

# RECORDS OF THE WESTERN AUSTRALIAN MUSEUM AND ART GALLERY.

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VOLUME II.

PART I.

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## A REVIEW OF THE LAND MOLLUSCA OF WESTERN AUSTRALIA.\*

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Forty odd years ago E. A. Smith of the British Museum published an account of the land shells of Western Australia, and since then numerous additions are available for record, and the present essay brings our statistical knowledge down to date. Twenty years ago Hedley listed the species, then known, in his Preliminary Index but no detailed revision was attempted. It must be emphasised that this review is intended to serve as a basis for Western Australian workers, and consequently most attention has been paid to the taxonomy and discrimination of the named forms. It is important in this group to know the topography, geography, geology and botany, a combination I have termed Geozology, of the State to define exactly the status of the molluses collected, all these factors being of definite influence in the evolution of the mollusc. It may be pointed out that in over one hundred years of history of the State no local naturalist has made any major contribution to our knowledge of this group though probably no more profitable group could be selected, the problems being innumerable and all of them interesting. Smith noted "The report is limited to those species occurring west of long. 129°E., the boundary line between West Australia and South Australian territory. Its extreme length from north to south is 1,250 miles and 800 from east to west, and it embraces an area of 1,000,000 square miles." The limits given are those of Western Australia, as politically known, but the area does not agree with that provided by the W.A. Government, which in the Year Book before me reads 975,920 square miles. I have indicated the natural divisions of Australia as shown by the Land Mollusca, and it will be seen from the map here reproduced that within the unnatural political boundaries of Western Australia three faunulae are represented, two restricted and one intrusive element. The Autochthonian Faunula restricted to the south-west corner, termed the Leeuwinian Area, is characterised by the very peculiar Bothriembryontid development. With it are a few Endodontids, the only Helicarionid west of Victoria, and a (perhaps) Rhytidid, no Helicids save through intrusion. On the other hand the north-west part of Australia, called the Dampierian Sub-Area, is inhabited by a Caurine Faunula which is of very peculiar facies related to the molluscan fauna of

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the East Indies rather than with that of the adjacent territories. These are peculiar Helicids, and no Bothriembryontids occur save as stragglers into the southern point. There is no *Helicarion* and no Rhytidid while the so-called Chloritids are peculiar, and two Microcystids occur. These two faunulae are very peculiar in their composition, and the third is that of the Centralian Area, known as the Eremian or Eyrean Faunula, an intrusive series. This faunula ranges across the whole of the centre of Australia and runs into the south-west, meeting members of the Autochthonian Faunula. It further reaches the coast to the north of the Leeuwinian Area, but so far it has not been recognised in connection with the Caurine Faunula. This inland area of Western Australia has not been explored for molluses so that probably many species exist. While these may be related to the known members of the Eremian Faunula it is possible that the novelties may offer shells of different form.

Possibly the vegetation will offer most assistance and in this respect "The Soils of Australia in relation to Vegetation and Climate" (Commonwealth C.S.I.R. Bulletin No. 52, 1931) by Prescott is worthy of intensive study. Examination of the vegetation map therein included suggests that the groups of Bothriembryontid molluses are distributed in accordance with the botanical data.

The following account as to the rainfall, the most important item in the life history of a snail, is taken from an official source. The rainfall varies throughout the South-West division, ranging from an annual average of 50 inches in the heavily timbered portions of the coastal districts to 18 inches at Geraldton and nearly 10 inches at Yalgoo, from 36 inches at Albany to 14 inches at Israelite Bay, and from 44 inches in the Darling Ranges to 21 at Toodyay, 16 at Northam, and 10 at Southern Cross. A similar diminution occurs eastward of Bunbury, starting with a register of 37 inches. The climatic conditions are vastly different in the tropical parts of Western Australia. Heavy tropical rains fall from the end of November to the end of March, with rarely a wet day during the rest of the year. For instance the average at Wyndham is nearly 27 inches of which  $24\frac{1}{2}$  fall in November to March, another  $1\frac{1}{2}$  in October and April, the total from May to September inclusive being less than 1 inch. On the other hand that of Perth is only 34 inches, December, January, February averaging nearly  $\frac{1}{2}$ -inch each month, April and May nearly 1 inch each while May, June, July and August have from 5 to 7 inches each month. The rainfall at Albany is a little lighter in the winter months, but a little heavier in the summer, totalling a little more than 39 inches in the year. In this connection it may be recorded that apparently most Western Australian snails develop a strong epiphragm for use during the long dry spells.

I have long hoped to provide a ground work for students of Australian land-shells as these are very abundant, varied in form and scientifically very valuable. To this end I have published A Basic List of the Land Mollusca of Australia in the Australian Zoologist (Vol. VIII., pp. 287-334, Mch 12, 1937; Vol. IX., pp. 1-39, pls. I-III, Nov. 12, 1937; and Vol. IX., pp. 83-124, pls. XII-XIII, Nov 30, 1938). I later prepared "An Annotated Check List of the Land Shells of South and Central Australia" which has appeared in the South Australian Naturalist (Vol. XVIII., pp. 6-57, pls. I-II, September 30, 1937). The present essay leaves Queensland and New South Wales to be as completely treated, and these I have in hand now. No section, however, provides the delightful complications present in the Western Australian



Fauna and I have to thank sincerely Mr. L. Glauert for the opportunity of examining so much material.

My thanks are also here tendered to my colleagues, Miss Joyce Allan, who has prepared the excellent drawings which accompany this report, and Mr. G. C. Clutton for the photographs of the Bothriembryontid forms.

## I.—HISTORICAL ACCOUNT.

While it be possible that some of the earlier visitors such as Vlaming, Pelsart, Dampier or Vancouver may have carried back landshells to Europe, the first real note was made by Peron in 1807 who recorded that on June 29, 1801, at Bernier Island, also Dorre and Dirk Hartog's Islands, in Shark Bay, "Two species of landshells extremely numerous, but all dead, occupied great stretches of the interior of the island, one was a small species of *Helix*, the other belonged to the genus *Bulimus* of M. de Lamarck."

Thus from this source Ferussac included in his *Prodrome* *Helix costulata*, *H. melones* and *H. torulus*. The former was not described and figured but localised as "Le port du Roi George, Péron: la baie des Chiens-Marins, Gaudicho," the second as "La Nouvelle-Hollande," the last as "La Nouv.-Hollande, voyage de Péron." It will be noted that another collector Gaudicho (Gaudichaud) is here mentioned. C. Gaudichaud was apothecary on the *Uranie*, on which vessel Quoy and Gaimard were the naturalists: this vessel visited Shark Bay September 12-27, 1818, and was shipwrecked at the Falkland Islands on its way home and the collections made lost; but apparently Gaudichaud managed to save some of his treasures. Lamarck published with a description in 1822 *Bulimus inflatus* citing as synonymous Ferussac's *H. costulata*. Another species named and figured by Ferussac, *Helix prunum*, and whose locality was given as "Les Terres Australes, voyage de Péron" has been credited to Western Australia, but examination of the figure suggests an Eastern Australian form. Then the English explorer Captain P. P. King, who was very interested in natural history, collected land-shells at King George's Sound on January 20, 1818. Gray, of the British Museum, described a species naming it after King in 1825, King's own account not being published until 1826. In the latter year the "Astrolabe" another French exploring vessel, was in Western Australian waters, and the brilliant and enthusiastic naturalists Quoy and Gaimard were on board, intent to make up for their losses in the *Uranie* shipwreck. The land-shells secured were this time safely taken to Paris and were carefully described and beautifully illustrated in one of the most splendid works on natural history yet issued.

An unknown collector, probably Robert Brown, provided Gray of the British Museum with some material, and it has only recently been recognised as coming from the Recherche Group. A little later a German collector, Dr. L. Preiss, visited South-West Australia in 1839-40, and Menke issued an account of the mollusca in 1843. At the same time Gilbert, the famous ornithological assistant of Gould, secured some shells and these were transferred to the British Museum by Gould, and have been regarded as having been collected by that gentleman, who, however, never reached Western Australia during his famous travels. Simultaneously Captain Stokes was exploring the West Coast and he and his men were notable collectors, Dring, Wickham and Ince all coming under notice in connection with land-shells. Unfortunately the exact localities were not preserved by those to whom the shells passed and thus in some cases it has been a matter of great difficulty in determining these at the present time. It must be remembered that this was the day of sailing vessels which called in and sheltered at places not now commonly resorted



to, but when intensive collecting is carried out it may become easy to fix the exact place as the species are comparatively well defined.

When Eyre crossed from South to West Australia he noted shells scattered about on the ground but that does not concern us as none appears to have been collected. It must be recalled that he was succoured by Captain Rossiter of the French whaler *Mississippi* on June 2, 1841. That particular captain happened to be a very zealous amateur conchologist, and later settled in Sydney, when the well-known professional conchologist John Brazier married his sister. Later Brazier circulated shells collected by his brother-in-law, who had secured them on the islands of the Recherche Archipelago when whaling about them.

Until this date all the species had been described in Europe, and a few collected by Dr. Bacon in the Swan River Settlement were named by Benson, but now Australian conchologists became qualified, and Cox, Hedley, Angas, Brazier, Tate and Hedley have all made additions to our knowledge. Still the spell of the extralimital worker held, although he was ignorant of local conditions and heedless of geography and history. Thus E. A. Smith in the *Zoology of the Voyage of the Erebus and Terror* dealt with two plates (that had been prepared for Stokes) under the impression that they had something to do with that voyage. Fortunately the species figured were so distinct that he could not make many mistakes, but he managed to confuse matters a little. Smith, however, assisted our study, when he prepared the first complete account of Western Australian land-shells based upon a collection made by the well-known entomologist, J. J. Walker,\* when he was chief engineer on H.M.S. *Penguin*, surveying off the North-West coast of Australia. It is unfortunate for Australian students that Walker's collection was made on almost inaccessible islands, but his discoveries opened a new vista for the forms were of novel facies and now provide the most intriguing problem in our science.

W. W. Froggatt, a professional entomological collector, went to Derby and explored the Napier and Oscar Ranges, and brought back some twenty species of land and fresh-water molluscs. Some of these were described by Cox and others by the great French conchologist Ancy, but no complete study of the collection was attempted. The bulk went into the Macleay Museum and has been here utilised. Years later Dr. Herbert Basedow went into the Napier Ranges, and an excellent collection was briefly recorded by Hedley. The dominant Western Australian group, *Bothriembryon*, was carefully monographed by Pilsbry, who had much material sent him for the purpose by Cox, but the localities provided by the latter were untrustworthy and misleading. Kobelt, a year later, also catalogued the group, practically following Pilsbry. Some odd species have been named by Fulton, Preston, Gude, Odhner and Thiele. The two latter dealt with collections made by Swedish expeditions to the North-West, and German expeditions to the South-West, respectively.

Mr. Sidney W. Jackson visited Western Australia in 1912, and working in the Bow River district, south coast, made a fine collection which was accompanied by excellent field notes. This series included many novelties and was examined by Hedley but the results were never published. About ten species were secured, all of them new, and suggest great possibilities to some local enthusiast.

The only recent collectors have been Mr. L. Glauert, the Director of the Museum, to whom I am greatly indebted for the opportunity of studying the material in that Museum, upon which this review is primarily based; Mr. F. R. Bradshaw, of Tambellup, and Mr. E. Sedgwick, of Nangeenan, each of whom have sent me very interesting shells.

\* Died February, 1939.



It is my great hope that this account will arouse someone in Western Australia to study their own molluscan fauna, which suggests more problems than almost any other in the world. Prior to Smith in 1894 some thirty-five species had been recorded: in his essay Smith added eighteen, that is half as many again. Hedley listed the fauna in 1915 as eighty, that is almost exactly half as many again. This list has increased the number in a similar proportion, and yet I conclude that the number on record is only a small proportion of the molluscs living. A representative collection will be made available at the Perth Museum for students, and I will be only too pleased to assist any such in any way that I possibly can.

## PHYLUM MOLLUSCA.

### Class GASTROPODA.

#### Subclass PROSOBRANCHIA.

#### Order PECTINIBRANCHIA.

#### FAMILY HELICINIDAE.

Small conical operculates, solid, spire short, whorls flattened, periphery subkeeled, umbilical area covered by a callus pad.

Genus **PLEUROPOMA** Möllendorff 1893.

- 1893—*Pleuropoma* Möllendorff, Ber. Senckenb. Nat. Ges. Frankfurt, 1893, p. 140, July. Orthotype *Helicina dichroa* Möllendorff.
- 1905—*Aphanoconia* Wagner, Denksch. K. Akad. Wissen. Wien, Math. Nat. Class., Vol. LXXVII., p. 388. Logotype Iredale, Austr. Zool., Vol. VIII., p. 291, 1937, *Helicina verecunda* Gould.
- 1905—*Reticulata*, *Sculpta*, *Dichroa* id ib., sectional names only with Tautotypes.
- 1909—*Albocincta* Wagner, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. 18, heft cccxxv., lief 535, p. 169. Tautotype *Helicina albocincta* Hombron & Jacquinot.
- 1909—*Sphaeroconia* id. ib., heft cccxxviii., lief 538, p. 189. Logotype Iredale, Austr. Zool., Vol. VIII., p. 292, 1937, *Helicina sphaeroconus* Möllendorff.

#### **Pleuropoma walkeri** Smith 1894.

Plate I., fig. I.

- 1894—*Helicina walkeri* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 99, pl. VII., fig. 26, June. Queen's, Baudin and Parry Islands, North-West Australia.
- 1909—*Aphanoconia* (*Sphaeroconia*) *baudinensis* Wagner, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XVIII., p. 217, pl. 43, figs. 11-13, as of Smith *errore*, new name for *walkeri* Smith. Baudin Island, N.W.A.

Shell small, depressedly conical, spire short, whorls flattened, last whorl subkeeled, mouth lunate, outer lip slightly thickened, umbilical area covered by a callus which extends across to outer lip. Coloration fawnish with a whitish peripheral band, and sometimes a paler base, some shells unicolor fawn. Apical whorl smooth, adult whorls three and one half, dull, with faint growth striae but no spiral striation. The umbilical pad is



roughened, the columella short, straight, the operculum thick, horny. The specimens before me from Baudin Island, presented by the collector J. J. Walker, are apparently slightly smaller than the type measured by Smith, who gives "Diam. maj. 5, alt. 3.5 mm.": these are about 4 mm. in breadth by 3 mm. in height.

#### FAMILY CYCLOPHORIDAE.

This family does *not* occur in Western Australia, though two species were described by Benson as having been collected at the Swan River by Dr. Bacon. As this collector also worked in India it is apparent that the localities became confused, and the Cyclophorids described originated in India. The names were *Cyclostoma loricinctum* and *C. orbiculatum* Benson, Ann. Mag. Nat. Hist., Ser. II., Vol. XI., p. 106, February, and they were figured by Reeve, Conch. Icon. Vol. XIII., *Cyclophorus*, Vol. XX., sp. 100 and 101, Aug. 1861. They can now be completely dismissed from this fauna.

#### Subclass PULMONATA.

This subclass includes all the land snails save those with an operculum, and as only one of the latter comes into our review, the remaining members of our fauna here follow. Numerous smaller divisions are utilised in classifying this large number.

#### Order STYLOMMATOPHORA.

The subclass is separated into two Orders, but only one is represented in this fauna, but this has been subdivided into many large groups, but as they seem somewhat artificial, only the families are here mentioned.

#### FAMILY VERTIGINIDAE.

This family name was previously used for all Australian pupoid shells, but as now restricted, no representative is yet known from Western Australia, but as the species are very small and difficult to find and so little searching has yet been done in this land it cannot be definitely stated that the family is absolutely absent from the State.

#### FAMILY GASTROCOPTIDAE.

The minute Pupoid shells of Australia were placed in one family in the Basic List, following Pilsbry's Monograph, but upon reconsidering the species in connection with the South Australian forms I regretted that action. I merely noted my objection in my account, but here allocate the Western Australian shells in a more scientific manner. It became quite obvious that we were dealing with diverse stocks, and then it was seen that Pilsbry himself had been dubious of his own action. Steenberg, a European authority, has given an excellent account of the anatomy of these difficult minutiae, and separated the Palaearctic forms into many families. Following this worker, the Australian species would be arranged in four families, and this is much nearer the truth. The few Western Australian species then fall into three families:

Shell very small, pupoid, with small mouth with complex armature;  
species dextral or sinistral.

Gastrocoptidae.

Shell small, but larger than preceding, with no armature in mouth save  
a tubercle or base of shell adjacent to outer lip.

Pupoididae.



Shell very small, stouter than first named, mouth armature not so complex and folds differently placed.

Pupillidae.

Genus **AUSTRALBINULA** Pilsbry 1916.

- 1916—*Australbinula* Pilsbry, Man. Conch. (Tryon), 2nd Ser., Vol. XXIV. (pt. 93), p. II., Dec. 18: id. (pt. 94) pp. 155/166, July 18, 1917.  
 Orthotype *Gastrocopta hedleyi* Pilsbry.

Small Pupoid shells, dextral, rarely sinistral, faintly striate, with the small mouth almost closed by teeth blocking the aperture: a large columellar tooth; on the base of the shell one to three, called the parietal teeth, one of which is generally larger than the others; and on the inside of the outer lip three or four, called palatal, teeth. All the shells are small, up to 3 mm. in length, and must be examined microscopically for differentiation.

***Australbinula wallabyensis* Smith 1894.**

- 1894—*Pupa wallabyensis* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 97, June. East Wallaby Island, Houtman's Abrolhos (Walker).  
 1916—*Bifidaria wallabyensis* Hedley, Journ. Roy. Soc. West. Aust., Vol. I., p. 217 (68 in sep.).  
 1917—*Gastrocopta wallabyensis* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XXIV., pt. 94, p. 171, July 18.

Unfortunately this species has not yet been figured, and no specimens from the Abrolhos are available. Smith described it in great detail as follows: "Shell dextral, cylindrical, pellucid, white, narrowly rimate; whorls five, very convex, sutures profoundly impressed, very obliquely striate, the last whorl ascending at the aperture; spire cylindrical, obtuse to the apex; aperture very small, ringent, one fourth the total length of the shell, furnished with seven unequal teeth (three very small parietals, the middle one largest, one large columellar lamelliform tooth, three large lamelliform palatals); peristome lightly expanded, margins approaching, joined by a thin callus. Length 2.5, diameter 1 mm. *Hab.*, East Wallaby Island, Houtman's Abrolhos (Walker). The teeth of this species are very characteristic, and block up the aperture to a considerable extent. The three parietal are much smaller than the rest, and situated close together, the central one being the largest. That on the columella is large, lamelliform, and prominent. The central palatal tooth is narrow, long, and extends inwards; those on each side of it are shorter, but a trifle more prominent perhaps. *P. Macdonnelli*, Brazier, from Fitzroy Island, N.E. Australia, is a little shorter than this species and has more feeble armature in the aperture." Pilsbry added: "Mr. B. B. Woodward, who has kindly examined the type specimen for me, states that the columellar lamella ascends within. The species is therefore related to the polymorphic *G. larapinta*. It differs by the unusually small aperture (only one-fourth the total length, while in *larapinta* it is at least one-third), and the narrower contour of the shell."

***Australbinula complexa* sp. nov.**

Plate 1. Fig. 7.

Pilsbry (Man. Conch. (Tryon), Ser. II., Vol. XXIV. (pt. 94), p. 170, July 18, 1917) proposed *Gastrocopta larapinta deserti* for a form of pupoid shell, picked out of series sent from Central Australia by Professor Tate as



"mooreana." Various Centralian localities were confused, and Pilsbry added Forrest River, North-Western Australia, an indiscreet addition. However he figured the specimens so that separation is easy. His first measurement of his "*deserti*" is length 2.25, diameter above aperture 1.15 mm., and that agrees with his figure 3 on plate 2, which is here selected as type. His figure 1 shows a more slender shell also without locality.

Mr. E. Sedgwick has sent from Nangeenan via Merredin shells recalling this figure 1 in form, but with the whorls even less rounded and the tip more obtuse. The angular lamella is more pronounced and there is a notable basal fold present. The type measures 3 mm. in length by 1.25 mm. in breadth.

***Australbinula helmsiana* sp. nov.**

Plate 1. Fig. 2.

1917 *Gastrocopta larapinta deserti* Pilsbry, Man. Conch., (Tryon), Ser. II., Vol. XXIV., p. 171, pl. 30, fig. 1, July 18. Specimens only from Forrest River, North-Western Australia (R. Helms).

At the place quoted Pilsbry recorded that these specimens, one of which he figured was "a little larger, 2.5 to 2.55 mm., long, diameter 1.1 mm., or 2.4. 1.2 mm. There is no brownish tint except what may be caused by the dried animal. There is a small infraparietal nodule in some examples, wanting in others. The columellar lamella has a rounded outline and ascends obliquely inward. Lower parietal plica is strong, the upper smaller and far shorter. There is no basal fold. The lip expands broadly." Shell minute, cylindrical, dextral, whorls round, sutures deep, spire obtuse, sculpture delicate oblique striae, mouth with outer lip expanded, aperture with intrusive teeth as noted above.

***Australbinula mooreana* Smith 1894.**

Plate 1. Fig. 4.

1894—*Pupa mooreana* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 97, pl. VII., fig. 25, June. Roebuck Bay, North-West Australia.

1916—*Bifidaria mooreana* Hedley, Journ. Roy. Soc. West Austr., Vol. I, p. 217, (p. 68 in separate).

1917—*Gastrocopta mooreana* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XXIV. (pt. 94), p. 160, pl. 30, fig. 4 (copied from Smith): Vol. XXVI. (pt. 104), p. 230, pl. 24, fig. 6, 7, Nov. 1921: paratypical specimens figured.

"Easily distinguished by the sculpture."

Striae irregular, interrupted by malleation or shallow uneven pitting the parietal lamella is not connected with the angular lamella which is straight, the parietal not very long and only slightly curved. There are only two palatal folds, the lower being larger and almost taking the place of the basal which is missing. The columellar lamella is deeply set and straight. Perhaps nearer *ficulnea* than *Gastrocopta* the angular laminae being present but not connected; this feature may be of value in either connection, hence to indicate this abnormality the new subgeneric name **Westralcopta** is here introduced. Pilsbry's account of paratypes is here added for reference: "The shell resembles *G. larapinta* in contour, but has a special character in the sculpture as seen under the microscope, the striae being made irregular, and in places interrupted by *malleation* or shallow, uneven pitting, producing sometimes a sort of reticulation, not unlike that of some *Nesopupae* (*Indopupa*). The



straight angular lamella joins the lip weakly or scarcely. It *does not connect* with the parietal lamella, which is high but not very long. The columellar lamella is high on the columella, and ascends very slightly inward, being nearly horizontal. There are two short palatal folds, the lower being larger and somewhat more immersed. No basal fold. Peristome reflected and thickened moderately within. Length 2.2, diam. to edge of lip 1.2 mm.;  $5\frac{1}{2}$  whorls."

#### FAMILY PUPOIDIDAE.

The small pupoids assigned to this family are generally larger than the remaining Australian pupoid shells, and are either sinistral or dextral, rather stoutly built, not conspicuously sculptured, and with the mouth rather square the outer lip expanded, and a parietal lamina, which lies adjacent to the junction of the outer lip.

Genus **THEMAPUPA** Iredale 1930.

1930—*Themapupa* Iredale, Vict. Naturalist, Vol. 47, p. 120, November.  
Haplotype *Pupa beltiana* Tate.

The definition above given applies to the Australian members of the family.

**Themapupa contraria** Smith 1894.

1894—*Pupa contraria* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 96, June. East Wallaby Island, Houtman's Abrolhos (Walker).

1916—*Pupoides contrarius* Hedley, Journ. Roy. Soc. West Austr. Vol. I., p. 217 (68 in sep.).

1921—*Pupoides contrarius* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XXVI. (pt. 103), p. 144 (not. pl. 15, figs. 9, 10 *eremicola*), August 4.

As this shell has not yet been figured, and we have no Abrolhos material, Smith's description is reproduced: "Shell sinistral, rimate, fuscous horny, obliquely very finely striate; whorls  $5\frac{1}{2}$ , convex, separated by a deep suture, the last whorl scarcely broader than the one preceding, ascending at the aperture; spire elongate, convex, pyramidal, subglobose at the apex; aperture one-third the total length; peristome white, expanded, margins joined by a thin callus, a tubercle near the insertion of the lip. Length 4.5, breadth 2 mm. Aperture 1.5 mm. long. This species may possibly prove to be the sinistral form of *P. adelaidae* Ad. and Angas, which is only known to me by the description."

*P. adelaidae* is obviously a larger shell, as is *eremicola* with which the present species was later associated.

**Themapupa sinistralis** Pilsbry 1921.

1894—*Pupa pacifica* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 96, June. Cassini I., N.W. Australia (J. J. Walker).

1921—*Pupoides pacificus* form *sinistralis* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XXVI. (pt. 103), p. 144, Aug. 4.

When Smith recorded the East Coast *pacifica* from North-West Australia he noted: "All the specimens from Cassini Island are sinistral; otherwise they resemble the normal form."

Pilsbry, in accepting this determination, observed that numerous specimens from all the other localities admitted furnished dextral specimens alone and recorded the Cassini Island shells as a form *sinistralis*, and this name may be used specifically to keep this shell under review.



***Themapupa lepidula* A. Adams and Angas 1864.**

Plate I., figs. 5 and 5a.

- 1864—*Buliminus* (*Chondrula*) *lepidula* A. Adams and Angas, Proc. Zool. Soc. (Lond.), 1864, p. 38, June 24. Shark Bay, W.A. Fig'd. Cox, Mon. Austr. Land Shells, p. 69, pl. XIX., f. 14, May, 1868, from a painting of the type by Angas.
- 1894—*Pupa lepidula* Smith, Proc. Malac. Soc. (Lond.), 1894, p. 96, June, cites "Cox, op. cit., p. 69 (unfigured)."
- 1916—*Pupoides lepidulus* Hedley, Journ. Roy. Soc. West. Austr., Vol. I., p. 217.
- 1921—*Pupoides pacificus* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XXVI. (pt. 103), p. 141, August 4 (part).

This is a very distinct species judging from Cox's figure of the type which is here reproduced. Pilsbry rather carelessly included it in the synonymy of *P. pacificus*, observing, "It came from well within the known range" of that species, whereas it was well outside. Then he figured a specimen from Forrest River, near Wyndham, which was not much like Cox's figure, and noting that the lip was narrower concludes, "If this proves constant they might be separated as a race *lepidula*."

The original description is here added as no one has collected land-shells at Shark Bay in recent years: "Shell turritid, pupiform, umbilicate, thin, glossy, semipellucid, corneous; whorls 5 strongly convex, longitudinally striate. Aperture rotund-ovate; peristome interrupted, white, broadly reflected; outer lip provided above with a small, white, tuberculiform callus. Length 2, width 1 line. This little species differs from *C. adalaidae* in being semipellucid, shining and of a horn colour. The whorls, moreover, are much more strongly convex."

In view of the fact that species have been confused under the name *pacificus*, it is somewhat amusing to record a recent conclusion. Rensch (Zool. Jahrbuch. (Syst.), Jena Bd. 63, heft I., pp. 1-130, Apl. 12, 1932), led astray by a desire to recognise affinities without regard to local conditions, has proposed to admit one species *Pupoides coenopictus* Hutton, with an old-world range as follows:—

*P.c. coenopictus* Hutton. India, Ceylon, Afghanistan.

*P.c. senegalensis* Morelet. West Africa.

*P.c. connectens* nov. Sumba.

*P.c. pacificus* Pfeiffer. Australia, Islands of Torres Straits.

The idea of introducing a new subspecies, in an amalgam of such a composition, does not seem in accordance with his own theory of widespread "races." These "races" appear to be superspecies of other malacologists.

***Themapupa anapacifica* sp. nov.**

Plate I., fig. 9.

- 1874—*Bulimus pacificus* Smith, Zool. Erebus & Terror, Moll., p. 3, pl. IV., f. 6. Pigeon I. N.W. Australia (Richardson). Not *B. pacificus* Pfeiffer, Proc. Zool. Soc. (Lond.), 1846, p. 31.
- 1894—*Pupa pacifica* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 96, June. Pigeon I., near Wallaby I., Houtman's Abrolhos, West Australia; Roebuck Bay and Baudin I., N.W. Australia (J. J. Walker).



1921—*Pupoides pacificus* Pilsbry, Man. Conch., Ser. 2, Vol. XXVI. (pt. 103), p. 141, pl. 15, fig. 14 only, Aug. 4. Forrest River, East Kimberley District (Richard Helms).

The Western shell has been associated with *pacificus* by Smith, and Pilsbry, although the latter noted the discontinuous distribution, and figured as representative of a North Queensland island shell, specimens from Narrabri, inland New South Wales, Forrest River, West Australia, and apparently only one from Facing Island, almost in the south of Queensland. The last named, as would naturally be concluded, appears to be the nearest to the true *pacifica*. The Forrest River shell is here named. Shell small, pupoid, dextral, whorls convex, sutures deeply impressed, umbilicate, apex obtuse, coloration pale brown, outer lip white. The apical whorls are smooth, the adult whorls obliquely finely striated with threads, in some cases well marked, the mouth rather small. Length 4.25 mm.: breadth 2 mm.

***Themapupa dirupta* sp. nov.**

Plate I., fig. 8.

Mr. W. W. Froggatt collected a few specimens of a pupoid shell in the Barrier-Napier Range, and these break up the "*pacifica*" phantasy.

They are definitely of that association, but also perfectly distinct, being smaller than any of the so-called forms, measuring 3.5 mm. length by 1.5 mm. in breadth. The whorls are flatter than in the previous species though the sutures are deep, the shell darker coloured, the sculpture weaker, the mouth comparatively larger, the shell having a more squat appearance.

This is apparently the first inland representative in Australia of the "*pacifica*" series.

***Themapupa beltiana* Tate 1894.**

Plate I., figs. 3 and 6.

1894—*Pupa beltiana* Tate, Trans. Roy. Soc. South Austr., Vol. XVIII., p. 191, November. Central Australia.

Fig'd Rep. Horn Sci. Exped. Centr. Austr. (pt. II.), Zool., p. 204, p. XVIII., fig. 15, Feb. 1896 (as dextral form of *P. contraria* Smith).

1921—*Pupoides contrarius beltianus* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XXVI. (pt. 103), p. 145, pl. 15, figs. 5, 7, 8, August 4.

Apparently there is definite local variation in this species as well as individual variation, and a good series from Cardanumbi shows all the specimens to be broader than cotypes of *beltiana*. These may be regarded as a subspecies ***T. b. contexta* nov.** The type measuring 6 mm. in length by 2.75 mm. in breadth, some even being broader, whereas the type of *beltiana* was only 4.5 mm. in length by scarcely 2 mm. in breadth, paratypes being more slender still. A series from Nangeenan via Merredin collected by Mr. E. Sedgwick, shows a more conical form than any of Pilsbry's excellent figures, recalling a dextral fig. 9 (*contraria*). The shells are variable in size but all show the same shape, the whorls flatly rounded, the sutures deep, the angular nodule rather small, and may be called ***T. b. asserta*, subsp. nov.**, the type measuring 5.5 mm. in length and 2.5 mm. in breadth.

**FAMILY PUPILLIDAE.**

The usage of northern families for southern shells will probably later be as amusing to our successors as some of our predecessors' work is to ourselves. Nevertheless it is necessary to have some refuge for these waifs, and therefore the above is here used with reservation.



Genus **OMEGAPILLA** Iredale 1937.

1937—*Omegapilla* Iredale, Austr. Zool., Vol. VIII., p. 304, March 12. Orthotype *Pupa nelsoni* Cox.

Small pupoid shells, dextral or sinistral, mouth small, teeth three or four, differently arranged from those of other Pupoids, though obviously correlative.

Hedley placed this in the European genus, *Vertigo*, while Pilsbry includes it in the Palaearctic genus, *Pupilla*, under a section, *Primipupilla*, based on a Caucasian shell, but later discarded this in favour of *Gibbulinopsis* Germain, proposed for an "Enneid" shell from the Island of Reunion.

I reiterate my conclusion that the association of southern Australian Pupoids with those from Europe and South Africa is basically unsound, and should not be recognised by Australian conchologists.

### ***Omegapilla occidentalis* sp. nov.**

Plate I., fig. 10.

1894—*Pupa lincolnensis* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 961, June. Pigeon Island, near Wallaby Island (Dr. Richardson, in British Museum), and East Wallaby Island, Houtman's Abrolhos (Walker).

1916—*Vertigo lincolnensis* Hedley, Journ. Roy. Soc. West Austr., Vol. I., p. 217 (p. 68 in separate).

1921—*Pupilla australis* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XXVI. (pt. 104), p. 218.

Smith remarked "This species is described [by Cox (Mon. Austr. Land Shells, p. 80, pl. XV, fig. 16, May, 1868; Port Lincoln, South Australia)], as having only a single tooth or tubercle in the aperture. The specimens collected by Dr. Richardson and Mr. Walker have a second basal tubercle as indicated in Cox's figure, and a third far within upon the columella. It is possible that in the examples examined by Dr. Cox the denticles were only feebly developed, or they may even have been overlooked, being rather indistinct."

Many specimens from Rottneest I. are much smaller than South Australian *lincolnensis* or *australis*, and have the teeth placed much further back and less noticeable, the parietal tooth most pronounced, the columellar one smaller and more hidden, the basal one well inside.

### **FAMILY SUCCINEIDAE.**

This family is at present allowed a world-wide range, but this is questionable, and recent researches into British forms show distinct groups definable in that small compact area. I have therefore introduced the generic name *Austrosuccinea* for the common southern Australian type as the animal has been shown to differ from that of the northern group whose shell is most like. For a second peculiar Australian group I have proposed *Arborcinea*: both these occur in Western Australia but there may be a third later separated.

Genus **AUSTROSUCCINEA** Iredale 1937.

1937—*Austrosuccinea* Iredale, Austr. Zool., Vol. VIII., p. 307, Mch. 12, Orthotype *Succinea australis* Ferussac.

The waxy appearance and peculiar form make these molluscs recognisable at sight. Subbulimoid in form with a very short spire and open oval



mouth, imperforate, texture very thin, the outer lip fragile, sculpture of rude growth radials, sometimes with fine subordinate lining.

**Austrosuccinea scalarina** Pfeiffer 1861.

Plate I., fig. 11.

1861—*Succinea scalarina* Pfeiffer, Proc. Zool. Soc. (Lond.), 1861, p. 28, May 1. King George's Sound, South-West Australia. Fig'd. Cox, Mon. Austr. Land Shells, p. 89, pl. XX, fig. 19, May, 1868, from a painting of the type by Angas.

"Shell ovately conical, scalarine, rather solid, irregularly rugosely plicated, slightly shining, reddish; spire elongated, rather acute; whorls  $3\frac{1}{2}$ , convex, last slightly exceeding the spire, somewhat attenuated at the base; columella receding, nearly straight, forming with the peristome an indistinct angle; aperture oblique, oval, scarcely angular above, peristome simple, columellar margin slightly reflected above."

Such is the description of a *Succinea*, and is here reproduced as a standard. The shell is reddish when alive but commonly fades to horny, the solidity is usually missing, thin and fragile better describing the species; length 15 mm.; breadth 7.5 mm.; length of aperture 9 mm.

**Austrosuccinea contenta** sp. nov.

Plate I., figs. 12 and 13.

1843—*Succinea oblonga* "Dr." Menke, Moll. Nov. Holl. Spec., p. 6 (Apl. 11), *nom. nud.*, in cracks of limestone rocks not far from the sea near Perth.

1844—*Succinea oblonga* Menke, Zeitschr. für. Malak. (Menke), 1884, p. 56, Apl. 10. New Holland specimens described.

Not *Succinea oblonga* Draparnaud, Tab. Moll. France, p. 56, 1801.

Probably there are many species in the Perth district, but obviously Menke's name was used for the common one.

This has a short spire with a rather swollen body whorl, the spire shorter than that of *scalarina* and the body whorl a little broader; the shell is not so rugose, the early whorls being much smoother, the inner lip is a little thickened and a slight body glaze connects with the outer lip. The length of the type is 11 mm., the breadth 7 mm., the length of the aperture 8 mm.

Specimens from Rottnest Island appear to differ in their narrower form, less swollen body whorl, longer spire and may represent a distinct subspecies, **A. contenta isolata** subsp. nov., but this will be more fully discussed later. The type measures 11 mm. in length, 6 mm. in breadth and the aperture 6.5 mm. in length.

**Austrosuccinea caurina** sp. nov.

Plate I., fig. 16.

1895—*Succinea scalarina* Hedley, Proc. Malac. Soc. (Lond.), Vol. I., p. 260, July. Fitzroy River, North-West Australia.

1898—*Succinea scalarina* Ancey, Proc. Linn. Soc. N.S.W., Vol. XXII., (1897), p. 777, June 4. Lennard River, 100 miles inland from Derby, North-West Australia (W. W. Froggatt).

This north-western species which has been confused with the south-western one has a general superficial resemblance to that, but is smaller, nar-



rower and lacks the rugose plications. This reads very similarly to the description of *strigillata* but the shape is different.

Shell elongate, rather narrow, spire moderate, attenuate, mouth oval not much expanded, sculpture weak, early whorls almost smooth. The whorls are rounded, but not strongly convex, the sutures fairly deep. There is very little body glaze connecting the inner and outer lips. Length of type 12 mm., breadth 6.25 mm., length of aperture 7 mm.

***Austrosuccinea strigillata* A. Adams and Angas 1864.**

1864—*Succinea strigillata* A. Adams and Angas, Proc. Zool. Soc. (Lond.), 1864, p. 38, June 24. Shark Bay, West Australia.

Fig'd. Cox, Mon. Austr. Land Shells, p. 89, pl. XV., fig. 5, May, 1868.

No specimens are available from Shark Bay so the original description is here given: "Shell ovately conical, thin, semi-pellucid, pale horny yellow; spire scarcely equalling the aperture; apex papillary; whorls  $3\frac{1}{2}$ , strongly convex, longitudinally finely and minutely striated; aperture oblong ovate; left margin with a long thin callus deposit, right simple. Length 5 lines, breadth  $2\frac{1}{2}$  lines. A species somewhat allied to *Succinea strigata* Pfr., from South Australia, having the same papillary apex; but differing in being smaller, thinner, of a lighter colour, and in the whorls being less strongly rugose."

Smith (Proc. Malac. Soc. (Lond.), Vol. I., p. 97, June, 1894) has recorded *Succinea scalarina* from E. Wallaby I., Houtman's Abrolhos, W.A., and given a figure but whether this be from the type of *scalarina* or from an Abrolhos shell is not stated. At present as no specimens are available the identity of the island form cannot be ascertained.

***Austrosuccinea aridicola* sp. nov.**

Plate I., fig. 15.

Shells collected at Boulder by W. D. Campbell are unlike any of the coastal forms, but still more unlike the Centralian *interioris*. Shell small, elongate, spire long, mouth short of moderate expansion, whorls very rounded, sutures very deep. The shells are dead, the periostracum missing, the sculpture weakly strigose, the strigations still notable on the early whorl. The spire is almost as long as the aperture, the latter being rather a regular oval, the inner lip connecting with a body glaze to the outer lip, which is thin as usual. Length 10.5 mm., breadth 6 mm., length of aperture 5.5 mm.

***Austrosuccinea coxi* Finlay 1927.**

Plate I., fig. 17.

1927—*Succinea coxi* Finlay, Trans. New Zeal. Inst., Vol. 57, p. 521, Jan. 19, new name for

1868—*Succinea aperta* Cox, Mon. Austr. Land Shells, p. 90, pl. XVII., fig. 6, May. King George's Sound, West Australia (Masters).

Not *Succinea aperta* Lea, Trans. Amer. Phil. Soc., Vol. VI., p. 101, 1838.

This species is recognisable at sight by the large mouth which is the bulk of the shell, the spire being only one-third the length of the aperture. From conchological features alone it deserves separation subgenerically as *Cerinasota* nov., and it is fairly certain that the anatomy will necessitate a higher value.



Genus **ARBORCINEA** Iredale 1937.

1937—*Arborcinea* Iredale, Austr. Zool., Vol. VIII., p. 308, Meh. 12. Orthotype *Succinea eucalypti* Cox.

The tree living Succineids have very different habits from those on the ground which frequent damp places, and it has been recently argued that field observations must be taken into account in the taxonomic disposition of our molluscs. I recorded many years ago that on Sunday Island, Kermadec Group, the tree living snails were altogether unrelated to those living on the ground adjacent. In the present series the tree living Succineids live under the bark of the trees and seal themselves to the wood, carrying a thick epiphragm. Normal Succineids with a large animal live in moist places, and many kinds have been separated among those alone. The shell features of *Arborcinea* include a short spire, swollen body whorl and a rather bold sculpture with a truncated thickened columella.

***Arborcinea menkeana*** Pfeiffer 1850.

Plate I., fig. 14.

1843—*Succinea amphibia* "Dr." Menke, Moll. Nov. Holl. Spec., p. 6, Apl. nom. nud. "Under the Bark of Eucalypts." District Hay, West Australia.

1844—*Succinea amphibia* Menke, Zeitschr. für Malak (Menke), 1844, p. 55, Apl. 10. Specimens described.

Not *S. amphibia* Draparnaud, Tab. Moll. France, p. 55, 1801.

1850—*Succinea menkeana* Pfeiffer, Zeitschr. für Malak (Menke), 1849, p. 110, Jan. 1850, fide C.D.S. New Holland (L. Preiss) = *amphibia* Menke, i.e., from Hay as above.

Fig'd. Pfeiffer, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth XI., p. 45, pl. 4, figs. 36, 37, 38. 1855.

1930—*Succinea brevissima* Thiele, Die Fauna Südwest Australiens, Bd. V., lief 8, p. 587, pl. IV., f. 66. Collie, South-West Australia.

The description indicates the genus thus "Shell ovately-elliptical, thin, distinctly striated, pellucid, shining, horny; spire short, papilliform, suture deep; whorls  $2\frac{1}{2}$ , the last but one very convex, the last attenuated at the base; columella somewhat callous, regularly curved; aperture slightly oblique, regularly oval; peristome simple, thin, margins approaching. Length  $3\frac{1}{2}$  lines; breadth  $1\frac{5}{8}$  lines."

## FAMILY BOTHRIEMBRYONTIDAE.

Probably the most intriguing land shells in Australia are the bulimoid forms inhabiting the South-West corner. A large number of species and races has developed, and probably only a tithe has been described. It is unfortunate these have not yet been studied by anyone conversant with local conditions, and it is certain that they will provide future students with much research. No more exciting subject could be chosen by the student, but the unravelling of the many problems will necessitate much investigation. The present essay, also by an outsider, is the result of over a dozen years of consideration, the specimens having been handled from every viewpoint, geological data, botanical data, meteorological data and even soil conditions have been brought under review. The first species were described from the collections of the French naturalists; a little later similar shells taken by British



explorers being made known. A German naturalist then collected some specimens, and these, of course, were dealt with by German conchologists. Some time later Cox, the Sydney conchologist, listed the species in his Monograph, but was content to indicate the various varieties only. Hedley attempted to arrange the forms but did not publish his conclusions.

A real attempt to systematise them was made by the inimitable American malacologist, Pilsbry, in the "Manual of Conchology." To assist him, Cox sent him a large collection but unfortunately the bulk of that collection was labelled "King George's Sound," the name covering all the adjacent locality within a radius of a hundred miles or so. Thus Pilsbry was baffled with the great variation in the shells from this locality. It is indeed fortunate that the Cox collection, including the specimens handled by Pilsbry, is now in the care of the Australian Museum, and has been utilised in this study. A year or so later the German monographer, Kobelt, dealt with this group, and in the main followed Pilsbry, but did not realise the value of exact localities. In the future the science of geozoology will probably play a great part in the elucidation of this group, as the species and even higher groupings appear to be living in government by their geological and botanical environment, with, of course, the rainfall being a matter of importance.

The Bothriembryontids vary in size from about 25 mm. to 50 mm. in length, from very narrow to plump in form, and from almost smooth to heavily granose sculpture. It is probable that future investigators will discover anatomical features in the animal to assist them, but at present only the shells are available for examination.

The notable variations are easily seen, as *dux*, *indutus*, *melo*, *onslowi*, *kingii* and *gratwickii*. According to Pilsbry's researches these appeared to show different apical features so that as a guide for future investigators I introduced subgeneric names, *Hartogembryon* for *onslowi*, and *Satagembryon* for *gratwickii*. The type of *Bothriembryon* is *melo*, and *Hartogembryon* seems to be an offshoot from this source, while *Satagembryon* may be a specialised product of the *kingii* root. However, *dux* and *indutus*, the two largest forms, are thus left nameless, and while the latter may be related to the *melo* branch, it is now differentiated clearly, and is here subgenerically named **Dialembryon**. The source of *dux* is at present indeterminable, and a subgenus **Ponembryon** is here proposed to distinguish it. As *Satagembryon* is so abnormal, a subgenus **Telembryon**, is introduced for the normal *kingii* series. By the usage of these subgeneric names, and the allotment of the named species will secure greater accuracy and lead to a better knowledge of this interesting series of land-shells. It must be pointed out, however, that though *dux* and *indutus* are in no danger of confusion, there are some shells that appear to link together *kingii* and *melo*, but better material and more local knowledge might easily dissipate the clouded outlook of the extralimital struggle for light in this delightful molluscan group.

The Bothriembryontids are practically confined to the south-west corner of Western Australia, which I have called the Leeuwinian Area, and constitute a remarkable element of the Autochthonian Faunula. Northwards the group reaches Shark Bay, there mingling with the outliers of the Caurine Faunula of the Dampierian Sub-Area. Eastwards a few members range along the southern sea coast of the Centralian or Larapintine Area, while one form is found in the middle of this Area, among the true representatives of the Eremian or Eyrean Faunula. Now, in this Leeuwinian Area the groups abovenamed already seem to be limited in their distribution. Thus we have *Telembryon* from Vasse just north of Cape Naturaliste, then cling-



ing to the coast from there to Cape Leeuwin and thence still coastwise to 70 miles east of Israelite Bay. Though apparently a coastal group, it has not been collected yet on the islands of the Recherche Group, although one species comes from Doubtful Island, a coastal islet. On the other hand, the true *Bothriembryon* is abundant on the islands of the Recherche Group and the mainland adjacent, and then from King George's Sound seems to make an inland march across to Perth. It has not yet been recorded from the Stirling Ranges where a peculiar *Telembryon* lives alongside *Dilembryon*. The range of this last-named group is peculiar, species being known from the Darling Ranges inland from Perth, the Stirling Ranges and the hazel scrubs a little west of King George's Sound. Still more curious is the distribution of the giant *Ponembryon*, which appears somewhere about King George's Sound and occurs eastward to the Fraser Range. This leaves *Hartogembryon* and *Satagembryon*, which are localised, and as above noted these may be only specialised offshoots from *Bothriembryon* and *Telembryon* respectively. A glance at a rainfall chart will show that these larger groups are *not* governed by present-day rainfall, though investigation suggests that species vary in accordance with the annual rainfall. Furthermore, it seems that certain trees live under certain geological conditions, and that some of these snails are associated with definite botanical formations. This cannot be definitely asserted as there are too little data, but it would be a good line to follow.

The species are easily distinguishable, but there is a lot of individual variation. No mechanical method of diagnosis can be used, though examination of series enables differentiation with ease. Consequently the norm of the series is here described and the connectant variation recorded, but specimens must be available for comparison and recognition. Figures without confirmative shells can prove very misleading, whereas topotypes are of very definite value and few mistakes will be made in their use.

Genus **BOTHRIEMBRYON** Pilsbry 1894.

1894—*Bothriembryon* Pilsbry, Nautilus, Vol. VIII., p. 36, July. Orthotype *Bulimus melo* Quoy and Gaimard.

1861—*Liparus* Martens, Die Heliceen (Albers), 2nd ed., p. 229. Orthotype *Bulimus inflatus* Lamarek.

Not *Liparus* Albers, Die Heliceen, 1st ed., p. 172, 1850.

1933—*Hartogembryon* Iredale, Rec. Austr. Mus., Vol. XIX, p. 41, Aug. 2. Orthotype *Bulimus onslowi* Cox.

1933—*Larapintembryon* Iredale, Rec. Austr. Mus., Vol. XIX, p. 41, Aug. 2. Orthotype *Liparus spenceri* Tate.

1933—*Satagembryon* Iredale, Rec. Austr. Mus., Vol. XIX., p. 41, Aug. 2. Orthotype *Buliminus gratwicki* Cox.

The characters of the genus, as here used, are those already fully detailed in connection with the family just preceding.

**Bothriembryon melo** Quoy and Gaimard 1832.

Plate II., fig. 1.

1832—*Helix melo* Quoy and Gaimard, Voy Astrol. Zool., Vol. II., p. 109, pl. 9, figs. 4-7. Summit of Bald Head, King George's Sound, South-West Australia.



- 1832—*Helix melones* id. ib., in synonymy, ex Ferussac, Tabl. Syst. Limaçons, Prodr., p. 58, Jan.: p. 54, June, 1821 (*Helix*) (*Cochlogena*) *melones* nom. nud. cf. Potiez & Michaud, Gal. Molus. Mus. Douai, Vol. I., p. 147, pl. XIII., fig. 15-16, 1838.
- 1838—*Bulimus ovum* Deshayes, Règne Animal (Cuvier) Disciples ed. pl. 23, fig. 1, Quoy MS. ? error only for *melo*.
- 1839—*Bulimus melo* Sowerby, Zool. Beechey's Voy., p. 145, pl. 38, fig. 16. "n.2 error."
- 1843—*Bulimus melo* Menke, Moll. Nov. Holl., Spec. p. 7, April "four varieties described. Among Melaleuca in Hay district.
- 1843—*Bulimus physodes* Menke, id., ib., as synonym of var. a. of the preceding.
- 1844—*Bulimus melo* Menke, Zeitschr. für Malak. (Menke), 1844, p. 56, April 10. The above varieties discussed, and var. a. recognised as typical *B. melo* Quoy & Gaimard.
- 1859—*Bulimus melo* Pfeiffer, Mon. Helic. viv., Vol. IV., p. 477, six varieties differentiated, but not named.
- 1868—*Bulimus melo* Cox, Mon. Austr. Land Shells, p. 74, pl. XIII., fig. 6, May.
- 1892—*Liparus inflatus*, with vars. *melo*, *physodes*, *castaneus*, *bullæ* and *rhodostoma*, Hedley, Rec. Austr. Mus. Vol. II., p. 29, Aug.
- 1900—*Bothriembryon inflatus* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XIII., p. 3, pl. 1, figs. 1-5, apex, pl. 4, figs. 73, 74, April 23 and var. *melo*, p. 4, pl. 1, figs. 7-10, (other vars. not referable here).
- 1900—*Bothriembryon physoides* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XIII., p. 9, pl. 2, figs. 35-36-37, Apl. 23.
- 1901—*Bothriembryon physalis* Kobelt, Syst. Conch. Cab. (Mart & Chemn.), ed. Kuster, Bd. I., Abth. XIII (2), p. 778 (28: vii: 1907) error only.

Shell elongately conical, rather plump, spire conical not quite as long as aperture, whorls rather flattened, sutures lightly impressed, last whorl two-thirds the length of the shell, mouth oval, elongate, lip thin, columella straight, reflected, hiding, but not closing, a deep narrow umbilicus.

The coloration is commonly unicolor, pale fawn, sometimes with a sub-sutural reddish band and red longitudinal streaks but never with a red circum-bilical patch. Dead shells are white as the coloration lies in a very fine periostracum.

The apex is rather flattened, of two whorls, the sculpture of fine punctation or thimbling as it is sometimes termed, this being coarser than that of the Swan River *bullæ*; the adult sculpture consists of radial growth lines, irregular and wavy, becoming less marked on the last whorl. On the early whorls there is a faint concentric sculpture also seen but this is never notable and usually vanishes early. Length 26 mm., breadth 15.5 mm. This description is drawn up from specimens from the type locality, where a great deal of colour variation is not seen. As related below, many shells have been regarded as answering to the original nominations, but as now restricted the above applies exactly.

The confusion in connection with the common King George's Sound shell has lasted since its discovery. A similar shell was found in the Perth district, and another not a great deal unlike at Shark Bay. Apparently Férussac distinguished these, and Lamarek confused them, and then Quoy



and Gaimard re-recognised Férussac's form. Menke, however, could not understand them, and added some more species. Collections did not solve the problems, as the localities whence the shells came were not accurately distinguished. Hence we have the great authority on land-shells of eighty years ago, Pfeiffer (Mon. Helic. viv., Vol. IV., p. 477, 1859), allowing one species under the name *melo*, but arranging six varieties, which he did not systematically name, but used phrases only. The first words were afterwards recorded as varietal names, and these read *castaneus*, *luteus*, *major*, *albidus*, the fifth without a distinctive adjective to begin with, and the sixth, *tenius*, citing *physodes* Menke as equivalent. No localities were known for these different variations, and it is now impossible to determine these varieties. Cox mentioned Menke and Pfeiffer, and that he could add more varieties, but did not give any names. Hedley arranged the shells in the Australian Museum and gave names to two colour varieties as was the custom then, but did not publish these when he listed the species under the name *Liparus inflatus* Lamarek, with varieties, *melo* Q. & G., *physodes* Menke, *castaneus* Pfeiffer, *bulia* Menke and *rhodostoma* Gray. Pilsbry introduced the new generic name *Bothriembryon*, and using *inflatus* as the specific name, admitted as varieties *melo* Q. & G., *castaneus* Deshayes, and added var. *maculiferus* and var. *conispira*, allowing *physodes*, *bulia* and *rhodostoma* as different although he could not recognise the two last-mentioned. Kobelt did not know what to do, so recorded most of these following Pilsbry's descriptions, but not admitting his valuation. His account is too confused to need much discussion, his descriptions and figures being hereafter allotted as far as possible.

#### ***Bothriembryon castaneus* Pilsbry 1900.**

Plate II., fig. 2.

1900—*Bothriembryon inflatus* var. *castaneus* Pilsbry, Man. Conch. (Tryon), Ser. 2., Vol XIII., p. 5, pl. I., figs. 11, 18, April 23, ex Deshayes MS. (citing Vol. VIII., p. 245, Lamarek, Hist. 2nd ed., where it does not occur). King George Sound, West Australia—Doubtful Island, South-West Australia.

Quoy and Gaimard figured as a variation of their *Helix melo*, a narrower brown shell with a broad white peripheral band. This variation was included by Deshayes, but he did not assign it any name, writing, "var. (ietas) *castanea*: vitta cineta alba." Pilsbry used the name *castaneus* as a varietal one, copying Quoy and Gaimard's figure, but describing a specimen sent by Dr. Cox, which he also figured. I am selecting the latter as the type of Pilsbry's *castaneus*, as it was one of a series from Doubtful Island, and his specimen is here refigured. The Doubtful Island shells are constant in coloration and size, the sculpture being a little stronger, and the size a little less. Length 23 mm., breadth 12.5 mm.

#### ***Bothriembryon rhodostomus* Gray 1834.**

Plate II., figs. 3-7.

1834—*Bulimus rhodostomus* Gray, Zool. Soc. (Lond.), 1834, p. 67, November 25. New Holland (probably collected by Robert Brown at Goose Island, Recherche Group, W.A.).

Not *Bulimus rhodostoma* Reeve, and later authors.

1900—*Bothriembryon inflatus* var. *maculiferus* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XIII., p. 5, pl. I., figs. 12-14, Apl. 23. "King George Sound, South-West Australia." = Recherche Group based on a shell collected by Rossiter.



1901—*Bothriembryon martensi* Kobelt, Syst. Conch. Cab., (Mart. & Chemn.) ed. Kuster, Bd. I., Abth. 13 (2), p. 764, pl. 112, figs. 3, 4, (sheet dated 21 VI. 1901). New Holland.

Through lack of specimens this species has been overlooked, a different species being figured by Reeve, but with doubt, yet he has been followed. If the description had been studied, the shell would have been recognised as it is really quite good: "Shell ovate, perforate, solid, striate, whitish marbled with rose, cuticle thin, olivaceous, suture delicately circulate; whorls with two obscure posterior bands; throat roseate; peristome a little thickened; axis anteriorly deep brown. Axis  $1\frac{1}{4}$ ; diam.  $\frac{3}{4}$  unc."

The size and proportions do not fit any other species than the following. When it is realised that Robert Brown was on Goose Island, one of the Recherche Group, where this kind of shell is common, its recognition is easy. Reeve figured a different shell under Gray's name, but he doubted the association, and he was right in that doubt, as his specimen almost certainly came from the Perth district. Rossiter also collected specimens in the Recherche Group, and one of these was named by Pilsbry as the Coxian locality "King George's Sound" misled him. The remainder of Rossiter's specimens in the Brazier collection are labelled "Recherche Group."

One of the most interesting revelations of Australian conchological science was made by Mr. A. F. Basset Hull, who visited the Recherche Group, with the assistance of Messrs. Henry Grant and J. H. Wright of the Australian Museum. Many specimens were collected on the mainland at Esperance, and on the eastern islets of the Archipelago. They found that each locality showed a definite variety, and these are illustrated and diagnosed here.

At first sight these recall the King George Sound *melo*, but are larger, and restricting *rhodostomus* to the western islands of the Recherche Archipelago, those from the eastern ones are here described.

The Gunton Island shells may be called ***B. rhodostomus hullianus*** subsp. nov. The ground colour is pale brownish cream, a reddish brown band below the suture followed by a pale band, and then another reddish brown band above the periphery with a similar red brown patch around the umbilicus. The aperture generally pale creamy white inside, sometimes purplish, the columella pale or dark purplish brown, rarely white. A strong wrinkling below the suture gives the subsutural red band a streaked appearance. In form, they are roundly elongate, the spire being about equal in length to the aperture. Some thirty specimens are still available, of which two are unicolor, the others constant. The variation in measurements is: 35 mm. in length by 18 mm. in breadth (type), 34 by 20, 34 by 17 and 31 by 20 mm. One shell from Rob Island (Mondrain) is smaller with the ground colour pinkish white, heavily streaked with purplish brown, the aperture and columella purplish, and probably comes nearest true *rhodostomus*.

A longer series from Charley Island shows more variation, the darker shells being brownish cream, longitudinally heavily streaked with dark brown, some are less heavily marked, the streaking being fewer, and bands showing through so that one almost agrees with the Gunton Island shell, and some are even unicolor. In the other direction, the streaks tend to coalesce until the last whorl is practically uniform dark purplish brown. The aperture varies in coloration, according to the exterior, from white with a rose columella, and outer lip internally, through pale reddish to dark purple. In shape some are comparatively plump while others have the spire lengthened,



but in none is the spire shorter than the aperture. Measurements read length, 40 mm. by breadth, 20 mm. (type), 38 by 22, 38 by 20, 35 by 20 to 32 by 20. These may be called *B. r. grantianus* subsp. nov. Another fine series from Rabbit Island (not Rabbit Island in King George's Sound) are similar in size and form to the preceding, but are paler throughout, and are here named *B. r. wrightianus* subsp. nov. The markings are always paler, and pallid shells are more numerous, while these are generally smaller, all the largest ones being streaked. Only one approaches the normal Gunton Island form coloration, and the measurements of the streaked shells are length 36 mm. by breadth, 21.5 mm. (type), 36 by 20, and 35 by 21 mm., while the pale unicolor shells measure 34 by 21, 34 by 20 and 33 by 17 mm. The shells from Woody Isle are a little smaller, with a pale cream zone below suture, and a pale patch on base, the whorl being brown streaked with dark purplish brown, the streaks almost coalescing on the last whorl and forming a broad band. The measurements are, length, 31 mm. by 17 mm., and 30 mm. by 18 mm. This may be called *B. r. perspectus* subsp. nov., and this leads to the mainland Esperance form.

The mainland shells, collected commonly at Esperance, recall *melo*, but are generally larger and paler. Pilsbry has figured this as *maculiferus*, fig. 14, but as his figs. 12 and 13 of *maculiferus* are alike in colouring, and are larger and are part of a lot from the Recherche group, *maculiferus* becomes a synonym of *rhodostomus*.

Some hundreds of shells were collected at Esperance crawling on grass and bushes after rain, and these are quite constant, although the streaks vary in number, the colouring is pale, and none is dark as the island forms, and this is here described as a distinct species.

#### *Bothriembryon esperantia* sp. nov.

Plate II., fig. 8.

Shell plumply elongate, not as broad as *bullia*, with less sculpture, the spire conical as long as the aperture, whorls rounded, the columella reflected over the umbilicus but still leaving a notable chink, shell solid. Coloration greyish white sparsely flamed with irregular streaks of dull pinkish brown, the ground colour dominating the coloration. Apex finely punctate, a little more elevated than that of typical *melo*, the adult sculpture rough, irregular radial growth ridges with very little cross sculpture and no decussation notable in some cases: in other rather coarsely granulose as the one described and figured by Pilsbry (p. 6, pl. I., fig. 14) which is here refigured, the form and coloration being diagnostic. Length 23 mm., breadth 15 mm. The largest measures 26 mm. by 16 mm.

#### *Bothriembryon balteolus* sp. nov.

Plate II., fig. 9.

Many shells from the Esperance Mallee Belt district, 50 miles south of Norseman, Madura, Salmon Gums, are all dead and agree in showing a strong banded coloration.

In form the shells recall *bullia*, but the spire is not so exsert and they must be near to *rhodostomus* geographically. The shells have the spire definitely less elate than the Esperance coastal species, with the sculpture more regular almost producing a cancellation on the penultimate whorl and shoulder of the last whorl. The ground colour is chalky-white with a narrow purple peripheral band and a large purple circumbilical patch. The columella is



reflected almost covering up the umbilicus, the outer lip thin, and a glaze connects the inner lip to the outer lip across the body whorl. The apex is eroded but shows the coarse pitting of the *melo* series. Measurements—length 21 mm., breadth 15 mm. (Esperance Mallee Belt). The range of this form inland would be interesting, as we might get intermediate localities between this and the Centralian *spenceri*. From Newman Rocks shells are a little more globose, spire shorter, and the colours reversed, being pale brown with a peripheral white band recalling *castaneus*, but differing in sculpture. Bednall (Trans. Roy. Soc. South Austr., Vol. XVI., p. 66, Dec., 1892), recorded *Bulimus melo* Q. & G. from the Fraser Range, from dead shells alone: this report may refer to specimens of this species.

**Bothriembryon serpentinus** sp. nov.

Plate II., fig. 10.

A large series of shells collected alive by Mr. L. Glauert at Serpentine Falls, Darling Range, all agree in form and coloration though varying a little in proportions. Thus some are shorter recalling the coastal *bulla*, and others are elongate similar to *indutus*, but very unlike in shell texture. These are thin and are pale brownish-yellow thickly longitudinally streaked, being thus referable to the *bulla* style rather than to the *indutus* series. The apex is finely punctate the succeeding whorls rounded, the spire about equal to the mouth, four adult whorls succeeding the two punctate whorls sharply. The columella is reflected, brownish purple, leaving a very small umbilical fissure, the outer lip thin, the aperture brown within. Sculpture, rough closely set irregular radials overrun by concentric lines, almost forming a distinct cancellation on the earlier whorls. A couple picked at random give measurements—length 25 mm., breadth 16 mm., and length 32 mm., breadth 16 mm. The shell figured (type) measures 28 mm. in length and 16 mm. in breadth. The locality falls into the 30-inch annual rainfall belt.

**Bothriembryon praeceus** sp. nov.

Plate II., fig. 11.

One specimen from Kellerberrin may be immature, but it is large and very distinct from any shell from the Darling Ranges or the Perth district. The locality is inward of the ranges, and lies in the 10-15 inches rainfall belt.

The shell is inflated but the spire is conical and short, the aperture a little longer than the spire and open, shell very thin. Coloration almost uniform being brown, growth lines lighter. The apex is worn but shows a flattened two whorls stopping suddenly so that almost a varix appears: there is a reticulate pitting now seen. The adult sculpture consists of fine radials crossed by fine concentric lines almost cutting the radials into lozenges, these vanishing below the shoulder on the last whorl, only the rather rude radials persisting. The columella is white, reflected, almost concealing the umbilicus, a very slight glaze crossing to the edge of the outer lip which is thin. The measurements read—length 29 mm., breadth 20 mm., length of aperture 17 mm., breadth of aperture 10 mm.

**Bothriembryon sedgwicki** sp. nov.

Plate II., fig. 12.

Shell small, spire conical, shorter than aperture, body whorl swollen, umbilicate, but only slight chink remains, shell thin. Coloration brown marked with irregular longitudinal streaks of dirty white which are the



elevated radial ribbing. Apex typical of the *bulia* style, finely punctate, adult sculpture of rough radials, cut by concentric lines forming a subnodulose sculpture, the concentric lines disappearing on the base of the last whorl. Height 17 mm., breadth 11 mm.

Mr. E. Sedgwick, who collected this interesting form at Nangeenan via Merredin, sent a series including juveniles, which are merely the apical whorls, punctate, horny, umbilicate; the next stage shows the adult sculpture forming, succeeding a slight but distinct varix, and at this stage capable of making a perfect epiphragm. On the next whorl the concentric lines appear to be bearing fringes, but these are absent in the adult.

***Bothriembryon bulia* Menke 1843.**

Plate II., fig. 13.

- 1843—*Bulimus bulia* Menke, Moll. Nov. Holl. Spec., p. 7, April. Darling Range, West Australia.
- 1844—*Bulimus bulia* Menke, Zeitschr. für Malak. (Menke), 1844, p. 57, April 10.
- 1848—*Bulimus rhodostoma* Reeve, Conch. Icon., Vol. V., pl. xlix., sp. 323. Nov. New Holland.
- 1854—*Bulimus baconi* Benson, Ann. Mag. Nat. Hist., Ser. 2, Vol. XIII., p. 99, Feb. 1. Darling Range, West Australia.  
Fig'd. Cox, Mon. Austr. Land Shells, p. 73, pl. xix., fig. 13, May, 1868, from a painting of the type by Angas. Refig'd. Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 95, pl. vii., fig. 32, June, 1894 (type).
- 1892—*Liparus inflatus* var. *bulia* Hedley, Rec. Austr. Mus., Vol. II., p. 29, August.
- 1892—*Liparus inflatus* var. *rhodostoma* id. ib.
- 1892—*Liparus baconi* id. ib.
- 1900—*Bothriembryon inflatus* var. *conspira* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XIII. p. 6, pl. 1, figs. 15-17; apex, fig'd. pl. 4, figs. 71-72, April 23. "King George's Sound, W.A." error = Perth.
- 1900—*Bothriembryon bulia* id. ib., p. 15.
- 1900—*Bothriembryon baconi* id. ib., p. 16, pl. 2, fig. 42.
- 1901—*Bothriembryon baconi* Kobelt, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. 13, Theil 2, heft CLXV., lief. 463, p. 770, pl. 112, fig. 18; pl. 116, fig. 6, sheet dated 8-7-1901.
- 1901—*Bothriembryon bulia* id. ib., heft CLXVIII., lief. 467, p. 777, pl. 113, figs. 15-16, sheet dated 10-7-1901.
- 1901—*Bothriembryon rhodostoma* id. ib., p. 786, pl. 114, fig. 6, sheet dated 28-7-1901.
- 1902—*Bothriembryon durus* id. ib. heft CLXXIII., lief. 473, p. 930, pl. 131, figs. 1-2, sheet dated 8-4-1902. Probably Australia.

Shell elongate, plump, spire conical, short, last whorl plump, not obese, shell thin, whorls rather flattened, last whorl very large, mouth broad oval, elongate, outer lip thin, columella straight, reflected, hiding umbilicus which however, still remains open but narrow. Coloration somewhat varied, a greenish appearance prevailing: the background pale green finely streaked with reddish brown and a pale peripheral band overrun however by the streaking: sometimes the green prevails and there is almost a uniform shell but this is rare. At others the red is predominant and the shell takes on a



reddish tone, but always the coloration is characteristic. The apex is punctate, the thinning finer than in the southern *melo*: the longitudinal irregular ribbing is cut into nodules by the concentric lining and there is commonly a notable deep line just below the suture which is never seen in *melo*, the sculpture being much more pronounced in this species. Some specimens elongate with age and thus we get Reeve's "*rhodostoma*" and Pilsbry's *conispira*. The normal shell measures 25 mm. in length by 16.5 mm. in breadth, *conispira* being 25 by 14.5 mm., and others up to 28 mm. by 16.5 mm.

***Bothriembryon bradshawi* sp. nov.**

Plate II., fig. 14.

A good series, collected by Mr. F. R. Bradshaw at Tambellup, north of the Stirling Ranges, and south of Broome Hill, provides an interesting problem.

The shell is small, thin, spire and mouth about equal in length, spire conical, mouth a little inflated so that it appears somewhat intermediate between the *kingii* and *melo* series.

The apex is a little more elevated than in the *melo* form, but not so elate as in the *kingii* group, and is finely punctate, the sculpture fading away so that no varix-like division is seen. The adult sculpture consists of fine sloping radials being more rude as the shell develops, and continuing on to the base of the last whorl. On the first adult whorl a few widely spaced concentric lines are seen which soon vanish. The early coloration is whitish mottled with reddish brown, the mottlings massing so that the coloration of the last whorl resembles that of some of the well-colored forms of *kingii*.

Length, 19.5 mm., breadth, 12 mm.

***Bothriembryon irvineanus* sp. nov.**

Plate II., fig. 15.

A series, collected by Mrs. Irvine, a very well-known West Australian shell lover, at Cape Naturaliste, along with *B. naturalistarum*, but probably occupying a distinct station ecologically, is here named.

The shell is thin, elongate, of the *melo* form, but narrower and showing no perforation, recalling *serpentinus*, but broader, the spire a little shorter than the aperture, columella twisted. Coloration uniform with no red circumbilical patch. The apex is coarsely punctate recalling that of *kingii*, but broader, more elevated than that of *bulla*; adult whorl strongly rudely radially ribbed crossed by concentric ditches producing a strong subnodulose effect, the radials persisting strongly on to the body whorl but concentric ditches disappear on base. Length of type, 26 mm.: breadth, 16 mm.

***Bothriembryon richeanus* sp. nov.**

Plate II., fig. 16.

A series labelled "Cape Riche, King George's Sound, S.W. Australia" by Brazier, proves that the locality "King George's Sound" was used for the whole of that south-west block, as Cape Riche is sixty miles distant, and is a well known landmark.

The shells are quite distinct, being strongly granulose recalling *leeuwinensis* and *brazieri*, but are narrower than the former, and broader than the latter. They belong to the *kingii* series, but are broader with the



spire not attenuate and about the length of the aperture. The apical whorls are strongly punctate, the adult whorls rounded, the sculpture being rather strongly nodulose, the nodules irregular, but squarish, and persisting but weakening on to the base of the body whorl. The shell is thin and consequently the outer lip is thin, the columella reflected, leaving so minute a chink that the shell appears imperforate. The coloration is a dirty fawn with indistinct longitudinal streakings of dull red; the red circumbilical patch is only seen in one specimen. The type measures 24 mm. in length, 13 mm. in breadth, the aperture 12 mm.

***Bothriembryon leeuwinensis* Smith 1894.**

Plate II., figs. 17 and 18.

1894—*Bulimus* (*Liparus*) *leeuwinensis* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 94, pl. VII., fig. 27, June; Cape Leeuwin, South-West Australia.

1900—*Bothriembryon leeuwinensis* Pilsby, Man. Conch. (Tryon), Ser. 2, Vol. XIII., p. 13, pl. 3, fig. 49, Apl. 23.

1901—*Bothriembryon leeuwinensis* Kobelt, Syst. Conch. Cab. (Mart & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, heft CLXV., lief 463, p. 768, pl. 112, fig. 4 (sheet dated 8 VII. 1901).

Smith's comparison reads: "*B. melo* is a broader and more bulky species, and *B. kingii* is more acuminate above, less granular, and exhibits more coloration both externally and within the aperture. The umbilicus is more closed than in the present species, and is surrounded by a brown zone." The notable feature is the strong granulation and this appears to connect it with the *kingii* series. Mr. A. W. B. Powell, of the Auckland Museum, has given me three specimens collected at Flinder's Bay by Clement L. Wragge, and these are topotypes of the species. The apical features prove it to be referable to the *kingii* series from which at sight it appears very different. The shell is elongate, rather stout, the spire about equal to the aperture, but not attenuate, the whorls appreciably shouldered. The apex is elevated, finely punctate, the punctations separable until the end of two whorls, where a definite small varix can be seen. The adult sculpture consists of coarse granulation, rough separate radials being cut into oblong lozenges by concentric deep irregular lines, the unevenness of the radials giving a nodulose suggestion. This continues on to the upper half of the last whorl, the rough radials alone being observed on the lower half. The columella is white, reflected, but leaving a notable umbilical chink behind; a white glaze connects the inner lip with the outer lip which is thin. The coloration is a uniform creamy white.

The length of the figured shell is 29 mm., the breadth 15 mm. A specimen from Lake Cave, Margaret River, generally agrees but is much narrower, measuring 28 mm. by 13 mm.

Another series from Margaret River is short and broad, recalling the *melo* series, but the apex seems to belong to the *kingii* series. The mouth and aperture are about equal, and the sculpture is similar to that of the above, but much weaker, the concentric lines disappearing on the body whorl. The columella is reflected but leaves an open chink, and the outer lip is thin. The coloration is dirty white with flesh streaks. There appears to be much confusion in the area from Cape Leeuwin to Cape Naturaliste, and for the present this form is being only named subspecifically ***Bothriembryon leeuwinensis eventus*** subsp. nov.; the type measuring 23 mm. in length by 14 mm. in breadth.



**Bothriembryon costulatus** Lamarek 1822.

Plate II., fig. 19.

- 1822—*Helix costulata* Lamarek, Hist. Anim. s. Vert., Vol. VI., pt. 2, p. 122, Apl. as synonym of *inflatus* infra, ex "Daudeb, No. 405," which refers to
- 1821—*Helix (Cochlogena) costulata* Férussac, Tabl. Syst. Anim. Moll. Limaçons, p. 58, Jan.; p. 54, June. Nomen nudum. "Le port du Roi George, dans la Nouvelle-Hollande, Péron: la baie des Chiens-Marins, Gaudicho."  
Shark Bay is here selected as type locality.
- 1822—*Bulimus inflatus* Lamarek, Hist. Anim. s. Vert., Vol. VI., pt. 2, p. 122, Apl. Nouvelle Hollande.  
Not *Bulimus inflatus* Olivier, Voy. Othoman, Vol. II., p. 356, 1801.
- 1838—*Bulimus costulatus* Potiez et Michaud, Galerie des Molusques Mus. Douai, Vol. I., p. 138, pl. XII., figs. 17-18, October, ex *Cochlogena costulata* Férussac.
- 1841—*Bulimus inflatus* Delessert, Recueil Coq. Lamarek, pl. 28, fig. 1. Lamarek's shell figured.
- 1864—*Bulimus onslowi* Cox, Cat. Austr. Land Shells, p. 24. Dirk Hartog I., West Australia (Onslow).  
Figs. Cox, Mon. Austr. Land Shells, p. 74, pl. XIII., f. 13, May, 1868.
- 1892—*Liparus onslowi* Hedley, Rec. Austr. Mus., Vol. II., 29, Aug.
- 1894—*Bulimus (Liparus) onslowi* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 95, pl. VII., fig. 28 (not fig. 29), June. Dirk Hartog Island, West Australia (J. J. Walker).
- 1900—*Bothriembryon onslowi* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XIII., p. 11, pl. IV., figs. 43, 44, 48; Apex, pl. IV., fig. 75, Apl. 23.
- 1901—*Bothriembryon onslowi* Kobelt, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, lief 463, p. 769, pl. 112, fig. 15-16, (p. 765 dated 8 VII. 1901).

The identity of Lamarek's species seems to be obvious though hitherto overlooked. His description reads: "B. testâ ovatâ, ventricosâ, perforatâ, longitudinaliter striatâ, squalide albâ; spira obtusiuscalâ; labro margine subreflexo. Habite dans la Nouvelle Hollande. Mon cabinet. Longueur, près d'un ponce."

This agrees very well with the Shark Bay shell, the words "ventricosâ . . squalide albâ . . spira obtusiuscula" being characteristic of that form. Férussac had previously named the shell *costulatus*, and Lamarek rejected this, renaming it *inflatus*, but unfortunately the latter had been previously used by Olivier, so that Férussac's name comes into use. As localities Férussac gave King George's Sound and Sharks Bay, and though the former locality has been accepted for Lamarek's *inflatus*, the figure given by Delessert is of the Shark Bay shell. This figure measures 27 mm. by 17 mm., and Shark Bay shells vary from 26 to 28 mm. by 17 mm., smaller ones 24 mm. by 16 mm., and 21 mm. by 15 mm. Smith's figure of *onslowi* measures 24 mm. by 16 mm., and Cox's measurements of *onslowi* are equal to 21.2 mm. by 15 mm.

Péron records from Bernier (and other) island(s) in Shark Bay: "Two species of land shells extremely numerous, but all dead, occupied great



stretches of the interior of the island; one was a small species of *Helix*, the other belonged to the genus *Bulimus* of M. de Lamarek." Férussac gave as the collector of his Shark Bay shells, "Gaudicho"; this refers to C. Gaudichaud, the apothecary on the *Uranie*, which visited Shark Bay in 1818.

In further confirmation, Potiez and Michaud are cited, as they figured the Shark Bay shell under the name *Bulimus costulatus* Férussac, and acknowledged the assistance of Férussac.

The shell is roundly oval, the spire short, obtuse, less in length than the aperture, which is oval, outer lip thin, rather solid. The coloration of all the dead shells seen is white, but the living shell is orange, longitudinally flamed with dull streaks.

Apex flattened not distinguished finally from adult whorls, the sculpture beginning as faint wrinkled lines, the succeeding whorls sculptured with fine concentric lines cutting the faint growth lines into small lozenges which vanish below the periphery of the last whorl. Columella short, reflected triangularly over the umbilicus, which however is not closed.

### ***Bothriembryon minor* Pilsbry 1900.**

Plate II., fig. 20.

1900—*Bothriembryon onslowi* var. *minor* Pilsbry, Man. Conch. (Tryon), 2nd Ser., Vol. XIII., p. 12, Apl. 23, for Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 95, pl. VII., fig. 29, June. Dirk Hartog I., West Australia (J. J. Walker).

1901—*Bothriembryon melo* var. *hartogensis* Kobelt, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. 13, Theil 2, p. 770, pl. 112, fig. 15, dated June 19. Dirk Hartog's I., W.A.

Smith wrote: "*onslowi* . . . . Five other examples are considerably smaller, averaging only 15 to 18 mm. in length. They are a trifle less globose, and more strongly granular just below the suture." Pilsbry commented: "Apparently adult specimens of this small form before me are even smaller than the dimensions given by M. Smith, two measuring: Alt. 13.5 diam. 9, longest axis of aperture 8 mill, whorls  $4\frac{1}{2}$ ; and alt. 14.5, diam. 8.2, longest axis of aperture 8 mill., whorls a trifle over 5. They are strongly granose below the suture, and striped longitudinally with pale reddish or grey and opaque white." Kobelt later also named this form, and it seems common and easily separable and not a dwarf of "*onslowi*." Collecting might solve the problem as there is no similar instance of dwarfing in this family.

### ***Bothriembryon whitleyi* sp. nov.**

Plate II., fig. 21.

A nice series, collected by my colleague, Mr. G. P. Whitley, at Geraldton, is composed of white dead shells. They are, however, quite fresh and do not appear to have been coloured. Shell small, dead white rather shining subglobose perforate, perforation hidden by reflected columella. Apex of two whorls, finely punctate, a subvarix separating these from the adult four whorls which are longitudinally radially wrinkled, the radials crossed by concentric lines, which produce a subnodulose appearance, the base of the last whorl smooth. The mouth is oval, the outer lip thin, the columella rather broadly reflected, hiding the umbilicus, but leaving it quite open. Height 16 mm., breadth 12.5 mm. This is a plumper shell than *minor*, and differs in coloration.



**Bothriembryon perobesus** sp. nov.

Plate II., fig. 22.

One specimen from the mouth of the Moore River obviously belongs to the "*onslowi*" series, but is even more globose than the most inflated typical "*onslowi*." It is a live shell, and has the same style of coloration as the *onslowi* forms, but in the living shell the ground colour is pale yellowish green, the longitudinal banding a rich brown. The shell is stout, the spire very short and somewhat flattened, the body whorl taking up the bulk of the shell which consists of four adult whorls and two apical whorls, the latter being somewhat strongly eroded. The columella is broad, white, strongly reflected, hiding the narrow umbilicus, which, however, still remains open. Only a slight subcancellate sculpture appears below the suture, the shell otherwise being smooth, the growth lines scarcely showing up. The height of the shell is 25 mm. while its breadth is 19 mm. the length of the aperture being 15 mm., its breadth 8 mm. The annual rainfall is between 15 and 20 inches.

**Bothriembryon indutus** Menke 1843.

Plate II., fig. 23.

1842—*Bulimus indutus* Menke, Moll. Nov. Holl. Spec., p. 6, Apl. Darling Range and Mt. Eliza, West Australia.

Fig'd. Cox, Mon. Austr. Land Shells, p. 73, pl. 13, fig. 10, May, 1868. Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XIII., p. 13, pl. 3, figs. 58-61, Apl. 23, 1900. Kobelt, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, heft CLXVIII., lief. 467, p. 783, pl. 114, figs. 2, 3, 7, sheet dated 28-XII.-1907.

1877—*Bulimus ponsonbyi* Angas, Proc. Zool. Soc. (Lond.), 1877, p. 70, pl. xxvi., fig. 1. Western Australia (J. Gould).

1901—*Panda ? ponsonbyi* Kobelt, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, heft CLXVIII., lief. 467, p. 785, pl. 114, fig. 5, sheet dated 28-VII.-1901. Angas, figure copied.

Although this species is one of the most distinct it was overlooked for some time but is now well known from its form and coloring as well as size. Two notable colour variations occur dull greenish yellow with dark growth period stop marks, and reddish brown with pale yellow growth period stop marks. Apparently these shells stop growth, and the inside of the outer lip takes on a different colouring, and when the shell restarts, it leaves a very distinct contrasting record of the stoppage. The shell is very elongate, stout, regularly narrowed about twice as long as broad, and while the columella is twisted a slight umbilical chink is present, the spire about equalling the aperture in length. The apex is punctate but usually eroded, and no varix can be seen, the adult whorls show a faint nodulose reticulation on upper whorls, the last whorl only with obscure growth marks.

The specimen figured is from King's Park, Perth, and measures 40 mm. in length by 19 mm. in breadth, while smaller ones measure 34 mm. by 16 mm. The dead shells are white as the coloration lies in the rather thick periostracum which clothes the shell.

Hedley (Proc. Malac. Soc. (Lond.), Vol. I, p. 260, 1895), wrote: "Judging from the figure of *Bulimus Ponsonbyi*, and from the travels of its collector, I am disposed to deny that it is a *Liparus*, or that it comes from Western Australia, but hold it rather to be a variety of *Panda atomata* collected in New South Wales." There is now little doubt that Gilbert collected the specimens in the neighbourhood of Perth, and that the name is an absolute synonym of *indutus*.



**Bothriembryon glauerti** sp. nov.

Plate II., fig. 24.

A very distinct form belonging to the *indutus* series, but easily distinguished by its shape, the very short spire and the swollen body whorl, which is more than two-thirds the bulk of the shell. There is a glossy green periostracum which shows the characteristic "*indutus*" growth stages in darker relief. The apex is elevated, and the incurved earliest portion is coarsely anastomosingly wrinkled, a coarse irregular pitting succeeding, with finally a fine wrinkling striae forming; with a strong lens this sculpture can be traced on the body whorl, and more notably on the earlier whorls, subsutural wrinkling being present. The columella is twisted, white, a white glaze crossing the body whorl, the aperture within being bluish white, the outer lip thin; there is no umbilical fissure left, the shell appearing imperforate though in the very juvenile stage a small chink may be noted. The type measures 38 mm. in length by 22 mm. in breadth, the length of the body whorl being 30 mm. and that of the aperture 21 mm. The locality is Stirling Ranges, which is included in the 20 to 25 inches annual rainfall belt.

**Bothriembryon fuscus** Thiele 1930.

Plate II., fig. 25.

1930—*Bothriembryon fuscus* Thiele, die Fauna Süd-West Australiens, Bd.

V., lief 8, p. 588, pl. IV., fig. 68. Torbay, South-West Australia.

Thiele described a very immature specimen which appears to be a representative of a very large series collected by Mr. Sidney W. Jackson many years ago in the karri forests at Nornalup Inlet, Deep River, which has a rainfall of 35 to 40 inches annually, which is the same as at Torbay. The Denmark shells are here described, and if these should be later proven distinct, as Thiele's figure is not exactly agreeable they may be called *franki* suggested by Mr. Jackson.

Shell large, elongate, narrow, spire and aperture about equal, latter oval, columella slightly thickened, appressed, commonly closing umbilicus, but very rarely this may be retained as a chink. Coloration varying from straw to dark brownish yellow, streaked with darker brown, especially along the growth lines. Sometimes the juveniles are uniform straw, at others dark chocolate; again shells may be found bearing a broad dark band above the periphery, a form of coloration seen in the shells from the Recherche Archipelago, forms of *rhodostomus*. When the shell rests the outer lip edge is darkened and this provides the dark growth streaking, a feature of all the *indutus* series. The apex is elevated, minutely wrinkling sculptured, the wrinkles fading into growth ridges, the whorls showing no distinct separation but succeeded by a fine concentric lining which never becomes prominent and soon disappears. The growth lines are flattened so that they are more notable as colour streaks than ridges, and the faint concentric lines can only be seen with a lens, the body whorl appearing smooth. Length (type of *franki*) 40 mm., breadth 21 mm., length of aperture 20 mm. These shells are found in hazel scrub up high on hazel trees and leaves, up to 40 feet on the limbs.

**Bothriembryon kingii** Gray 1825.

Plate II., figs. 26-28.

1825—*Bulimus kingii* Gray, Annals Philos (Thomson), Vol. XXV., (2 Ser., Vol. IX.), p. 414, June. New Holland (Capt. King) = King George's Sound, South-West Australia.



- 1826—*Helix bulimus* King, Narr. Surv. Coasts Austr., Vol. I., p. 12, "1827"  
= Apl. 15, 1826. Near Bald Head, King George's Sound.
- 1828—*Helix kingii* Wood, Suppl. Index Test, p. 22, pl. 7, *Helix*, fig. 27,  
(pref. May 17), New Holland. Brit. Mus. Type figured.
- 1822—*Helix trilineata* Quoy & Gaimard, Voy. Astrol., Zool., Vol. II., p. 107,  
pl. IX., figs. 1-3. Bald Head, King George's Sound, S.W.A.
- 1848—*Bulimus trilineatus* Reeve, Conch. Icon., Vol. V., pl. XLVIII, sp. &  
f. 310, November, as of Q. & G. New Holland.
- 1849—*Bulimus trilineatus* Reeve, Conch. Icon., Vol. V., pl. LIX., sp. & f. 397,  
January, ex Q. & G. "Port George," New Holland.
- 1864—(*Bulimus*) *quoyi* Cox, Cat. Austr. Land Shells, p. 23, new name for  
Reeve's fig. 397, not Reeve's fig. 310.
- 1868—*Bulimus kingi* Cox, Mon. Austr. Land Shells, p. 75, pl. XIII., fig. 7,  
May.
- 1892—*Liparus kingi* & var. *trilineatus* Hedley, Rec. Austr. Mus., Vol. II.,  
p. 29, Aug.
- 1900—*Bothriembryon kingii* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol.  
XIII., p. 7, pl. 2, figs. 21-28, apex, pl. 4, fig. 77-78, Apl. 23.
- 1900—*Bothriembryon physoides* var. *humilis* Pilsbry, Man. Conch. (Tryon),  
Ser. II., Vol. XIII., p. 10, pl. II., figs. 33-34, Apl. 23. King  
George's Sound, West Australia.
- 1901—*Bothriembryon trilineatus* Kobelt, Syst. Conch. Cab. (Mart. &  
Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, heft CLXV., lief.  
463, p. 766, pl. 112, figs. 5-9, (sheet dated 8, VII., 1901).
- 1901—*Bothriembryon kingii* Kobelt, id. ib., heft CLXVIII., lief 467, p. 779,  
pl. 113, figs. 19-23, pl. 116, figs. 14-15, (sheet dated 10 VII., 1901).
- 1901—*Bothriembryon physoides* var. *humilis* Kobelt, id. ib., p. 790, pl. 116,  
figs. 9-10, (sheet dated 2 VIII, 1901).

The typical *kingii* shows the attenuate form of this group, though the shell was only half grown; a little later Quoy and Gaimard gave excellent figures of the shell and animal from exactly the same place as King had collected them. Their shell was fully grown, and less boldly marked, and both names have sometimes been used but the latter name is absolutely synonymous. Unfortunately the general locality, King George's Sound, was used for shells from the surrounding area where more than one race may occur. Hence Pilsbry named a var. *humilis* of *physoides*, which is based on a small local series of the present species, but the name can not be used, as no definite locality is known, and the shells appear immature.

The shell is elongate, the spire acuminate, the apex elevated, the mouth elongate, shorter than the spire, the columella reflected and appressed with a twist, obliterating the umbilicus, outer lip thin. The shell is thin and delicate, and the coloring is a dirty white streaked more or less thickly with pale brown, rarely of a reddish tinge. The streaks are commonly notable as in the type of *kingii*, and are as commonly almost obsolete as in the type of *trilineatus*. Some are almost clear white, others clear yellowish, and in some cases the streaks coalesce, and an almost uniform brown body whorl is formed. The thinness and shape are however constant as is the lack of any defined sculpture, the rude flattened radials showing no cross sculpture. The apex consists of two whorls, the tip elevated, minutely punctate, the punctations finally running into lines: the adult whorls follow without a varix, but the



change can be seen. The columella is reflected, closing the umbilicus as a general rule, but in some cases as in *trilineatus* typical, as here shown, the swelling of the body whorl allows the retention of a slight chink indicating that the juvenile is perforate. A circumbilical red patch is usually present in this group. The two specimens figured are from the type locality, and represent normal *kingii* and *trilineatus*, the former measuring 24 mm in length, by 13 mm. in breadth, the latter being 29 mm. in length, by 15 mm. in breadth.

The type of Pilsbry's var. *humilis* is also here figured, and it measures 17.5 mm. in length, by 10 mm. in breadth. It is obviously referable to this series, but differs from the typical form in showing a coarser longitudinal radial ribbing, cut by a few concentric lines on the earlier whorls and on the shoulder of the last whorl. There is an umbilical chink, and no red circumbilical patch, and somewhat similar shells have been seen from the Pallinup River, South Coast.

***Bothriembryon notatus* sp. nov.**

Plate II., fig. 29.

An excellent series from the Pallinup River, south coast, recalls *B. jacksoni*, but the shells are narrower and have a paler ground colour. Shell thin, elongate, of the *kingii* style, but the spire not so attenuate, and the mouth is equal to the spire in length. Coloration greyish-white longitudinally flamed with red brown, the markings varying in intensity, some showing few marks being almost unicolor, while others have the markings running together so as to produce an almost uniform dark shell. The red circumbilical patch is always present. The apex is of the typical *kingii* form, the succeeding whorls sculptured with wide longitudinal ribbing, which is most pronounced below the suture producing a puckered collar. This persists on to the body whorl, where otherwise the ribbing becomes obsolete. The columella is reflected so as to hide the umbilicus, which, however, remains open as a chink. Length 24 mm., breadth 11 mm., length of aperture 12 mm.

***Bothriembryon jacksoni* sp. nov.**

Plate II., fig. 30.

A very interesting form of the *kingii* series was collected by Mr. Sidney W. Jackson at Deep River, Frankland River, Nornalup, to the west of King George Sound, on trees and shrubs in the hazel scrub among the karri.

It lacks the acuminate spire having a rather swollen body whorl with a conical short spire, the texture thin, the colouring bright fawn with deep red brown streaks, and a deep red brown circumbilical patch. The apex is finely regularly punctate throughout the two whorls, the sculpture on the subsequent whorls being composed of rude radials crossed lightly on the earlier whorls by fine concentric lines forming a fine nodulation at places, but irregular and becoming obsolete on the body whorl. The columella is twisted, white, and reflected leaving an umbilical chink. The length of the type is 27 mm., the breadth 15 mm., length of spire 13 mm.

***Bothriembryon maxwelli* Kobelt 1901.**

Plate II., fig. 31.

1901—"Bothriembryon" *maxwelli* Kobelt. Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, heft CLXVIII., lief 467, p. 781, pl. 112, figs. 4, 5, 17, sheet dated 28 VII. 1901, ex Brazier M.S. No definite locality = "Doubtful Island King George's Sound, W.A."



- 1868—*Bulimus kingi* Cox, Mon. Austr. Land Shells, p. 75, pl. 19, fig. 12, 12a, May. Doubtful I., W. Australia (Masters).  
 1900—*Bothriembryon kingii* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XIII., pl. 2, fig. 29 only, Apl. 23.

Although Cox figured this form he did not mention it in the text, and Pilsbry also figured a specimen which is here refigured, and then Kobelt brought in a Brazier MS. name for this shell. There are many specimens in the Australian Museum bearing Brazier's MS. name, and localised as Doubtful Island, but which Doubtful I. is intended must be found out by local collectors. On the labels here it is said to be "Doubtful Island, King George's Sound," and many shells of the *melo* series are also so labelled, one set being the *castaneus* form (Pilsbry's fig. 18), and another set agreeing with Pilsbry's figure 3. If there be three distinct series of *Bothriembryon* living on Doubtful Island, the place is in need of close investigation. The shell is a small thin representative of the *kingii* form, but is smaller, narrower and not so attenuate as the typical shell. It is always of a fawn colour, rarely streaked with reddish and the red circumbilical patch is usually absent. The apex is elevated, normally punctate, the punctations linking up into lines, the adult sculpture easily separated, rough radial ribbing developing below the suture where it persists through growth. The radials become obsolete with age, while a regular series of concentric lines appears on the earlier whorls, none of which cuts the radials. The columella is appressed, almost closing the umbilicus, but generally a chink remains. The length of the figured specimen is 20 mm. with a breadth of 10 mm.

Recent research suggests that this Doubtful Island is the island off Doubtful Island Bay, and this is confirmed by the name *maxwelli* as there is a Mt. Maxwell overlooking that bay.

### ***Bothriembryon perditus* sp. nov.**

Plate II., fig. 32.

Specimens collected by E. Gratwick, 70 miles east of Israelite Bay, that is, some twenty miles east of the type locality of *gratwicki*, are all dead, but show remains of the colour pattern, which is that of the *kingii* series. The shape is elegant, the body whorl not swollen, but the aperture about equal to the spire, the texture thin, the spire is not acuminate. The coloration shows regular reddish flame streaks on a whitish ground, some however nearly unicolor. Apex elevated, punctate, the succeeding sculpture regular wavy growth lines with transverse cross lining but the whole sculpture very weak: the puckering below the suture is well marked and a little of the longitudinal radials remains on the body whorl. Columella twisted and appressed so that no umbilical fissure remains, the shell appearing imperforate. A thin glaze crosses from the inner lip to the edge of the outer which is thin. Length of type 24 mm., breadth 12 mm.

The locality is in the annual rainfall 15-20 inches belt.

### ***Bothriembryon sayi* Pfeiffer 1847.**

Plate II., figs. 33 and 34.

- 1847—*Bulimus sayi* Pfeiffer, Proc. Zool. Soc. (Lond.), 1846, p. 114, Jan. 26, 1847. Locality unknown = Cape Freycinet, West Australia. Fig'd Reeve, Conch. Icon., Vol. V., pl. LXV., sp. and fig. 458, 1849.



1900—*Bothriembryon kingii* var. *solidus* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XIII., p. 9, pl. II., fig. 28, April 23. West Australia = Margaret River.

Specimens from Cape Freycinet agree so closely in their features with the figure and description of *sayi* that they can be so named, while *solidus* Pilsbry appears to be merely a large local variation of this species.

The typical shell is small, with an attenuate spire with the whorls flattened, rather solid, with the umbilicus always left a little open. The coloration is whitish with a few pale red streaks at times. There is no circumbilical patch in this series, other wise there is no discrepancy at all. A rather notable feature is the thickening of the columella and the strong white glaze connecting the inner and outer lips, the latter having the edge stouter than usual.

The type of *solidus*, here figured, is much larger and more solid, and belongs to a series from the Margaret River, having the same conical attenuate spire with flattened whorls, and the longitudinal sculpture a little stronger.

### ***Bothriembryon naturalistarum* Kobelt 1901.**

Plate II., figs. 35 and 36.

1901—*Bothriembryon kingii* var. *naturalistarum* Kobelt, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, h-ft CLXVIII., lief. 467, p. 781, pl. 113, figs. 22-3, sheet dated 28-VII.-1901. Cape Naturaliste, West Australia.

1900—*Bothriembryon kingii* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XIII., p. 9, pl. 2, fig. 30 only, Apl. 23. Cape Naturaliste, W.A.

Pilsbry wrote: "Fig. 30 is a small specimen from Cape Naturalist. There are 5 whorls, the last inflated below, almost imperforate. It is beautifully streaked with opaque, glossy white on a corneous and purplish brown ground. Alt. 20, diam. 11, longest axis of aperture 10, 7 mill. The aperture is decidedly more oblique than in the typical form from King George Sound. It is not unlikely that this will prove a geographic race or variety. From the Cox collection." Kobelt gave this the varietal name *naturalistarum*. The series from which Pilsbry selected the figured shell is before me, and I am refiguring his specimen. Again it is immature, but numbers collected by Tom Carter at the same locality show that it develops into an elongate shell very like that from Margaret River, which I regard as *sayi*, but it is thin and has the mouth more expanded, is smooth, and measures 25 mm. in length by 13 mm. in breadth.

Local naturalists must study these shells and fix the status of the named forms.

### ***Bothriembryon revectus* sp. nov.**

Plate II., fig. 37.

While collecting numerously *B. jacksoni* at Deep River and Bow River, Mr. Sydney W. Jackson also found alive under debris on ground in dense hazel scrub at the Bow River some shells of the *kingii* series, but sculptured after the style of *brazieri* and *leeuwinensis*. The narrow shell here selected as type measures 23 mm. in length by 11 mm. in breadth; a broader shell measures 23.5 mm. in length by 12.5 mm. in breadth. The spire about equals the aperture in length, and is not attenuate. The columella is appressed so that barely a chink remains, and there is a red circumbilical patch, while the



apex is of the *kingii* style. The sculpture is subnodulose, the radials irregular and rather ill-defined, while the concentric lines vary in strength, but the sculpture is notable in every case. The coloration is fawn, more or less flamed with red brown, the shell thin and the surface lustreless.

A similar shell was found on small bushes "in jarrah forest, Mt. Frankland," three months later by Jackson.

Smith's record of *physoides* (Proc. Malac. Soc. (Lond.), Vol. I., p. 95, pl. VII., figs. 30-31, June, 1894) may refer to shells of this form.

**Bothriembryon brazieri** Angas 1871.

Plate II., fig. 38.

- 1871—*Bulimus* (*Liparus*) *brazieri* Angas, Proc. Zool. Soc. (Lond.), 1871, p. 19, pl. I., fig. 28, June 12. Sinclair's (error for Stirling) Range, King George's Sound, West Australia.
- 1873—*Bulimus* (*Liparus*) *brazieri* Brazier, Proc. Zool. Soc. (Lond.), 1872, p. 807, correction of error of locality name.
- 1892—*Liparus brazieri* Hedley, Rec. Austr. Mus., Vol. II., p. 29, Aug.
- 1900—*Bothriembryon physoides* var. *brazieri* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XIII., p. 10, pl. 2, figs. 38-40, Apl. 23.
- 1901—*Bothriembryon brazieri* Kobelt, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, heft CLXVIII., lief. 467, p. 778, pl. 113, figs. 17-18, (sheet dated 10, VII, 1901).

This extraordinary development of the *kingii* series is shorter than usual, not so acuminate in the spire, the whorls more rounded. The coloration is a brownish fawn with a few red radial streaks and a bright red circumbilical patch. The sculpture is coarsely granular, the rude longitudinal ribs being cut into nodules by deep concentric lines, and this sculpture continues on to the base of the body whorl. The apex is of the *kingii* style, finely punctate and stopping abruptly at the end of two whorls. The columella is white, appressed leaving a small chink. The shell is thin, and the figured one measures 19 mm. in length by 10 mm. in breadth.

**Bothriembryon gratwicki** Cox 1899.

Plate II., fig. 39.

- 1899—*Buliminus gratwicki* Cox, Proc. Linn. Soc., N.S.W., Vol. XXIV., p. 435, fig. in text, December 9. 50 miles East of Israelite Bay, South-West Australia.
- 1900—*Bothriembryon gratwicki* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. XIII., p. 11, pl. 2, figs. 31, 32, pl. 45, figs. 2-4, Apl. 23.
- 1901—*Bothriembryon gratwicki* Kobelt, Syst. Conch. Cab., (Mart & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, heft CLXVIII., lief. 467, p. 789, pl. 116, fig. 718, (sheet dated 2, VIII, 1901).

This interesting shell is elongated, narrow, spire long, pointed, longer than aperture, which is narrowly oval, solid, chalky, umbilicate. The coloration is chalky white. Strongly sculptured throughout, thereby differentiating this species from all others save *brazieri*. The sculpture consists of elevated irregular rounded ribs, apparently intensified growth lines, over-run with concentric lines forming a subnodulose ornament, the nodules irregular in size and form.



The apex is coarsely wrinkly striate around the upper part of the whorls, the lower reticulately pitted, consisting of two full whorls, the adult sculpture abruptly forming thereafter, almost a varix intervening.

The columella is strongly reflected, but does not hide the umbilicus, and joins the outer lip, which is thin, by means of a glaze across the body whorl, almost freeing the mouth.

Length of figured shell, 27 mm.; breadth 12 mm.

The locality is in the annual rainfall 10-15 inches belt.

### **Bothriembryon dux** Pfeiffer 1861.

Plate II., fig. 40.

1861—*Bulimus dux* Pfeiffer, Proc. Zool. Soc. (Lond.), 1861, p. 24, May 1. King George's Sound, South-West Australia. Fig'd. Cox, Mon. Austr. Land Shells, p. 71, pl. XIII., fig. 4, pl. XVIII., fig. 16, May, 1868.

1892—*Liparus dux* Hedley, Rec. Austr. Mus. Vol. II., p. 29, August.

1894—*Bulimus (Liparus) dux* Smith, Proc. Malac. Soc. (Lond.), Vol. 1, p. 94, June.

1900—*Bothriembryon dux* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XIII., p. 3, pl. 3, fig. 62, Apl. 23.

1901—*Bothriembryon dux* Kobelt, Syst. Conch. Cab., (Mart & Chemn.), ed. Kuster, Bd. I., Theil 2, heft CLXV., lief. 463, p. 763, pl. 112, figs. 1-2, sheet dated 21 : VI. : 1901.

This magnificent species stands alone in its large size, its white colour, and its solidity. The apex is regularly punctate, the sculpture is of rough radials crossed on the earlier whorls by fine concentric lines, the cross sculpture vanishing on the shoulder of the last whorl. The columella is broadly reflected, concealing an open umbilicus, and the outer lip is thin. The spire is about the same length as the aperture. The shell figured measures 60 mm. in length by 35 mm. in breadth. Odd specimens are known from Norseman, Dundas, Salmon Gums, Balladonia, Esperance Mallee Belt, and it thus seems to be an inhabitant of the drier inland belt and not coastal although all the early collected specimens are labelled King George's Sound.

### **Bothriembryon barretti** Iredale 1930.

Plate II., figs. 41 and 42.

1930—*Bothriembryon barretti* Iredale, Viet. Naturalist, Vol. XLVII., p. 119, fig. in text, Nov. Nullarbor Plain, S.W. Australia.

1879—*Bulimus indutus* var. *pallidus* Tate, Trans. Proc. Roy. Soc. Adelaide, South Austr., 1878-9, p. 134. Bunda Plateau, Nullarbor Plain, South Australia.

Not *B. pallidus* C. B. Adams, Proc. Bost. Soc. Nat. Hist., Vol. II., p. 12, 1845.

1900—*Bothriembryon indutus* var. *pallidus* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. XIII., p. 15, pl. 3, figs. 63, 64, 65. Apl. 23.

1901—*Bothriembryon indutus* var. *pallidus* Kobelt, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Theil 2, heft CLXVIII., lief. 467, p. 784, pl. 114, fig. 8 (sheet dated 28-VII.-1901). Pilsbry's figures copied only.



The original description of *barretti* reads: "Shell elongate, dirty white, aperture about equal to length of spine (spire). The apex is sculptured with a curious fine wrinkling, which develops into fine radials which are later crossed by revolving lines. This causes a mat-like appearance of rather longitudinal nodules, which, however, disappear upon the base. A young example shows the spiral sculpture much more prominently than in the adult. There is an umbilical chink present, and the outer lip is sharp. Whorls, six; length, 27 mm.; breadth, 15.5 mm.

The type of *B. barretti* was collected near Hampton inside the Western Australian boundary. Tate's locality, "Bunda Plateau" also crosses the border line, and in a series sent to Pilsbry he figured two variations, the general label being "Eucla." Among the shells before me now there are also two varieties, and it is now seen that the coastal shells are narrower than the more inland ones. Upon referring to the rainfall again, that is given as being 20-25 inches on the coast, and only 15-20 inches in the inland area. The narrow form was figured by Pilsbry, f. 63, and his specimen is here refigured as type of a subspecies, *B. b. indictus* nov., the shell measuring 30 mm. in length by 15 mm. in width, the series coming from Eucla.

#### **Bothriembryon distinctus** sp. nov.

Plate II., fig. 43.

A series of shells from Cardanumbi, west of Eyre, is of great interest, the shells having an acuminate spire with a swollen body whorl. This shape is not seen in any other series, the *kingii* being elegantly slender, while the *melo* forms are regularly oval.

The coloration is dirty white in the dead shells examined. The apex is not elevated, wrinkled, the wrinkling being succeeded by a punctation, no subvarix visible, the adult sculpture being of the usual rough radials, somewhat subdued, and crossed by fine concentric lines, irregularly forming squarish nodules, which disappear altogether on the body whorl, only faintly discernible on the penultimate one, and never very strong on any of the earlier whorls. Although the umbilicus is open, the broadly reflected columella hides it, the mouth is rather large, the outer lip thin. The spire is longer than the aperture but the body whorl is large and dominant. The length of the type is 27 mm., breadth 15.5 mm., length of the aperture 12 mm., the breadth of the penultimate whorl 9 mm.

The locality is in the annual rainfall 10-15 inches belt, and from the 70-mile tank at Balladonia similar shells have been sent along with *barretti*.

As above stated, this species does not fit into any of the named subgeneric groups so is here differentiated as *Celatembryon* subgen. nov.

#### **FAMILY LAOMIDAE.**

Though this family name is continued, it may need revision as all the Australian forms have unarmed mouths, and a distinct shell appearance, the Neozelanic typical *Laoma* having teeth in the aperture, and a different shell texture. However our shells appear to be of Paralaomid alliance, and that is a Neozelanic group with suggested relationship to *Laoma*.

#### **Genus WESTRALAOMA** gen. nov.

Ordinary looking Paralaomids in general appearance, but with the protoconch concentrically spirally striate. The shells are small, generally under 3 mm. in breadth, and 1.50 mm. in height, depressedly conical with



comparatively large apical whorls, the apex, as above, concentrically spirally striate, the adult sculpture radial threads, with larger radial ridges, more or less distant, and usually well marked, rarely with concentric striation. The umbilicus is comparatively wide and open, the mouth circular, the lip thin. The type of *Westralaoma* is *W. experta* nov.

The true *Paralaoma* (Iredale Proc. Malac. Soc. (Lond.), Vol. X., p. 380, Sept., 1913) was based on a similar looking Kermadec shell, which has a smooth or radiately striate protoconch, and which lived in dry places, and the majority of Australian *Paralaomids* have the same habit.

***Westralaoma experta* sp. nov.**

Plate I., figs. 18 and 28.

1868—*Helix morti* Cox, Mon. Austr. Land Shells, p. 21, pl. XI., fig. 13, W. Australia.

1894—*Patula morti* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 87, June; above record only.

When Smith included this species on Cox's record, he noted "This is the only instance among the Australian *Helices* in which the same species occurs on both sides of the continent," as it had been described from Sydney. Once again geographical values prove more important than superficial association, as upon re-examination, the Westralian shells are seen to differ in the essential feature of the sculpture of the protoconch. The series so named by Cox is available and the species is named as above. Shell very small, subconical, narrowly umbilicate, brown. The apex is large, bulbous, of two whorls, spirally finely striate, adult whorls sculptured with distant radial ridges and fine striae, on the last whorl the strong radials number between thirty and forty, the interstices finely radially striate with a finer concentric striation, forming a subreticulation under a high power; the mouth is large, the outer lip thin. Breadth 1.25 mm.; height .5 mm. The type locality is King George's Sound, collected by Masters.

***Westralaoma scitula* sp. nov.**

Plate I., fig. 19.

This species, discovered by Mr. Sidney W. Jackson at the Bow River, South Coast, is somewhat depressed, the umbilicus open, deep, and about one-third of the basal breadth.

The apical whorls are finely concentrically striate without any varix, the adult sculpture being composed of fine radial striae, with about twenty to twenty-five developing into prominent ridges, about six to eight striae between each ridge. The whorls are convex, the last whorl subangulately rounded, but not keeled, the mouth open subcircular, lip thin, columella straight, a little reflected, not obscuring the umbilicus in any way.

Breadth 1.5 mm.; height .6 mm.

Found in Hazel and Karri scrub under debris on ground.

***Westralaoma expicta* sp. nov.**

Plate III., fig. 4.

A typical *Paralaomid* form with the apex elevated, superficially smooth but, with a strong power, concentric lining can be recognised: adult sculpture of the regular *Paralaomid* style, fine radials with distant coarse ridges about



twenty-five, the fine radials crossed by fine concentric threads suggesting a faint decussation which is faintly seen on base. The umbilicus narrow deep, about one-fourth the breadth of the base, the mouth descending, subcircular, outer lip thin, columella slanting, reflected. Breadth 1.5 mm; height 1 mm.

Nangeenan via Merredin, W.A., collected by E. Sedgwick.

**Westralaoma aprica** sp. nov.

Plate III., fig. 7.

A depressed Paralaomid form lacking strong radial ridges, and the fine radials are crossed by a subordinate concentric threading producing a finely decussate appearance which is more notable in the umbilical cavity, which is about one-third the breadth of the base. Shell subdiscoidal, spire little elevated, apex finely concentrically striate, mouth subcircular, outer lip thin, columella a little reflected. Breadth 2 mm.; height 1.1 mm.

Nangeenan via Merredin, W.A., collected by E. Sedgwick.

Genus **INSULLAOMA** Iredale 1937.

1937—*Insullaoma* Iredale, South Austr. Naturalist, Vol. XVIII., p. 19, Sept. 30. Haplotype *Paralaoma riddlei* Iredale.

This name was introduced subgenerically for the South Australian forms of *Paralaoma*, as these had the apical whorls spirally striate or even lirate, whereas the typical form had the apex smooth or radially finely striate. The shell selected as type of *Insullaoma, riddlei*, was somewhat elevated, umbilicus narrow, finely reticulately sculptured, and had the apex boldly strongly concentrically lined. Of course this cannot be seen without a strong lens. Moreover, in this case there was a peripheral subkeeling. The recognition of a Western Australian form agreeing in all these features has led to the admission of this group generically.

**Insullaoma predicta** sp. nov.

Plate I., fig. 22.

Another of the discoveries of Mr. Sidney W. Jackson at Bow River, South Coast, especially as it appears to be a true *Insullaoma*. Shell small, subdiscoidal, spire short, brown, umbilicus narrow. The apical two whorls are large and bulbous, and are coarsely spirally lirate: the adult whorls are closely fine radiate, with a fine concentric striation crossing it, the last whorl subkeeled. The mouth is subcircular, outer lip thin, columella a little reflected, the umbilicus open, narrow, less than one-third the width of the base. Breadth 1.25 mm.: height .6 mm.

Found alive under karri bark at foot of karri tree on edge of wattle scrub.

Genus **GRATILAOMA** gen. nov.

Type **G. cara** sp. nov.

Plate I., fig. 20.

This beautiful little shell collected by Mr. Sidney W. Jackson at the Bow River, South Coast, suggests an elevated relation of *Westralaoma*, as it is subconical with similar radials, but has a cross sculpture of crosslining, the umbilicus being narrowed.

As *Westralaoma* is constant in form it seems better to name the present form separately than refer it to that genus, and thus spoil the homogeneity of the group.



Shell very small, subconical, whorls a little rounded, sutures lightly impressed, last whorl descending rather rapidly, mouth subcircular, oblique, outer lip thin, columella rather broadly reflected, obscuring a little the narrow open deep umbilicus. Coloration pale brownish. Apex very finely concentrically striate, about two whorls, adult whorls three and a half, sculpture with fine growth striae and these are crossed by very obscure concentric striation. A few distant large striae develop but they can scarcely be called ridges; these number about twenty-five to thirty but they are irregularly spaced and never prominent. Breadth 1 mm.: height .8 mm.

Found alive under karri bark in dense wattle scrub.

#### FAMILY DIPNELICIDAE.

This family was introduced for an interesting shell from Hammock Island, South Australia, and it was remarked "It has not yet been discovered on the mainland, which suggests that it is a relict form of great age." Mr. Sidney W. Jackson collected, at the Bow River and Deep River, specimens of another curious shell, and though it differs in detail it seems to recall the South Australian shell in some respects. It apparently does not fit into any of the other families, such as Charopidae, Laomidae, Flammulinidae or Rhytididae.

Genus **ANNOSELIX** gen. nov.

Type **A. dolosa** sp. nov.

Plate I., figs. 24 and 27.

A very curious little shell, regularly broadly conical, the base convex, the periphery keeled, umbilicus deep, very narrow, the mouth squarish, the outer lip thin, columella.

Coloration brown, base paler brown, but sometimes flamed with reddish brown.

One apical whorl apparently smooth but obscurely radially striate, the striae developing on the adult whorls without any intervening varix. There are four and one-half adult whorls regularly increasing, whorls flattened, sutures scarcely impressed. The radial striae develop slowly and become very numerous and fine, while a delicate concentric striation also forms, producing a very fine semi-cancellate appearance. On the base the concentric spirals generally predominate. Breadth, 7.5 mm.: height 5 mm.

The type is from Deep River, and some specimens from Bow River. South Coast, show that, in some cases, the radials, every now and then, strengthen into ridges and create a fringe at the periphery and continue strongly on to the base. This fringe sticks out a little, and presents a saw-like appearance to the peripheral keel.

#### FAMILY CHAROPIDAE.

This family has a few members in Western Australia, but there may be many more, as they are minute and difficult to find. Seven species have been described and while one is rejected, a few are added. One eastern genus, *Pernagera*, based however on a western shell, is admitted, but the remainder of the species appear to be of endemic origin. All the species so far seen have no armature of the mouth, and all are openly umbilicate. The features of the family are the small size of the shell, the depressed helicoid form, commonly discoidal, with an adult sculpture of numerous radial ridges of varying strength.



Genus **PERNAGERA** Iredale 1933.

1933—*Pernagera* Iredale, Rec. Austr. Mus., Vol. XIX., p. 53, Aug. 2. Ortho-type *Helix albanensis* Cox.

Shell small, somewhat elevated for this family with a very wide cavernous umbilicus, the radial sculpture being rather coarse. Whorls loosely coiled, sutures deep, almost canaliculate, apex radially striate, the tip smooth. The mouth is subcircular, outer lip thin, columella straight, scarcely reflected at all.

**Pernagera albanensis** Cox 1868.

Plate I., fig. 23.

1868—*Helix albanensis* Cox, Proc. Zool. Soc. (Lond.), 1867, p. 723, April 3. King George's Sound, West Australia (Masters). Fig'd. Cox, Mon. Austr. Land Shells, p. 15, pl. IV., fig. 2, May, 1868.

Shell small, almost subglobose, spire conical, whorls rounded, loosely coiled, almost separated by a canaliculate suture, the last whorl descending, other characters as for the genus. Coloration fawn, irregularly rayed with reddish. Apex tip smooth, then radiately striate, the striae developing into riblets which are numerous and fairly regularly spaced, about seventy-five on last whorl, the interstices finely radially striate, no concentric lines apparent. Umbilicus funnel shaped, about one-half the width of the shell. Breadth 5 mm.; height 3 mm.

**Pernagera lena** sp. nov.

Plate III., fig. 3.

A very pretty little shell, collected by Mr. Sidney W. Jackson at the Bow River, recalls *albanensis* in miniature. Shell small, subdepressed, spire slightly elevated, whorls rounded, sutures deep, almost canaliculate, last whorl descending a little, mouth subcircular, columella straight, scarcely reflected, umbilicus wide, funnel shaped exposing all the whorls. Coloration pale brownish with broad red flames. Apex smooth at tip, then finely radially striate, the striae developing into ridges which are regular and numerous, numbering about one hundred and twenty on the last whorl, the interstices striate. Umbilicus about half the width of the base of the shell. Breadth 3 mm.; height 1.5 mm. Under bark and leaves on the ground in Hazel scrub.

Genus **LUINODISCUS** Iredale 1937.

1937—*Luinodiscus* Iredale, Austr. Zool., Vol. VIII., p. 331, Mch. 12. Ortho-type *Helix cuprea* Cox.

"Small flattened charopid shells, spire not sunken, umbilicus wide, mouth small, thin, sculpture of regular fine radials, protoconch spirally lirate." While the type of *Luinodiscus* is a small shell, other species, referred for the present to this group, are large and more bulky.

**Luinodiscus cupreus** Cox 1868.

Plate III., fig. 5.

1868—*Helix cuprea* Cox, Mon. Austr. Land Shells, p. 22, pl. XII., fig. 9, May. King George's Sound, West Australia (Masters, A. M.).

1875—*Helix* (*Charopa*) *nupera* Brazier, Proc. Linn. Soc., N.S.W., Vol. I., p. 18, Apl. 27. King George's Sound, W.A. (Masters).



Shell discoidal, spire not sunken, whorls rounded, sutures deeply impressed, last whorl descending a little, mouth subcircular, lip thin, columella not reflected, straight, umbilicus very wide. The apex is concentrically striate, the adult whorls closely finely ribbed, ribs about eighty in number, interstices striate. Coloration fawn. Breadth 2.5 mm.; height 1.5 mm.

**Luinodiscus sublesta** Benson 1853.

1853—*Helix sublesta* Benson, Ann. Mag. Nat. Hist., Ser. 2, Vol. VI., p. 30, Jan. 1. Fremantle, Swan River, West Australia.

Fig'd. Reeve, Conch. Icon., Vol. VI., pl. 174, sp. 1177, Oct. 1853.

Fig'd. Cox, Mon. Austr. Land Shells, p. 16, pl. XI., fig. 10, May, 1868.

1930—*Charopa hedleyi* Thiele, Die Fauna Südwest Austr., Bd. V., lief 8, p. 587, pl. IV., fig. 67. Brunswick.

Benson naturally gave no details as to the protoconch features nor the number of ribs. It was differentiated from "*H. Iuloidea*, Forbes, by its narrower umbilicus, and the want of concavity in the spire; from *H. cygnea* by the first mentioned feature, and the sculpture."

Thiele does not compare his new species with this, and generally there is agreement, the protoconch being described as spirally sculptured, its size being given at 3.75 mm. in breadth, 1.8 mm. in height, with the umbilicus 1 mm. wide.

Benson's description is here given as the species needs fixation: "Shell rather broadly umbilicate, orbiculate depressed, above red horny, below horny, very minutely costulately striate above, rather flattened, sutures impressed, whorls four, the last a little depressed, rounded, aperture vertical, roundly lirate, peristome acute, umbilicus perspective. Diam. major 3, minor  $2\frac{1}{2}$ , axis 1 mill."

Specimens from the Swan River, collected by R. Helms, measure up to 4 mm. in breadth by 2 mm. in height. These generally agree that the spire is flattened, but not depressed, the umbilicus wide, open, perspective, fully one-third the width of the base. The apex appears to be smooth but under a high power is seen to be finely concentrically striate, the adult sculpture of radial ridges shows between ninety and one hundred on the last whorl, the interstices being crossed by very fine concentric threads, only discernible by a high power.

Specimens from Peppermint Grove are consistently smaller but otherwise there appears to be no definable distinction.

**Luinodiscus cygnea** Benson 1853.

Plate I., fig. 25.

1853—*Helix cygnea* Benson, Ann. Mag. Nat. Hist., Ser. 2, Vol. VI., p. 30, Jan. 1. Perth, Swan River, West Australia (Dr. J. F. Bacon).

Fig'd. Reeve, Conch. Icon., Vol. VII., pl. 174, sp. 1182, Oct. 1853.

Fig'd. Cox, Mon. Austr. Land Shells, p. 16, pl. 12, fig. 3, May, 1868.

1930—*Charopa cuprea* Thiele, Die Fauna Südwest Austr., Bd. V., lief 8, p. 587. Fremantle, S.W.A.

Not *Helix cuprea* Cox 1868 *ut supra*.

Contrariwise, Benson separated this from *H. sublesta* by the more distant ribs, wider umbilicus, colour and larger size from *H. Iuloidea*, Forbes, of the eastern coast of Australia, by its more distant ribs and want of concavity on the upper side. Diam. major 4, minor  $3\frac{1}{2}$ , axis  $1\frac{1}{2}$  mill.



Thiele, again, overlooking this species, referred specimens to *cuprea* with the size 3.75 mm. by 2 mm., the protoconch finely sculptured spirally, and the adult whorls decussate. The size and the sculpture refer the specimens to this species, rather than to *cuprea*. Benson's description is here offered for reference: "Shell broadly umbilicate, orbiculate depressed, horny, furnished with rather remote oblique costulate radials; spire scarcely a little convex, sutures excavate, apex planate; whorls four and one-half, convex, last rounded, aperture subvertical, roundly lunate, peristome acute, umbilicus perspective." Reeve figured the type specimen the same year, and added to the above description "decussated, beneath the lens, in the interstices with very minute spiral striae" and showed this character in his illustration.

***Luinodiscus repens* sp. nov.**

Plate I., fig. 21.

Another of Mr. Sidney W. Jackson's discoveries at the Bow River and Deep River, this species is the largest yet found of this group, measuring 6 mm. in breadth by 2.5 mm. in height.

The shell is fawn flamed with red.

Apex large, of two whorls, finely spirally lirate, about fifteen lirae counted from above, almost a varix intervening before the adult radial sculpture begins. This, on the first adult whorls, consists of about one hundred regular fine radials, the interstices being finely concentrically striate, almost giving the effect of fine beading to the radials.

The shell is flat-topped, the mouth large, while the umbilicus is narrow and deep, measuring about one fourth of the basal breadth.

***Luinodiscus tumidus* Odhner 1917.**

Plate III., fig. 2.

1917—*Endodonta* (*Charopa*) *tumida* Odhner, Kungl. Svensk., Vetensk., Handl. Bd. 52, No. 16, p. 72, pl. 3, figs. 72-74, Sept. 19. Noonkanbah, Fitzroy River, North-West Australia.

Odhner's description was somewhat brief, but from a paratype more details can be given.

Shell discoidal, spire concave, umbilicus moderately wide (narrow, half the width of the last whorl, Odhner) mouth open lunate no teeth in aperture outer lip thin columella straight slight callus joining lips but outer lip descending a little so that it does not reach above the level of the last whorl, sutures deep, almost excavate, whorls well rounded. The apical whorls are two, ending in a varix, and are sculptured with faint concentric striae which are overridden by distant radial lirae of the same character as the adult sculpture. This consists of regularly closely spaced ridges, about eighty on the first adult whorl and continuing similarly closely packed to the end of the last whorl. The interstices are very finely, regularly, closely, concentrically striate. The type measured 3.9 mm. in breadth, the height 2 mm., the specimen above described being very slightly smaller.

It is curious that the majority of Western Australian Charopids so far found have the apical whorls concentrically striate, the striae varying in strength, thus while *cupreus* has the striae well marked almost lirae, *sublestus* has the whorls almost smooth, the concentric striations being seen only by a strong lens and then they are obscure. The present species has the apex



somewhat differently sculptured, the concentric striae being overridden by distant radials, the forerunners of the adult sculpture. As the shell is also concave above, a feature not seen in any southern shell, a new subgenus *Corinomala* being introduced with *E. tumida* as type.

Genus **EPINICIUM** gen. nov.

Type *E. restifer* sp. nov.

Plate I., fig. 26.

A very beautiful shell sent by Mr. Glauert from Serpentine attracted by the bold ridges, recalling those of the much smaller Eastern *Egilomen*.

Shell small, subdiscoidal, spire a little elevated, whorls rounded, loosely coiled, sutures deep, last whorl rounded, descending in front, mouth obliquely semicircular, outer lip thin, columella straight, umbilicus wide, cavernous, walls steep.

Coloration deep brown. Apex tip smoothish, finely radially striate, succeeded in the adult by strong distant radial ribs, the interstices closely radially striate, the ribs on the last whorl numbering about thirty-five, the last ten before the aperture being crowded. Breadth 4 mm.; height 2.5 mm.

This genus differs from *Luinodiscus* in its smoothish apex, sculpture and widely umbilicate form, and from *Pernagera* in its depressed shell, different apex, sculpture, and umbilical features.

One specimen, dead, from Peppermint Grove, is larger, flatter, and with more ribs, the umbilicus wider, and may for the present be regarded as a subspecies only, *E. r. firmatum* nov.

Genus **DUPUCHAROPA** Iredale 1937.

1937—*Dupucharopa* Iredale, Austr. Zool., Vol. VIII., p. 332, Mch. 12.  
Orthotype *Helix millestriata* Smith.

Medium size Charopid shells with depressed spire, narrow deep umbilicus, and sculpture of fine radials with fine spiral striation throughout."

The size separates this from most Charopids but the distinction in sculpture must be characteristic, the spiral striations being continuous over the radials, a very uncommon feature.

**Dupucharopa millestriata** Smith 1874.

1874—*Helix millestriata* Smith, Zool. Voy. Erebus & Terror, Moll., p. 2, pl. 4, fig. 5. Dupuch's I., West Australia.

1894—*Patula millestriata* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 87, June.

1916—*Endodonta millestriata* Hedley, Journ. Roy. Soc., West Austr., Vol. I., p. 220, (p. 71 in separate).

Smith described the species as follows: "Shell thin, horn-colour perspective, umbilicated, depressedly orbicular, ornamented with very close arcuately-radiating thread-like riblets, which are coarser on the upper than the lower surface, entirely covered with microscopic spiral striations, which are continuous on, and between the riblets, spire nearly flat, only slightly elevated; whorls five, slowly increasing, rather convex, separated by a deepish suture, last not descending in front; the umbilicus occupying one-fourth the width of the base; mouth roundly-lunate; peristome simple, thin, columellar



margin a little dilated above. Greatest diameter 7 mill., smallest 6; height 3. Hab. Dupuch's Is., West Australia (Richardson). This small but prettily sculptured species is chiefly characterised by the fine riblets, and the microscopic spiral striations, which are not, as in some other species, interrupted by the riblets, but are continuous over them. The inferior surface is slightly shining, the upper not so."

Smith, later, added: "This is the largest of the W. Australian *Patulae* at present described. Several bear a very strong family resemblance, but appear to be distinguishable in certain minute details."

### FAMILY MICROCYSTIDAE.

This family comprises many small flattened conoid shells of thin shell and glassy appearance, whose exact relationship must be determined by anatomical examination. So far only one group, with two species, has been discovered and in shell characters it has shown peculiarities sufficient to differentiate it from all East Australian groups.

Genus **WESTRACYSTIS** Iredale 1933.

1933—*Westracystis* Iredale, Rec. Austr. Mus., Vol. XIX, p. 56, Aug. 2.  
Orthotype *Lamprocystis lissa* Smith.

Smith described the type species in the genus *Lamprocystis*, observing that it was "well characterised by the peculiar dentiform thickening of the columella and the ridge which arises from it, and passes up the very contracted umbilicus." Hedley transferred it to *Microcystis*, but it was obviously more closely related to *Lamprocystis*.

### **Westracystis lissus** Smith 1894.

1894—*Lamprocystis lissa* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 86, pl. VII., figs. 22-23, June; Queen's Islet, Parry Island (Walker); Burner (error for Barrier) Ranges (Cox), North-West Australia.

The first locality, Queen's Islet, is here selected as the type locality Smith's description reading: "Shell narrowly perforate, orbicular, depressedly conoid above, thin, horny, shining, sculptured with very thin growth striae and microscopic spiral striations; whorls five, little convex, narrowly margined below the suture, the last whorl slightly descending; spire shortly conoidal, rather obtuse at the apex; aperture obliquely lunate, small; peristome thin, the margins approaching, joined by a thin callus, the columella thickened, forming a peculiar tooth above the perforation; umbilicus very narrow, furnished with an intrusive keel terminating at the columellar tooth. Breadth 8.5; height 5 mm."

### **Westracystis tentus** sp. nov.

Plate III., fig. 14.

A large number of specimens, collected by W. W. Froggatt in the Barrier Range, all show an engraved umbilicus, a feature not recorded by the very accurate Smith in his description of *W. lissa*, though he carefully examined the umbilical features. Yet this is a feature of many members of this family.

The Barrier Range species is smaller, less elevated, the umbilical ridge less notable and the umbilical cavity is filled with a gum-like matter. It measures 7 by 4.25 mm. against 8.5 by 5 mm. The umbilicus is also quite open, and though narrow would not be termed "very contracted."



FAMILY **HELICARIONIDAE**.

This family is based on Tasmanian and Eastern Australian molluscs, which, though sluglike in form, still retain a thin semi-circular thin shell. Many species are known, extending as far north as Cape York, and extralimital species north of that place have been included. None is known from North-West Australia, while a single species is included from South-West Australia, although the group is absent from South Australia.

The local form has a shell quite unlike that of the Tasmanian and Victorian species, but apparently has a black animal like that of the latter, as Quoy and Gaimard recorded it under the name *Vitrina nigra*, which they introduced on account of the black colour of the animal.

Genus **LUINARION** Iredale 1933.

1933—*Luinarion* Iredale, Rec. Austr. Mus., Vol. XIX., p. 38, Aug. 2. Haplo-type *Helicarion thomsoni* Ancey = *Vitrina castanea* Pfeiffer.

*Luinarion* was introduced as a subgenus of *Helicarion*, but it seems to stand further apart, as the shell is so unlike that of other Australian Helicarionids that it has not been recognised up to the present although described eighty years ago.

Shell with the spire a little elevated, smooth, somewhat depressedly globose, mouth large, open, subcircular, outer lip, sinuate, receding basally, base convex, columella arched, a little reflected. Shell fragile.

**Luinarion castaneus** Pfeiffer 1853.

Plate III., fig. 1.

1832—*Vitrina nigra* Quoy and Gaimard, Voy. de l'Astrol., Zool., Vol. II., p. 136, part only (Western Port, Victoria) and King George's Sound, West Australia.

1853—*Vitrina castanea* Pfeiffer, Mon. Helic. Viv., Vol. III., p. 5, (pref. May) Australia.

1854—*Vitrina castanea* Pfeiffer, Proc. Zool. Soc. (Lond.), 1852, p. 56, Mch. 22, 1854. Australia.

1854—*Vitrina castanea* Pfeiffer, Syst. Conch. Cab. (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XI., p. 24, pl. 6, figs. 1-4. Australia (in my collection).

1862—*Vitrina castanea* Reeve, Conch. Icon., Vol. XIII., pl. VI., sp. 37, May (ex Verreaux in Mus. Cum. "chestnut olive").

1868—*Vitrina castanea* Cox, Mon. Austr. Land Shells, p. 84, pl. XIV., fig. 11, May, copied from Reeve (colour all wrong).

1885—*Helicarion castaneus* Tryon, Man. Conch., Ser. II., Vol. I., p. 169, pl. 38, fig. 41, July 3. Bad copy of Pfeiffer's coloration.

1889—*Helicarion thomsoni* Ancey, Le Naturaliste, 1889, p. 19. Geographe Bay, South-West Australia.

1895—*Helicarion thomsoni* Hedley, Proc. Malac. Soc. (Lond.), Vol. I., p. 260.

1916—*Helicarion thomsoni* Hedley Journ. Roy. Soc. West Austr., Vol. I., p. 220 (71 in separate).

Quoy Gaimard wrote "Le port du Roi Georges nous a fourni des individus plus petits, (than the Victorian species), vivant sous les arbres,



loin de l'eau douce." Although Cox recorded this note in the earliest catalogue of our Land Shells by himself in 1864, Smith in 1894 wrote "No species of *Vitrina*, *Helicarion* . . . are yet known from this region." This was corrected by Hedley, who pointed out Ancey's description of 1889, but also overlooked Quoy & Gaimard's notice. Apparently everyone has omitted notice of Pfeiffer's *castanea*, which, published in 1853, is undoubtedly the present species.

#### FAMILY CHLORITIDAE.

This family comprises many shells covered with a periostracum bearing hairs but, through lumping, species without such a covering are commonly included. The typical *Chloritis* is a large flattened umbilicate shell with a recurved outer lip, and the apex granulose. It is essentially of northern origin, and species occur throughout East Australia as far south as Victoria and along the north coast. However many species have been referred to this group, whose claims are very doubtful and a redistribution is sorely needed. Gude reviewed the series, and went so far as to group all the Australian species, whatever their form, under *Austrochloritis*, a somewhat peculiar conclusion.

Genus **DAMOCHLORA** Iredale 1938.

1938—*Damochlora* Iredale, Austr. Zool. Vol. IX., p. 97, Nov. 30. Orthotype *Helix millepunctata* Smith.

This generic name was introduced for some North-Western species, which Smith placed under *Helix*, using as a subgenus *Chloritis*, the type species being described as minutely punctate and with the form of *delessertiana*, while *rectilabrum* was subgranulose, clothed with a thin scabrous epidermis and the form unlike. It is probable that these are not at all closely related, and in order to stress this point the subgeneric name **Perochlora** is introduced, the apertural characters of the type, *rectilabrum*, reading quite differently.

#### **Damochlora millepunctata** Smith 1894.

1894—*Helix (Chloritis) millepunctata* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 88, pl. VII., fig. 11, June. Baudin Island, North-West Australia.

Smith's description reads: "Shell orbicular, widely umbilicate, thin, horny, subpellucid; whorls five, slowly increasing, everywhere minutely punctate, convex, sutures profoundly impressed, sculptured with thin obliquely arcuate growth-striae, last whorl rounded at the periphery, scarcely descending in front; aperture oblique and broadly lunate, spire very short, rather obtuse to the apex; peristome thin, very little thickened, narrowly expanded and reflected; columellar edge very oblique, a little arcuate, dilated a little above where it joins the whorl. Diam. maj. 16, min. 13 mm.; alt. 8.5 mm. Aperture 6 high, 7 broad. *Hab.*—Baudin Island, N.W. Australia. This species has much the general aspect of *H. delessertiana*. It is, however, flatter, and, of course, quite different in sculpture."

#### **Damochlora cassiniensis** Smith 1894.

1894—*Helix (Chloritis) millepunctata* var. *cassiniensis* Smith. Proc. Malac. Soc. (Lond.), Vol. I., p. 88, pl. VII., fig. 12, June. Cassini Island, North-West Australia.

Smith briefly described this: "Shell smaller than the typical form, umbilicus a little narrower, aperture more contracted, peristome a little more



thickened. Diam. maj. 14.5, min. 10.5 mm.; alt. 7 mm. Aperture 5 high, 5 broad. Hab. Cassini Island, N.W. Australia. Although smaller and differing from the type in the points referred to, it seems advisable to consider this form as a variety, rather than as a distinct species."

**Damochlora rectilabrum** Smith 1894.

1894—*Helix* (*Chloritis*) *rectilabrum* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 88, pl. VII., fig. 14, June. Parry Harbour, N.W. Australia.

The description given by Smith reads: "Shell orbicular, depressed, umbilicate, pallid brownish, subgranulate, clothed with a thin scabrous epidermis; spire a little elate, obtuse to the apex; whorls five slowly increasing, convex, sutures profoundly impressed, last whorl rounded at the periphery, very slightly keeled, descending slightly in front; aperture almost horizontal, lunate; peristome thin, narrowly expanded and reflected, margins coming together, the basal edge straightened a little towards the columellar dilation. Diam. maj. 13, min. 11 mm, alt. 6 mm. Aperture 4 high, 5.5 broad. Hab. Parry Harbour, N.W. Australia.

A dead specimen devoid of epidermis does not appear nearly so granular as fresh living examples, although traces of the granulation, especially upon the apical whorls, are discernible."

Genus **KIMBORAGA** Iredale 1933.

1933—*Kimboraga* Iredale, Rec. Aust. Mus., Vol. XIX., p. 50, Aug. 2. Orthotype *Chloritis micromphala* Gude.

Gude named a large series of shells under *Chloritis* many of which appear to be not closely related to the genotype of *Chloritis*, while some, such as the present series, seem to have very little affinity.

Shell globose, thin, elevated spire, mouth large, subcircular, outer lip a little expanded, thin, columella broadly reflected, umbilicus deep, open, apex smooth, shining, with faint growth radials only. No periostracum discernible and sculpture of fine growth radials crossed by fine concentric lines. The apex is large, a little eccentric, a half whorl smooth, another whorl finely striate radially, and three adult whorls only. The related, superficially, forms *Gloreugenia* and *Parglogenia* have the apex small and regularly coiled, and the first whorl and a half are succeeded by five adult whorls.

**Kimboraga micromphala** Gude 1907.

Plate III., fig. 12.

1907—*Chloritis micromphala* Gude, Proc. Malac. Soc. (Lond.), Vol. VII., p. 231, pl. XXI., fig. 6, April 3. Barrier Range, North-West Australia.

The generic details above given cover the species; the coloration is pale fawnish, and the norm measures 28 mm. in breadth and 18 mm. in height, the aperture being about 11 mm. high and broad, the outer lip descending appreciably in front.

[**Parglogenia forrestiana** Angas 1875.

1875—*Helix forrestiana* Angas, Proc. Zool. Soc. (Lond.), 1875, p. 389, pl. XLV., figs. 3, 3a. North-West Australia.

The locality "North-West Australia," almost certainly refers here to an extra-limital locality, as, from the description, the shell is very close to, if not identical with *pelodes* Pfeiffer = *pseudoprunum* Pilsbry. The last named



was also described from north-western Australia, by which Pilsbry intended Port Darwin, which is politically in the Northern Territory. An earlier name still may be *subgranosa* Le Guillou, and the shell has also been known as *prunum* Férussac, which has been shown to be very different. Misled by the incorrect association, Hedley confused the shell, *Kimboraga micromphala*, and thus included *forrestiana* in his W.A. list.]

Genus **TORRESITRACHIA** Iredale 1933.

1933—*Torresitrachia* Iredale, Rec. Austr. Mus., Vol. XIX., p. 55, Aug. 2.  
Orthotype *Helix endeavourensis* Brazier.

Shell subdiscoidal, spire a little obtusely elevated, vitreous, whorls rounded, sutures impressed, periphery rounded, mouth subcircular, open, outer lip thin, reflected all round, a little thickened basally, columella almost straight, a little reflected, umbilicus narrow, deep, open, showing coiling and not obscured by columellar reflection. Coloration greenish white, unicolor. Apex smooth, adult sculpture close radial ribbing almost ridges above, base smooth save for growth striae.

This North Queensland style of shell appears to travel along the north coast into North-West Australia.

**Torresitrachia bathurstensis** Smith 1894.

Plate 3, Fig. 2.

1894—*Helix* (*Trachia*) *bathurstensis* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 93, pl. VII., fig. 20, June. Heywood Island and Bathurst Island, King Sound, N.W. Australia.

A curious complication is seen in the fact that the specific name is taken from one island, and the type shell came from the other; these islands lie at each side of the Sound and the species are probably distinct on each island. Curiously enough the specimen before me, collected by Mr. J. J. Walker, is a paratype, but it has no definite locality.

This specimen is very like the species of *Torresitrachia* but can be separated by the finer, closer, and more regular character of the costulation. The type from Heywood Island measured 15.5 mm. in breadth by the height omitted, while the Bathurst Island shell was 13.5 mm. in breadth, again no height being given. The paratype abovementioned and here figured measures 14.5 mm. in breadth and is 8.5 mm. in height. The ribbing on the base is stronger than on the base of the Queensland shells, but is not as strong as on the upper surface nor is it regular.

**Torresitrachia monticola** sp. nov.

Plate III., fig. 13.

The species of *Torresitrachia* are found on the islands of Torres Strait and along the north coast of Queensland. The occurrence of similar shells on the islands off the North-West Coast was unexpected, but not so surprising as the recognition of a form among the shells collected by W. W. Froggatt in the Barrier (Napier) Range, many miles inland.

This species is flattened, subdiscoidal, whorls rounded, openly narrowly umbilicate, mouth subcircular, open, lips thin reflected, columella arcuate. The apex is smooth, a subvarix separating this from the adult sculpture which consists of deep well separated very regular costulations, which continue onto the base where however they are less marked. Coloration trans-



lucent and glassy. The umbilicus is narrow, deep, only about one eighth the width of the base yet the previous whorling may be seen therein. The outer lip is reflected all round, though thin, and the columella is little thickened. Breadth 15.5 mm.; height 9.5 mm.

The costulations are a little stronger than in the coastal shell, the spire a little more elevated and the umbilicus a little wider.

Genus **BAUDINELLA** Thiele 1931.

1931—*Baudinella* Thiele, Handbuch syst. Weicht., Vol. I., p. 685. Orthotype, *Helix baudinensis* Smith.

1933—*Gonobaudinia* Iredale, Rec. Austr. Mus., Vol. XIX, p. 55, Aug. 2. Orthotype, *Helix baudinensis* Smith.

Thiele's Handbuch was not available when I introduced *Gonobaudinia*, and Thiele's subordination of his subgenus *Baudinella* to *Angasella* is difficult to understand. Small, stout, widely umbilicate with contracted mouth, it resembles no other Australian shell.

Shell discoidal, spire flattened, whorls few, last descending a little, mouth small, broader than high, outer lip thickened and reflected, with a ditch behind, umbilicus wide and open, nearly half the width of the base. The apex is granulose of about two whorls, the adult sculpture developing without any varix intervening: this consists of stout radial ribs with wide interspaces, the ribs running across the upper surface in a sigmoid manner, then with an even curve into the umbilical cavity where twenty-one may be counted on the last whorl. Along the upper part of the last whorl there is a deep depression which causes the eccentricity in the rib development, and this depression appears in the outer lip as a tooth.

**Baudinella baudinensis** Smith 1893.

Plate III., fig. 9.

1893—*Helix* (*Gonostoma*) *baudinensis* Smith, The Conchologist, Vol. II., p. 97, fig. in text, Mch. 25. Baudin I., North-West Australia (J. J. Walker).

The generic characters are, at present, sufficient to enable the recognition of this bizarre little shell, which measures 6 mm. in breadth by 3 mm. in height. There is a stout epiphragm in the aperture of the shells collected alive.

Genus **SETOBAUDINIA** Iredale 1933.

1933—*Setobaudinia* Iredale, Rec. Austr. Mus., Vol. XIX., p. 55, Aug. 2. Orthotype *Helix collingii* Smith.

The detailed specific account following shows that this differs from the preceding genus in the essential distinction that the shell is covered with a pilose periostracum. Otherwise it is larger, lacks the characteristic sculpture, and has a more open mouth. It is almost certain that it is not closely related.

**Setobaudinia collingii** Smith 1893.

1893—*Helix* (*Gonostoma*) *collingii* Smith, The Conchologist, Vol. II., p. 98, fig. in text, Mch. 25. Baudin I., North-West Australia (J. J. Walker).

As no shells are available in this case, Smith's account reads: "Shell flatly discoidal, with the spire only very little raised above the body-whorl, rather openly umbilicated, light brown above, and pale beneath. When in



fresh condition the surface is covered with a thin, shortly pilose epidermis. Worn shells exhibit innumerable minute punctures showing where the short delicate setae have been. Whorls  $4\frac{1}{2}$ , regularly and rather slowly increasing, moderately convex, and separated by a deep sutural line, besides the punctures, exhibiting fine lines of growth; last whorl rounded at the periphery, only very feebly deflexed close to the aperture, and exhibiting a slight depression above about the middle of the upper margin of the peristome. Aperture somewhat triangular in outline, but with rounded angles, almost horizontal in position; peristome narrowly reflected above, more broadly expanded along the basal margin, especially over the umbilicus. A conspicuous tubercle or prominence occurs on the inner edge of the basal margin, and a less pronounced one within the upper margin corresponding to the slight depression upon the outer surface of the whorl. Breadth 10 mm.; height 4 mm."

Genus **WESTRALTRACHIA** Iredale 1933.

1933—*Westraltrachia* Iredale, Rec. Austr. Mus., Vol. XIX, p. 55, Aug. 2.  
Orthotype *Trachia froggatti* Ancey.

This generic name was introduced for a number of species, which Ancey had, with great doubt, referred to *Trachia*. The species are flattened helicoids with low spires and keeled or subkeeled periphery, narrow umbilicus and transverse mouth sometimes basally flattened and indistinctly toothed. Although generally smooth and shining, the type is granulose and dull, and it may be that the smooth species should constitute a separate subgenus, which may be called **Zygotrachia** the species, *W. alterna*, being named as type.

**Westraltrachia froggatti** Ancey 1898.

Plate III., fig. 10.

1898—*Trachia froggatti* Ancey, Proc. Linn. Soc. N.S.W., Vol. XXII., p. 774, pl. XXXVI., fig. 2, June 4. Oscar Range, 100 miles inland from Derby, North-West Australia (W. W. Froggatt).

Shell small, subconical, depressed, stout, spire a little elevated, whorls flattened, sutures little impressed, last whorl acutely keeled, mouth oblique, outer lip expanded and a little recurved. Apex radially finely subgranose, adult sculpture flattened coarse granulation finer on the base.

**Westraltrachia derbyi** Cox 1892.

Plate III., fig. 6.

1892—*Helix (Hadra) derbyi* Cox, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. VI., p. 566, pl. XX., figs. 4, 5, May 23, Derby District, North-West Australia (W. W. Froggatt).

1894—*Helix (Trachia) derbyana* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 92, pl. VII., fig. 19, June. Burner (error pro Barrier) Ranges, Derby, North-West Australia.

Shell small, subdiscoidal, spire a little elevated, whorls little rounded, sutures impressed, umbilicate, umbilicus narrow, deep, columella reflected, mouth open, outer lip a little reflected with a slight subnodulation on base. Coloration whitish marbled with brown flames above, a post peripheral brown band, rest of base dirty white, shell shining. Apex smooth, adult sculpture faint growth lines only. Breadth 11 mm.; height 6 mm. Collected on the Barrier (= Napier) Range by W. W. Froggatt.



**Westraltrachia orthocheila** Ancey 1898.

Plate III., fig. 8.

1898—*Trachia orthocheila* Ancey, Proc. Linn. Soc. N.S.W., Vol. XXII., p. 774, pl. XXXVI., fig. 4, June 4. Oscar Range, 100 miles inland from Derby, North-West Australia (W. W. Froggatt).

Shell a little larger than the preceding, subdiscoidal, spire scarcely elevated, whorls scarcely rounded, sutures impressed, umbilicus narrow, deep, columellar reflection small, outer lip thin a little reflected, mouth open with no basal subnodulation nor flattening. Coloration whitish marbled above, with a brown band below the periphery, the rest of the base white, shell shining. Apex smooth, and only fine growth lines seen on the adult whorls. Breadth 13-14 mm., height  $6\frac{1}{4}$ -7 mm.

The Oscar Range is twenty miles distant from the south end of the Napier (or Barrier Range), and its shell fauna appears to be different although this species is very close to *derbyi*.

**Westraltrachia alterna** sp. nov.

Plate III., fig. 17.

Shell large for this genus, subdiscoidal, spire a little elevated, whorls slightly rounded, sutures impressed, last whorl descending a little, subkeeled, mouth flattened horizontally. The apical whorls, two in number, are smooth, the adult four and a half sculptured only with regular striae, which become more distant on the last whorl. Outer lip reflected, base of lip flattened and almost nodulose, columella broad, angularly joining the base of the lip, reflected. Umbilicus narrow, open, half hidden by the reflection of the columella. Coloration horny, banded with dull brown above and below the periphery, base almost white. Breadth 17 mm., height 9 mm. Collected on the Barrier Range (i.e., Napier) by W. W. Froggatt.

**Westraltrachia increta** sp. nov.

Plate III., fig. 16.

Shell large, not as large as preceding, conical, spire elevated, whorls rounded, last subkeeled a little descending at the aperture, the mouth flattened horizontally. Colour pale brownish white banded above and below the periphery with broad brown bands, the base dirty white. The two apical whorls are smooth, the adult four and a half have only subobsolete striae vanishing on the base. The umbilicus narrow, almost concealed by reflected columella, which is broad and almost angularly meets the base which is flattened and almost subnodulose. Breadth 15.5 mm., height 9.5 mm. Collected by W. W. Froggatt on the Barrier (= Napier) Range.

Genus **QUISTRACHIA** gen. nov.Type **Trachia monogramma** Ancey.

Shell thin, subdiscoidal, spire a little elevated, whorls rounded, umbilicus narrow, perspective, outer lip thin, a little reflected, subcircular open mouth, columella rather broadly reflected.

Although hitherto classed with the preceding this shell is unlike any of the *Westraltrachia* in texture and form, and is nothing like *Rhagada*.



**Quistrachia monogramma** Ancey 1898.

Plate III., fig. 20.

- 1898—*Trachia monogramma* Ancey, Proc. Linn. Soc. N.S.W., Vol. XXII., p. 775, pl. XXXVI., fig. 3, June. Oscar Range, N.W.A. (W. W. Froggatt).

In addition to the characters mentioned above, the shell is horny brown with a darker brown on peripheral band. The apical whorls are smooth as is the rest of the shell save for indistinct growth lines, the whole surface slightly shining ("oleoso," Ancey wrote). The figured shell measures 17 mm. in breadth by 10 mm. in height, while the type, a unicum, measured 15.5 by 8.5 mm.

**[Helix australis** Menke 1843.

- 1843—*Helix (Helicella) australis* Menke, Moll. Nov. Holl. Spec., p. 6 (Apl. 11), among limestone rocks at Mount Eliza near the Swan River.  
 1853—*Helix australis* Pfeiffer, Syst. Conch. Cab. (Martini & Chemnitz), ed. Kuster, Bd. I., Abth 12, pt. 2, p. 276, pl. 123, figs. 7, 8 (after June, 1852). Specimen from Menke Collection figured.  
 1852—*Helix australis* Reeve, Conch. Icon., Vol. VII., pl. 131, sp. 803, Oct. Swan River, New Holland. Mus. Cuming.

This species has caused a lot of trouble, yet it seems certain that it is merely a South African shell mixed with the Western Australian collection of Dr. L. Preiss. Why this has remained on the list, when this possibility was known is curious. Reeve noted, "A small striped species of European aspect," while of the South African shell he wrote, "Closely allied to a well-known European form." Menke himself compared it with a South African shell, and Benson recorded that "this South African representative could not be refound by Dr. Bacon." Smith questioned the identity of Reeve's specimen with Menke's species, and placed the shell under *Xerophila*, a European subgenus. So it may be omitted from Western Australian lists as it is unlike any local shell in size and form.]

**FAMILY XANTHOMELONTIDAE.**

The most notable mollusc in North Australia is a large thick globose shell, for which many years ago the descriptive name, *Xanthomelon*, was introduced. It is common about Port Darwin, and goes eastward along the coast round the Cape York Peninsula and down towards Moreton Bay. As far as yet is known this form does not occur in Western Australia, an extraordinary result from superficial knowledge. In the interior of Australia, apparently degenerate relations live, and these penetrate into Western Australia in the mid and southern areas. This series, named *Sinumelon*, appears to be characteristic of the Centralian Area; different forms, species or genera being developed on each Range.

**Genus SINUMELON** Iredale 1930.

- 1930—*Sinumelon* Iredale, Vict. Naturalist, Vol. XLVII., p. 120, Nov. Haplo-type *Helix nullarborica* Tate.  
 1932—*Notobadistes* Cotton and Godfrey, South Austr. Naturalist, Vol. XIII., pp. 169-170, Aug.-September 30. Orthotype *Helix bitaeniata* Cox = *flindersi* Angas.

These desert living Xanthomelontids, ranging all through the interior in suitable places, enter into southern Western Australia, and apparently all the



subgroups appear there. Shells small for the family, subglobose, more or less openly umbilicate, no definite sculpture, longitudinal growth ridges overridden by granulation, mouth subcircular, open, the columella thickened and reflected.

***Sinumelon nullarboricum* Tate 1879.**

Plate III., fig. 19.

1879—*Helix nullarborica* Tate, Trans. Proc. Phil. Soc. Adelaide, South Austr., 1878-9, p. 133, pl. VI., ff. 1 a-b, ex p. 126, *nom nud.* Bunda Plateau, Nullarbor Plain, South Australia.

Shells from Eucla agree in detail with paratypes of Tate's species. These are subglobose, dirty white, sculptured with rough radials, spire a little elevated, umbilicus narrow, columella thickened, outer lip thickened.

The two apical whorls are smooth and shining, but show under a lens very fine radials towards the suture. The rude irregular radials show dents on the last whorl, which appear concentrically as if they were broken rough incised lines, but fine incised concentric lines may be seen on the base of some specimens subordinate to the denting. The columella is reflected, almost concealing umbilicus, which is encircled by a ridge.

Height 14 mm., breadth 16 mm.

***Sinumelon datum* sp. nov.**

Plate III., fig. 18.

1895—*Helix angasiana* Hedley, Proc. Malac. Soc. (Lond.) Vol. I., p. 260, July. Eucla, Western Australia.

Not *Sinumelon godfreyi* Iredale, Rec. Austr. Mus., Vol. XIX, p. 52, Aug. 2, 1933, new name for *Helix angasiana* Pfeiffer, Journ. de Conch., Vol. X., p. 228, pl. X., fig. 2, July 1, 1862: near Lake Torrens, South Australia.

Shell subglobose, broader than *nullarboricum*, with the spire less elevated, the sutures deeper, the umbilicus wider and more open, the columella more curved and reflected, the outer lip reflected but not thickened. Coloration dirty white.

The one and a half apical whorls have more prominent radial sculpture easily seen with a lens, the adult sculpture being rough radials with granulo-subordinate sculpture, the grains lengthening on the last whorl into broken radials. The dents are less marked and even more concentrically arranged. Breadth, 19 mm.; height 14 mm. Type from Eucla. Shell from Madura larger and broader but obviously conspecific.

***Sinumelon kalgum* sp. nov.**

Plate III., fig. 25.

From Hannans, Kalgoorlie and Lake Kalgoorlie dead shells (which were probably coloured in life) appear to be relations of the *fodinate* series. They are stouter than *datum*, and have not the deep sutures of that species, and the sculpture differs. The shell is subglobose, stout, spire short, sutures impressed but not subcanaliculate as appear those of *datum*. The apical whorls are not so markedly striate, while the radials are finer and the delicate granulation present never becomes radial, and there appear to be no signs of concentric striae nor any denting. The mouth is more vertical and



more circular, while the umbilicus is more hidden though still open: the columella thickened with the outer lip reflected. Breadth, 20 mm.; height, 17.5 mm.

Bednall's record of *fodinalis* (Trans. Roy. Soc., South Austr., Vol. XVI., p. 63, Dec. 1892), from between Victoria Spring and Fraser Range may refer to this species.

**Sinumelon lennum** sp. nov.

Plate III., fig. 21.

1892—*Helix (Galaxias) perinflata* Bednall, Trans. Roy. Soc. South Austr., Vol. XVI., p. 62, December. Cavanagh Range. About three miles south of Camp 58, Victoria Desert. Between Fraser Range and Yilgarn Goldfields, Western Australia.

Not *Helix perinflata* Pfeiffer, Proc. Zool. Soc. (Lond.), 1863, p. 528, Apl. 20, 1864, MacDonnell Ranges, Central Australia.

Representatives of the *perinflata* series occur throughout the interior of South-West Australia varying in size and form according to locality.

Shell subglobose, spire short and conical, whorls rounded, sutures impressed, umbilicus very narrow hidden by reflection of columella, mouth large and subcircular. Coloration green. Apex finely granulated, adult whorls  $4\frac{1}{2}$ , sculptured with faint radial growthlines, with irregular granules covering the whole surface tending to lengthen into beaded radials. Breadth, 24 mm.; height, 21 mm. (type from Boulder).

Specimens from Madura are broader with the same height, the spire being shorter and the body whorl more swollen; these measure 26 mm. in breadth by 21 mm. in height, and may be called **S. l. mutuum** subsp. nov.

**Sinumelon vagente** sp. nov.

Plate III., fig. 24.

From Mt. Singleton, inland from Geraldton, comes a relation of *perinflata*, more elevated and less inflated than *lennum*, with a stronger granose sculpture.

Shell subglobose, spire short, whorls rounded, sutures impressed, umbilicus very narrow almost concealed by expansion of columella, mouth large, round, outer lip thin. Coloration brownish green. Apex finely radially granulose, adult whorls four, sculptured with fine irregular growth radials which are overridden by a fine granulation.

Columella strongly reflected and united to the outer lip by a thin callus. Breadth, 21 mm.; height, 19 mm.

Genus **PLEUROXIA** Ancy 1887.

1887—*Pleuroxia* Ancy, Conch. Exchange, Vol. II., pt. 3, p. 38, September, new name for

1864—*Angasella* Angas, Proc. Zool. Soc. (Lond.), 1863, p. 521, Apl. 20, 1864, ex A. Adams MS. Haplotype *Helix cyrtopleura* Pfeiffer.

Not *Angasiella* Crosse, Journ. de Conch., Vol. XII., p. 50, footnote, Jan. 1, 1864.

These shells, referred on account of anatomical details, to the family Xanthomelontidae, are very unlike typical members of that family in every conchological feature.



The type has the spire depressed, the shell discoidal, the umbilicus very wide and open, the mouth circular, lip a little reflected; the apex is granosely radiate, the radial sculpture developing into ribs, the grains continuing as a subordinate feature. The south-western species, represented by *oligopleura*, have the apex smooth, spire elevated, shell subdiscoidal, sometimes subglobose, the mouth circular, with the lips continuous, the umbilicus narrow. The sculpture is similar but coarser, and this series is separated as a new subgenus, **Angasietta**.

The Gantheaume Bay species, *P. abstans*, however, has the apex coarsely granular, spire elevated, the umbilicus moderately wide, the mouth circular, lips continuous, expanded rather broadly and constricted behind, and is therefore subgenerically differentiated as **Gantomia** nov.

### **Pleuroxia polypleura** Tate 1899.

Plate III., fig. 27.

1899—*Angasella polypleura* Tate, Trans. Roy. Soc. South Austr., Vol. XXIII., p. 246, pl. VI., figs. 2a-c, Dec. Bunda Plateau, Great Australian Bight, South Australia.

1879—*Helix cyrtopleura* Tate, Trans. Proc. Phil. Soc. Adelaide, South Austr., 1878-9, p. 126, not of Pfeiffer, 1862.

1895—*Helix cyrtopleura* Hedley, Proc. Malac. Soc. (Lond.), Vol. I., p. 260, July, not of Pfeiffer, Journ. de Conch., Vol. X., p. 227, pl. X., fig. 4, July 1, 1862.

Shell subdepressed, flattened, widely umbilicate, with about sixty sigmoid threadlike ribs, the interspaces coarsely granular, the apex large and smooth, breadth 18 mm., height 10.5 mm. Specimens from the road between Madura and Mundrabilla agree in size and sculpture and one is here figured. The umbilicus is better described as narrow and open, not much more than one-fifth the width of the base, while the large open subcircular mouth has the thin lip reflected, and the lips are connected by a strong body callus. Shells collected at Newman Rocks are similar in shape and sculpture but much smaller with the umbilicus a little wider, the granulation finer. The largest measures 13.5 mm. in breadth and 8 mm. in height, and is subspecifically named **Pleuroxia polypleura elfina** nov.

### **Pleuroxia commenta** sp. nov.

Plate III., fig. 26.

Specimens collected by Mr. Charles Barrett, the famed Victorian naturalist and writer, on the Nullarbor Plains were recorded as *P. polypleura*. Better knowledge allows their description as distinct, and the exact locality proves to be Hampton Tablelands, inside the West Australian boundary.

Shell small, subdepressed, spire a little elevated, sutures impressed, whorls rounded, last whorl flattened above and then rounded, a little descending in front, mouth large, subcircular, outer lip a little reflected, umbilicus narrow, deep, open. The coloration of the living shells is a dirty brownish white. Very similar in general appearance and size to *P.p. elfina*, but a little more depressed, and with much coarser sculpture. The ribs are much stronger, more distant, and the granulation almost obsolete, the ribs numbering forty to forty-five. The mouth and umbilical features are very similar to those of the preceding. The shell measures 13 mm. in breadth by 7 mm. in height.



**Pleuroxia oligopleura** Tate 1894.

Plate III., fig. 28.

1894—*Hadra oligopleura* Tate, Trans. Roy. Soc. South Austr., Vol. XVIII., p. 193, Nov. Eyre's Sand Patch, 160 miles west from Eucla, West Australia (Adcock).

1896—*Angasella oligopleura* Tate, Rep. Horn. Sci. Exped. Centr. Austr., pt. II., Zool., p. 219, pl. XIX., fig. 39, Feb. "Flinders' Range, South Australia," error only, through interchange of localities with *H. wilpenensis* only.

"Similar to *H. cryptopleura* (sic) but the plications sharper, higher, and about one-third less in number (35 to 40); the outer lip is thin, and the whorl is more constricted behind it. Diameters, 14.15 and 12; height, 8; height of aperture 6 mm." Topotypes agreed with this diagnosis but shells from 70 Mile Tank east of Balladonia are a little larger and flatter, and probably belong to the same subspecies that occurs on the Hampton Tableland and at Cardanumbi, west of Eyre. This subspecies is altogether larger, more depressed the last whorl flattened above and rounded below, the periphery subkeeled, and the rib sculpture much more pronounced and the ribs only about thirty in number, interstitial granulation obsolete. The coloration of the living shell is brownish white, and the type measures 18 mm. in breadth and 8.5 mm. in height, the subspecies being named **Pleuroxia oligopleura numba** nov.

**Pleuroxia gascoynensis** Smith 1894.

1894—*Helix* (*Trachia*) *gascoynensis* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 93, pl. VII., fig. 13, June. Gascoyne District, Western Australia (H. P. Woodward).

"Shell depressed, orbicular, broadly and openly umbilicated, whitish, rather solid; whorls four, convex, sutures deeply impressed, closely and minutely granulated, sculptured with oblique rugae or irregular rugose plicae, the two apical smoother, the last whorl rounded or subangulate at the periphery, descending conspicuously in front, the underside rugose; spire flat, apex obtuse, a little elevated; aperture subhorizontal, rounded; peristome continuous, appressed to the last whorl, narrowly expanded, the lower margin broadly dilated. Diam. maj. 12.5, min. 10 mm.; alt. 5.5 mm. Aperture 4 high, 4.5 broad. It is similar in form to *H. cyrtopleura*, Pfr., from South Australia, but differs in size and sculpture. It is smaller, flatter, and has the peristome more decidedly continuous. Rather a powerful lens is necessary to observe the fine granulation which covers the entire surface."

**Pleuroxia abstans** sp. nov.

Plate III., fig. 22.

A series labelled "On chalk, Murchison House, Gantheaume Bay," consists of dead shells, smaller than the preceding, the largest being only 10 mm. in breadth and barely 5 mm. in height, and having the apex coarsely granulose.

Shell small, subdiscoidal, spire scarcely elevated, sutures deep, whorls a little rounded, last whorl descending in front, umbilicate, umbilicus wide, open, mouth oblique, subcircular, chalky white. Apex half whorl strongly granulated, not differentiated from four adult whorls, the granules massing to form radial ribs. On the last whorl these ribs are well marked closely set ridges,



somewhat irregular in spacing, the interstices somewhat obscurely very finely grained. The ridges continue into the umbilicus which is open and about one-third the diameter of the base. The mouth is subcircular, the outer lip thickened and reflected, an antelabial ditch present; the columella is arched, reflected a little, and connects with the outer lip by a strong callus.

[*Pleuroxia radiata* Hedley 1905.

1905—*Xanthomelon radiatum* Hedley, Trans. Roy. Soc. South Austr., Vol. XXIX., p. 163, pl. XXX., figs. 4, 5, 6, December. Mt. Davies, Tomkinson Range, and Musgrave Ranges, Central Australia.

The Tomkinson Range extends across the border into Western Australia, but Mount Davies is on the South Australian side. The Mann Range is also only a short distance on the wrong side of the West Australian border, and in the same paper, Hedley recorded *Thersites basedowi*, described from the Musgrave Ranges, and now placed in the family Hadridae, and *Xanthomelon asperillum*, now regarded as *Glyptorhagada*, but with a distinct subgenus *Eximiorhagada*, was described from the Mann Ranges. These records suggest many novelties from the multitude of ranges indicated on the map running south-west from the Tomkinson Range to Mt. Margaret, and thence south to Kalgoorlie.]

FAMILY RHAGADIDAE.

The notable Caurine faunula is characterised by many species of mollusca of a solid chalky appearance, many with coloured bands, of normal helicoid aspect, quite unlike those from the rest of Australia.

The typical *Rhagada* is a small solid striped Helicoid with the umbilicus closed by appression of the columella; the umbilicus is narrow and open in the juvenile but rarely open in the adult, sometimes showing a chink but commonly completely closed. The only sculpture is growth lines and the mouth is roundly lunate, a subbasal tubercle present. Many species are larger, some more globose, and some with regular sculpture above but the facies of all resembles each other. This family is utilised tentatively to include some species which are not solid, coming from this Dampierian Sub-Area. It is strange that so far no similar shells have been found in the Northern Territory.

The earliest Rhagadoid shells were collected by Péron and Lesueur, and later the collectors with Stokes secured similar shells. Fifty years ago that fine collector and entomologist W. W. Froggatt collected many specimens in the Barrier and Oscar Ranges. A little later an extraordinary addition to our knowledge was made by another entomologist, J. J. Walker, whose official post was engineer on the surveying vessel Penguin. Apparently parties were landed on various islets between Broome and Darwin, and this industrious collector in his search for insects secured a large number of curious land shells. Owing to the donation of this collection to the British Museum the curator of molluscs (E. A. Smith) examined them and found so much novelty that he prepared a List of the Land Shells of Western Australia, the only monographic attempt made. Twenty years ago Dr. H. Basedow explored the Napier Range and again many land shells were procured. Although the general locality "Napier Range" was the same for Froggatt's and Basedow's collections there was so much discrepancy in the material that it became imperative to investigate their collecting grounds as otherwise recorded.

The localities visited by W. W. Froggatt are given in the Proc. Linn. Soc., N.S.W., Ser. 2, Vol. IV., pt. 2, p. 199, Sept. 20, 1889, as follows:—(1)



Ironstone Ridge, 25 miles South-East of Yeeda Station, Fitzroy River; (2) Mount Marmion; (3) Mount North Creek, Napier Range; (4) Lennard River Gorge, Napier Range; (5) Barrier Range Homestead, Napier Range; and (6) Oscar Range, north-east side.

On the other hand an account of Basedow's Expedition has appeared in the Transactions of the Royal Geographical Society of Australasia, South Australian Branch, Vol. XVIII, pp. 105-295, July 17, 1918. From the route thereon given we find that Dr. Basedow passed through the Barker Gorge in the middle of the Napier Range, then retraced his steps and went along the western side northwards to another gap where he found the limestone caves which he later named Wangalinnya Caves. Thus Basedow's localities are quite distinct from those of Froggatt though the general name Barrier or Napier Range was used by both. All Froggatt's shells were collected in the southern end of the Range and in the Oscar Range which lies some twenty miles to the south-east.

I have continually observed that our land molluscs must be studied in conjunction with geographical, geological and climatic conditions. This instance provides a striking example as the variation seen in the two collections (with the same locality label) was not understood until the geography of the district was known. In a geological sketch plan which accompanies Basedow's account, the Napier Range is shown as Devonian limestone, the approach from Derby as Permo-Carboniferous, while the Kimberley block to the northward appears as Cambro-Ordovician, a pre-Cambrian sector intervening just north of the Napier Range. A peculiar note is the showing of a small patch of Permo-Carboniferous to the south-east of Wyndham whence come some peculiar snails. With regard to the variation seen in the Napier Range collections other factors, such as climatic, may have interfered as this aspect needs consideration.

Genus **RHAGADA** Albers 1861.

1861—*Rhagada* Albers, Die Heliceen, 2nd ed. (Martens), p. 108, "1860."  
Orthotype *Helix roinga* Gray = Pfeiffer.

The restricted group of true *Rhagada* comprises small shells, of flattened Helicoid aspect, but chalky, rather shining, spire little elevated, sutures impressed, whorls rounded, mouth subcircular, outer lip thin but a little reflected, inner base showing a slight tubercle, columella curved, appressed generally closing the umbilicus in the adult, a narrow perforation always visible in the juvenile stage. Sculpture of obscure radials only. Coloration white with a few coloured bands.

**Rhagada torulus** Férussac 1819.

Plate IV., fig. 1.

1819—*Helix torulus* Férussac, Hist. Moll. livr. 6, pl. XXVII., figs. 3, 4, November; Syst. Tabl. Hist. Moll., p. 34, Jan. p. 30, June 1821. New Holland (Péron) = Shark Bay, W.A.

The only locality whence Péron could have secured a shell such as Férussac figured is Shark Bay, and we find that, dealing with the natural history of Bernier Island, with which he associated that of Dorre and Dirk Hartog's Isles, he mentioned "two species of land shells extremely numerous, but all dead, occupied great stretches of the interior of the island. One was a small species of *Helix*."



Smith suggested that *reinga* Gray might be synonymous with this species, writing: It seems to me probable that the *H. torulus* Fér., is identical with this species (*reinga*). It was collected by Péron during one of the early French voyages, but the exact part of Australia, where he obtained it is not stated. Accepting this suggestion Hedley used *torulus*, and I utilised it in the Basic List, but in the more detailed examination necessary for this account I found too many discrepancies, and now record *torulus* as available for a Shark Bay shell, which is not at present in our collection.

Deshayes' description agrees with the figure which shows a subglobose, subperforate shell, smooth, white with one ante-peripheral brown band: the sutures deep, the whorls convex. The illustration is of a shell of the Shark Bay form, being more convex than the more northern *reinga* series.

**Rhagada reinga** Pfeiffer 1846.

Plate IV., fig. 2.

- 1846—*Helix reinga* Pfeiffer, Symb. Helic., Vol. III., pp. 31, 50, 73 ex Gray Ms. New Zeal., t. 1, f. 11, 12. New Zealand, type in Pfeiffer Coll. No. 459.
- 1848—*Helix reinga* Pfeiffer, Mon. Helic. viv., Vol. I., p. 289, cites Chemn., ed. II., *Helix*, N. 443, t. 73, f. 8-9.
- 1851—*Helix reinga* Pfeiffer, Syst. Conch. Cab., (Mart. & Chemn.), ed. Kuster, Bd. I., Abth. XIII., Teil 2, p. 52, pl. 73, fig. 8-9.
- 1852—*Helix reinga* Reeve, Conch. Icon., Vol. VII., pl. 128, sp. 772, Oct.
- 1890—*Helix reinga* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. VI., p. 185, Dec. 16, refers to Vol. IV., p. 256, pl. 36, fig. 39, Jan. 3, 1889, where the plate was issued but no text appeared with it.

This species was described as "depressedly globose, obliquely striate, whitish, with one chestnut band and many orange lines; spire little elevated, whorls convex; aperture oblique narrow; with a hidden perforation and an obtuse tooth on the base of the mouth, breadth 15, height 10 mm. New Zealand."

The shell had not come from New Zealand, apparently Pfeiffer being misled by inspection of a plate of New Zealand shells which Gray had had prepared. This plate was never issued. A specimen from Broome is here figured as it agrees with the figure and description, and the original specimen may have been collected at Cygnet Bay along with *leptogramma* described about the same time.

**Rhagada richardsonii** Smith 1874.

Plate IV., fig. 7.

- 1874—*Helix richardsonii* Smith, Zool. Voy. Erebus & Terror, Moll., p. 2, pl. 4, fig. 14. Dupuch's I., West Australia.  
Fig'd Tryon, Man. Conch, Ser. 2, Vol. IV., pl. 36, fig. 35, 36, cf. Pilsbry, id. ib., Vol. VI., p. 185, Dec. 16, 1890.
- 1877—*Helix elachystoma* Martens, Monatsb. AK. Wissen Berlin, 1877, p. 273, pl. 1, figs. 8-9, May no. Mermaid Strait, North-West Australia (T. Studer).  
Fig'd Martens, Nov. Conch., Vol. V., p. 35, pl. 144, fig. 1-4, 1877.  
Pilsbry, Man. Conch., Ser. 2, Vol. VI., p. 187, pl. XI., figs. 41-43, Dec. 16, 1890.



1894—Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 89, June, (synonymised *H. elachystoma* Martens).

As the localities are adjacent, the descriptions and measurements agree there can be no hesitation in accepting Smith's valuation. The size, 19 mm. in breadth by 12 mm. in height, with the perforation concealed, apparently completely, though this is not certain, the coloration and form will make this species easily recognisable when topotypes are secured.

**Rhagada radleyi** Preston 1908.

Plate IV., fig. 8.

1908—*Rhagada radleyi* Preston, Proc. Malac. Soc. (Lond.), Vol. VIII., p. 120, text. fig., July 20. Western Australia.

Preston described this, without definite locality, as follows: "Shell discoidal, depressed, white, painted above the periphery with two greyish-brown bands, and below with five bands of the same colour; whorls  $4\frac{1}{2}$ , transversely marked with lines of growth, the last whorl descending; sutures well impressed; aperture rather oblique, roundly lunate; peristome expanded, scarcely reflexed; columella descending obliquely, expanded over and *almost* concealing the umbilicus and diffused above into a slight parietal callus. Alt. 8.5; diam. maj. 15 mm.; aperture, alt. 6; diam. 4 mm. Allied to *R. reinga*, grey, but smaller, and much more depressed; the umbilicus also is not quite closed, as is invariably the case in that species." It is unfortunate that neither the source nor the collector was given, as from the latter we might have traced the exact locality whence this species came. It was not collected by Froggatt, as it does not coincide with any of his shells.

**Rhagada construa** sp. nov.

Plate IV., fig. 3.

This was recorded by Ancey as *R. reinga*, but it differs from that species in its larger size, different shape and coloration. Shell globosely depressed, shining, banded, sculptured with faint growth lines only, whorls rounded, sutures depressed, columella thickened, appressed, completely sealing umbilical cavity. Coloration white, variously banded, but always with a well-marked brown peripheral band; sometimes one weaker above and three paler below; in rare cases four above and six below of varying strength, rarely are the minor ones completely absent. The long series available shows variation in size and elevation, the type measuring 16 mm. in breadth and 12 mm. in height; the largest measures 19 mm. by 12 mm., and the least 13 mm. by 9 mm., a flattened form being 16 mm. by 10 mm. The immature shell is subkeeled showing a narrow perspective perforation.

Collected by W. W. Froggatt in the Oscar Range, North-West Australia, "among the limestone."

**Rhagada gatta** sp. nov.

Plate IV., fig. 5.

This was recorded as *Helix reinga* by Smith, who had only one specimen which he noted was "rather flatter and somewhat more finely sculptured" than specimens from other localities. This is very like *construa*, but is larger, broader, and less conoidal. The bands are just as variable, the



broad medium brown band being omnipresent, but all the others are inconstant, from one to three above, and one to six below of different strength. The columella completely seals the umbilicus in the adult. The type measures 18 mm. in height, and 12.5 mm. in breadth.

This was collected by Dr. H. Basedow about the middle of Napier Range, while W. W. Froggatt had previously collected it towards the south end of the same range.

***Rhagada mimika* sp. nov.**

Plate IV., fig. 4.

This is almost a miniature of *gatta* rather than of *construa*, but constantly shows more banding, having usually two bands above the median broad band, and five below, all being fairly strongly coloured brown. The shell has the umbilicus completely sealed, and the type measures 12.5 mm. in breadth with 9 mm. in height, and was collected by W. W. Froggatt in the Napier Range "on grass, etc." These are always small, and the columellar tooth is more marked than in the larger shells.

***Rhagada basedowana* sp. nov.**

Plate IV., fig. 6.

A large series, collected by Dr. H. Basedow "on trees and on *Triodia* tussocks" off the Limestone Caves at the north end of the Napier Range, is uniformly chalky white, the characteristic median band being missing. Some of the juveniles are faintly banded but the coloration soon disappears. As some hundreds were collected this is a striking feature, the shells being solid with the umbilicus completely sealed, but the immature deep narrow perforation persists until the shell is practically full grown, these juveniles being notably keeled, and the last whorl is almost subcarinate. The type measures 15 mm. in breadth and 10 mm. in height, the series varying from 13 to 15 mm. in breadth and 9 to 11 mm. in height.

***Rhagada sutra* sp. nov.**

Plate IV., fig. 9.

This differs from the preceding four species in coloration, but notably in that the umbilicus is never completely sealed up. The shell is small, similarly formed to the preceding forms, but the coloration has massed so that the general appearance of the shell is brownish with a few whitish bands. A few adult shells and many immature ones were "found under logs and damp stones" by W. W. Froggatt in the Napier Range. The type measures 12 mm. in breadth by 8 mm. in height.

***Rhagada convicta* Cox 1870.**

Plate IV., figs. 10-13.

1870—*Helix convicta* Cox, Proc. Zool. Soc. (Lond.), 1870, p. 171, pl. XVI., f. 6, Nov. 11. Nichol Bay, West Australia.

Fig'd. Pilsbry, Man. Conch. (Tryon), Ser. 2 (pt. 23). Vol. VI., p. 187, pl. 14, f. 65 (copy of Cox's figure); pl. 35, figs. 8, 9, 10, Dec. 16, 1890.

1877—*Helix convicta* Martens, Monatsb. Ak. Wissen. Berlin, 1877, p. 272, pl. I., figs. 6, 7, May No. Mermaid Straight, North-West Australia (T. Studer).



Fig'd. Pilsbry, Man. Conch. (Tryon), Ser. 2 (pt. 23), Vol. VI., p. 187, pl. 30, figs. 7, 11, Copies of Marten's figs. Dec. 16, 1890.

The type and a series of paratypes are bright shining white with a subsutural and a peripheral narrow band of golden brown of medium elevation, subglobose, spire whorls slightly rounded, sutures lightly impressed, last whorl well rounded, base convex, outer lip thick, reflected, columella short, reflected, sealing the umbilicus. Apex apparently smooth but showing fine radial growth lines, the adult sculpture consisting only of similar growth lines with a very fine concentric lining. The type measures 25 mm. in breadth by 18 mm. in height, and for this solid form of Rhagadoid shell a new subgenus, **Tumegada**, is proposed, *convicta* Cox being the orthotype.

The paratypes show comparatively little variation save in the number of the coloured bands, some having two or three above the periphery and six or seven thin ones below the periphery. Many odd shells from the general locality differ in detail but the reason for the differences cannot be ascertained without exact locality. However, one specimen from the Strelley River, collected by Dr. J. R. Cieland, is smaller with less elevation, measuring 20 mm. in breadth by 14 mm. in height, and may represent a new subspecies **R. c. strella** nov.

A couple from Tambrey Station, Fortescue River, are as large as the preceding but flatter, duller in coloration and measuring 20 mm. in breadth by 13.5 mm. in height and these may be subspecifically named **R. c. tambra** nov.

A series collected on Rosemary I. (so named by Dampier) shows a brownish-white shell with three or four pale brown bands, the specimens are smaller than the typical form but comparatively more elevated, the type measuring 18 mm. in breadth by 14 mm. in height, and is regarded as a subspecies **R. c. perprima** nov.

#### **Rhagada tescorum** Benson 1853.

Plate IV., fig. 14.

1853—*Helix tescorum* Benson, Ann. Mag. Nat. Hist., Ser. 2, Vol. XI., p. 30, Jan. 1. Shark's Bay, West Australia.

Fig'd. Reeve, Conch. Icon., Vol. VII., pl. 171, sp. 1154, Oct. 1853. Cox, Mon. Austr. Land Shells, p. 63, pl. IX., fig. 5, May 1868.

1890—*Helix tescorum* Pilsbry Man. Conch. (Tryon), Ser. II., Vol. VI., p. 187, Dec. 16, for Tryon, Vol. IV., p. 256, pl. 36, f. 34, Jan. 3 1889.

1894—*Helix tescorum* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 89, June.

Smith noted: "In form and size this species is very like *H. convicta*; it is, however, remarkable for the caniculate (sic) suture" adding "It is within the range of possibility that this feature is due to weathering. If, in reality, such be the case, this species should undoubtedly be united with *H. convicta*."

Benson remarked, "the single specimen . . . is apparently in a sub-fossil state."

#### **Rhagada oscarensis** Cox 1892.

Plate IV., figs. 15-16.

1892—*Helix (Hadra) oscarensis* Cox, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. VI., p. 565, pl. XX., figs. 6-7, May 23. Oscar Ranges, 20 miles from Derby, North-West Australia (W. W. Froggatt).



1894—*Helix* (*Rhagada*) *inconvicta* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 90, pl. VII., f. 10, June. Oscar Ranges, 120 miles S.E. of King Sound, North-West Australia.

Shell rather depressed, spire small, last whorl keeled at the periphery, umbilicus not sealed. Apparently this species is restricted to the Oscar Ranges, but there appears to be local variation as in addition to a series of fifteen "under stones" agreeing with the type, and obviously paratypes and topotypes, there is another series of twenty-five "crawling about on the ground" which consists of uniformly smaller shells. Their elevation varies a little, sometimes even more depressed than the larger species, at others comparatively more elevated. These show more colouring, being generally horn with slightly darker flaming above, a broad brown band below the periphery, which fades basally into almost white. The shell is thinner, the lip a little more expanded, and the umbilicus is a little more open. Measurements, breadth 17-18 mm., height 11-12 mm. These may be called *R.o. perca* subsp. nov., the typical shell measuring 18 mm. in breadth by 11 mm. in height.

*Rhagada astuta* sp. nov.

Plate IV., fig. 17.

Among the shells collected at Koolan Island, Yampi Sound, was one more flattened, and upon closer examination it was seen to be sculptured on the upper surface.

Shell flattened, subdiscoidal, spire little elevated, whorls rounded, mouth oblique, wide, open, but lips not flaring, the columella reflected almost closing umbilicus, which is, however, still left open; almost a subnode seen basally on inner edge of lip. The apex worn, but apparently finely striate, striae being seen at suture, the adult whorls sculptured by oblique radials above, the under surface smooth; the radials are very numerous, regular, and distinct. Breadth 20 mm., height 12 mm.

This species is nearest *oscurensis* in form and character, but is even flatter and is easily distinguished by the upper sculpture. This feature is so alien to the true *Rhagada* that this species may prove very distinct, and in order to keep this point in view a new subgeneric name, *Thetagada*, with this as type, is introduced.

Genus **PARRHAGADA** Iredale 1938.

1938—*Parrhagada* Iredale, Austr. Zool. Vol. IX., p. 114, Nov. 30. Orthotype *Thersites woodwardi* Fulton.

This group comprises solid shells with short spire, broad body whorl and the mouth open, the outer lip expanded as a flange giving them a very distinct appearance. The type has the umbilicus tightly sealed, but some of the species, though agreeing very closely in every other feature, leave the umbilicus slightly open.

A very curious ecological note states that one of the most solid was collected "on trees off the Limestone Caves." The solidity of the tree-dweller can only be explained by the abundance of lime in their environment.

*Parrhagada woodwardi* Fulton 1902.

Plate IV., fig. 18.

1902—*Thersites* (*Rhagada*) *woodwardi* Fulton, Proc. Malac. Soc., (Lond.), Vol. V., p. 33, fig. in text, April. North-West Australia.

This species was described by Fulton from specimens sent him by B. R. Woodward, without definite locality. Two specimens in the Perth Museum



are labelled "types," and these are certainly very distinctive in appearance. having a short spire, the umbilicus sealed, but with the mouth open, the lips expanded in a manner quite unlike that of the species *convicta* and *incon-victa*, with which it has been confounded.

The spire is subconical, a little elevated, the periphery subkeeled in the earlier whorls, the last whorl well rounded, the mouth a little descending, the outer lip expanded all round giving it a flaring appearance; the columella reflected, flattened, entirely closing the umbilicus, which is very narrow and open in the young. The shell is chalky white, somewhat bright, not dead, and there is no sculpture save faint growth lines. The type measured 22 mm. in breadth and 15 mm. in height.

Many shells from "On trees off the Limestone Caves," north end of the Napier Range, collected by Dr. H. Basedow.

***Parrhagada sedula* sp. nov.**

Plate IV., fig. 20.

A single specimen collected by Dr. H. Basedow "in rocks" at Limestone Caves, North end Napier Range, differs in size and coloration from those collected on trees somewhere in the same locality. Shell small, whorls rounded, sutures deep, spire a little elate, coloration brownish cream fading on the last whorl, mouth open, lip thin reflected all round, umbilicus sealed. The sculpture is of the same kind, but appears to be a little coarser than in the larger shells, while the apical whorls are smooth and shining, a minute radial striation being only obscurely seen under a strong lens. Breadth 17 mm.; height 11 mm.

***Parrhagada detecta* sp. nov.**

Plate IV., fig. 22.

A fine series, collected by Dr. Herbert Basedow in the Barker River Gorge, Mid Napier Range, differs from another long series secured by the same collector "on trees off the Limestone Caves" at the northern end of the Napier Range, in their smaller size but more in their shape. The whorls are more flattened, the sutures less impressed, the spire more depressed and rounded, the last whorl showing a little subkeeling, and the mouth not so thrown out, more in line with the spire, the outer lip however flaring as in *woodwardi*, and the umbilicus sealed. The type is a dead shell measuring 20 mm. in breadth by 14 mm. in height.

***Parrhagada commoda* sp. nov.**

Plate IV., fig. 19.

Another lot of shells, collected by Dr. H. Basedow and labelled Barker River Gorge, are all dead, and divisible into two series, obviously collected at two different places in the Gorge. One series consists of large shells all weathered white, varying from 20 to 23 mm. in breadth and from 14 to 16 mm. in height. In form, height, appearance these agree very closely with *woodwardi*, but differ in the fact that the columella instead of being appressed, sealing the umbilicus, runs into the cavity and covers half the umbilical opening but leaves it quite unsealed. So many shells have been collected that this character is of valid specific worth in this case, though often such is not the case, and each instance must be judged separately.



**Parrhagada ferrosa** sp. nov.

Plate IV., fig. 21.

This name is given to the smaller shells from the same lot as the preceding as they measure 18 mm. in breadth and 11 mm. in height and are all reddish as if dug out of red earth. These generally agree well with the preceding save in size, and the outer lip is still more expanded and thickened.

In my South Australian essay I pointed out that the variation seen in many cases was difficult to determine. In this case the present "species" may prove to be amply distinct living under different conditions, or it may be an ecological variety only. It may even be a borecol, a name selected to designate a time variety, that is, the shells here treated may be true dwarfs, brought about by climatic conditions of some previous season. It may be a geodecol, that is, a shell living under different ground conditions, the vegetation being unsatisfactory for rapid and full growth, but these items can only be solved by local workers studying these animals under natural conditions.

**Parrhagada koolanensis** sp. nov.

Plate V., fig. 1.

These shells collected on Koolan Island, Yampi Sound, resemble very closely *P. commoda* but with the spire a little more elevated and the mouth not so much thrown out.

Shell subconical, spire elevated, sides rather straight, whorls little rounded, sutures lightly impressed, last whorl subkeeled, mouth descending, open, subcircular, outer lip broadly expanded all round, columella reflected into umbilical cavity not completely closing it, though obscuring it so that only a wide chink is left apparent. Dead shells chalky white, but there are remnants of a thin yellowish periostracum. There is no sculpture save delicate growth striae, the apex smooth. Breadth 22 mm.; height 19 mm.

In this *Parrhagada commoda* complex, this appears to be a real geographical variant in contradistinction to the forms from the Napier Ranges just preceding.

Genus **AMPLIRHAGADA** Iredale 1933.1933—*Amplirhagada* Iredale, Rec. Austr. Mus., Vol. XIX., p. 52, Aug. 2.Orthotype *Helix sykesi* Smith.

This group, which I introduced as a subgenus only, appears to be of higher value and has a distinct range.

Shell stout, spire elevated, whorls rounded, mouth rather small, columella with basal tooth, umbilicus more or less covered. While the species are apparently Rhagadoid the elevation of the spire separates them and it may be that they are less closely related than would appear at first sight. The complexity of the group necessitates subdivision, as in the past through lack of close examination the confusion reached a stage almost defying simplification.

**Amplirhagada sykesi** Smith 1894.

Plate V., fig. 3.

1894—*Helix (Hadra) sykesi* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 92, pl. VII., fig. 8, June. Parry Island, Admiralty Gulf, N.W. Australia.

A paratype is here figured and described. Shell fairly large, conical, spire well elevated, whorls rounded, sutures deeply impressed, last whorl descending, well rounded though earlier a little keeled, mouth oblique, open,



outer lip thickened and reflected, columella very slanting, bearing a small prominent tubercle anteriorly, reflected over and closing the umbilicus save for a minute chink. Coloration shining with a subsutural and a peripheral narrow band of golden brown. Apex very finely striate, adult sculpture of fine regular radial striae, a subordinate fine concentric lining developing later which almost overcomes the radials on the body whorl. There is a strong creamy callus connecting the columella with the outer lip across the body whorl. Breadth 22 mm., height 18 mm.

***Amplirhagada montalivetensis* Smith 1894.**

Plate V., fig. 5.

1894—*Helix* (*Hadra*) *montalivetensis* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 91, pl. VII., fig. 21, June. Montalivet I., North-West Australia.

Smith described *sykesi* by comparison with *montalivetensis*, so the process may here be reversed, a paratype again being used. Shell much more depressed than the preceding though the coloration is the same, the mouth is more open, the tubercle on the columella is broader and more flattened, the columella more expanded, but the umbilicus is left more open though obscured. The outer lip seems more expanded with an antelabial ditch present, and the base appears flattened around the umbilicus. Breadth 21.5 mm., height 15 mm.

***Amplirhagada herbertena* sp. nov.**

Plate V., fig. 6.

A specimen collected by Dr. H. Basedow in the Buccaneer Archipelago, the exact island not indicated, was regarded by Hedley as representing "*montalivetensis* Smith var.," but it is quite distinct.

Shell fairly large for this group, subconical, spire elevated, base flattened appreciably, the last whorl subkeeled, the whorls fine with two apical whorls which are apparently smooth. The whorls are convex with sutures scarcely impressed producing a characteristic appearance. The sculpture is of faint growth radials, but on the last whorl, with a strong lens, a light subordinate fine concentric striation can be discerned. Mouth well open, outer lip thin, a little reflected, basally thickening and producing a flattened tubercle, columella curved, thickened, reflected, half covering the open narrow perspective umbilicus. Base a little convex, then flattened and surrounding the umbilical cavity with a subdued ridge. Breadth 22 mm., height 17 mm.

***Amplirhagada imitata* Smith 1894.**

Plate V., fig. 7.

1894—*Helix* (*Hadra*) *imitata* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 92, pl. VII., fig. 15, June. Baudin, N. Maret, and Condillac Islands and Cape Bougainville, N.W. Australia.

This was distinguished on account of its coarse sculpture above, and this feature immediately separates it. I select Baudin I. as the restricted type locality and figure a specimen from that locality. Shell medium, elevated, whorls rounded, strongly obliquely striate above, the striations becoming lirae almost, disappearing, however, on the base. A little more elevated than *montalivetensis* and a little less than *sykesi*, it shows the apertural and columellar features of the latter almost exactly. There is, however, no coloration seen, and the breadth is 20 mm., with a height of 15 mm.



Specimens from Vansittart Bay, N.W. Australia, collected by Capt. W. Burrows, are more elevated and have finer sculpture above, although this is still strong and well marked. One specimen shows a peripheral and subsutural brown band. Height 16 mm.; breadth 20 mm. This specimen is named *A. burrowsena*. (Plate V., fig. 9.)

***Amplirhagada combeana* Iredale 1938.**

Plate V., fig. 10.

1938—*Amplirhagada combeana* Iredale, Austr. Zool, Vol. IX., p. 113, Nov. 30, new name for.

1894—*Helix* (*Hadra*) *imitata* var. *cassiniensis* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 92, pl. VII., fig. 16, June. Cassini Islands, North-West Australia.

Not *H. millepunctata* var. *cassiniensis* Smith, op. cit. p. 88.

This is a delightful little species judging from a paratype which is here figured.

Shell smaller than preceding, more solid, comparatively more elevated, mouth more thickened, rather smaller, sculpture coarser and more prominent on base, whorls more rounded, sutures deeper. There is also a golden peripheral narrow band, but no subsutural colour can be seen.

Breadth 15.5 mm.; height 12.5 mm.

***Amplirhagada burnnerensis* Smith 1894.**

Plate V., fig. 11.

1894—*Helix* (*Hadra*) *burnnerensis* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 91, pl. VII., fig. 18, June. Burner (error pro Barrier) Ranges, Derby District, N.W. Australia (Cox).

This species appears to fall into *Amplirhagada* though it is outside the range of the other *Amplirhagada*. It is quite unlike its associates geographically and I note that Smith allied it to *sykesi*.

A series of sixty labelled by Froggatt "among the limestones" shows a peculiar coloration, the upper whorls greyish white probably through the dead animal, as some are horn or creamy, the last two whorls creamy suffused below the suture and towards the umbilicus with rich amber. The apex is radially granulose, the usual fine growth radial sculpture with a very fine concentric lining present, on the adult whorls. These are rounded, last whorl large, mouth a little descending, outer lip thin, slightly reflected, columella straight, short, reflected sealing the umbilicus. Breadth 21.5, height 15 mm.

A smaller horny shell, associated with the preceding, is more conical, thinner, last whorl subkeeled, mouth more open, apex less granulose, adult sculpture a little coarser. Its exact status is at present unknown, it may be a horecol, but for the present it is named *A. terma* sp. nov. the type measuring 15.5 mm. in breadth by 11.5 mm. in height. (Plate V., fig. 8.)

***Amplirhagada novelta* sp. nov.**

Plate V., fig. 12.

Shell subglobose, spire conical, rather elevated, whorls rounded, last whorl large, descending at mouth which is large, open, subcircular, outer lip thin, slightly expanded, columella small but reflected, sealing the umbilicus.



The dead shell is whitish with a faint brownish peripheral narrow band. The apex is almost smooth, but shows slight radial striae, the adult sculpture is faint radial growth lines, somewhat irregular in strength. Breadth 23 mm.; height 17.5 mm.

Compared with *sykesi*, this species has a much more conical spire, more flattened whorls and lacks the columellar tubercle while the umbilicus is completely sealed, there is not the slightest chink showing.

Collected on the Drysdale River, Napier Broome Bay, North-West Australia.

Genus **TENUIGADA** gen. nov.

Type **T. percita** sp. nov.

Many thin shells are labelled "In rocks, Limestone Caves, Napier Range," and these do not correlate with any of the named groups. Shell thin, helicoid, a little conical, umbilicate, whorls rounded, sutures shallow, last whorl rather bulky, mouth descending, a little oblique, subcircular, the outer lip thin, reflected, the columella slanting, broadly reflected across and hiding the umbilicus but not appressed.

These shells have a different texture from the preceding Rhagadoid forms while the columella does not enter the umbilical cavity nor is it appressed but expands across the umbilical opening. The apex is finely radially striate, whereas generally in Rhagadoid shells the apical whorls are smooth.

**Tenuigada percita** sp. nov.

Plate V., fig. 14.

Shell thin, transparent, subglobose, spire somewhat elate, conical, whorls rounded, sutures little impressed, last whorl with a faint peripheral keel at beginning, periphery well rounded finally, outer lip a little descending, mouth roundish, open, outer lip thin, reflected all round, the columella broadly angulately reflected over umbilicus which however is not closed by it. The apex is rather coarsely radiate, the radials breaking up into granules, the succeeding sculpture being rather coarse growth radials, almost radial riblets, which become weaker with age when concentric striation appears, and this can also be seen obscurely on the base. A callus connects the outer lip and the columella. Coloration pale brownish horn. Breadth 19 mm.; height 14 mm.

Collected in rocks at the Limestone Caves, North End of Napier Range, by Dr. H. Basedow.

**Tenuigada ignara** sp. nov.

Plate V., fig. 13.

Collected with the preceding, but probably in a slightly different location, were many smaller specimens of the same type, but there were paler in coloration, more depressed, the peripheral keel more noticeable, smaller, the mouth more descending, the umbilicus comparatively larger and more open. The apex is more strongly granulose, the adult radial sculpture weaker, the concentric striae scarcely discernible. Breadth 16 mm.; height 10.5 mm.

Genus **EXILIGADA** gen. nov.

Type **Exiligada negriensis** sp. nov.

Mr. Richard Helms, in the year 1896, collected a number of shells at Negri Outstation, twenty-five miles north of Ord River Station, East Kimberley. Two species were procured and they do not fall into any Rhagadoid



group previously known, and are quite unlike any other type of Australian land mollusc.

The shell is depressed, spire little elevated, whorls a little rounded, last whorl rounded, base somewhat flattened, umbilicate, mouth fairly large, outer lip a little recurved.

The notable features are the texture and coloration. The shell is strong, but not as stout as true *Rhagada*, and the shells are banded profusely but not in the *Rhagadoid* style. In the type the bands are broken into bars by growth periods, but in the second species the bands are continuous, twelve to sixteen bands being counted on the last whorl. The columella is reflected, leaving the umbilicus exposed in the type but almost concealing it in the second species.

***Exiligada negriensis* sp. nov.**

Plate V., fig. 4.

Shell subdiscoidal, large, spire a little elevated, whorls little rounded, last whorl however well rounded at the periphery, mouth descending a little, aperture oblique, subcircular, open, outer lip reflected a little all round, flattened basally, columella slanting, broadly reflected but not obscuring the umbilicus, which is narrow but open, shell rather solid.

Coloration peculiar: whitish encircled by a number of brown lines interrupted by growth stages so that the lines appear as a series of dashes, the lines are practically of the same width and number about a dozen on the last whorl, three above the peripheral one which is no stronger than the others, the remainder on the base. The apex is quite smooth, and apparently stopped by a varix, the adult whorls being only sculptured by very faint growth striae only. The base is somewhat flattened, the umbilical area excavate.

Breadth 22 mm.; height 11 mm.

***Exiligada qualis* sp. nov.**

Plate V., fig. 2.

Shell with the spire more elevated than in the preceding species, the whorls a little rounded, the sutures impressed, the mouth large, the outer lip a little recurved but not flattened basally. The shell has the same texture as the preceding and is surely related, but at first sight it differs as the coloured bands are unbroken. The ground colour is whitish and the lines are more numerous, two about the periphery being much broader than the remainder and a brighter red-brown. There are half a dozen above and half a dozen below with even one narrow line between the two broad ones.

The apex is apparently smooth but there are microscopic radial striations present, the adult shell being very finely radially growth striate throughout.

The columella is a little arcuate and expanded, closing the umbilicus save for a chink.

Breadth 20 mm.; height 14 mm.

Genus **PLECTORHAGADA** Iredale 1933.

1933—*Plectorhagada* Iredale, Rec. Austr. Mus., Vol. XIX., p. 52, Aug. 2.

Orthotype *Helix plectilis* Benson.

This group has a different facies from *Rhagada*, the spire being more conical, the mouth descending more rapidly and being more circular, the umbilicus being open though hidden by the expansion of the columella, and



the characteristic sculpture. The apex is smooth, the adult whorls rugosely plicate, the plicae irregular, and overall a curious granulation. This sculpture is so peculiar that the type species appears to have been described three times, Reeve calling the sculpture "crumpled," which is probably the best word used.

**Plectorhagada plectilis** Benson 1853.

Plate V., fig. 15.

1853—*Helix plectilis* Benson, Ann. Mag. Nat. Hist., Ser. 2, Vol. XI., p. 29, Jan. 1. Shark Bay, West Australia.

Fig'd. Reeve, Conch. Icon., Vol. VII., pl. 172, sp. 1162, Oct., 1853.

Cox, Mon. Austr. Land Shells, p. 44, pl. IX., fig. 17 (copy of Reeve's figure); pl. XX., fig. 8, from a painting of the type by Angas, May, 1868. Tryon, Man. Conch., Ser. II., Vol. III., p. 215, pl. 49, fig. 18, 1887. Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. VI., p. 88, pl. 35, figs. 16, 17, 18, 1890.

1854—*Helix paleata* Reeve, Conch. Icon., Vol. VII., pl. 199, sp. 1399, Dec. Banks of the Swan River, Australia (Bacon).

Tryon, Man. Conch., Ser. II., Vol. III., p. 215, pl. 49, fig. 17, 1887. (Cox and Pilsbry, opp. cit., treat this as a synonym of above.)

1864—*Helix carcharias* Pfeiffer, Proc. Zool. Soc. (Lond.), 1863, p. 528, Apl. 20, 1864. Shark Bay, West Australia.

Fig'd. Cox, Mon. Austr. Land Shells, p. 45, pl. XX., fig. 12 (from a painting of the type by Angas), May, 1868.

The locality "Banks of the Swan River" is definitely incorrect, the species being only known from Shark Bay. Some are labelled Dirk Hartog's Island and it is possible that there may be races or even distinct species on the islands such as Dirk Hartog, Bernier, Dorre, as well as Peron Peninsula. Péron recorded that helicoid land-shells were abundant on those islands, and we have no series for examination yet. The specimen labelled "Dirk Hartog's Island" is undoubtedly the same as those labelled "Shark Bay," and probably all are from the one lot. This measures 15.5 mm. in breadth by 11 mm. in height, and agrees very closely with Angas' painting of the type of *plectilis*. Pfeiffer's *carcharias*, according to Angas' painting, is more conoidal, and is a living specimen, "flesh-coloured," all the dead shells being white.

Rensch (Zool. Jahrbuch (Syst.), Jena, Bd. 63, heft 1, pp. 1-130, Apl. 12, 1932), dealing with the Molluscan Fauna of the Sunda Expedition, has recorded (p. 94), *Rhagada plectilis supracostulata* Schepman, from Sumba, recording as additional races of *R. plectilis*, *plicata* Preston, *colona* Martens, and *savaensis* Schepman. Such reviews by continental workers, being based on scant material and no local knowledge, are very misleading. The Australian shells, thus associated by Rensch as "races," *plectilis* and *plicata*, have little close relationship, and are very definitely not conspecific. The mere fact that they come from Western Australia seems to be the decisive factor in Rensch's judgment.

**Plectorhagada rovina** sp. nov.

Plate V., fig. 17.

A very beautiful little shell from Shark Bay, regarded as the missing *H. australis* Menke, is here described, as it is quite unlike the description of the Menkean species. Shell small, stout, subglobose with elevated spire, sutures deep, whorls very rounded, mouth large and circular, umbilicus



narrow, open, columellar reflection slight, outer lip thin not reflected, coloration shining white, with two faint brown bands on last whorl, one peripheral, the other midway between this and suture. Apical whorls, one and a half, smooth, adult whorls five and one half, sculptured with close wavy irregular rough ridges, subgranulose, base a little smoother. Columella a little curved with a strong glaze connecting inner and outer lip, but not forming a continuous aperture.

Height, 11 mm.; breadth, 12 mm.; aperture, 6 mm. high by 6 mm. broad.

While the rough sculpture is not identical with that of *plectilis*, it recalls that, and no other Western Australian shell has any sculpture at all like. This species is therefore placed tentatively under *Plectorhagada*, but as its shape is so different from that of the type, a new subgeneric name is here introduced, *Idamera*, with *P. roxina* as type.

Genus **BELLRHAGADA** Iredale 1938.

1938—*Bellrhagada* Iredale, Austr. Zool., Vol. IX., p. 114, Nov. 30. Orthotype *Rhagada plicata* Preston.

Smallest Rhagadoid shells, flattened globose, imperforate, sutures almost canaliculate, mouth subcircular, lip little expanded, sculpture of regular radials weaker on the base, the apical whorls large and smooth.

This little shell is quite similar to the type of *Rhagada* but is plicate above, and is here differentiated, as it appears to have an extra-Australian representative in *supracostulata*, which has the umbilicus not completely sealed.

**Bellrhagada plicata** Preston 1914.

Plate V., fig. 16.

1914—*Rhagada plicata* Preston, Proc. Malac. Soc. (Lond.), Vol. XI., p. 13, fig. in text, Mch. 30. Montebello Is., West Australia.

The smallest of the Rhagadoid series, this shell is flattened globose, spire short, very little elevated, whorls little rounded, sutures deep, last whorl descending a little, mouth subcircular, open, outer lip a little reflected, basally thickened; columella slanting, appressed, sealing the umbilicus save for a minute chink, coloration white with one broad peripheral band, two narrower above, and half a dozen below: these are pale brown but may be darker in life.

The sculpture is peculiar, the apical whorls smooth, the adult whorls with flattened oblique distinct radials, these persisting obscurely on the base. Breadth 10 mm.; height 8 mm.

[**Helix dringi** Pfeiffer 1846.

1846—*Helix dringi* Pfeiffer, Symb. Helic., Vol. III., p. 73, "Austral. oriental. (Dring in Mus. Cuming)."

1848—*Helix dringi* Pfeiffer, Mon. Helic. viv., Vol. I., p. 289, "Australia oriental, prope 'Torres Strait' (Dring)."

1852—*Helix dringi* Reeve, Conch. Icon., Vol. VII., pl. 128, sp. 769, October.

1868—*Helix dringi* Cox, Mon. Austr. Land Shells, p. 64, pl. XI., fig. 9, May.

1890—*Helix dringi* Pilsbry, Man. Conch. (Tryon), Ser. II., Vol. VI., p. 186, Dec. 16, fig. for Vol. IV., pl. 36, fig. 40, Jan. 3, 1889, where there is no text.

All these references refer to the single specimen collected by Dring, and credited to Eastern Australia, near Torres Strait. The figure recalls species



of *Torresitrachia*, but these are always openly umbilicated, while this is described as having a covered umbilicus, which suggests *Rhagadoid* affinity. Dring collected on the West Coast so that it is possible that this species was found somewhere on the west, rather than on the East Coast.]

Genus **GLOBORHAGADA** Iredale 1933.

1933—*Globorhagada* Iredale, Rec. Austr. Mus., Vol. XIX, p. 52, Aug. 2.  
Orthotype *Helix* (*Hadra*) *prudhoensis* Smith.

I distinguished this form as a subgenus of *Rhagada*, observing that the type species was globose, with open circular mouth, the columella thickened, much reflected and appressed, but not closing the umbilicus, a thick glaze joining the inner and outer lips.

The globose form separates this group clearly and the apertural characters appear distinct from those of true *Rhagada*. The columella crosses the umbilical cavity whereas the *Rhagada* species have it entering it.

**Globorhagada prudhoensis** Smith 1894.

Plate V., fig. 19.

1894—*Helix* (*Hadra*) *prudhoensis* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 91, pl. VII., fig. 9. Prudhoe Island, N.W. Australia (Lieut. J. W. Combe, H.M.S. "Penguin").

"Shell umbilicate, globose (whitish, clothed with a yellowish epidermis); whorls five convex, rapidly increasing, striate with oblique growth lines, the last whorl large, inflated, obliquely descending suddenly at the aperture; spire obtusely conoidal; aperture rotundately-lunate, length about three-fifths of the height of the shell; peristome interiorly slightly thickened, outwardly scarcely expanded, a little effuse anteriorly, a thin callus joining the margins, columella oblique, reflected, dilated above, almost hiding the umbilicus. Diam. mag. 25, min. 20 mm.; alt. 22 mm. Aperture 14 long, 11.5 broad. Hab. as above.

This is a smooth globular species, probably without much coloration, judging from the only two specimens at hand. These are in a dead condition, without any trace of colour, and probably are more or less bleached. The umbilicus is deep and moderately broad; the inner edge of the oblique columella is gently arcuate, but the outer margin is almost straight or faintly incurved."

**Globorhagada leptogramma** Pfeiffer 1846.

Plate V., fig. 18.

1846—*Helix leptogramma* Pfeiffer, Proc. Zool. Soc. (Lond.), 1845, p. 127, Feb. 1846. Cygnet Bay, North Australia (Ince).  
Fig'd. Reeve, Conch. Icon., Vol. VII., pl. LXXXII., sp. 437, Mch. 1852. Cox, Mon. Austr. Land Shells, p. 41, pl. XI., fig. 4, May 1868.  
Smith, Zool. Erebus & Terror, Moll., p. 2, pl. IV., fig. 18, 1874. Tryon Man. Conch., Ser. 2, Vol. IV., p. 256, pl. 36, fig. 33, 1887.

Specimens from Broome agree fairly save that they are slightly larger, and topotypical examples are not available.

Shell globose, spire very short, last whorl very large and bulky, whorls rounded, sutures deep, last whorl descending a little, mouth almost circular wide open, outer lip a little reflected all round, columella very slanting across



the umbilical cavity concealing the umbilicus but not closing it, a thick glaze crosses the body whorl from columella to outer lip. Dead shell white with four brownish bands on body whorl, two narrow above the periphery, one a little broader peripheral and another similar just below. Sculpture of growth striae only.

Height 19 mm.; breadth 21 mm.

**Globorhagada montebelloensis** Preston 1914.

Plate V., fig. 20.

1914—*Rhagada montebelloensis* Preston, Proc. Malac. Soc. (Lond.), Vol. XI., p. 13, fig. in text, Mch. 30. Montebello Is., West Australia.

Shell subglobose, spire short, whorls well rounded, mouth round wide, columella thick reflected, almost closing umbilicus. This is a flatter shell than *leptogramma*, more depressed, somewhat recalling some forms of *Rhagada* but with the columellar features of *Globorhagada*.

Shell brownish white with one peripheral pale brown band. Apex finely radially striate, adult sculpture only of rough radial growth striae, smoother on base.

Height 13 mm.; breadth 17 mm.

**Globorhagada obliquirugosa** Smith 1894.

Plate V., fig. 21.

1894—*Helix (Hadra) obliquirugosa* Smith, Proc. Malac. Soc. (Lond.), Vol. I., p. 90, pl. VII., fig. 17, June. Parry Harbour, North-West Australia.

The original description reads: "Shell globose, narrowly perforate, white, clothed with a thin yellowish epidermis, striate with oblique growth lines, everywhere obliquely irregularly corrugated; whorls five convex, rapidly increasing, sutures deeply impressed, last whorl large, globose, slightly descending at the aperture; aperture oblique, broadly lunate, white; spire moderately elevated, somewhat obtuse at the apex; peristome slightly thickened, scarcely expanded above, a little reflected below, the columellar margin dilated broadly, especially at the insertion, thus partly concealing the umbilicus. Diameter major 21, min. 16.5 mm; height 18 mm. Aperture 14 long, 10 broad. Only dead specimens of this species were obtained, almost entirely denuded of the periostracum. The remains of it, however, within the aperture show that it was of a yellowish tint. One example, fresher than the rest, has the spire of a very pale brownish tint, so it is likely that this species, when living, is of a light brownish colour above, and covered with a thin periostracum."

**FAMILY OCCIRHENEIDAE.**

For the present it is better to use a name such as the above to include a species from Western Australia whose status is unknown. I introduced the generic name *Occirhenea* for *Helix georgiana* Quoy and Gaimard, which had been placed previously under *Rhytida*, *Flammulina* and *Zonites*, none of which occurs in this area.



Genus **OCCIRHENEAE** Iredale 1933.

1933—*Occirhenea* Iredale, Rec. Austr. Mus., Vol. XIX., p. 48, Aug. 2. Orthotype *Helix georgiana* Quoy and Gaimard.

I wrote, "The strongly sculptured base, narrow umbilicus, and produced outer lip differentiate" this species which had previously been placed under *Rhytida*, *Flammulina* and *Zonites*, three genera representing distinct groups of superfamily distinction. Apparently although the figure shows a strongly sculptured base this is an error in the drawing.

***Occirhenea georgiana*** Quoy and Gaimard 1832.

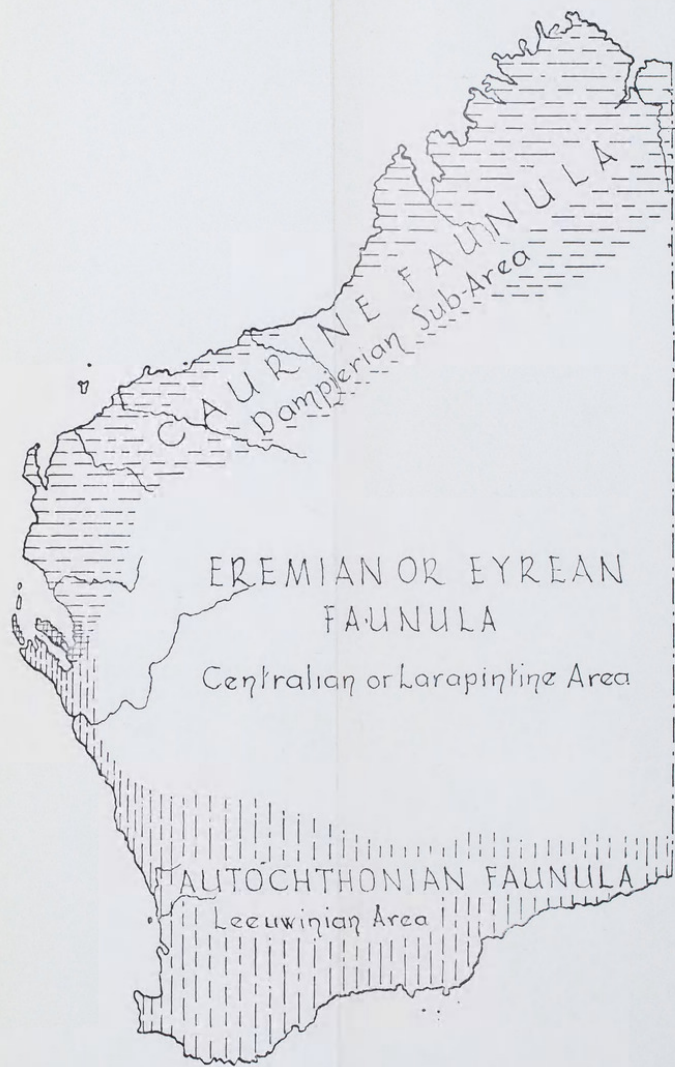
Plate V., figs. 22 and 22a.

1832—*Helix georgiana* Quoy and Gaimard, Voy. Astrol. Zool., Vol. II., p. 129, pl. X., figs. 26-30. King George Sound, South-West Australia.

Shell orbicular, translucent and fragile, strongly striated above, yellow; whorls four, the last cylindraceous; aperture large, subrotund; lip thin. Diameter 5 lines, height 2 lines.

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WESTERN AUSTRALIA.

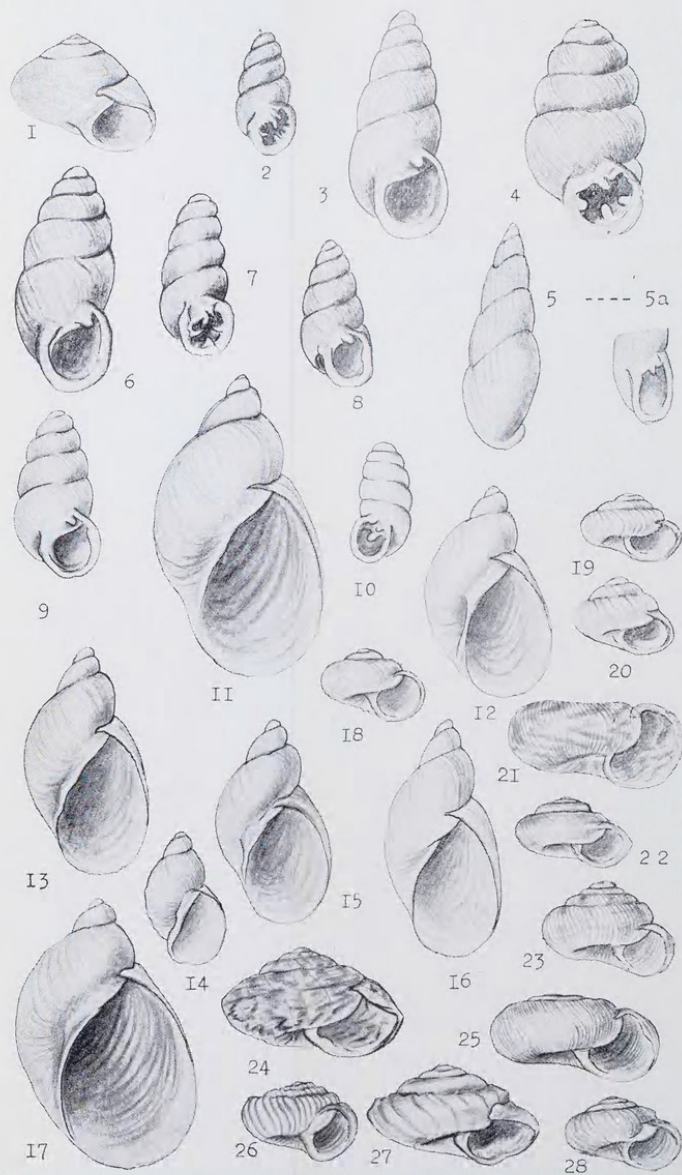






## EXPLANATION OF PLATE I.

- Fig. 1. *Pleuropoma walkeri* Smith.  
 2. *Australbinula helmsiana* Iredale.  
 3. *Themapupa beltiana asserta* Iredale.  
 4. *Australbinula moorcana* Smith.  
 5, 5a. *Themapupa lepidula* A. Adams and Angas.  
 6. *Themapupa beltiana contexta* Iredale.  
 7. *Australbinula complexa* Iredale.  
 8. *Themapupa disrupta* Iredale.  
 9. *Themapupa anapacifica* Iredale.  
 10. *Omegapilla occidentalis* Iredale.  
 11. *Austrosuccinea scalarina* Pfeiffer.  
 12. *Austrosuccinea contenta* Iredale.  
 13. *Austrosuccinea contenta isolata* Iredale.  
 14. *Arborcinea menckana* Pfeiffer.  
 15. *Austrosuccinea aridicola* Iredale.  
 16. *Austrosuccinea caurina* Iredale.  
 17. *Austrosuccinea cori* Finlay.  
 18, 28. *Westralaoma experta* Iredale.  
 19. *Westralaoma scitula* Iredale.  
 20. *Gratilaoma cara* Iredale.  
 21. *Luinodiscus repens* Iredale.  
 22. *Insullaoma predicta* Iredale.  
 23. *Pernagera albanensis* Cox.  
 24, 27. *Annoschke dolosa* Iredale.  
 25. *Luinodiscus cygneus* Benson.  
 26. *Epiniicum restifer* Iredale.









## EXPLANATION OF PLATE II.

Fig. 1. *Bothriembryon melo* Quoy and Gaimard.

2. " *castaneus* Pilsbry.
3. " *rhodostomus* Gray.
4. " " *hullianus* Iredale.
5. " " *grantianus* Iredale.
6. " " *wrightianus* Iredale.
7. " " *perspectus* Iredale.
8. " *esperantia* Iredale.
9. " *balteolus* Iredale.
10. " *serpentinus* Iredale.
11. " *praeclusus* Iredale.
12. " *sedgwicki* Iredale.
13. " *bulia* Menke.
14. " *bradshawi* Iredale.
15. " *irvinianus* Iredale.
16. " *richeanus* Iredale.
17. " *leewardsensis* Smith.
18. " " *eventus* Iredale.
19. " *costulatus* Lamarek.
20. " *minor* Pilsbry.
21. " *whitleyi* Iredale.
22. " *perobesus* Iredale.
23. " *indutus* Menke.
24. " *glauerti* Iredale.
25. " *franki* Iredale.
26. " *kingii* Gray.
27. " " (*trilineatus*).
28. " " (*humilis*).
29. " *notatus* Iredale.
30. " *jacksoni* Iredale.
31. " *maxwelli* Kobelt.
32. " *perditus* Iredale.
33. " *sayi* Pfeiffer.
34. " " (*solidus*).
35. " *naturalistarum* Kobelt.
36. " " (large form).
37. " *revertus* Iredale.
38. " *brazieri* Angas.
39. " *gratwicki* Cox.
40. " *dux* Pfeiffer.
41. " *barretti* Iredale.
42. " " *indictus* Iredale.
43. " *distinctus* Iredale.









## EXPLANATION OF PLATE III.

- Fig. 1. *Luinarion castaneus* Pfeiffer.  
 „ 2. *Luinodiscus tumidus* Odhner.  
 „ 3. *Pernagera lena* Iredale.  
 „ 4. *Westralaoma expicta* Iredale.  
 „ 5. *Luinodiscus cupreus* Cox.  
 „ 6. *Westraltrachia derbyi* Cox.  
 „ 7. *Westralaoma aprica* Iredale.  
 „ 8. *Westraltrachia orthocheila* Ancey.  
 „ 9. *Baudinella baudinensis* Smith.  
 „ 10. *Westraltrachia froggatti* Ancey.  
 „ 11. *Torresitrachia bathurstensis* Smith.  
 „ 12. *Kimboraga micromphala* Gude.  
 „ 13. *Torresitrachia monticola* Iredale.  
 „ 14. *Westracystis tentus* Iredale.  
 „ 15. *Pleuroxia polypleura olfina* Iredale.  
 „ 16. *Westraltrachia incerta* Iredale.  
 „ 17. *Westraltrachia alterna* Iredale.  
 „ 18. *Sinumelon datum* Iredale.  
 „ 19. *Sinumelon nullarboricum* Tate.  
 „ 20. *Quistrachia monogramma* Ancey.  
 „ 21. *Sinumelon lennum* Iredale.  
 „ 22. *Pleuroxia abstans* Iredale.  
 „ 23. *Pleuroxia oligopleura numba* Iredale.  
 „ 24. *Sinumelon vagante* Iredale.  
 „ 25. *Sinumelon kalgum* Iredale.  
 „ 26. *Pleuroxia commenta* Iredale.  
 „ 27. *Pleuroxia polypleura* Tate.  
 „ 28. *Pleuroxia oligopleura* Tate.  
 „ 29. *Sinumelon lennum nutuum* Iredale.









## EXPLANATION OF PLATE IV.

- Fig. 1. *Rhagada torulus* Ferussac.  
 " 2. " *reinga* Gray.  
 " 3. " *construa* Iredale.  
 " 4. " *mimika* Iredale.  
 " 5. " *gatta* Iredale.  
 " 6. " *basedowiana* Iredale.  
 " 7. " *richardsonii* Smith.  
 " 8. " *radleyi* Preston.  
 " 9. " *sutra* Iredale.  
 " 10. " *convicta* Cox.  
 " 11. " " *strella* Iredale.  
 " 12. " " *tanbra* Iredale.  
 " 13. " " *perprima* Iredale.  
 " 14. " *tescorum* Benson.  
 " 15. " *oscarenensis* Cox.  
 " 16. " " *perca* Iredale.  
 " 17. " *astuta* Iredale.  
 " 18. *Parrhagada woodwardi* Fulton.  
 " 19. " *commoda* Iredale.  
 " 20. " *sedula* Iredale.  
 " 21. " *ferrosa* Iredale.  
 " 22. " *detecta* Iredale.

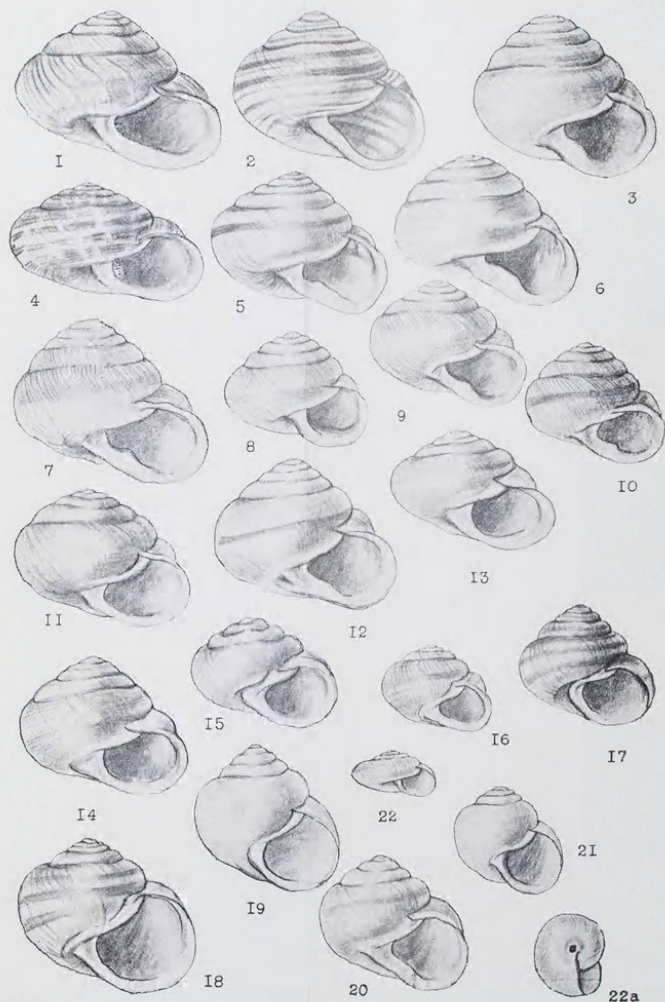






## EXPLANATION OF PLATE V.

- Fig. 1. *Parrhagada koolanensis* Iredale.  
 „ 2. *Exiligada qualis* Iredale.  
 „ 3. *Amplirhagada sylkesi* Smith.  
 „ 4. *Exiligada negriensis* Iredale.  
 „ 5. *Amplirhagada montalivictensis* Smith.  
 „ 6. „ *hebertena* Iredale.  
 „ 7. „ *imitata* Smith.  
 „ 8. „ *terma* Iredale.  
 „ 9. „ *burrowseni* Iredale.  
 „ 10. „ *combeana* Iredale.  
 „ 11. „ *burnerensis* Smith.  
 „ 12. „ *novella* Iredale.  
 „ 13. *Tenuigada ignara* Iredale.  
 „ 14. „ *percita* Iredale.  
 „ 15. *Plectorhagada plectilis* Benson.  
 „ 16. *Bellrhagada plicata* Preston.  
 „ 17. *Plectorhagada rovinia* Iredale.  
 „ 18. *Glotrhagada leptogramma* Pfeiffer.  
 „ 19. „ *pruthocensis* Smith.  
 „ 20. „ *montebelloensis* Preston.  
 „ 21. „ *obliquirugosa* Smith.  
 „ 22. & 22a. *Occirhena georgiana* Quoy & Gaimard.







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