts of the island explored, with no further results. Consequently, though I hope I have made known the whole of the non-marine molluscan fauna, I feel I can make no justifiable claim to have done so. A strange mollusc must here be dealt with. Shells were dredged in various depths, up to 25 fathoms, which I immediately recognized as non-marine though of Rissoid appearance. Later, Mr. W. L. Wallace discovered them alive crawling over wet moss on the sea-cliff of Dayrell Island, one of the outlying islets. Then Mr. W. R. Brook Oliver discovered them on the mainland in a similar situation. I searched very closely, but only found a few well hidden in crevices where water trickled down after heavy rain. From their occurrence in dredgings they would have been collected numerously had their station been discovered. From shell characters they would be referable to *Assiminea*, but they are inoperculate. Upon examining the Lifu marine Mollusca in the Manchester Museum, I recognized my puzzling shell in the type of *Barleeia chrysomela*, Melv. & Standen. This species was described from dead specimens found among shells and collected at Lifu, and the type has the mouth badly broken. I cannot discern the least difference between the Lifu shells and my own, but *Barleeia* is a very bad selection for generic location.

It seems of interest to note the great distinction between the tree-dwelling species and those found upon the ground. Owing to falling leaves, some of the former were occasionally noted on the ground, but none of the ground-livers were ever noticed to occur on trees.

The tree-dwelling molluscs were—

Helicarion Kermadecensis (Smith).
Ptychodon Royanus, Iredale.
Calymna arboricola, Iredale.
Flammulina miserabilis, Iredale.
Charopa pseudanguicula, Iredale.
Pronesopupa senex, Iredale.
Tornatellina sp., a slender form.
T. sp., near *bilamellata*, Anton.
Elasmias inconspicua (Brazier).

To the ground were confined—

Fanulum expositum (Mousson).
Kieconcha Kermadeci (Pfeiffer).
Ptychodon pseutes, Iredale.
P. amandus, Iredale.
Charopa Macgillivrayana, Iredale.
C. exquisita, Iredale.
Paralaoma Raoulensis, Iredale.
P. ambigua, Iredale.
Tornatellina Novoseelandica (Pfeiffer).
T. sp., conoid form.

3. Systematic Account.

The account herewith given is purely conchological. I am incompetent to deal with the anatomy of the snails obtained, though I have ample material in spirit which will be placed at the disposal of any anatomist willing to study and report upon them. It must be understood that the notes given here are mainly critical and are based upon shell features alone, and I would point out that I must conclude that even in the study of land Mollusca a fair consideration should be given to shell characters when attempts at classification are made. I find that Mollusca with heterogeneous shell characteristics are lumped together because some small anatomical feature is found constant, while shells, conchologically similar, are placed far apart on account of anatomical differences. There seems to be more reason in the latter procedure than in the former, but the anatomist seems to have outdone his brother conchologist in confusing material with immaterial differences. It is also imperative that for the study of zoogeography the exact generic location should be ascertained if possible, since the more restricted the genus the more accurate will be the conclusions drawn. The placing of a shell in any genus does not help much, and the consequent differentiation in the ensuing part is due to an attempt to observe the relationships of the molluscs collected. I shall have further to say on this subject under the generic names utilized.

Genus Helicarion.

Helicarion, Férussac, Tabl. Syst. Moll., 1821, p. 24. Copy in Brit. Mus. (Nat. Hist.).

Type (by subsequent designation), *H. Cuvieri*, Férussac.

Helicarion Kermadecensis (Smith).

Vitrina Kermadecensis, E. A. Smith, Ann. Mag. Nat. Hist., ser. iv, vol. xi, p. 288, 1873.

Vitrina ultima, Mousson, Journ. de Conch., vol. xxi, p. 110, pl. vii, fig. 1, 1873.

Hab.—Sunday Island, Kermadec Group. Living upon the underside of the leaves of the nikau palm on the highest point of the island only.

The generic reference would seem in this case to be easy, as Smith compared it with *Strangei*, Pfr., an Australian species, which should certainly be congeneric with the Australian *H. Cuvieri*, the type of the genus. It has been shown that the glassy shells commonly referred to *Helicarion* cover very differently constituted animals. I note that the coiling of the Indian shells, for instance, is quite regular, and quite unlike the rapidly increasing, somewhat excentric coiling of the present species, which agrees with Australian shells.

In the Trans. New Zeal. Inst., vol. xvi, 1883, p. 204 (1884), "*Vitrina Kermadecensis*, Pfr." is included in the New Zealand List as occurring at "Hobson's Glen, Auckland (T. W. Kirk)". This record is quite untrustworthy, as no other worker has found it in this locality; secondly, on the same authority European shells such as *Neritina fluviatilis* were recorded from the Wanganui River; and thirdly the specimens described by Smith were forwarded to him by a close relative of T. W. Kirk, so that an erroneous locality might have been easily added.

Genus Fanulum, nov. gen.

This name is proposed for the small group of molluscs typified by *Trochonanina exposita*, Mousson, and which includes *Helix insculpta*, Pfr., and *Medyla imitatrix*, Sykes. They have obviously little relationship with *Trochonanina*, and cannot remain in *Medyla*. My friend Mr. G. K. Gude has pointed out to me that the genus *Medyla* was proposed by Albers (*Die Heliceen*, 2nd ed., 1860, p. 47) to replace *Vitrinella*, Gray, which was preoccupied by C. B. Adams, and as type was designated *Nanina viridis* (Quoy). In the Gen. Rec. Moll., vol. ii, app., p. 642, 1858, Albers, however, was anticipated by H. and A. Adams, who had provided *Otesia* for exactly the same group. Consequently *Medyla* is quite unavailable. In the Proc. Malac. Soc., vol. iii, pp. 330–3, 1899, Suter gave some anatomical notes upon *H. insculpta*, Pfr., and referred it to *Medyla* (*Euplecta*), and wrote that, on account of anatomical similarities, *Kaliella*, *Sitala*, *Coneuplecta*, and *Euplecta* would probably be best regarded as sections of one genus. The same writer later, in the *Index Faunæ Novæ Zealandiæ*, 1904, p. 63, referred to the Kermadec species as *Medyla* (*Coneuplecta*). Under such conditions, and inasmuch as I do not advocate the lumping of such diverse groups as regards shell characters, I am putting forward the above new name.

Fanulum expositum (Mousson).

Trochonanina exposita, Mousson, Journ. de Conch., vol. xxi, p. 111, pl. vii, fig. 2, 1873.

Hab.—Sunday Island, Kermadec Group. Living on the ground in local scattered colonies on the underside of rotten nikau palm leaves, only on the higher ground.

This species, as previously stated, was characterized by its occurrence gregariously in a few widely separated colonies. It was found on the highest point of the island, occurring as an aberration of a white colour, the regular colour being brown, and living under rotten logs in a solitary manner. The few specimens collected seemed somewhat more flattened, but some more conical ones were included, so that the only appreciable difference to grasp is the coloration. Yet the animals had somewhat different habits, as above noted. On account of these differences I carefully preserved some animals for investigation, and would refer to them as var. *Moumoukai*, nov. var. By this means it may be able to fix this variation. This shell is practically smooth. The two described Norfolk Island forms which I would refer here, *insculptum* and *imitatrix*, are both heavily sculptured on the adult whorls, but the initial ones are smooth. On Norfolk Island also occurs a smooth race with a tendency to form sculpture, from which I should deduce that the unsculptured form is the oldest. Not much variation is shown in shape in the Kermadec shells, but the Norfolk Island *insculptum* seems to have a tremendous range, from a flattened conical shape to a high turreted one, which latter has become fixed in the species *imitatrix*. A still undescribed Norfolk Island smooth form is somewhat flattened, resembling the Kermadec species.

Genus Kieconcha, nov. gen.

This generic name is proposed for the shell called *Helix Kermandeci*, Pfr. Mousson included it in the genus *Microcystis* in the Journ. de Conch., vol. xxi, p. 111, 1873. Hedley and Suter allowed it to remain in the same genus in the Reference List of the New Zealand Mollusca, but later Suter transferred it to *Macrochlamys*.

The following notes regarding the generic name *Microcystis* may be of interest. In the Index Moll. Beck introduced on p. 2 as a subgenus of *Nanina*, Gray,

"Microcystis, Beck.

1. *M. pellicula*, Beck. F.H. ix, A 5–7 (?). Antill (?). An *H. Helicolimax pellicula*, F. (?).
2. *M. trifaciella*, Beck. I. Jamaica. An *H. trifasciata*, Stentz (?).
3. *M. pictella*, Beck. I. Jamaica.
4. *M. ornatella*, Beck. I. Opara.
5. *M. filiceti*, Beck. I. Pitcairn.
6. *M. amœnula*, Beck. I. Opara."

Sherborn gives a note to the following effect: "This appeared in 2 pts.; I, pp. 1–100, 1837; II, pp. 101–124, perhaps first in 1838. This was a preliminary issue. The final issue of pp. 1–124 and pp. 1–8 (the n.spp.) was issued in 1838."

From this the above is absolutely the earliest introduction of *Microcystis*, and unless the first species can be considered as equalling "pellicula Férussac" it must be regarded as a *nomen nudum*. The pp. 1–8 (the n.spp.) mentioned by Sherborn, which were issued in 1838, contain descriptions of the five succeeding species mentioned after *M. pellicula*, and these are all described as "*Nanina* (*Microcystis*)", and from this introduction it would appear that *Microcystis* must be quoted. The following is the order:—

p. 2.	*Nanina*	(*Microcystis*)	*trifasciella*, p. 2, No. 2.	*Hab.*,	Insulam Cuba.
p. 3.	,,	,,	*pictella*, p. 2, No. 3.	,,	Ins. Jamaica.
	,,	,,	*ornatella*, p. 2, No. 4.	,,	Opara.
	,,	,,	*filiceti*, p. 2, No. 5.	,,	Pitcairn.
	,,	,,	*amœnula*, p. 2, No. 6.	,,	Opara.

What should be considered the type of this heterogeneous mixture requires a little consideration. In the Proc. Zool. Soc. Lond., 1847, p. 170, Gray, being in a quandary, wrote: "(?) *Microcystis*, Beck. ? *Helicolimax*, sp. Férus. *M. pellicula*." It would seem, in face of the data given, that this type-designation can be ignored.

In 1860, in *Die Heliceen*, 2nd ed., p. 49, *Microcystis*, Beck, is included, and "Typus: *H. ornatella*, Beck" definitely stated. I should therefore conclude that this might be accepted, and *Microcystis* thus retained in the conventional usage. Accepting *ornatella* as the type of *Microcystis*, I would not recognize *Kermadeci* as congeneric unless that generic name was used with a very wide significance. For the purposes of zoogeographical study genera of wide limits are valueless, and I therefore do not adopt them. The transference of the species to *Macrochlamys* cannot be defended, as Godwin-Austen has shown that the only species really referable to *Macrochlamys* (save a Mauritian form, probably introduced) are confined to India. The only other generic name suggested in connexion with this species was *Microcystina*, Mörch, which, however, was founded on a Nicobar species, and is quite unsuitable for the Kermadec shell. Granting that *Kermadeci* might prove from animal characters to be referable to *Microcystis*, *sensu lato*, the shell characters deserve recognition by some other name, especially as typical *Microcystis* occur on Norfolk Island. I have therefore introduced the new name given above, and have assigned to it full generic rank until such time as the animals are dissected and compared with the type of *Microcystis*.

Kieconcha Kermadeci (Pfeiffer).

Helix Kermandeci, Pfeiffer, Proc. Zool. Soc. Lond., 1856, p. 326.

Hab.—Sunday Island, Kermadec Group. Living under rotten nikau leaves and rotten wood on the ground.

Pfeiffer's description reads "*turbinata*", and the measurements are given as diam. maj. $3\frac{2}{3}$, min. $3\frac{1}{3}$ mm.; alt. $2\frac{1}{2}$ mm. This suggests an immature specimen, and the type, still preserved in the British Museum, though in imperfect condition, confirms that suggestion. The adult is conical, recalling *Trochonanina*, but the last whorl is not keeled and the base is rounded. I counted six whorls regularly increasing and descending; the aperture not oblique, almost regularly broadly sublunate; columella nearly vertical, somewhat expanded; no umbilicus.

Genus Ptychodon, Ancey.

Ptychodon, Ancey, Bull. Soc. Mal. France, vol. v, p. 372, 1889.

Type (by original designation), *Helix leioda*, Hutton.

The correct attachment of the Polynesian, Neozelanic, and Australian 'Endodonts' is difficult. It is somewhat strange that much of the confusion seems due to the action of the maker of modern terrestrial malacology. Thus Pilsbry, when he evolved order out of chaos in his monumental *Guide to the Helices*, wrought some little confusion in this group by lumping all the Polynesian 'Endodonts' in *Endodonta*. He has been somewhat slavishly followed by later writers who have overlooked the fact that he subsequently corrected his own erroneous conclusions.

Whilst collecting I separated my shells into their apparent genera. Unfamiliar with land molluscs, I was unaware of the subtleties constituting the different groupings, and simply knew at sight a '*Flammulina*' by shell characters from a Charopoid, and knew a Charopoid with an armed mouth was a *Ptychodon*. Attempting to gain information I consulted the unquestioned authority, Pilsbry's *Guide to the Helices*. I there found the family Endodontidæ comprising *Endodonta* and *Flammulina*, and that *Endodonta* covered *Ptychodon*, *Charopa*, *Phenacharopa*, etc., these 'genera' being regarded as sections only. The typical *Endodonta* seemed to show little relationship as regarded shell characters with my 'Endodontoid' forms, and I also observed that Pilsbry himself seemed to have had no little trouble in attempting to produce a satisfactory classification of these minute forms. His final diagnosis of the genus *Endodonta* reads: "Animal having distinct grooves above the margins of the foot, but no caudal mucous gland."

One of the few criticisms of this classification is that by Moellendorff, who, writing upon the Land Shells of the Caroline Islands (Journ. Malac., vol. vii, p. 107, 1900), recorded the genus *Flammulina*. The animal was dissected by Suter, who observed: "the presence of a peripodial groove, a caudal pore, the plaited jaw, and the radula clearly indicate that it must be classed under *Flammulina*." Moellendorff therefore wrote: "As I have said elsewhere, I consider Pilsbry's arrangement of including the well-defined family of Phenacohelicidæ, Suter (= *Charopidæ*, Hutton) within his Endodontidæ as a regrettable step backwards. The two families are not only conchologically well distinguished, but have different types of jaw and radula, and the Phenacohelicidæ possess a mucous pore . . . This (Suter's above quoted) confirmation of my classification is interesting for two reasons. Firstly, it proves that shell characters are not by any means so unimportant as modern malacology tends to consider them, and secondly that the Phenacohelicidæ extend much more to the North than hitherto known, the most northern habitat observed being New Caledonia." It will be noted that both Moellendorff and Pilsbry agree in accepting as a differential feature the absence of a caudal mucous pore.

I would now suggest that careful criticism of shell characters will prove as beneficial to malacology as the premature grasping of misunderstood animal characters. Thus, much as it displeases me, I must call for reconsideration the presence or absence of a caudal mucous gland as being of primary or even secondary importance. The shell I hereafter name *Ptychodon Royanus* is a typical Polynesian 'Endodontoid' in shell characters, and it covers an animal possessing a well-developed caudal mucous gland in life. It is a tree-dweller, and it should be noted that of the four discoidal forms living on tree-trunks, from shell characters two are easily referable to *Flammulina*, the third is the above-noted *Ptychodon*, and the fourth is a typical *Charopa*. I would suggest that all four possess a caudal mucous pore, whilst I should not be surprised to find that no ground-living Endodont was possessed of such a feature. It should be remarked that no *Flammulina* was found permanently ground-dwelling, and my explanation of the presence of a caudal mucous pore was quite simple! To the snails which had taken up a tree-life a mucous gland was a necessity, whilst to those ground-dwelling it would be a luxury. Whether in these latter it had become aborted through disuse, or in the former it had been developed through necessity, and also the exact relationship of *Flammulina* and '*Endodonta*', I must leave to the anatomist to puzzle out. My own conclusions as to the classification put forward by Pilsbry is that it was based upon too little material, and too much value was given to a really insignificant feature. Had more material been handled it is probable that a tree-living Endodont might have been included. As a matter of fact little damage has been done, as, after a very few animals were dissected, the molluscs were almost entirely grouped by means of shell characters. Having thus mentioned the general classification I would deal with the generic names *Ptychodon* and *Thaumatodon*.

Ptychodon was proposed for the Neozelanic *leioda*, Hutton. In the Man. Conch., ser. II, vol. ix, p. 25, Pilsbry introduced *Thaumatodon* as a section of *Endodonta*. Under this a large number of Polynesian and New Zealand snails are classed. No type is named, but as *multilamellata*, Garrett, is selected for illustrative purposes, I would designate that as type. Now from the diagnosis of *Ptychodon* and *Thaumatodon* given by Pilsbry, no differences can be observed, and the two seem absolutely synonymous. If they can be maintained from shell characters alone, a multitude of sections can be introduced. But my criticism of Pilsbry's figures and description of *multilamellata* (I have seen many specimens from Garrett's own collection, but none agreeing with Pilsbry's account) leads me to recognize in it a close relation, judging from shell characters, of my caudal mucous pore-bearing *Ptychodon*, so that it is quite possible that *Thaumatodon* may come into use for such forms. In the meanwhile it would be much better to drop *Thaumatodon* and refer to these armoured Charopas as *Ptychodon* only.

As I have noted, Pilsbry called all the Polynesian Endodonts *Endodonta*, whatever their shell characters might be, and in this he has been followed by most Australian and New Zealand writers. But in 1906 he and Ferris introduced the genus *Radiodiscus* (Proc. Acad. Nat. Sci. Phil., 1906, p. 154) for a shell from Arizona, and wrote: "In the Endodontidæ, where small differences in the shell characterize extensive series of species, it seems desirable to recognize as generic such readily definable groups as *Radiodiscus*." Later, writing on the Non-marine Mollusca of Patagonia in the Reports Princeton Univ. Exped. Patag., 1896–9, vol. iii, p. 516, 1910, this was reprinted, and then was added—"Some Tasmanian snails have a great resemblance to *Radiodiscus* in size, form, and sculpture, a resemblance possibly due to convergence, but perhaps indicating affinity. I have not been able to actually compare specimens. On account of their spirally sculptured embryonic shells Hedley has referred them to the sub-genus *Allodiscus* of the genus *Flammulina*." The species indicated by Pilsbry are figured by Petterd & Hedley (Rec. Aust. Mus., vol. vii, p. 288, 1909), and the shells called *Fl. Roblini*, Petterd (pl. lxxxiv, figs. 19–21), and *Fl. curacoæ*, Brazier (pl. lxxxiii, figs. 14–16), have certainly an unfamiliar appearance when contrasted with typical *Flammulina*. It might be noted that Hutton considered *Helix ide*, Gray, such a typical *Charopa* that he cited it as the type, whereas on account of anatomical features, including the possession of a caudal mucous gland, it is included in *Flammulina* by Pilsbry, though a new sectional name was bestowed upon it, viz. *Suteria*, to replace *Patulopsis*, Suter, preoccupied.

I would endorse Pilsbry's dictum, above quoted, on the introduction of *Radiodiscus*, and advocate the introduction of many new names to be used generically in the family Endodontidæ. Through the kindness of Mr. J. H. Ponsonby I have been enabled to examine many Australian Endodontids, and I note many of the forms of shell differ: and it would seem that examination of the apical features might lead to a better understanding, since so far I have observed that similar shell characters are subsequent to similarly constituted protoconchs. I hope to have further to say on this subject later.

PTYCHODON ROYANUS, n.sp. Pl. XVIII, Fig. 10.

Shell discoidal, spire not sunken, last whorl scarcely descending, widely umbilicate. Whorls 4, in very old shells 5. Colour red-brown, sometimes unicolor, sometimes flammulate with darker. Protoconch consisting of one whorl finely sculptured with closely set slanting radial threads, over sixty being easily counted; adult whorls with a sculpture of straight erect sharp lamellæ, regular and equidistant, between which are clearly marked minor threads. On the first adult whorl there are about fifty regular lamellæ with a couple of minor threads between each; the next has sixty lamellæ, more widely spaced, with generally three minor threads intervening, and so on. Umbilicus deep and wide, almost one-third the diameter of the shell, sides steep, exposing previous whorls. Aperture lunate, lip thin. Apertural armour: on the parietal wall are three long prominent slender lamellæ, two of which project so as to be observed when the shell is viewed sideways and displacing five of the lamellæ of the previous whorl; sometimes the third and lowest also is thus observed, but generally it does not pass the outer lip. On the outer lip are five lamellæ; two strongest agreeing in position with the two major ones on the parietal wall, a third weaker agreeing with the weaker parietal lamella, and two still smaller situated on the basal curve; they can scarcely be said to be placed on the columella. This description is drawn up from an old specimen with a max. diam. of 4 mm. The teeth vary somewhat with age, as a young shell shows four well-defined parietal lamellæ, a thin slender one occurring between the two prominent ones above noted. Diam. max. 3·4, min. 3 mm.; alt. 1·5 mm.

Hab.—Sunday Island, Kermadec Group. Living on the moss-covered trunks of trees.

PTYCHODON PSEUTES, n.sp. Pl. XVIII, Fig. 12.

Shell sub-discoidal, spire slightly raised, narrowly umbilicate, sutures deeply impressed, last whorl descending to about half-way down the penultimate whorl. Colour pale reddish brown with darker flammulate markings. Whorls $4\frac{1}{2}$, well rounded; first whorl and a half, constituting the protoconch, radially sculptured with fine slanting threads, abruptly ceasing when the adult sculpture of straight, even-spaced lamellæ commence, about sixty being counted on the first adult whorl; the lamellæ regularly increase in number, but the spaces widen a little with age, and minute threads occur betwixt. Umbilicus narrow and deep, exposing the previous whorls, about one-fourth the diameter of the shell. Aperture lunate, lip thin. Apertural armour: well inside on the centre of the parietal wall is situated a long bifurcate lamella; on the columella are two separate, somewhat crass, conical teeth, the basal one the larger; on the inside of the outer lip, situated far back, are six lamellæ, one in the upper bend of the whorl almost unnoticeable and five even-spaced ones lower. Diam. max. 1·75, min. 1·6 mm.; alt. 9 mm.

Hab.—Sunday Island, Kermadec Group. Living under stones, rotten wood, and dead nikau leaves.

PTYCHODON AMANDUS, n.sp. Pl. XVIII, Fig. 11.

Shell sub-discoidal, spire slightly elevated, narrowly umbilicate, last whorl descending to about one-third the depth of the penultimate whorl. Colour white. Whorls and sculpture as in preceding. Aperture regularly lunate, outer lip thin, sharp. Apertural armour: much as in preceding; on the top of the outer lip inside is a very small thin lamella which is almost unnoticeable; four equal-placed lamellæ can be seen situated well back on the inside of the outer lip. Diam. max. 1·75, min. 1·5 mm.; alt. 1 mm.

Hab.—Sunday Island, Kermadec Group. Living under stones, rotten wood, and dead nikau leaves.

This is one of the quaint puzzles which occur to the thinking collector. To the systematist handling the shells it would only appeal as a well-marked colour variety, yet I am quite satisfied it is a well-differentiated species. I studied it on the island for nine months, and though the only appreciable difference was the colour, it occurred separately from *P. pseutes* and was always recognizable; it occurred all over the island, yet no intergradation as regards colour was met with. I have described a typical shell, but as regards the apertural characters some *P. pseutes*, Pfeiffer, seem to show exactly the same.

I note that of a Tasmanian shell Petterd & Hedley (Rec. Austr. Mus., vol. vii, p. 288, 1909) write: "*Endodonta antialba*, Beddome. Noted for the fact that half the specimens are milkwhite, and the balance brown colour." I do not know whether the conditions under which this shell lives have been reported upon, and therefore cannot be sure whether it provides a parallel case to the pair I have separated. In view of my experience, field observations of *antialba*, Beddome, might prove interesting.

Genus Charopa, Albers.

Charopa, Albers, *Die Heliceen*, 2nd ed., 1860, p. 87.

Type (by original designation), *Helix coma*, Gray.

(Not *Charopus*, Erichson, Entomogr. 1840, p. 119.)

This genus name provided for the toothless 'Endodont' *Helix coma*, Gray, has been used to cover many different styles of toothless 'Endodonta'. It seems certain that instead of lumping, if splitting were indulged in we should have a better chance of gauging the immediate relationships of the species described. It would be easy to form sections of *Ptychodon* where teeth in varying numbers and shapes are present, but it is not so easy in *Charopa*, yet my Charopoid forms are certainly of diverse origin. I am of the opinion that my tree-living *Charopa* has a caudal mucous gland, and its shell characters certainly differ from those of the ground species. As noted previously, Pilsbry has recently advocated the splitting of the genus *Endodonta*, though it was due to his influence that these well-marked genera were merged into *Endodonta*. Australasian workers have not yet accepted his retraction, and most recently described species of *Charopa* have been placed in *Endodonta*.

Charopa Macgillivrayana, n.sp. Pl. XVIII, Fig. 6.

Shell sub-discoidal, whorls regularly coiled, spire not sunken, last whorl scarcely descending, widely umbilicate. Colour cream. Whorls $3\frac{1}{2}$; first whorl and a half, constituting the protoconch, smooth; adult sculpture consisting of straight, evenly spaced, erect lamellæ, about sixty on the first adult whorl and 80 to 90 on the next, becoming uneven and more widely spaced towards completion of whorl; interstices with minor threads. Aperture regularly lunate, outer lip thin, sharp. Mouth unarmed. Umbilicus deep, about one-fourth the diameter of the shell, exposing all the previous whorls. Diam. max. 2, min. 1·75 mm.; alt. 1 mm.

Hab.—Sunday Island, Kermadec Group. Living under stones, rotten logs, etc., on high land only.

Charopa (Discocharopa, n.subgen.) exquisita, n.sp. Pl. XVIII, Fig. 8.

Shell minute, discoidal, thin, spire slightly sunken, widely umbilicate. Colour cream. Whorls 3, well rounded, last whorl scarcely descending. Sculpture: apical quarter whorl unsculptured; the remainder of the first whorl sculptured with very fine radial lamellæ, 40 in number; succeeding whorl with straight, even-spaced very closely set radial lamellæ, about 100 in number, increasing on last whorl to about 120, only due to rather wider spacing. Aperture lunate, lip thin, mouth unarmed. Umbilicus deep and very wide, exposing all previous whorls and more than one-half the breadth of the shell. Diam. max. 1·25, min. 1 mm.; alt. 5 mm.

Hab.—Sunday Island, Kermadec Group. Living under rotten wood, stones, etc.

Mr. J. H. Ponsonby has generously allowed me to examine his fine collection of Australian Endodonts, and among them I noted a series bearing the data "Bassi, Brazier, 6 miles S. of Hobart. Under rocks 3 or 4 feet deep. Beddome". Under the microscope these were seen to be, comparatively speaking, gigantic facsimiles of the shell above described in form and sculpture, even to the apical characters. The coincidence of habitat must certainly indicate relationship, and I note that Suter (Ann. Mag. Nat. Hist., ser. VI, vol. xiii, p. 64, 1894) refers 'bassi' to the section *Gerontia* of *Flammulina.* Such a location is conchologically impossible, so that if Suter's shells were similar to the ones I have examined the species cannot be correctly placed in *Charopa.* As the apical features differ from those of *Charopa* and are constant in such distant localities as the Kermadecs and Bass's Straits, I propose the new sub-generic name DISCOCHAROPA with *Charopa exquisita* as type.

CHAROPA PSEUDANGUICULA, n.sp. Pl. XVIII, Fig. 9.

Shell discoidal, whorls loosely coiled, spire slightly elevated, last half whorl somewhat descending, widely umbilicated. Colour buff, regularly flammulate with rich red brown. Whorls $3\frac{1}{2}$; first whorl and a half unsculptured, including a bulbous first whorl a little tilted; the succeeding sculpture consists of very slender straight distant lamellæ, becoming more separate on last whorl; the interstices are finely threaded, and about fifty lamellæ occur on the first adult whorl. Aperture regularly lunate, lip thin, mouth unarmed. Umbilicus wide, cavernous, exposing all previous whorls. Diam. max. 1·9, min. 1·6 mm.; alt. ·9 mm.

Hab.—Sunday Island, Kermadec Group. Living upon moss-covered trunks of trees.

Genus PARALAOMA, nov. gen.

The first turbinate land shell I noted on Sunday Island was that which I call *Paralaoma Raoulensis.* I was quite unable to generically locate it, and provisionally called it "*Charopa*", but the shape and sculpture seemed to effectually remove it from that genus. I knew of no New Zealand shell which remotely suggested this, and I felt convinced it should not be placed in *Endodonta, sensu lato.* Recently Mr. J. H. Ponsonby loaned me a large number of Australian Endodonts to look over, and almost at once I noted a shell from New South Wales which was apparently congeneric. This was labelled "*Morti*". In the Mem. Nat. Mus. Melb., No. 4, p. 7, 1912, Cox and Hedley place this species in *Laoma* and synonymize with it a shell Tate called *Flammulina retinodes.* In the same place figures are given (pl. ii, figs. 9–12) of *Laoma mucoides*, considered closely related. This was a generic location that had never suggested itself to me, and as my shells do not seem to have the least resemblance to typical *Laoma*, I am proposing the above generic name.

Laoma was thus introduced: In the Proc. Zool. Soc. Lond., 1849, p. 167 (1850), Gray described a new species of shell from New Zealand under the name "*Bulimus ? (Laoma) Leimonias*", writing, "I am inclined to regard this shell as the type of a particular sub-genus of shell which may be characterized by the simple peristome, the perforated axis, the square mouth, and the spiral ridges in the throat. If it prove distinct, it may be called *Laoma*."

Pilsbry in the *Guide to the Study of the Helices* lumped all the species assigned to *Phrixgnathus* under the genus *Laoma*, but later, in the *Index Faunæ Novæ Zealandiæ* (1904), Suter admitted a family Laomidæ (p. 62), comprising the two genera *Laoma* and *Phrixgnathus*. No conchologist could possibly place the shells here discussed in *Laoma* from a study of the shell characters of the type of *Laoma*. As Australian conchologists have variously chosen *Flammulina*, *Endodonta*, and now *Laoma*, I consider the introduction of a new generic name necessary, granted even that the animal may possess the structural characteristics of *Laoma*, *sensu lato*, which I have not yet seen proved.

In the Rep. Horn Sci. Exped., vol. ii, Zool., p. 188, 1890, Tate referred his *Charopa retinodes* to *Flammulina*, and wrote: "This species resembles *Helix paradoxa*, Cox, but is more depressed, the spiral sculpture more distant, and the umbilicus wider. The animal was not studied, but by shell characters it should be conspecific with the fore-named species, which Suter (Ann. Mag. Nat. Hist., Jan. 1894, p. 64) refers to *Laoma*, section *Phrixgnathus*. On the other hand, it is also comparable with an undescribed species of *Flammulina*, inhabiting South Australia, which possesses the caudal gland, pedal suture, jaw and dentition proper to that genus, whilst the form of the shell is more consonant with *Flammulina* than with *Laoma*."

In the Rec. Austr. Mus., vol. vii, p. 294, 1909, Petterd and Hedley synonymized *paradoxa*, Cox, with *Morti*, Cox, and in the Mem. Nat. Mus. Melb., No. 4, p. 11, 1912, Cox and Hedley added *Flammulina retinodes*, Tate, as another synonym, whilst in the former place they recorded as habits, "always in dry positions nestling under stones." Here, again, we have a coincidence of form, sculpture, and habits in such distant localities as the Kermadecs and Eastern, Southern, and Central Australia, which seems most suggestive of generic affinity.

PARALAOMA RAOULENSIS, n.sp. Pl. XVIII, Fig. 7.

Shell small, sub-conical, spire elevated, thin, translucent, last whorl descending, somewhat flattened, but periphery rounded, umbilicus wide; whorls $3\frac{1}{2}$; colour uniform brown. Sculpture: first whorl and a half smooth; the succeeding whorls sculptured with slanting, distant lamellæ, between which are minor threads crossed by minute scratches; on the penultimate whorl the major lamellæ number over thirty, and on the last whorl exceed forty. Aperture almost circular, columella slightly reflected, lip thin, sharp, mouth unarmed. Umbilicus wide and deep, exposing previous whorls, and about one-third diameter of shell. Diam. max. 2·0, min. 1·8 mm.; alt. 1·5 mm.

Hab.—Sunday Island, Kermadec Group. Living under stones, wood, and dead leaves on the ground.

PARALAOMA AMBIGUA, n.sp. Pl. XVIII, Fig. 5.

Shell small, sub-discoidal, spire little elevated, thin, translucent, last whorl descending, flattened above and periphery semi-keeled;

umbilicus wide; whorls $3\frac{1}{2}$; colour, uniform rich pale brown. Sculpture as in preceding species, but the lamellæ more distant and sharply defined with clearly marked minor threads, four to six between, and cross scratches obsolete; the lamellæ number less than twenty-five on the penultimate, and less than thirty on the last whorl. The aperture somewhat more quadrate than in the preceding species, whilst the umbilicus is slightly narrower; compared with the above it is flatter, paler, and more sharply sculptured. Diam. max. 2·1, min. 1·9 mm.; alt. 1·1 mm.

Hab.—Sunday Island, Kermadec Group. Living under stones, wood, and dead leaves on the ground.

Genus Flammulina, Martens.

Flammulina, Martens, Critical List, New Zealand Mollusca, 1873, p. 12.

Type (by subsequent designation by Suter), *Helix compressivoluta*, Reeve.

Pilsbry divided his family Endodontidæ into two genera, *Endodonta* and *Flammulina*, the former being possessed of no caudal mucous pore, such being present in the latter. Mr. Suter, to whom Pilsbry was most indebted for his knowledge of the New Zealand molluscan fauna, had, however, issued the warning (Ann. Mag. Nat. Hist., vol. xiii, p. 64, 1894): "I do not attach very great importance to the presence or absence of the caudal gland, as we really do not know its true significance."

Subsequently Suter, in the *Index Faunæ Novæ Zealandiæ*, 1904, p. 62, retained his own family Phenacohelicidæ, including as genera (?) *Flammulina*, *Suteria*, *Phenacohelix*, *Therasia*, *Pyrrha*, *Allodiscus*, *Gerontia*, *Carthæa*, *Thalassohelix*, and *Phacussa*.

Hedley in recent papers seems to have utilized *Flammulina* in the Pilsbryan sense, but there seems to be ample room for subdivision from a criticism of the species he has allotted to *Allodiscus*, for instance, in the Tasmanian fauna.

The type of *Flammulina* is characterized by few whorls, somewhat rapidly increasing, and an oblique mouth, whose breadth is greater than its depth. Whatever sculpture is present is fine, and the costulæ are more or less evanescent in similarly shaped shells. According to Suter the jaw is characteristic.

A more scientific treatment would be the recognition of a family Flammulinidæ, and then the sections would be raised to the rank of genera and the relationships of the species denoted by means of these generic names. Thus Hedley in his recent *Index to the Land Shells of Victoria*—written in conjunction with Cox, but the classification would seem to be referable to Hedley—has included species of *Flammulina*, but the figures of *F. Fordei*, Brazier (Mem. Nat. Mus. Melb., No. 4, pl. ii, figs. 13–15, 1912), *F. elenescens*, Cox & Hedley (ibid., pl. iii, figs. 16–18), and *F. meraca*, Cox & Hedley (ibid., pl. iii, figs. 19–21), portray shells having very different shell characters. If these had been placed in different genera we might have had a clue to their relationship other than that afforded in the description, without the examination of all recorded species of *Flammulina* and *Endodonta*, for the latter is also necessary through the acceptance of the spirally striated nuclear whorls as characteristic of *Allodiscus*, considered as a sub-genus of *Flammulina*. In the following cases I refer one species to *Calymna* on account of its ~~co~~stulate appearance, whilst the other I simply call *Flammulina*, *sensu lato*, as my studies have not yet enabled me to place it. When Suter (loc. cit.) gave his experience with regard to the examination of Tasmanian molluscs, he concluded that the majority of Tasmanian '*Flammulinæ*' belonged to *Gerontia*, but I note that Cox and Hedley have replaced some of these in *Endodonta*, where, judging from shell characters, they seem more happily located. *Endodonta*, however, seems, as regards species with armed aperture, very rare in Australia, whilst it also appears doubtful whether typical *Charopa* has yet been recorded. The delimitation of genera would certainly make these points more obvious.

FLAMMULINA MISERABILIS, n.sp. Pl. XVIII, Fig. 4.

Shell minute, thin, sub-conical, spire slightly elevated, sutures deep, umbilicus narrow. Colour uniformly pale-brownish fawn. Whorls $3\frac{1}{2}$; first whorl and a half finely spirally striated; succeeding whorls sculptured with fine radial striæ, and between the striæ closely set spiral scratchings. Aperture obliquely lunate, lip thin, sharp. Umbilicus deep and narrow, about one-fifth the diameter of the shell. Diam. max. 1·5, min. 1·25 mm.; alt. ·8 mm.

Hab.—Sunday Island, Kermadec Group. Living on the moss-covered trunks of trees.

CALYMNA ARBORICOLA, n.sp. Pl. XVIII, Fig. 3.

Shell small, sub-discoidal, thin, fragile, umbilicus narrow. Whorls $3\frac{3}{4}$, somewhat rapidly increasing, sutures well marked. Colour pale fawn with darker red-brown flammulate markings. Sculpture: first whorl and a half, constituting the protoconch, finely spirally striated; the succeeding $2\frac{1}{4}$ whorls radially sculptured with closely set, low, evenly spaced riblets, about eighty being counted on the first adult whorl, minute threads intervening between each; on the following whorl the riblets and threads become almost inseparable, and about one hundred major riblets can be noted in most specimens, with two or three minor ones clearly marked between and almost as prominent; in some shells the major ones disappear on the last quarter whorl, and this consequently appears smoother in comparison. Aperture oblique, somewhat lunate ovate, columella reflected. Base rounded, umbilicus deep and narrow, about one-sixth the diameter of the shell. Diam. max. 2·6, min. 2·2 mm.; alt. 1·25 mm.

Hab.—Sunday Island, Kermadec Group. Living on the moss-covered trunks of trees.

HELIX CHIMMOI, Pfeiffer.

In the Proc. Zool. Soc. Lond., 1856, Pfeiffer described two shells supposed to have come from Sunday Island, Kermandec [*sic*] Group. The first (p. 326) was called *Helix Kermandeci*, and has since been recognized from Sunday Island. The other was called *H. Chimmoi*, and both were received from Lieutenant Chimmo, whom I have suggested may have been one of the officers of the H.M.S. *Herald.*

I took with me to Sunday Island copies of all the descriptions of the known Kermadec shells, and I could find nothing on the island answering at all to the description of *H. Chimmoi.* In the British Museum I found specimens of the shell I have called *Ptychodon pseutes* so labelled, and concluded they must be the original specimens, though they disagreed with the original description as to size. I have, however, now found specimens which bear the label *H. Chimmoi*, and which someone has marked 'Type', and which agree with the Pfeifferian description. I have carefully examined them and would now suggest that the locality is quite erroneous. They are quite unlike anything I have collected, and though I do not claim to have absolutely obtained every mollusc, I cannot think that such a large and conspicuous form should have escaped me. My suspicions seem further confirmed in that two species about the same size were contained in this typical lot, and the other one is also quite unrepresented in my collection and is quite as unfamiliar as the typical *H. Chimmoi.*

Patula modicella, Férussac, var. *vicinalis*, Mousson.

In the Journ. de Conch., vol. xxi, p. 112, 1873, Mousson described as from Sunday Island, Kermadec Group, a shell he compared with *P. modicella*, Férussac, and only gave it varietal rank, but doubted that it might be regarded as specifically distinct. He wrote: "Ces différences consistent avec une forme générale assez analogue, en des tours un peu plus arrondis," and his measurement read "diam. 3; alt. 1·2 mm."

Here, again, nothing agreeing with this description was found, though the shell I have called *Ptychodon Royanus* suggested itself by its size. Comparison with *Patula modicella* showed that this had no relationship and could never be contrasted, and no other shell measuring anything like 3 mm. was found.

What can be the solution of these extraordinary puzzles? I have recorded our search for *Helicarion Kermadecensis.* Can it be that both *Helix Chimmoi*, Pfr., and *Patula modicella vicinalis*, Mousson, have been exterminated or likewise driven to some last undiscovered stronghold? The suggestion seems preposterous, so that I simply record here the facts that shells supposed to have been collected by Macgillivray and Graeffe were not found by me, though I should think I made much more extended and diligent search than either of my predecessors. Can it be that either of these shells were collected on one of the outside islands and characterize the former molluscan faunula of the group?

Genus Pronesopupa, nov. gen.

The small shell for which I propose the above name has greatly perplexed me. It can be shortly characterized as a *Nesopupa* without any apertural armour. When Pilsbry wrote upon the Pacific Pupoid Shells (Proc. Acad. Nat. Sci. Philad., 1900, pp. 431–3) he introduced

Nesopupa (p. 432) for the shells previously named *Pagodella*, H. and A. Adams, and *Ptychochilus*, Boettger, both these names being preoccupied. Pilsbry's diagnosis reads—

"Small, dark brown, opaque and lustreless; ribbed, costulate or striate, the aperture armed . . . , lip expanded.

"Type, *N. tantilla*, Gld. This is *par excellence* the Polynesian type of *Pupa*. A number of sections may perhaps eventually be distinguished, but only one seems to have any foundation in nature. This may be defined thus:

"*Nesopupa*, s.s. Peristome discontinuous above; palatal folds of moderate length.

"*Lyropupa*, n.sect. Peristome continuous; upper palatal fold very long; shell strongly costate.

"Type, *N. lyrata*, Gould."

The species here described resembles *Nesopupa* in shell characters, but the unarmed mouth easily separates it. Moreover, it is not "opaque and lustreless" as I understand those words. I would rather describe some specimens as "semitransparent and somewhat glossy". I have little doubt, however, that my genus will be later degraded, as some specimens of *Nesopupa* I have examined show that the teeth grow with age and are absent in the juvenile stage. These species, however, differ somewhat from the type of *Nesopupa*, and the series may not be congeneric, whilst they cannot be allotted to *Lyropupa*.

Pronesopupa senex, n.sp. Pl. XVIII, Figs. 1, 2.

Shell minute, pupoid, dextral, few whorls. Colour brown. Whorls 4; the first whorl and a half smooth; the succeeding whorls have a sculpture of distant sharp lamellæ, the intervening spaces threaded with striæ; in some shells the lamellæ are obsolete, or only occur on the last half whorl, whilst in others they regularly appear on each whorl; on the last whorl about a dozen can be counted, either indistinct or very prominent. A narrow deep umbilicus is present. The columella is straight and reflected; aperture discontinuous, almost circular, with the outer lip reflected and expanded. In general shape the specimens vary, some being more loosely coiled than others which have a humped-up appearance. Height 2, breadth 1·25 mm.

Hab.—Sunday Island, Kermadec Group. Living on tree-trunks, not moss-covered, and hiding in the crevices of bark in dry weather.

No species, in any way allied to this, has yet been recorded from New Zealand, though I have seen very similar shells with the mouth fully armed from Fiji. Nothing of this nature has yet been found on Lord Howe Island, but the species named *Vertigo norfolcensis* by Sykes, from Norfolk Island, is referable to *Nesopupa*; it is, however, very much larger and sinistral.

Family Tornatellinidæ.

My systematic notes on the molluscs referred to this family are brief, for the following reason: When I had got together a few notes regarding the synonymy and forms, Pilsbry published in the *Nautilus* (vol. xxiii, p. 122, 1910) a synopsis of the classification of this group as adopted in the *Manual of Conchology*, shortly to be issued. I at once forwarded specimens and notes to Dr. Pilsbry, asking him to make use of them. In the paper quoted, Pilsbry recognized three genera of Tornatellinids: *Elasmias*, nov., with *Tornatellina aperta*, Pease, as type; *Tornatellina*, Pfeiffer, 1842, with *T. clausa* = *bilamellata* (Anton) as type; and *Tornatellides*, nov., with *T. simplex*, Pease, as type.

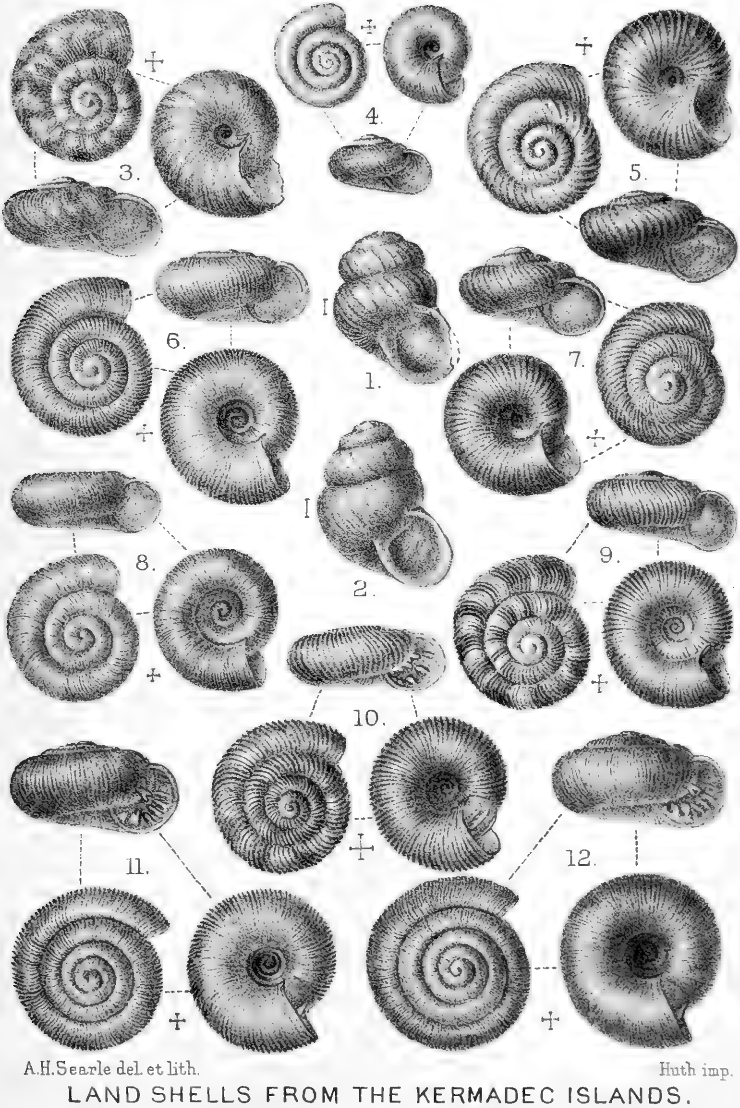
The introduction of the first-named genus seemed necessary to me from a study of the animal and shell characters of the mollusc mentioned as *T. inconspicua*, Brazier, in the earlier part of this paper. The fact that this mollusc was only found in one place on the low-lying part of the island nearest the present and former dwelling-places of the few settlers, led me to suggest its recent introduction to this faunula. Its recognition as identical with a Lord Howe mollusc, rare or apparently of restricted habitat under similar conditions, seems to confirm my conclusion, whilst, as pointed out to me by Mr. Hedley, the figures of *T. eucharis*, Brazier, and *T. Wakefieldæ*, Cox, approach this and may refer to the same species. I have recognized five species, two of which are ground-dwellers and three tree-dwellers.

The *Elasmias* would appear to be constantly a plant-living genus, as I note that when Benson described his *T. cernica* (certainly referable to this group) he noted (Ann. Mag. Nat. Hist., ser. II, vol. vi, p. 254) "creeping in showery weather on the leaves of Niccioli hedges". One of the tree-living species has the armature of the mouth closely agreeing with that of *T. bilamellata*, Anton, whilst in the other it is very slender. The two ground-dwelling forms are very different, one being a conical straight-sided form, the other being probably the one recorded as *T. novoseelandica*, Pfeiffer. In these Proceedings, vol. viii, p. 263, pl. xi, fig. 30, 1909, Suter described *T. subperforata* and observed: "The inflated body whorl, the straight, not tortuous, columella, and the narrow perforation separate it at once from *T. novoseelandica*, Pfeiffer."

When Pilsbry's monograph of these molluscs appears, we shall learn all about these.

4. General Conclusions.

It was anticipated that the collection of Land Mollusca would give some clue as to the relationship of the group, but I do not think any considerable deductions can be drawn from them. As a whole, their affinity is undoubtedly with the forms of the North and not with those of New Zealand. It must never be forgotten that New Zealand has been well searched for minute land molluscs, and has a great area with variable climatic conditions, as well as being most favourably disposed for the rapid differentiation of these minute forms through isolation. The northern islets have still innumerable minute forms to be brought to light, and not until much more is known can anything very definite be decided. The negative evidence afforded by this collection is, however, of much interest, and may be briefly glanced at. The faunulas and flora of the Kermadec Group has been



A. H. Searle del. et lith. Huth imp.

LAND SHELLS FROM THE KERMADEC ISLANDS.

generally compared and contrasted with those of Norfolk Island, Lord Howe Island, and New Zealand, whilst recent evidence points to its great distinction. It is unfortunate that the land molluscs of Lord Howe Island are unknown as regards the minute forms, and although a fairly representative collection was obtained by Macgillivray at Norfolk Island, it remained unexamined until quite recently. It was, however, then studied by Sykes (Proc. Malac. Soc., vol. iv, p. 139 seq., 1900), who observes: "As pointed out by Professor Tate and others, the faunal relationship of Norfolk Island lies rather with New Zealand and Lord Howe Island than with the Australian Continent." This conclusion is so contrary to the nature of the molluscs recorded by Sykes, that it is quite impossible to explain it. To take Sykes' own generic dispositions, he admitted fourteen genera, including twenty-six species, and of these fourteen only five have been recorded from New Zealand. Of these five one is the Polynesian *Endodonta*; the second is *Charopa*, to which the Norfolk Island species are questionably referred and which is also Polynesian; the third and fourth, *Omphalotropis* and *Diplommatina*, which are typically Polynesian, have only one representative each in the north of New Zealand, the latter a very doubtful record; this leaves the fifth, *Carthæa*, which is an endemic New Zealand genus, but here the Norfolk Island shell does not seem correctly placed. What a hindrance to the zoogeographer must prove such an erroneous statement as that put forward by Sykes is only known to those interested! It would be quoted by many not conversant with molluscs, and who would depend upon Sykes' reputation as a conchologist for the correctness of his conclusions.

I have fortunately been able to examine a large quantity of material from Norfolk Island, and its extraordinary distinction from New Zealand forms is so markedly noticeable as to cause much wonderment as to its origin. Its distinction from that of the Kermadec Island is only emphasized by the finding of a species on each group closely allied. The genus *Fanulum*, which I have introduced for *Trochonanina exposita*, Mousson, apparently includes *Medyla insculpta*, Mousson, and *M. imitatrix*, Sykes, as well as a third undescribed species, all from Norfolk Island. Mr. Gude, however, who suggested the name and pointed out the differences between this genus and *Medyla* would include in its limits *Thais*, Homb. & Jacq., from the Solomon Islands and *rectangula* from the Marquesas. This at once discounts the affinity of the Kermadec with the Norfolk Island forms of the genus. As noted above, no minute forms are yet known from Lord Howe Island, but the general aspect of that molluscan faunula is just as distinct from that of Norfolk Island as the New Zealand one has been shown to be. As Hedley pointed out, the Lord Howe land Mollusca show most affinity with those of New Caledonia, the presence of *Placostylus* being most suggestive.

Now, the Kermadec faunula is characterized by the entire lack of any molluscs of appreciable size, whereas such do commonly occur in New Zealand (as *Placostylus*, *Paryphanta*, *Rhytida*, etc.), Lord Howe Island (as *Nanina*, *Placostylus*, etc.), and Norfolk Island (as *Fretum*, *Rotula*, etc.). It is conceded that Lord Howe Island has a relationship with New Caledonia in the same manner as New Zealand has through *Placostylus*. It is obvious that Norfolk Island, from the absence of *Placostylus*, does not enter into the same chain, whilst the predominance of the *Fretum* group points to a relationship of Norfolk Island with the Solomons and the Fiji Islands. There is nothing in the Kermadec Mollusca that is distinctive in the same manner as the *Placostylus* and *Fretum* are. The general character of the minute species of the Kermadecs differs from that of most northern groups in the absence of *Omphalotropis* and *Diplommatina*, which both occur on Lord Howe and Norfolk Islands, and seem to just reach New Zealand. It would follow, then, that these genera did not arrive at New Zealand via the Kermadecs. The presence of Tornatellinids on the Kermadecs points to their easy colonization of the Pacific groups by means of drift or other conveyance. I feel certain that *Elasmias* has very recently settled on the Kermadecs, and also on Lord Howe Island. The Endodontoid shells show as much relationship with those of Polynesia as they do with New Zealand forms, whilst the Pupoid shell I have called *Pronesopupa* is Polynesian, no such form having yet been found in New Zealand. The species for which I have proposed the genus *Paralaoma* does not seem as yet to have relations recorded from New Zealand, though I consider the Australian *morti*, Cox, to be absolutely congeneric. This species has apparently a wide range in Australia, being recorded from Tasmania, Victoria, New South Wales, and South Australia. The *Helicarion* certainly came from the North, since no representative of this genus occurs in New Zealand, nor does it occur on Lord Howe or Norfolk Islands.

In view of the known molluscan faunulæ of New Zealand, Fiji, New Caledonia, Lord Howe, and Norfolk Islands, the whole facies of the Kermadec land Mollusca suggests the entire extinction of the faunula comparative with those named, and the re-peopling of the group by means of drift, and that the drift has been from the North. When the Northern groups have been thoroughly searched a more accurate comparison will be able to be made.

EXPLANATION OF PLATE XVIII.

Figs. 1, 2. *Pronesopupa senex*, n.sp.
,, 3. *Calymna arboricola*, n.sp.
,, 4. *Flammulina miserabilis*, n.sp.
,, 5. *Paralaoma ambigua*, n.sp.
,, 6. *Charopa Macgillivrayana*, n.sp.
,, 7. *Paralaoma Raoulensis*, n.sp.
,, 8. *Charopa exquisita*, n.sp.
,, 9. ,, *pseudanguicula*, n.sp.
,, 10. *Ptychodon Royanus*, n.sp.
,, 11. ,, *amandus*, n.sp.
,, 12. ,, *pseutes*, n.sp.

DEFINITIONS OF FURTHER NEW GENERA OF ZONITIDÆ.

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

Read 13th June, 1913.

On two previous occasions I have published in these Proceedings some notes on preoccupied generic names in the Zonitidæ. My further work in classifying this division of Gastropods has brought to light some instances of genera containing more or less heterogeneous assemblages of species, and it has been thought expedient meanwhile to revise these groups.

The first case is that of *Trochonanina*, a genus established by Mousson[1] for a somewhat numerous group which he considered should be separated from *Trochomorpha*, and which should include, besides the new species—*Trochonanina Schmeltziana*—he was describing at the time, *conus*, Phil., *rectangula* and *insculpta*, Pfr., *argentea*, Rve., *Calabarica*, *Labuanensis*, and *Mozambicensis*, Pfr., *conicoides*, Metc., *lychnia*, Bens., etc. This incongruous assemblage of species from widely separated regions, i.e. East and West Africa, the Mascarenes, the Malay Archipelago, and Oceania, it is impossible, according to our present views of generic limits, to retain in one genus, and several of them have, in fact, already been assigned to other genera. Thus *argentea*, Rve., has been classed in *Rotula* by Nevill,[2] *insculpta* of Pfeiffer has been referred to *Medyla* by Suter.[3] The type of *Medyla* being *Vitrina viridis*, Quoy, from the Philippine Islands, *insculpta* will require to be placed in another genus, but Mr. Iredale is dealing with this question, and I merely allude to this *en passant.*

Calabarica, Pfr., was classed by Bourguignat in *Moaria*,[4] while finally *Mozambicensis*, Pfr., was made the type of the genus *Martensia* by Semper.[5] Möllendorff, in creating the genus *Coneuplecta*[6] for the reception of *scalarina* (type), *confusa*, Mölldff., *rotundata* and *turrita*, Semp., proposed to include *Tongana*, Quoy, and *Schmeltziana*, Mouss. He referred to the fact that Pfeffer[7] had restricted *Trochonanina* to *radians*, Pfr., and *Schmeltziana*, Mouss., and that *Coneuplecta* was consequently synonymous with *Trochonanina*, as understood by Pfeiffer. For that reason he thought it advisable to suppress Mousson's name and to give a new name to the group of *conicoides*, but did not do so. I do not, however, consider that the Philippine species referred to are congeneric with the Pacific forms, and while it is perfectly true that Mousson did not specify a type, the fact that he had before him and was describing *T. Schmeltziana* is sufficient to enable us to fix that species as the type of *Trochonanina*, as was pointed out by

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1 Journ. de Conch., vol. xvii, p. 330, 1869.
2 Hand List Moll. Indian Museum, vol. i, p. 43, 1878.
3 Proc. Malac. Soc. Lond., vol. iii, p. 330, 1899.
4 Moll. Afrique Équat., 1899, p. 14.
5 Reisen Arch. Philippinen, vol. iii, p. 42, 1870.
6 Ber. Senckenb. Ges., 1893, p. 64.
7 Abh. Ges. Naturw. Hamburg-Altona, vol. vii, pt. ii, p. 22, 1883.

Lieut.-Colonel Godwin-Austen,[1] who suggested retaining the Pacific Island shells in that genus. With regard to *conicoides*, he stated that the animal belongs certainly to the Zonitidæ. Möllendorff subsequently[2] came to the conclusion that another name was available for the group of *conicoides*, i.e. *Dendrotrochus*, proposed by Professor Pilsbry as a sub-genus of *Papuina* for *Helix helicinoides* and its allies, which Mr. Hedley has proved,[3] however, to have affinity, not with *Papuina*, but with *Trochomorpha*. Under these circumstances I think we are justified in retaining the genus *Trochonanina*, taking *T. Schmeltziana* as the type, and in giving a new designation to the group of *conicoides*, from which I propose to dissociate *conus* and *multicarinata*.

Eurybasis, nov. gen.

Shell conoid or depressed conoid, imperforate, whorls increasing slowly; upper surface striated, generally with a few spiral liræ near the lower suture, but in some species the whole surface is spirally decussated; base finely striated, more or less excavated round the umbilicus. The margins of the aperture slightly thickened and reflexed.

Type, *Helix conicoides*, Metc.

The genus appears to have its centre of distribution in Borneo, twelve species being known from that island, while a single species is recorded from the Malay Peninsula, and another, referred to the genus with some doubt, occurs in Celebes.

Chiroktisma, nov. gen.[4]

Shell trochiform, imperforate, whorls flattened; upper surface covered with numerous raised spiral liræ; lower surface shining, finely striated transversely; margins of aperture acute, not reflexed.

Type, *Helix conus*, Phil.

H. multicarinata, O. Boettger, is cogeneric. The genus appears restricted to Java. The type much resembles *Trochomorpha coniformis*, Fér., except in the imperforate umbilicus.

Tegumen,[5] nov. gen.

Shell trochoid, narrowly umbilicated, spire concave; whorls flattened, strongly ribbed above, finely striated below, the striæ crossed by close microscopic spirals; acutely carinated, the keel pinched.

Type, *Helix petasus-chinensis*, Heude.

This species, from the valley of the Blue River, Southern China, does not appear to assimilate with any other species known to me. The genus may provisionally be placed with the two preceding in Ariophantinæ.

The next group comprises a number of species from the Marquesas, the Friendly, and the Society Islands, some of which have been

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[1] Proc. Malac. Soc. Lond., vol. i, p. 283, 1895.
[2] Nachr. Deutsch. Malak. Ges., 1897, p. 5.
[3] Records Australian Museum, vol. ii, p. 90, 1893.
[4] χείρ and κτισμα, a hand-creation, suggesting engine-turning.
[5] A covering, in allusion to the hat-like shape.

referred by various authors to *Trochonanina* or to *Microcystis*. For this I propose the name of—

DIASTOLE,[1] nov. gen.

Shell conoid, imperforate; whorls convex, angulate or keeled at the periphery, finely striated, the base densely covered with microscopic spirals; the columellar margin provided with a tooth or callus.

Type, *Helix conula*, Pease.

I would class the genus with *Trochonanina*; it is probably viviparous, since in one of the species (*conula*) embryos were observed inside the shells. The following species are included: *subconula*, Pease; *subvenosa*, Ancey; *angulifera*, Mouss.; *Garrettiana*, Ancey; and *rectangula*, Pfr.

The last genus to be proposed is monotypic—

ADVENA,[2] nov. gen.

Shell depressed conoid, imperforate; whorls increasing rapidly, planate above, tumid below, keeled at the periphery, coarsely and unevenly ribbed or wrinkled above, the earlier ones with the ribs decussated by about six spiral sulci which gradually become lost or indistinct on the later whorls, the decussation descending below the periphery and terminating rather abruptly, beyond which the base is smooth and polished.

Type, *Helix Campbelli*, Gray, from Norfolk Island and Phillip Island.

The present genus appears to me to have some affinity with *Fijia* and *Hemiplecta*.

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[1] διαστολή, a difference. [2] A stranger.

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A † is prefixed to the names of fossil species.

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