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THE NEW SOUTH WALES PYRAMIDELLIDAE AND THE GENUS *MATHILDA*.

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(Figures 1-98.)

INTRODUCTION.

This paper is intended primarily as an illustrated check-list of the species of Pyramidellidae of the Neoperonian Zoogeographical Province, and it includes mainly gasteropods with heterotrophe protoconchs. This widens the family limits as dealt with in Hedley's Check List (1917), but in addition to affording a more convenient classification, it is in general keeping with present-day opinion abroad. Opinions as to the phylogenetic value of the protoconch may differ, but in some families it is of undoubted importance. Here, at least, it affords a very definite character which, in the absence of any knowledge of anatomy and life history, links a number of shells with many other characters in common.

The family is old geologically and has a world-wide range, and the list of known species is great and continually growing. Of late years some detailed research on the animal and its life history has been done in Europe and America, but in Australia the systematist still holds the field. Here the immediate necessity is to determine and list the numerous species, so that deeper research may begin. In New South Wales the only knowledge of the animal so far is the description and figure of *Linopyrga pascoei* by Charles Hedley (1916). Hedley points out that this agrees very well with the animal of the other species of the family, as known elsewhere. Anatomically, the absence of a radula is held as a family characteristic, as is the presence of a horny, pauci-spiral operculum, notched to conform with the columella fold, and with the nucleus sub-marginal and anterior.

THE HETEROTROPHE PROTOCONCH.

This type of protoconch is very distinctive and varies little right throughout the family. Its peculiar form depends on the fact that in its larval state the animal is sinistral while in the adult stage it is dextral. The actual change takes place within and before the close of the larval period; it may be comparatively rapid or more or less prolonged, and there is nearly always a stage during which the symmetry of the animal is balanced and the resultant shell is in the form of a straight tube. It is these factors which make slight differences in the apices of the different species.

Typically the extreme nucleus is sinistral, consisting of generally two, but sometimes three or even four helicoid whorls, the first minute, the second inflated. When the change to the dextral form is rapid the whorl bends right back on itself and, still in the larval stage, encloses or passes below the apex in half or even a complex dextral whorl. At the close of the larval stage there is a pause, and the protoconch may be separated from the first adult whorl by a distinct varix which is, however, rarely visible. The angle the first dextral turn makes with the sinistral nucleus has a varying effect. In some species the nucleus is so enfolded as to be quite invisible; in many of the Turbonillas it lies recumbent on the peak of the adult shell. In the Eulimellas, particularly, the neutral stage, that is between sinistral and dextral, is so prolonged that the whole protoconch is extended, or lies at an angle with the axis of the mature shell. Figures 95-98 show protoconchs of four species of different genera, and illustrate variations in the coiling.

An important aspect of the heterotrophe protoconch is that recent research suggests that it shows a free-swimming larval stage. Larval sinistral shells have been found in numbers in plankton in European waters, and have been dealt with comprehensively by the Danish zoologist Gunnar Thorson (1946). He has identified these with local species of Pyramidellidae, and holds the view that the sinistral types are free-swimming

and that certain other dextral forms are not so. No dextral protoconch has so far been identified with certainty in any New South Wales species of this group, but the development of a varix is a common feature of larvae at the end of their free-swimming existence, and bears out Thorson's views. Further evidence can be found in their distribution, for they have been recorded from many of the Pacific oceanic islands. In these locations the marine fauna is invariably ill-balanced, consisting entirely of creatures capable, either in a larval or adult state, of traversing the intervening oceans.

HABITAT.

There is little information on this point. Very few of the local species have been taken alive, but their occurrence suggests that while some live in sand, the majority prefer a muddy or sand-mud bottom. Some definitely live on algae, and *Chemnitzia hofmani* is almost invariably so found, sometimes in such numbers as to be considered gregarious. *Linopyrga pascoei* is abundant under rocks in pools between tide marks, and we have found *Odostomia indistincta* in a large colony in galeolaria tubes between tide marks in Port Jackson. Most of our material, however, comes from beaches or from dredging and has been dead when obtained. Species occur from above low tide to very deep water, in at least 800 fathoms, and well beyond the continental shelf. There is no evidence of food, but in the absence of a radula, it is probable that they live on microscopic floating life, or on the organic material present in mud or sand.

THE GENERA OF PYRAMIDELLIDAE.

It has already been stated that the limits of the family as here dealt with are wider than that allowed in Hedley's Check List. Hedley included *Cingulina* and *Mathilda* in the Acteonidae, and *Eulimella* and *Pseudorissoina* in the Eulimidae. In the absence of knowledge of the animals of Australian shells, and working on shell characters alone, these genera, with the possible exception of *Mathilda*, have far more in common with the Pyramidellids than with either *Acteon* or *Eulima*. The heterotrophe protoconch has been taken as the main determining character, but there is abundant support for such a course in the opinions of most oversea conchologists.

The position of *Mathilda* is uncertain. The genotype is a European fossil, and nothing is known of the animal of the few living species. The protoconch is eccentric, but it is doubtful if the nucleus is sinistral, therefore it is not heterotrophe, thus differing from most of the true Pyramidellidae. On the other hand, in shell characters, it has much more in common with this family than with *Eulima* and its allies. Quite probably it should be considered a distinct family. Hence it has been thought better to consider it separately, and it is discussed in a section by itself at the end of this paper.

The basis of the modern classification of the Pyramidellidae was, until recently, a paper by W. H. Dall and P. Bartsch, published in 1904. Thiele (1931), generally accepted as the standard text-book on molluscan classification, follows Dall and Bartsch almost in entirety. Of the four genera mentioned above, Dall and Bartsch place *Eulimella* as a subgenus of *Pyramidella*, *Cingulina* as a subgenus of *Turbonilla*, and *Pseudorissoina* as a subgenus of *Odostomia*. *Mathilda* is not mentioned.

For the whole of the family they allowed but four genera, *Pyramidella* Lamarek, *Turbonilla* Russo, *Odostomia* Fleming, and *Murchisonella* Morch. These were divided into many subgenera and sections, using a selection of the many generic names introduced by various writers during the last hundred years. The paper is of the greatest value, but its main weakness is that it is too rigid and artificial to meet the requirements of conchologists working in detail in particular regions, and it contains some obvious anomalies. Another objection is that its adoption would lead to too great a departure from accepted binomial nomenclature. The use of generic, subgeneric and sectional, as well as specific and sometimes subspecific names, would necessitate the application of as many as five names for the one form, which is not only cumbersome but quite outside accepted practice.

In later years the most valuable contribution to the taxonomy of the family has been made by Dr. C. R. Laws, of Auckland, New Zealand. In a series of papers on the "Tertiary and Recent Neozelandic Pyramidellids" (1937-41), he has reviewed the nomenclature of the whole group and brought it into line with the Linnean system. Most of Dall and Bartsch's subgenera were restored to generic rank and others were proposed for Neozelandic forms. The addition of practical keys makes the work of great value to students.

The present paper had been practically completed before I had the opportunity of studying Dr. Laws' work, which was perhaps fortunate, for it meant a quite independent approach to the subject. It is interesting to note that the conclusions arrived at were essentially the same, and that the same interpretation was given to such names as *Agatha*, *Scalenostoma*, *Elodiamea*, *Pyrgulina*, *Miralda* and others. There are naturally differences, as the Neoperonian has a somewhat different facies from the Neozelandic fauna, but on the whole it is hoped that the papers will tie together satisfactorily as a basis for future work.

ACKNOWLEDGMENTS.

In the preparation of this paper my thanks are particularly due to Miss Joyce Allan, Conchologist to the Australian Museum, who has not only located many references for me, but has helped with suggestions and also read and checked the manuscript. To many members of the Marine Section of the Royal Zoological Society I am also indebted for supplementing the material collected by myself and my son, Mr. John Laseron. To the latter must go much of the credit in the detection of many of the new species, particularly those of minute size.

TYPES.

All species illustrated, as well as the types, have been presented to the Australian Museum, where they will be available for future reference.

DESCRIPTION OF SPECIES.

Reference :

"Hedley, 1026." Number in Hedley's Check List of Marine Mollusca of New South Wales. Supplement to Jour. Royal Soc. N.S.W., Vol. II, 1917.

"May, 959." Number in May's Check List of the Mollusca of Tasmania. Govt. Printer, Hobart, 1921.

Genus *Syrnola* Adams.

Typically elongated shells with flattened whorls, smooth and porcellanous in texture, often coloured or with brown bands, the protoconch exsert and tilted, heterotrophe, the columella fold single, generally prominent, but occasionally nearly obsolete and only visible inside the aperture.

Dall and Bartsch placed it as a subgenus of *Pyramidella*, an obvious anomaly, as the single columella fold at once removes it from that genus, or rather group of genera. Laws divided the Neozelandic *Syrnolas* into five genera, two of which, *Tibersyrnola*, with lirations within the outer lip, and *Costosyrnola* with axial ribs, have no Neoperonian parallels. Nor do the Neoperonian species altogether fit his key for the other three genera, except perhaps for *Puposyrnola*. This is here used for the new species *proletare*, and would also include the Tasmanian species *harrissoni* and *petterdi*, 957 and 958 on May's list. A more natural grouping of the local species would be by shell texture, dividing those with porcellanous shells, coloured or with bands, from those like *manifesta* which have translucent colourless shells with longer body whorls. The former group also fall into two groups, those with a prominent columella fold like *bifasciata*, *lata* and *jacksonensis*, and those with feeble folds like *tineta* and *aurantiaca*. In what might be called the *manifesta* group of species there seems a gradual transition to shorter shells, merging into *Puposyrnola*, *Agatha* and *Odostomia*. *Syrnola* is here retained in rather a wider sense than used by Laws, the alternative being the proposal of several new genera.

***Syrnola tincta* Angas.**

(Figures 1, 2.)

Hedley 1026; May 959.

This is one of the common species on our coast, and is found mainly on the beaches, both inside and outside the harbours. The specimens figured are from Manly Ocean Beach, Figure 1, 5.8 mm. in length, and Figure 2, 5.2 mm. in length. We also have it from Point Halliday on the North Coast, from Jervis Bay, and it extends to Tasmania. It is rather variable in width, the two figures representing about the extremes. The colour is uniformly yellow, the columella fold nearly obsolete and only visible within the aperture.

***Syrnola aurantiaca* Angas.**

(Figure 4.)

Hedley 1022.

The figure is not quite typical, being larger than the type, which is 6 mm. long with 8 whorls. The figured specimen is 9.5 mm. with 10 whorls, and was dredged in 15 fathoms, Jervis Bay. It is probably an old and exceptionally large specimen, agreeing otherwise with Angas's description. As this is not readily available these points may be noted: "Colour fulvous yellow, with a pale band below the suture, the sutures not impressed, the columella nearly straight, the fold small and indistinct." The type locality is deep water, Port Jackson.

Since the above was written specimens have come to hand from 6-8 fathoms Pittwater, Broken Bay. These are quite typical.

The rudimentary fold connects this with *S. tincta*, but the species is generally larger and wider, and the inner margin of the aperture is more strongly reflected. The fold, practically invisible from in front, is visible within the aperture.

***Syrnola bifasciata* Ten.-Woods.**

(Figure 8.)

Hedley 1023.

Colour variable, beach specimens generally white, but when fresh it is yellow with two orange bands. Common in many localities, the figured specimen is from reclamations in Botany Bay, and is 8 mm. in length. This is exceptionally large for the species. We also have it from Pittwater, and from Jervis Bay from the beach down to 5 fathoms. The species is much broader than *tincta*, the columella is broad and straight and strongly reflected, and the fold is very prominent.

***Syrnola lata*, sp. nov.**

(Figure 3.)

Shell of medium size, broadly conical, white with traces of brown bands. Protoconch heterotrophe, prominent. Mature whorls 6, increasing regularly, nearly flat, sutures barely indented, body whorl large. Aperture pyriform, produced anteriorly, outer margin thickened, interior margin widely reflected. Columella fold very strong, oblique. Length, 4.5 mm.; width, 1.8 mm.

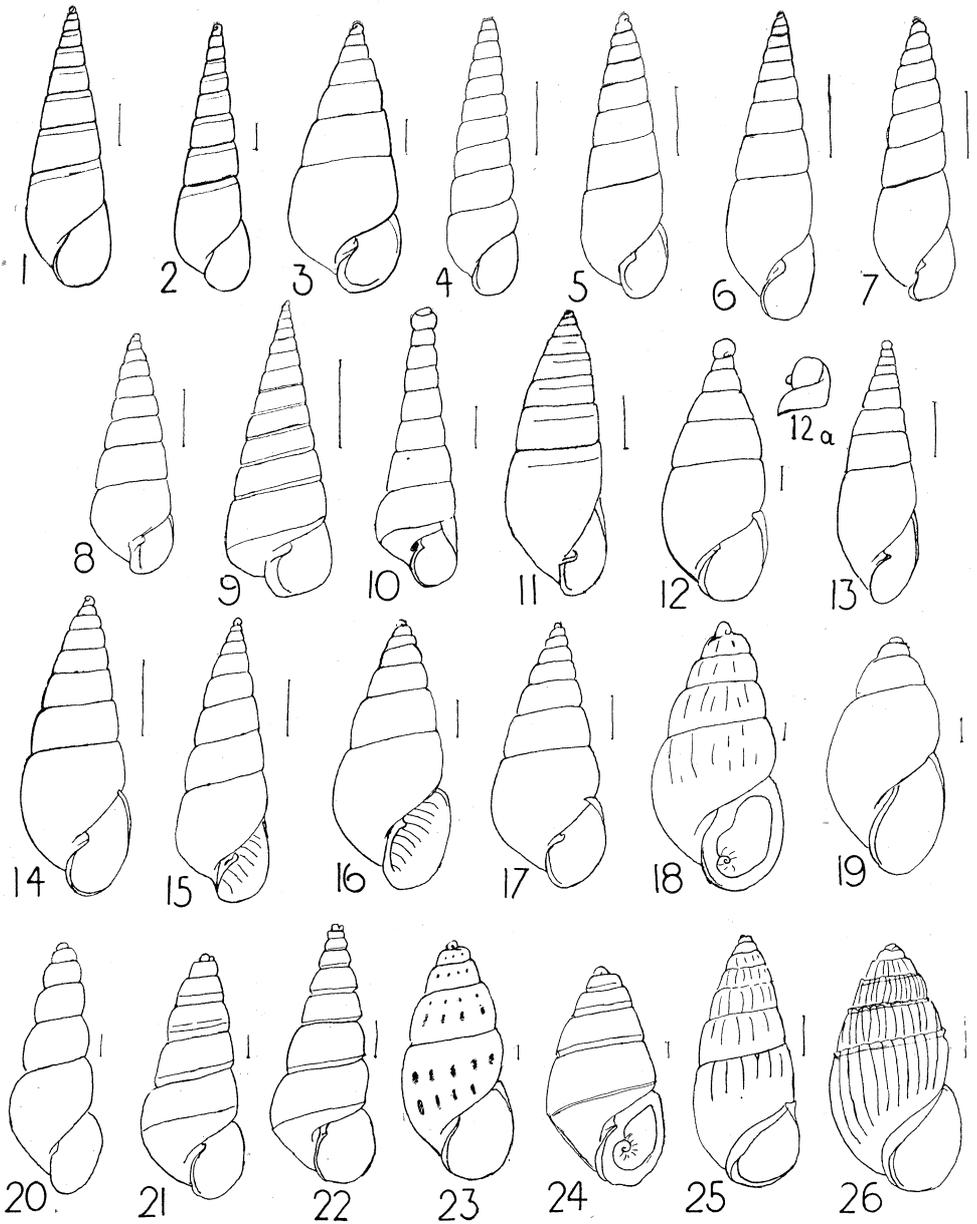
Localities.—On beach, Huskisson, Jervis Bay (type); also 6-8 fathoms, Pittwater.

Remarks.—I am not sure if the type is quite mature, but the great width relative to the length separates it from *S. bifasciata*, the species which it most closely resembles.

***Syrnola jacksonensis*, sp. nov.**

(Figure 5.)

Shell large for the genus, elongately conical, the early whorls increasing slightly more rapidly than the later, giving the shell a slightly curved contour, colour white with a yellow band on the periphery of the body whorl and immediately above the suture on the earlier



Figures 1-26.

- 1, *Syrnola tineta* Adams. 2, *S. tineta* Adams (broad variety). 3, *S. lata* Laseron. 4, *S. aurantiaca* Angas.
 5, *S. jacksonensis* Laseron. 6, *S. manifesta* Hedley. 7, *S. angusta* Laseron. 8, *S. bifasciata* Ten-Wood.
 9, *S. (Colysyrnola) decolorata* Iredale. 10, *S. macrocephala* Hedley. 11, *S. convexa* Laseron. 12, *Puposyrnola lasmanica* Ten-Woods. 13, *P. proletare* Laseron. 14, *Agatha australis* Angas. 15, *A. laevis* Angas. 16, *A. simplex* Angas. 17, *A. angasi* Tryon. 18, *Odostomia indistincta* Brazier. 19, *O. occultidens* May. 20, *O. stricta* Laseron. 21, *Scalenostoma subcarina* Laseron. 22, *S. ? subcarina* Laseron. 23, *Odostomia leopardis* Laseron. 24, *Scalenostoma pyramidata* Laseron. 25, *Rugadentia ignava* Hedley. 26, *R. doliae* Laseron.

whorls. Protoconch typically heterotrophe, two-whorled, the first minute, the second inflated. Mature whorls eight, nearly flat, sutures slightly impressed. Sculpture none, the surface smooth, polished and shining. Aperture short, produced anteriorly, outer margin simple, rounded, inner margin curved and reflected. Columella fold large and prominent. Length, 9 mm.

Locality.—Dredged in 15 fathoms between Heads, Port Jackson, eight specimens.

Remarks.—This species is related to *S. bifasciata*, but is much larger, narrower, and the inner margin of the aperture is curved and is not so greatly reflected. From *S. manifesta* it differs in shape and colour, the body whorl is not so long and the aperture is different.

***Syrnola manifesta* Hedley.**

(Figure 6.)

Hedley 1025.

The type locality is Port Stephens, and it is also recorded from the far North Coast. We have a number of specimens dredged in Port Jackson from North Harbour across to Sow and Pigs Reef. They agree very well with the type. The specimen figured is 11 mm. in length. The species may be recognized by the white, smooth shell, without coloured bands, by its regular tapering form, pyriform aperture, strong columella fold, and the elongated body whorl.

***Syrnola angusta*, sp. nov.**

(Figure 7.)

Shell of moderate size, elongated, white, shining, translucent. Protoconch typically heterotrophe, slightly tilted. Mature whorls eight, increasing more rapidly at first, making the contour of the top of the spire slightly convex. Whorls flattened, sutures not indented, body whorl comparatively long. Aperture narrowly pyriform, extended anteriorly, acutely angled posteriorly, outer margin thin, curved, inner margin strongly curved back and slightly reflected, columella fold strong, oblique. Length, 9 mm.

Locality.—Shellharbour (type); Cronulla (coll. by Mrs. F. Kay).

Remarks.—The type was separated from *S. manifesta*, and was thought at first to be a variety of that species, but further specimens from Cronulla, where it is not uncommon, show that the differences are constant, and that it is a good species. Compared with *S. manifesta*, it is slightly smaller, narrower, the spire has a different contour, and it differs in details of the aperture. With *S. manifesta* and the next species, *S. convexa*, it forms a small natural group, progressively approaching such species as *petterdi* and *tasmanica*, and linking *Syrnola* with *Odostomia*.

***Syrnola convexa*, sp. nov.**

(Figures 11, 95.)

Shell of medium size, comparatively stout, spire convex, white, shining and translucent. Protoconch small, heterotrophe, slightly tilted, the minute sinistral apex nearly reversed. Mature whorls seven, increasing at first much more rapidly, making the spire strongly convex. Whorls flattened, slightly stepped, sutures hardly indented, body whorl long. Aperture pyriform, long and narrow, extended anteriorly, sharply angled posteriorly, outer margin thin and rounded, inner margin short, nearly straight, and strongly reflected. Columella fold large, prominent and nearly transverse. Length, 7.6 mm.

Locality.—Cronulla (type), not uncommon (collected by Mrs. F. Kay); also Port Stephens and Shellharbour.

Remarks.—Allied to *S. manifesta* and *S. angusta*, it differs from both by being smaller, much broader, and by the strong convexity of the spire, the latter being a particularly good recognition point. The aperture is also narrower, and the strong reflection of the

inner margin also separates it. It is also allied to *S. petterdi*, a Tasmanian species, and before mature specimens came to hand, was tentatively referred to that species. Specimens from Shellharbour, which are apparently immature, are relatively narrower, and there seems to be some variation in this character.

***Syrnola macrocephala* Hedley.**

(Figure 10, after Hedley.)

Hedley 1024.

This curious shell is retained in *Syrnola*, though its characters suggest that it would be better relegated to a new genus. The only known specimen came from 63-75 fathoms off Port Kembla, its dimensions 6 × 1.5 mm. The large tumid protoconch and expanded base should prove ready recognition features.

Genus ***Colsyrnola* Iredale.**

Genotype, *Colsyrnola sericea* Iredale, *Australian Zoologist*, 1929, Vol. v, Pt. iv, p. 348, Pl. xxxviii, Figure 16.

Iredale designates no characters for his genus, beyond comparing it with the Japanese shell *Obeliscus brunneus*. To clear the matter for Australian conchologists, it can be stated that *Colsyrnola* has the same general characters as *Syrnola*, but is much larger, the whorls are more numerous and relatively much shorter.

***Colsyrnola sericea* Iredale.**

The type of this species came from dredgings by the "Triton" in the East Channel, Sow and Pigs Reef, Port Jackson, and was 26 mm. in length. Iredale also gives the locality of the species as North Queensland. This with other tropical shells came from a bed of sand some 30 feet below the harbour bed, and though some of these have since been rediscovered on the continental shelf, it is possible that others are extinct. Though specimens have retained their gloss and are in excellent condition, the colour has generally altered to some shade of yellow or orange, and has little value for specific determination. Thus the type of this species is given as orange-brown, that of the North Queensland shell as deep red-brown, which is probably the true colour.

***Colsyrnola decolorata* Iredale.**

(Figure 9.)

Records of Australian Museum, xix, 1936, p. 330, Pl. xxiv, Figure 14.

This species is confined to deep water, and is an inhabitant of the continental shelf. The specimen figured is from 25-30 fathoms, Shoalhaven Bight, and is 16 mm. in length. Apart from the generic characters of the numerous short whorls and the large size, the narrow yellow band is a good recognition point.

Genus ***Puposyrnola* Laws, 1937.**

Under *Puposyrnola* come shells which are intermediate between *Syrnola* and the Odostomids. The main characters are long body whorl, a pupoid shape, the contour being distinctly convex, while the aperture is restricted anteriorly, giving a distinct facies. *P. proletare* may be considered typical, while *Syrnola convexa* is on the borderline, linking *Puposyrnola* with the *manifesta* group of *Syrnola*. The Tasmanian species *harrissoni* and *petterdi* come here. Another Tasmanian species *tasmanica* is also doubtfully included, as the inflated protoconch and weak columella plait suggest different relationship.

***Puposyrnola proletare*, sp. nov.**

(Figure 13.)

Shell of medium size, elongate, conical, uniformly white and translucent. Protoconch typically heterotrophe, two-whorled, the first minute, the second inflated, somewhat flattened, the whole rather less than the apex of the main shell. Mature whorls eight, increasing rapidly, narrow, the body whorl elongated, nearly half the total length of the

shell. Whorls very slightly rounded, sutures moderately impressed, smooth and shining, the only sculpture a few faint growth lines. Aperture pyriform, elongated, acutely angled posteriorly, produced and rounded anteriorly, outer margin simple and rounded, inner margin rounded and very slightly reflected. Columella fold large and nearly transverse, no umbilical furrow. Length, 7.5 mm.

Locality.—30–35 fathoms off Crookhaven.

Remarks.—This is related to *P. petterdi*, *tasmanica* and *harrissoni*, but differs from these species in being much narrower, and also in the proportion of the body whorl to the whole length, which gives it a different facies.

***Puposyrnola tasmanica* Ten.-Woods.**

(Figure 12.)

May 958 (*Syrnola*).

Two specimens, sorted from dredgings, 15 fathoms, off the Clarence River, are rather doubtfully referred to this species. This is an addition to the New South Wales fauna. Further material may show, however, that it is an undescribed species. Characteristics are the rapid increase in the size of the whorls, and the large inflated protoconch. The length of the specimen figured is 3 mm.

May placed this species in *Syrnola*, and it is difficult to say just where *Syrnola* ends and *Odostomia* begins. The uncoloured *Syrnolas* such as *S. manifesta* merge through *S. convexa* into shorter spired shells such as *Puposyrnola petterdi*, this species and *P. proletare*.

Genus ***Agatha*** A. Adams, 1860.

Under *Agatha* come many species which have been listed in Australia as *Odostomia*. The Neoperonian species greatly resemble the Neozelandic forms both fossil and recent. Laws (1940) gives as the generic features of *Agatha*: "Large size, high body-whorl with elongated, subovate aperture, oblique, arcuate pillar with a strong plait entering aperture spirally at a high angle"; and there is also a slight umbilical chink. The strong reflection of the inner margin also gives a distinct facies. The protoconch is small, exsert, and typically heterotrophe.

***Agatha australis* Angas.**

(Figure 14.)

Hedley 1030.

This, a well-defined species, is common on the beaches and in shallow-water dredgings on many parts of the coast. The specimen figured is from 6–9 fathoms, Sow and Pigs Reef, Port Jackson, and is 10 mm. in length. We also have it from Port Stephens, Pittwater and elsewhere.

Around *A. australis* centre a group of species with very similar facies, with smooth, white, glossy shells, pyriform apertures, generally wider and shorter than in the preceding group, and with the body whorl also much shorter. The whorls increase more regularly, and the shell contour is therefore straighter. The columella fold is prominent. In some ways it links with *Syrnola* through *S. manifesta*. With it may be grouped *O. laevis*, *O. simplex* and *O. angasi*.

***Agatha laevis* Angas.**

(Figure 15.)

Hedley 1034.

Very similar to *O. australis*, but it is smaller and narrower. The aperture is sometimes faintly lirate within. The type locality is "deep water" Port Jackson, and the specimen figured comes from 6–9 fathoms, Sow and Pigs Reef, and is 7.6 mm. in length. We also have it from the beach at Shellharbour.

Agatha simplex Angas.

(Figure 16.)

Hedley 1039.

This is another species of the same group, but it is still smaller and correspondingly broader than either *O. australis* or *O. laevis*. A characteristic feature is that it is strongly lirate within the aperture. It was dredged abundantly in from 4 to 6 fathoms, North Harbour, Port Jackson, the specimen figured 5.2 mm. in length. Specimens from 6-9 fathoms, Sow and Pigs Reef, have the outer margin of the aperture much thickened, though this character is variable, apparently due to the age of the individual.

Laws (1940) considers that lirations within the aperture are of generic value and proposes the genus *Evelynella* for New Zealand species with this character. This course is not followed here as in *A. laevis* the lirations are very faint, and by retaining both *simplex* and *laevis* in *Agatha* the grouping is much more natural.

Agatha angasi Tryon.

(Figure 17.)

Hedley 1029.

This species, under which Hedley synonymized *O. lactea* of Angas, has been rather doubtfully identified. After comparison with specimens in the Australian Museum, specimens from 15 fathoms Jervis Bay have been taken as *A. angasi*, that figured being 6 mm. long. These are nearly identical with *A. simplex*, but there is no liration within the aperture, a character which may be taken as distinctive. For purposes of reference, Angas's description (1867) of *O. lactea* is here repeated: "Shell elongate, rather thin, smooth, white, shining; whorls six, flattened, sutures impressed, aperture small, ovate, somewhat produced anteriorly, one-third the length of the shell; columella fold strong and a little oblique; outer lip thin, simple. Length 3 lines, breadth 1 line."

Genus **Odostomia** Fleming, 1813.

Considerable difference in opinion exists as to the exact limitations of Fleming's genus. Dall and Bartsch used it as a subgenus as well as in the broader generic sense, in which they included all sculptured shells as well. Hedley used it in the wider sense also, only separating from it his own genus *Myxa*. In Dall and Bartsch, the subgenus *Odostomia* was restricted to smooth shells which were not inflated. For shells with inflated body whorls they used *Amaura* Moller, 1842. For rather similar shells from New Zealand Laws uses *Gumina* Finlay, 1928.

He also states (1939): "Odostomia in the strict sense has the following characters—Spire not greatly elevated, few whorls, and a single columella fold. Surface typically smooth. Strong, universal, spiral sculpture is absent. Protoconch low, considerably immersed and thus contrasting with that of the Turbonillids and Synchronids." Without proposing new genera, he also divides the New Zealand Odostomias into two groups, A and B, the first with the nucleus evident and helicoid, the second with the nucleus not projecting.

Of the Neoperonian species, *indistincta* agrees very well with the above limitation, *occultidens*, *tumera* and *leopardis* not so well, while *microlinea* and *stricta* are rather too elongated to fit. One feature all these species have in common is the weak columella fold, and most of them have the protoconch wholly or partially immersed.

Odostomia indistincta Brazier.

(Figure 18.)

Hedley 1033.

This is the smallest of the group, the specimen figured being 2 mm. in length. It is not uncommon on the beaches, but we found it alive abundantly in galeolaria tubes between tide marks in North Harbour, Port Jackson. It is abundant also at Angowrie, just south of the Clarence River. Characteristics, apart from size, are the thin, transparent

shell, the very small protoconch, occupying only about half of the summit of the shell, and the slight columella fold. The operculum is pauci-spiral, notched on the inner margin, the nucleus anterior, small but distinct, surrounded by short, strong growth lines, leaving the remainder of the surface smooth.

***Odostomia microlinea*, sp. nov.**

(Figure 47.)

Shell small, cylindro-conical, white, shining. Protoconch probably heterotrophe, infolded. Mature whorls four, increasing regularly, slightly rounded, sutures slightly indented. Sculpture under moderate magnification invisible, but under the microscope numerous well-defined but irregular growth lines can be seen. Aperture ovate, well extended anteriorly, elongated, thin, outer and anterior margins rounded, inner margin not reflected. Columella fold very slight. Length, 2.4 mm.

Locality.—6–9 fathoms, Sow and Pigs Reef (type); also 14 fathoms off Long Reef.

Remarks.—This species comes very close to *O. indistincta*, which has the same type of protoconch, the same nearly obsolete fold and the same microscopic growth lines, but it differs by being much narrower, and with a whiter, less translucent shell.

***Odostomia tumerea*, sp. nov.**

(Figure 45.)

Shell minute, broadly conical, white, shining and subtranslucent. Protoconch just visible above the apex in which it is infolded. Mature whorls three, rounded, constricted at the sutures, increasing rapidly, body whorls large and inflated. At the sutures is a narrow but distinct shelf. Practically smooth, the only sculpture consists of microscopic growth lines. Aperture sub-circular, thickened, extended anteriorly, outer margin rounded, inner margin reflected, standing out from the body whorl, producing a deep, umbilical slit. Columella fold small but distinct. Length, 1.3 mm.

Locality.—Shell sand, Gunnamatta Bay, Port Hacking (three specimens).

Remarks.—Though with only three whorls, I think the type is mature, as the aperture is so well developed. The general form, large body whorl, infolded protoconch and rounded aperture are good recognition points. It comes nearer to *O. indistincta* than to any other species.

***Odostomia occultidens* May.**

(Figure 19.)

May 965.

Several specimens dredged in Quarantine Bay, Port Jackson, agree very well with May's species, which is a new record for New South Wales. The specimen figured is 3 mm. in length. Characteristics are the large and inflated body whorl, and the small columella fold invisible from in front.

***Odostomia stricta*, sp. nov.**

(Figure 20.)

Shell of medium size, elongate, cylindrical, rather thin, colourless and translucent. Protoconch heterotrophe, small, nearly submerged. Mature whorls five, increasing regularly, rounded, constricted at the sutures. The surface smooth and polished without sculpture. Aperture ovate, extended anteriorly and rounded, outer margin rounded and simple, inner margin very slightly reflected. Columella fold slight but distinct, nearly invisible from in front. Length, 3.2 mm.

Locality.—Port Stephens in shell sand, five specimens, including the type; also Cronulla.

Remarks.—But for the slight but distinct columella fold, this might be placed in *Eulimella*, and its form may generally be compared with *E. moniliforme*. I know of no other *Odostomia* with which it can be compared. The elongate shell is a characteristic feature.

Odostomia leopardis, sp. nov.

(Figure 23.)

Shell minute, cylindrical, yellow-brown with two rows of vertically oblong, chestnut patches, fading on old specimens. Protoconch heterotrophe, relatively small, about half the width of the first mature whorl. Mature whorls four, increasing regularly, slightly rounded, sutures impressed. Surface smooth and polished, the only sculpture microscopic growth lines. Aperture ovate, produced anteriorly, outer margin simple, rounded, inner margin very slightly reflected. Columella fold slight but distinct. Operculum too far retracted for proper description, but thin with the nucleus anterior and covered with faint growth lines. Length, 1.8 mm.

Habitat.—Alive on sea-weed, 4 fathoms off Woollahra Point, Port Jackson; also two specimens dredged 6–9 fathoms, Sow and Pigs Reef.

Remarks.—The general form is unlike that of any other Australian *Odostomia*, and the distinctive colouring is a good recognition mark.

Genus **Scalenostoma** Deshayes, 1863.

Shells related to *Odostomia*, smooth and polished, but with a peripheral keel. The columella fold is prominent.

Scalenostoma subcarina, sp. nov.

(Figure 21.)

Shell elongated conical, colourless, polished and sub-translucent. Protoconch small heterotrophe, two-whorled, partially submerged. Mature whorls five, increasing regularly, slightly rounded, with a slight but distinct angulation above the sutures and on the periphery of the body whorl; sutures impressed. There is no sculpture and the surface is smooth and shining. Aperture ovate, produced anteriorly, outer margin simple, rounded, inner margin curved, slightly reflected. Columella fold prominent, nearly transverse. Length, 3 mm.

Locality.—6–9 fathoms, Sow and Pigs Reef, Port Jackson, abundant.

Remarks.—The slight but distinct angulation brings it within *Scalenostoma* as distinct from *Odostomia*, and there is none of the local species in this group with which it can be compared. Its nearest known ally is apparently *S. southlandica* Laws, an Oligocene fossil, from New Zealand.

Scalenostoma subcarina (?) Laceron.

(Figure 22.)

A single specimen from the Ocean Beach, Manly, more than 5 mm. in length, is probably an undescribed species, but is so close to *S. subcarina* that it may possibly be a giant specimen of that species with two extra whorls. Hence more material is needed before this question can be satisfactorily settled. There is no reason to doubt, however, that the type of *S. subcarina* is mature, for it was found in quantity, and of a uniform size, all about 3 mm. in length, and these specimens were slightly less angular than the doubtful one here figured.

Scalenostoma pyramidata, sp. nov.

(Figure 24.)

Shell small, pyramidal, colourless, polished and translucent. Protoconch relatively small, heterotrophe, half submerged. Mature whorls four, expanding regularly, flattened with a sharp and distinct keel above the sutures and on the periphery of the body whorl. Sutures channelled. There is no sculpture and the surface is smooth. Aperture oval, produced and expanded anteriorly, outer margin simple, inner margin moderately reflected, columella fold prominent, slightly oblique, umbilical slit narrow but distinct. Operculum sulcus on inner margin, nucleus anterior but sub-central, prominent, surrounded with short growth lines, outer portion smooth. Length, 2.2 mm.

Habitat.—Living on seaweed, 4 fathoms, Woollahra Point, Port Jackson, five specimens.

Remarks.—It is possible that the type is not quite mature, but its characters are so distinctive that the addition of another whorl is not likely to affect its future recognition. It is very different in form and other details from the other species of *Scalenostoma* here described.

Genus **Rugadentia**, gen. nov.

Genotype, *Odostomia ignava* Hedley.

Tumid shells related to *Odostomia*, white, solid and translucent, cyliandroconic, aperture comparatively small and pyriform, the inner margin with a broad band of callus, the columella fold reduced to a slight, narrow plication. Sculpture consisting of irregular, rounded, transverse ribs, more prominent on the early whorls, base smooth.

Hedley, when he described his species, considered that it belonged to the subgenus *Heida* of Dall and Bartsch, but in their key *Heida* is placed with *Odostomia* having no transverse sculpture. Broadly it might be placed with *Elodiamea* De Folin, but the broad callus, the barrel-like form, and particularly the slight, narrow plication which forms the columella fold are good generic characters.

Rugadentia ignava Hedley.

(Figure 25.)

Hedley 1032.

This species is fairly well distributed along the coast from Trial Bay to Port Jackson. The specimen figured is from Pittwater, and is 5.2 mm. in length. Characters already mentioned in the generic description form ready recognition marks.

Rugadentia doliae, sp. nov.

(Figure 26.)

Shell of medium size, broad and solid, white, shining and sub-translucent. Protoconch small, heterotrophe and half submerged. Whorls five-six, early whorls increasing more rapidly than the later ones, giving the spire a curved contour, whorls slightly curved, suture impressed with a narrow but distinct shelf. The sculpture consists of rounded, transverse ribs, about twenty-four on the body whorl, well defined on the early whorls but becoming fainter and irregular on the body whorl, persisting below the periphery. Aperture ovate, extended anteriorly, outer margin simple, the whole of the inner margin strongly reflected and adhering to the body whorl as a band of callus. The columella fold is very slight but distinct and reduced to a small, narrow plication, nearly invisible from in front. Dimensions: The type (five whorls), 4.5 × 2.4 mm.; another specimen (six whorls), 5.5 × 2.8 mm.

Localities.—Dredged in 15 fathoms between the Heads, Port Jackson, on a sandy bottom (type); also in Pittwater.

Remarks.—This is closely allied to *R. ignava* Hedley, but can be readily separated by the much broader form, more distinct sculpture and the greater number of ribs, of which there are about twice as many to the whorl.

Genus **Elodiamea** De Folin, 1884.

Related to *Odostomia*, but with the shell inflated, summits of the whorls slightly shouldered. The sculpture consists of rounded, transverse ribs and there is no spiral sculpture. These characters, as outlined by Dall and Bartsch, fit several of the local species. To them might be added that the ribs may persist right to the base, or may stop at or below the periphery, leaving the base smooth. Laws accepts *Elodiamea* in the same sense as Dall and Bartsch.

Elodiamea caelatura, sp. nov.

(Figure 28.)

Shell small, conical, white, sub-translucent. Protoconch typically heterotrophe, half submerged. Mature whorls five, increasing regularly, body whorl about half total length, rounded, bent in sharply above to form a prominent shelf at the sutures. Sculpture consisting of broad, rounded, transverse ribs, slightly oblique, about eighteen on the body whorl, and persisting to the base. Aperture ovate, extended anteriorly, outer margin simple, rounded, inner margin slightly reflected, columella fold prominent. Operculum paucispiral, nucleus anterior and sub-marginal, a rounded indentation opposite the columella fold, covered with fine, sharply defined growth lines. Length, 2.8 mm.

Habitat.—Several specimens alive in mussel beds at low tide mark, North Harbour, Port Jackson (type); also in shell sand, Point Halliday; Angowrie; and 6–9 fathoms, Sow and Pigs Reef.

Elodiamea vincula, sp. nov.

(Figure 29.)

Shell conical, turreted, white and sub-translucent, small. Protoconch prominent, free from the summit, heterotrophe, recumbent, of two whorls, the nucleus comparatively large. Mature whorls five, increasing regularly, rounded, sharply infolded above into the sutures, giving the spire its turreted appearance. Sculpture consisting of regular, prominent, rounded, transverse ribs, slightly oblique, about twenty on the body whorl, base smooth. Aperture ovate, extended anteriorly, outer margin simple, rounded, inner margin slightly reflected. Columella fold obsolete. Operculum too far retracted for detailed observation, but it is apparently nearly smooth with the nucleus anterior. Length, 3.5 mm.

Habitat.—Alive on seaweed, North Harbour (type); also Angowrie, Woolgoolga, Port Stephens and Ocean Beach, Manly.

Remarks.—The absence of a columella fold suggests *Turbonilla*, but it seems so closely allied to the preceding species, that it is retained here. From *E. caelatura* it differs also in being much narrower. It illustrates the difficulty of separating species generically on one character alone, which otherwise would seem of full generic value.

Elodiamea opaca Hedley.

(Figure 30, after Hedley.)

Hedley 1036.

The type locality is Chinaman's Beach, Middle Harbour, but so far the collection of this species has eluded us. The length given is 2.95 mm., and it is buff-coloured with two coloured spiral bands. The very slight columella fold would seem to place it between *E. caelatura* and *E. vincula*.

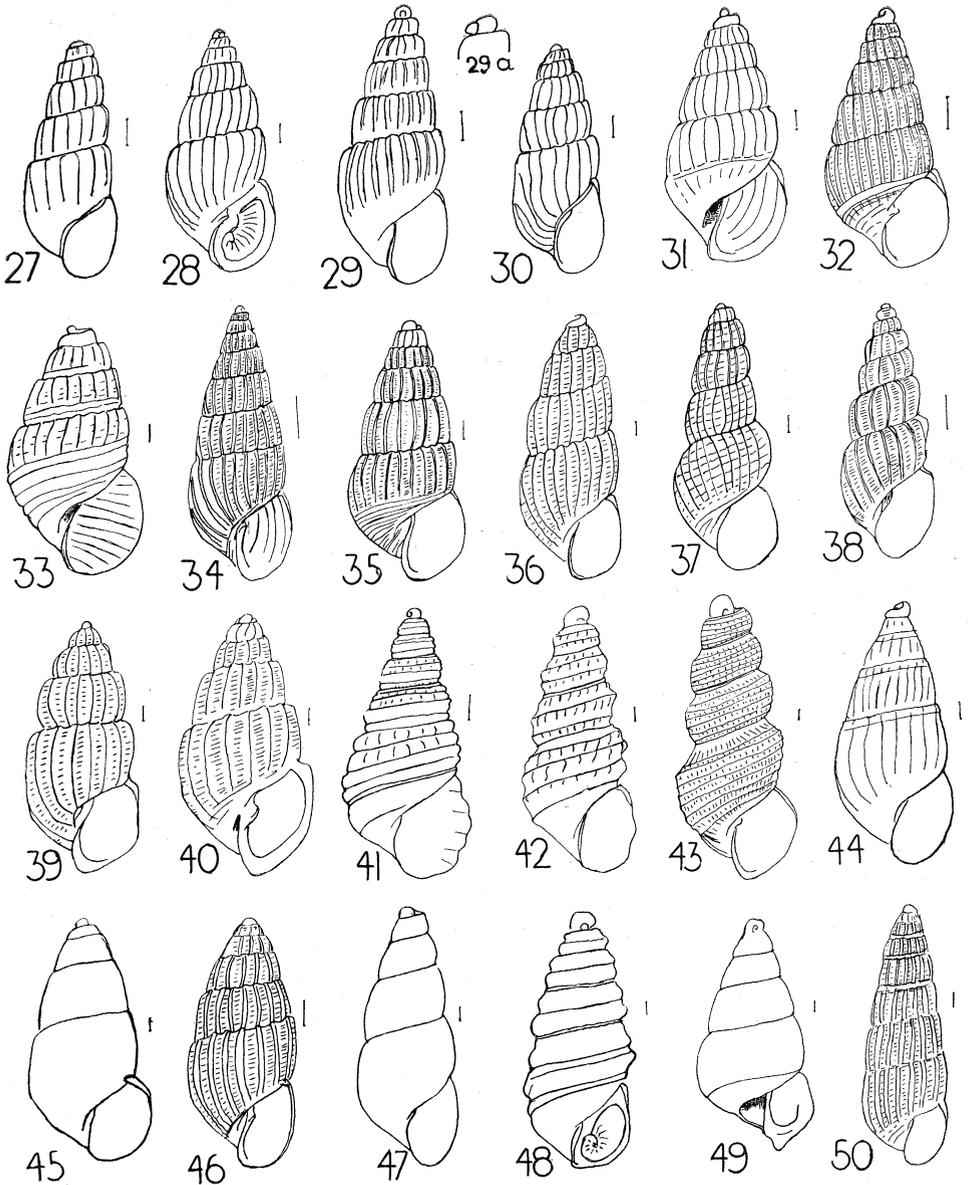
Elodiamea gunnamatta, sp. nov.

(Figure 44.)

Shell small, regularly conical, white, semi-translucent. Protoconch comparatively large, tilted, slightly larger than the apex of adult shell. Mature whorls four on type which may not be quite mature, increasing regularly, nearly flat, slightly constricted below the sutures which are moderately impressed. Sculpture irregular, consisting of low, rounded, transverse ribs, about eighteen to the whorl, persisting but becoming obscure on the base. Aperture sub-ovate, well extended anteriorly. Outer margin thin and rounded, inner margin thin and rounded, not reflected, columella fold almost obsolete, invisible from in front but just visible within the aperture. Length, 2.4 mm.

Locality.—Two specimens from shell sand, Gunnamatta Bay, Port Hacking.

Remarks.—It is doubtful if the type is quite mature, but even another whorl is not likely to affect the description given. The large protoconch, general form, and obscure ribbing distinguish it from the other species of the group.



Figures 27-50.

- 27, *Pseudorissoina exserta* Laseron. 28, *Elodiamea caelatura* Laseron. 29, *E. vincula* Laseron. 30, *E. opaca* Hedley (after Hedley). 31, *Egila mayii* Tate. 32, *Paregila henni* Brazier. 33, *Linopyrga bisculpta* Laseron. 34, *L. pascoei* Angas. 35, *L. portsaensis* Gatliff and Gabriel. 36, 37, *L. brevis* Pritchard and Gatliff. 38, *L. ceria* Laseron. 39, *L. nugatoria* Hedley (after Hedley). 40, *L. pegma* Laseron. 41, *Miralda suprasculpta* Ten-Woods. 42, *M. montuosa* Laseron. 43, *Pandorella declivita* Laseron. 44, *Elodiamea gunnamatta* Laseron. 45, *Odostomia tumera* Laseron. 46, *Linopyrga fornix* Laseron. 47, *Odostomia microlinea* Laseron. 48, *Oscilla tasmanica* Ten-Woods. 49, *Myxa exesa* Hedley (after Hedley). 50, *Pyrgiscus gravicosta* Laseron.

Genus *Egila* Dall and Bartsch, 1904.

Shells resembling *Elodiamea* in general characters, particularly the sculpture, which consists of transverse ribs alone without spiral striae. The main characteristic is, however, a double keel on the periphery with a shallow sulcus between.

Egila mayii Tate.

(Figure 31.)

May 963.

Several shells from the outer beaches are tentatively referred to *E. mayii*, which is either a new record for New South Wales, or they may ultimately prove to be new. The sulcus on the periphery, though narrow, is distinct, and brings them well within *Egila*. The shell is thin, transparent, the columella fold is very small, invisible from in front though distinct within the aperture. The figured specimen is from Port Stephens and is 3 mm. in length. We also have it from the Ocean Beach, Manly.

Genus *Paregila*, gen. nov.

Genotype, *Paregila henni* (Brazier).

Shell pyramidal, like *Egila* in general characters, with a double keel on the periphery and a sulcus between, but sculpture both transverse and spiral, the transverse consisting of strong ribs, weak on the base, the spiral of fine raised threads between the costae as in *Linopyrga*. Columella fold strong, protoconch large, tilted, heterotrophe.

Paregila henni Brazier.

(Figure 32.)

Hedley 1031.

Fairly common on the coast, it is easily recognized by two narrow keels on the periphery at which the prominent, transverse ribs abruptly terminate. The base is finely, spirally sculptured, and fine, spiral threads occur in the intercostal spaces higher on the whorl. The columella fold is very prominent. The specimen figured is from Shellharbour, and is 4 mm. long.

Genus *Linopyrga* Laws, 1941.

In seeking a name to include those New South Wales Odostomias with both spiral and transverse sculpture, it was at first intended to use *Pyrgulina* A. Adams in rather a wider sense than as used by Dall and Bartsch. In reviewing the Neozelandic species, Laws uses *Pyrgulina* in virtually a subfamily sense, his relevant paper (1941) being entitled "The Pyrgulinid Genera and the Genus *Evalea*." From *Pyrgulina* proper he separated certain species as a new genus *Linopyrga*, the main difference being that in *Pyrgulina* the intercostal spiral sculpture consists of fine incised lines, while in *Linopyrga* it consists of raised threads. Microscopic examination shows that all the New South Wales species are of the latter type, hence Laws' genus is used in preference to *Pyrgulina*. The common local species, *pascoei*, is very close to Laws' genotype, *rugata* Hutton, and these two at least are undoubtedly co-generic. For the remainder, the New South Wales species do not fit well with the Neozelandic types, and other new genera of Laws are not used, particularly as they are mainly for Cainozoic fossils. New South Wales species could easily be further subdivided by such characters as the persistence or non-persistence of the costae below the periphery, by the shouldering of the whorls, and particularly by the strength or obsolescence of the columella fold. This would necessitate the introduction of still more generic names, a course not at present taken, as it is thought that the present needs of local systematists will best be served by the broader grouping.

Under *Linopyrga* will therefore be grouped those shells with medium to short spires, with predominant axial sculpture, consisting of transverse ribs which may or may not persist to the base. Spiral sculpture is always present, as numerous, sub-equal raised threads between the costæ. On those species in which the ribs do not reach the base the spiral sculpture is there continuous. The strength of the columella fold is variable, sometimes very strong, in other species nearly obsolescent.

***Linopyrga pascoei* Angas.**

(Figure 34.)

Hedley 1037.

This is probably the commonest species of the whole family on the coast, and it is abundant, living under rocks in rock pools at low tide. The prominent transverse ribs, persistent right to the base, with the fine spiral ridges between, are good recognition marks. Young specimens of *L. pascoei* have rather a different facies and at first sight would often appear to be another species, but there is another, and closely related small species, which will be next described. The specimen here figured is from under rocks at low tide, Castle Rock, Middle Harbour, and is 6 mm. in length. Hedley (1916) figured the animal of the species.

***Linopyrga fornix*, sp. nov.**

(Figure 46.)

Shell small, broadly conical, white, solid. Protoconch small, heterotrophe, half submerged. Mature whorls five, increasing regularly, stepped at the sutures, the spire with a curved contour, the body whorl large, fully one-half of the total length. Sculpture consisting primarily of strong, rounded, broad, transverse ribs, in width equal to or wider than the spaces between, persisting to the base. The spiral sculpture consists of numerous fine threads, crossing the intercostal spaces but not the ribs. Aperture pyriform, produced anteriorly, outer margin curved, bent back posteriorly, inner margin curved, slightly reflected. Columella fold prominent, oblique. Length, 3.6 mm.

Locality.—6–8 fathoms, Pittwater.

Remarks.—This species is closely allied to *L. pascoei*. In any long series of *L. pascoei*, the young specimens can easily be misleading, and it was at first thought this was merely another of these. The well-formed aperture, however, shows a mature shell, and the curved contour of the spire, like a narrow gothic arch, is a ready recognition mark.

***Linopyrga portsaeensis* Gatliff & Gabriel.**

(Figure 35.)

May 966.

A small species, from Ocean Beach, Manly, 2.5 mm. in length, has been tentatively identified as the Tasmanian species, but more material is needed before it can be fully confirmed. In the meantime it is here listed and figured for future reference. It is generally comparable with *L. pascoei*, but is smaller and the transverse ribs do not persist on the base. The columella fold is also very slight and is invisible from in front.

***Linopyrga brevis* Pritchard & Gatliff.**

(Figures 36, 37.)

Hedley 1045 (*Turbonilla*).

This has been identified from specimens so labelled in the Australian Museum. Figure 37 is from Bayview, Pittwater, and is 2.5 mm. in length. Figure 36 is a younger specimen from Eden Harbour with one less whorl and 2 mm. in length. The inflation of the body whorl gives the mature shell quite a different facies. *L. brevis* appears in both Hedley's and May's Check Lists as a *Turbonilla*, but it seems much closer to *Odostomia* and its relations than to *Turbonilla*. The columella fold, though practically obsolete in the mature shells, is present in the younger shells and is visible within the aperture even if invisible from in front. It is fairly common right along the coast.

Linopyrga ceria, sp. nov.

(Figure 38.)

Shell of medium size, elongate-conical, turreted, white. Protoconch probably heterotrophe, but nucleus infolded and hidden. Mature whorls six, increasing regularly, flattened at the periphery, angled below the sutures which are channelled. Sculpture primarily of well-defined, elevated, narrow ribs, about fourteen on the body whorl, persistent to the base. The inter-costal spaces are broad and flat, and covered with numerous fine, rounded, spiral ridges. Aperture ovate, well extended anteriorly, outer and inner margins simple. Columella fold invisible from in front but distinct within the aperture. Length, 4.5 mm.

Localities.—15 fathoms between Heads, Port Jackson (type); also from the reclamations, Tempe, Botany Bay.

Remarks.—This is a distinct and handsome species, easily recognized by its elongate shape and the narrow and distant ribs. It belongs to a group of species centring about *L. pascoei*, all of which have the initial whorls of the protoconch infolded, and small columella folds only visible within the aperture.

Linopyrga nugatoria Hedley.

(Figure 39, after Hedley.)

Hedley 1035.

A small species of distinctive shape, found only on the continental shelf. The type locality is 41–50 fathoms off Cape Three Points, and other specimens were collected by the "Thetis" Expedition from 63–75 fathoms off Port Kembla. The length given is 2.2 mm., the width 1 mm.

Linopyrga pegma, sp. nov.

(Figure 40.)

Shell small, pyramidal, white and solid. Protoconch typically heterotrophe, sinistral whorls two, the initial one minute, the second inflated. Mature whorls four, increasing regularly, slightly rounded, bent sharply above to form a broad shelf at the suture. Sculpture consisting of broad, rounded, transverse ribs, slightly oblique, tending to become obsolete on the body whorl and fading out on the base. These are crossed by very fine, continuous and even spiral ridges. Aperture ovate, bent in posteriorly, and extended anteriorly where it is acuminate. Outer margin rounded and evenly thickened, inner margin strongly reflected. Columella fold large and prominent, oblique. Length, 2 mm., width, approximately 1 mm.

Locality.—Bottle and Glass Rocks, Port Jackson (collected by Mrs. Rutland).

Remarks.—A distinctive species, nearer to *L. nugatoria* than to any other Australian species. It is readily distinguished by its broad, pyramidal shell, the acuminate aperture, and the prominent columella fold. It also resembles *L. crassicosta*, a Tasmanian deep-water species, but differs chiefly in the characters of the aperture and by its strong columella fold.

Linopyrga bisulpta, sp. nov.

(Figure 33.)

Shell small, broadly conical, white, translucent. The protoconch may be heterotrophe, but the nucleus is infolded in the first dextral whorl, which is slightly tilted. Mature whorls four, increasing regularly, slightly rounded, with a shelf above at the suture. The sculpture consists on the upper part of the whorl of regular, well-defined, broad rounded, slightly oblique, transverse ribs, about twenty-four on the body whorl, which extend to the periphery. The spiral sculpture on the upper part of the whorls is at first ill-defined, appearing as irregular threads in the intercostal spaces, but below the periphery and on the base it consists of numerous, well-defined, low and rounded keels. The

uppermost two keels are visible above the suture in the earlier whorls. Aperture sub-circular large, extended anteriorly, outer margin simple and rounded, inner margin slightly reflected. Columella fold small, practically invisible from in front, but distinct within the aperture. Length, 2.3 mm.

Locality.—Port Stephens, a number of specimens from shell sand (type); Clontarf, Middle Harbour.

Remarks.—The broad form and distinctive sculpture are good features for recognition, and it cannot readily be confused with any other species. Generically, though placed in *Linopyrga*, it is merging on forms such as *Miralda* which have prominent spiral keels.

Genus *Miralda* A. Adams, 1864.

As defined by Dall and Bartsch, *Miralda* includes shells in which the "axial ribs are present but very feeble, usually indicated near the summit of the whorls. Spiral markings consist of several, strong, broad, tumid cords, one or more of the posterior cords crenulated." In a broad sense this can be applied to several Australian shells, the character to be emphasized being that the predominant sculpture is spiral, while the transverse sculpture, though present, is feeble.

Miralda suprasculpta Ten.-Woods.

(Figure 41.)

Hedley 1040.

This species may be recognized by the broad, rounded keels, the upper two of which are broken into rounded tubercles. The columella fold is nearly obsolete. The specimen figured is from shell sand, Port Stephens, and is 4 mm. in length.

Miralda montuosa, sp. nov.

(Figure 42.)

Shell small, conical, white, translucent. Protoconch typically heterotrophe, comparatively large. Mature whorls four, increasing regularly, sutures deeply impressed. The sculpture consists of three rounded sub-equal, spiral keels, a fourth appearing on the base of the body whorl. The centre keel is more elevated than the others. All are transversely indented, so that the summits are broken into regular, rounded tubercles. The base is smooth. Aperture ovate, slightly extended anteriorly, angled above, outer margin indented by the keels, inner margin slightly reflected. Columella fold nearly obsolete, invisible from in front but visible within the aperture. Length, 2 mm.

Locality.—Gunnamatta Bay, Port Hacking, in shell sand.

Remarks.—This species is closely allied to *M. suprasculpta*, but is smaller, narrower, and has fewer keels, all of which have tubercles, and not only the upper two.

Genus *Latavia*, gen. nov.

Genotype, *Eulimella pulchra* Brazier.

Elongated shells, colourless and translucent, protoconch typically heterotrophe. Columella fold slight to practically obsolete. Sculpture predominantly spiral as in *Miralda*, but the spiral ribs are flat, and broadened until the spaces between are reduced to narrow channels. Transverse sculpture nearly obsolete, reduced to pittings in the channels and slightly more prominent on the upper part of the whorls.

Latavia pulchra Brazier.

(Figure 65.)

Hedley 1075.

It has been rather difficult to decide definitely what is Brazier's species. Unfortunately his original figure and description are quite different, and it is probable that the figure is that of an immature shell. However, our specimens agree with those labelled in the Australian Museum, some of which were collected by Brazier himself. The best recognition features are the broad, flat keels, separated by narrow channels, the channels divided by cross sculpture into minute, square pits. The species is common on the coast, the figured specimen, 5 mm. in length, being found alive under rocks at Long Reef.

Latavia tricarinata, sp. nov.

(Figure 64.)

Shell of medium size, elongated conical, white and translucent. Protoconch small, typically heterotrophe. Mature whorls seven, increasing regularly, sutures deeply channelled. Sculptures consisting of spiral keels, three on the earlier whorls, five on the body whorl, two of which are on the base. The keels are flattened and separated by deep but narrow channels. The transverse sculpture is more noticeable on the two upper keels, which tend to be broken into tubercles, but it persists as microscopic oblique lines right on to the base. Aperture sub-quadrate, extended anteriorly, the outer margin thin and indented by the keels, the inner margin not reflected. Columella fold invisible from in front but prominent within the aperture. The operculum was too far retracted to observe. Length, 5 mm.

Habitat.—Alive under stones in rock pools, Long Reef.

Remarks.—This species was found in living association with *L. pulchra*, which it generally resembles, but from which it can be readily separated. It is relatively broader, it has a distinct columella fold within the aperture, and it differs in the details of its sculpture.

Genus **Pandorella**, gen. nov.Genotype, *Pandorella declivita* Laseron.

Shell minute, conical, white and translucent. Protoconch heterotrophe. Sculpture predominantly spiral, whorls sharply angulated, sutures greatly restricted. The spiral sculpture consists of numerous sub-equal, rounded keels, persistent to the base, and crossed by fine threads producing a microscopic cancellation. Columella fold present but slight.

Pandorella declivita, sp. nov.

(Figure 43.)

Shell minute, conical, white and translucent. Protoconch heterotrophe, relatively small, but prominent, laterally placed and about half the diameter of the summit. Mature whorls four, angled at the periphery, constricted below, and sloping above to the sutures which are greatly constricted. The sculpture consists of about seven sharp, narrow, keels, spaced evenly from the periphery to the base. These are crossed by numerous, very fine, transverse lines, producing a microscopic cancellation. Aperture ovate, well extended anteriorly where it is sub-acuminate, outer margin thin, bent back posteriorly, inner margin reflected. Columella fold slight but distinct. Length, 1.4 mm.

Locality.—From shell sand, Gunnamatta Bay, Port Hacking.

Remarks.—This beautiful little species is one of a number which occur on the Australian coast which do not fit into any known genus, and each of which must be considered by itself. Its characters are so distinctive that it cannot readily be confused with any other species.

Genus **Cinctiuga**, gen. nov.Genotype, *Cingulina diaphana* Verco.

Shell small, thin, translucent. Whorls very sharply angled at the periphery, greatly restricted at the sutures. The sculpture is entirely spiral, consisting of numerous rounded keels. Operculum with large nucleus, anterior but sub-centrally situated.

This needs generic separation from *Cingulina*, which includes solid shells, with no angulation at the periphery. It has an entirely different facies.

Cinctiuga diaphana Verco.

(Figure 77.)

This is another of the odd Australian shells which needs a genus to itself. It is not uncommon on beaches right along the coast and we have found it alive on seaweed in rock pools at North Harbour, the figured specimen 2.5 mm. in length. It can be readily recognized by its acutely angled whorls, greatly restricted sutures, and peculiar sculpture. The operculum is paucispiral, the nucleus large and sub-central.

Genus **Oscilla** Adams.

Shell small, tumid, solid, sculpture entirely spiral, with few, broad, rounded keels, columella fold obsolete, operculum paucispiral, with anterior but sub-circular nucleus.

Oscilla tasmanica Ten.-Woods.

(Figure 48.)

Hedley 1027.

This beautiful little species is quite common on the coast, living on seaweed in many localities. The specimen figured is from seaweed from North Harbour, and is 2 mm. in length. The colour is pink, and the peculiar form and sculpture make it readily distinguishable from any other species.

Genus **Myxa** Hedley.

Related to *Odostomia*, small, white and pyramidal, protoconch heterotrophe, no columella fold, and umbilicate.

Myxa exesa Hedley.

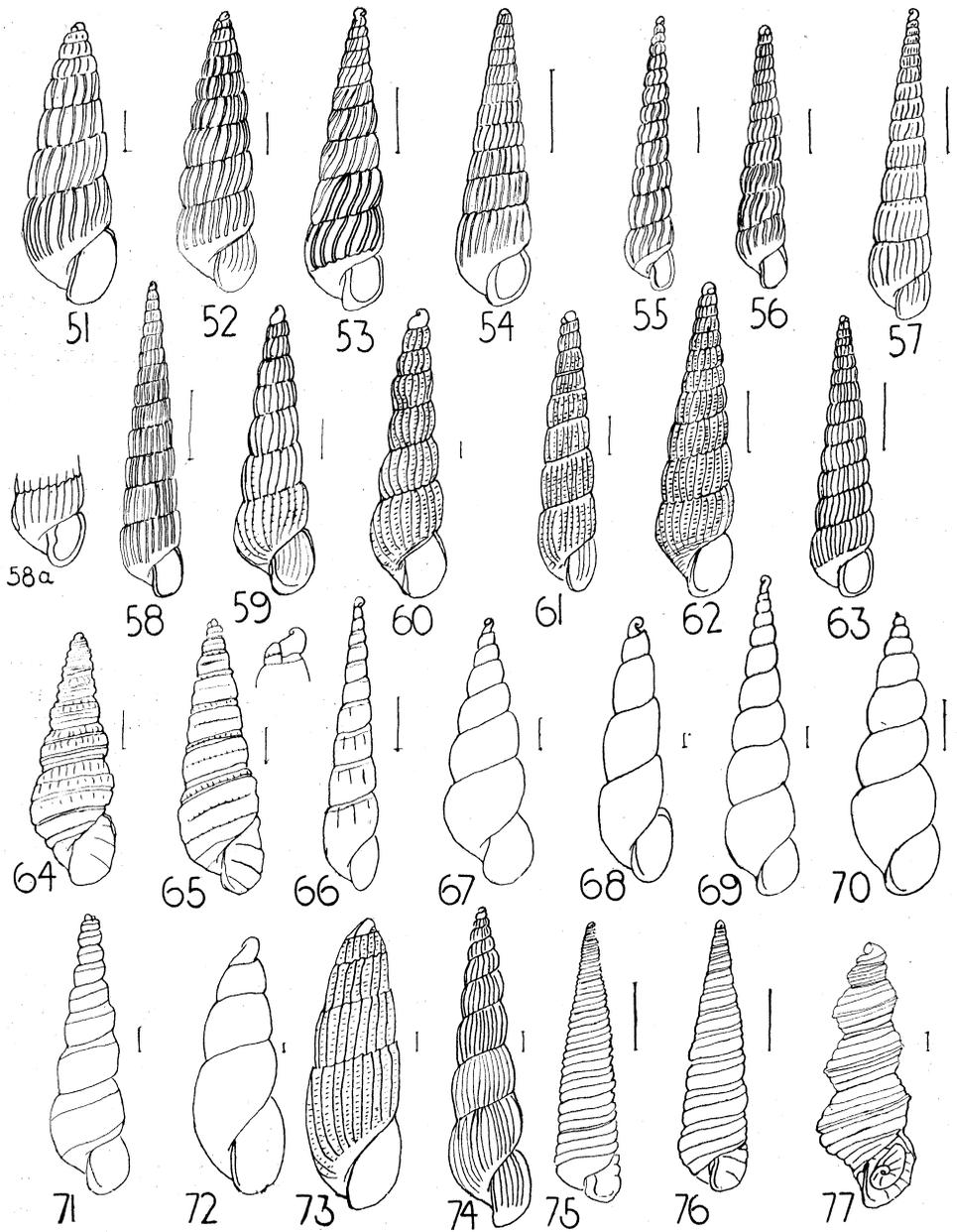
(Figure 49, after Hedley.)

Hedley 1028.

The type locality is from 41–50 fathoms off Cape Three Points, the specimen figured 1.6 mm. × 0.8 mm. An inhabitant of the continental shelf, I have not yet seen this species, but the broad, pyramidal shell, with the umbilicate base, should make it easy of recognition.

Genus **Turbonilla** Risso, 1826.

If certain discordant elements such as *Cingulina* be removed from *Turbonilla* as defined by Dall and Bartsch, it forms a large natural genus or group of genera with a similar facies throughout the world. Dall and Bartsch, as stated in the introduction, divided *Turbonilla* into many sections and subgenera, which was not altogether in accordance with Linnean nomenclature. Laws (1939), in his work on Neozelandic fossil and recent species, realized this and adopted a much more satisfactory classification, providing a key which is readily followed. Opinions may differ as to the characters sufficient for generic separation, and some of the genera proposed might seem to be based on rather slight differences, but on the whole his key is a natural one, and most of the New South Wales species fit in well with it.



Figures 51-77.

- 51, *Turbonilla beddomei* Petterd. 52, *Chemnitzia hofmani* Angas. 53, *C. mariae* Ten-Woods. 54, *C. gravis* Laseron. 55, *C. acicularis* Adams. 56, *C. acicularis*, var. *similis* Laseron. 57, *C. vana* Laseron. 58, 58a, *Turbonilla scalpidens* Watson. 59, *Pyrgiscus fusca* Adams. 60, *P. infans* Laseron. 61, *P. hedleyi* Laseron. 62, *P. varicifera* Tate. 63, *Chemnitzia propingua* Laseron. 64, *Latavia tricarinata* Laseron. 65, *L. pulchra* Brazier. 66, *Eulimella hasta* Laseron. 67, *E. moniliformis* Hedley and Musson. 68, *E. turrita* Petterd. 69, *E. coacta* Watson. 70, *E. tomacula* Laseron. 71, *E. anabathron* Hedley. 72, *E. minutissima* Laseron. 73, *Pyrgiscus pinguis* Laseron. 74, *Turbonilla thornleyana* Laseron. 75, *Cingulina spina* Crosse and Fischer. 76, *C. circinata* Adams. 77, *Cinctigula diaphana* Verco.

Some Neozelandic genera, particularly among the fossils, are absent from New South Wales, and the local genera, though capable of further subdivision, may be reduced to four, with a ready key for their separation. Two local species, those here called *Turbonilla thornleyana* and *Chemnitzia ambulata*, have such distinctive characters as to warrant probable generic rank, but as they otherwise fit into the key adopted, this course has not been taken.

What might be termed the *Turbonilla* genera have these characters in common: they include elongate, often acicular shells, many-whorled, the columella fold obsolete or entirely absent, the protoconch heterotrophe, well exerted, often recumbent on the apex of the mature shell, the sculpture predominantly strong, transverse, rounded ribs or costae, often slanting. Spiral sculpture may be absent or present, but is restricted to fine lines between the costae.

The absence or presence of spiral sculpture at once divides the group into two sections, the former generally white, the latter frequently coloured and with brown spiral bands. For the further division of these, Laws uses the intercostal grooves which may terminate abruptly at the periphery, their excavation being below the general surface of the shell, or they may fade out on the base. Using these characters as a basis, we get the following key for the four New South Wales genera, a key which will also be found applicable to species from Queensland, Tasmania and southern Australia.

Key to the Turbonilla Genera.

1. Without spiral sculpture.
 - A. Intercostal grooves fading on the base *Turbonilla* Risso
 - B. Intercostal grooves terminating at the periphery *Chemnitzia* D'Orbigny
2. With spiral sculpture.
 - A. Intercostal grooves fading on the base *Pyrgiscus*
 - B. Intercostal grooves terminating at the periphery *Pyrgiscilla* Laws

***Turbonilla beddomei* Petterd.**

(Figure 51.)

Hedley 1044.

The specimen figured comes from Huskisson, Jarvis Bay, and is 5 mm. in length. It agrees very well with specimens in the Australian Museum, labelled from Sydney and marked "compared with type". Similar specimens from Middle Harbour are the type of Brazier's *T. scalarina*, which Hedley synonymized under *T. beddomei*. In May's Tasmanian list, *beddomei* is shown as a shell with the transverse ribs practically obsolete, and it is possible that this is another species altogether. *T. beddomei* may be recognized, as it is the broadest of all the local species.

***Turbonilla scalpidens* Watson.**

(Figures 58, 58a.)

Hedley 1052.

This species is confined to the continental shelf, mainly in depths of about 60 fathoms. The specimen figured is from 30–35 fathoms, off Crookhaven, and is 9 mm. in length. It is not quite typical, being slightly slenderer than the figured type. Figure 58a shows the aperture of a more typical specimen, 7.5 mm. long, in the Australian Museum. The columella here shows a very slight plication in the columella, a character previously figured by Hedley (1903). Characteristic of this species are the strong, straight ribs, in the earlier whorls standing above the suture, and producing a turreted appearance similar to that of *Chemnitzia vana*.

Turbonilla thornleyana, sp. nov.

(Figure 74.)

Shell small, acicular, colourless, thin and transparent. Protoconch small, heterotrophe. Mature whorls nine, increasing regularly, rounded and inflated, constricted at the sutures. Sculpture consisting of numerous fine, low, rounded, transverse ribs, about thirty on the body whorl. Aperture greatly extended anteriorly, outer margin thin and rounded, inner margin straight and slightly reflected. Length, 2.5 mm.

Locality.—Shell sand, Patonga, collected by Miss G. Thornley, of the Marine Section, Royal Zoological Society, after whom the species is named.

Remarks.—This beautiful and delicate little species is quite unlike any other Australian *Turbonilla*, and it is rather doubtfully referred to that genus. It might be likened to the *Eulimellas* in general form, but differs of course in the typical *Turbonilla* sculpture. The delicate, transparent shell, the rounded whorls and constricted sutures are good recognition points.

Chemnitzia hofmani Angas.

(Figure 52.)

Hedley 1050.

This is the commonest of the New South Wales species, and it occurs in many locations right along the coast. Its general habitat is on seaweed, occasionally so abundantly as to be considered gregarious. The specimen figured, 5 mm. in length, is from kelp, Snails Bay, Port Jackson, and we have also found it in mussel beds in North Harbour, under rocks in the same locality, and on weed from 4 fathoms, Woollahra Point, and from 2 fathoms, Port Hacking. It is much narrower than *T. beddomei*, yet broader than most of the other local species.

Chemnitzia mariae Ten.-Woods.

(Figures 53, 98.)

Hedley 1051.

The specimen figured comes from the beach at Huskisson, Jervis Bay, and is 8.5 mm. in length. It generally resembles *T. hofmani*, but is larger, slenderer, more solid and with fewer ribs.

Chemnitzia gravis, sp. nov.

(Figure 54.)

Shell large, elongate, massive, white. Protoconch unknown, apparently deeply infolded in apex. Mature whorls eleven, increasing regularly, slightly rounded, body whorl short, sutures moderately impressed. Sculpture consisting of numerous broad, rounded, transverse ribs, much wider than the channels between, about twenty-two on the body whorl, and fading on the base. Aperture sub-quadrate, produced anteriorly, thickened, inner margin widely reflected. Length, 11 mm. (type), other specimens more than 12 mm.

Localities.—Patonga Beach (collected by Miss G. Thornley, type); Crookhaven Heads; 6–9 fathoms, Sow and Pigs Reef.

Remarks.—Generally resembles *C. mariae*, but is much larger and more massive and with more numerous and broader ribs. The narrow intercostal spaces are a useful recognition mark. Fragments of a similar but even larger form come from 14 fathoms off Long Reef, the length of one imperfect specimen being estimated at more than 16 mm. This may ultimately prove to be an undescribed species; in the meantime *C. gravis* may be considered the largest of the New South Wales species.

***Chemnitzia acicularis* Adams.**

(Figure 55.)

May 1970.

This was identified from Tasmanian specimens in the Australian Museum. It is thus a new record for the State. It is not uncommon from North Harbour, the specimen figured being 5.5 mm. in length. It may be distinguished by the extremely attenuate form, and the few large, prominent, oblique ribs, about eleven–twelve on the body whorl.

***Chemnitzia acicularis* Adams, var. *similis*, var. nov.**

(Figure 56.)

While studying a series of *C. acicularis* from North Harbour, a number of specimens were sorted out which at first sight appeared a distinct series, chiefly on account of the slightly broader form, and the greater number of ribs, about fifteen on the body whorl. Examination of other series from Port Stephens and Huskisson, however, disclosed intermediate specimens, and it was concluded that *C. acicularis* is a variable species within these limits. For purposes of record, the variety is given a name, the specimen figured from North Harbour being 6 mm. in length.

***Chemnitzia vana*, sp. nov.**

(Figure 57.)

Shell comparatively large, acicular, white, translucent. Protoconch typically heterotrophe, comparatively large, the initial whorl minute, the second greatly inflated. Mature whorls thirteen, rather flattened, contracted above to the suture. Sculpture consisting of regular, rounded, transverse ribs, about twenty–twenty-two on the body whorl, in width about equal to the spaces between, and slightly contracted just below the suture. Owing to the translucent shell the overlap of preceding whorls is visible and from some angles produces the illusion that the ribs are interrupted and fail to reach the suture above. The ribs end on the periphery of the body whorl, and the base is smooth. Aperture small, ovate, produced anteriorly, outer margin thin, inner margin curved, very slightly reflected. Length, 8.2 mm.; width, 1.5 mm.

Locality.—6–9 fathoms, Sow and Pigs Reef, Port Jackson, several specimens (type); 4–6 fathoms, off Kurnell, Botany Bay; Cronulla.

Remarks.—This species resembles *acicularis*, but it is larger, the aperture is of different shape, the inner margin is less reflected, and the ribs are more numerous and less oblique. It differs from *T. scalpidens* by being narrower, and by the details of its sculpture.

***Chemnitzia propingua*, sp. nov.**

(Figure 63.)

Shell comparatively large, attenuate, white, solid. Protoconch typically heterotrophe. Mature whorls thirteen, increasing regularly, early whorls flattened, becoming later slightly rounded, sutures impressed, the early whorls turreted. Sculpture prominent, consisting of very numerous, well-defined, rounded, transverse ribs, about thirty on the body whorl, the width of the ribs about equal to the spaces between. The ribs reach the suture and even stand above it, particularly in the early whorls, giving them their turreted appearance. On the body whorl the ribs terminate abruptly at the periphery and the base is smooth. Aperture sub-quadrate, small, produced anteriorly, outer and anterior margins rounded, inner margin nearly straight, reflected. Length, 9 mm.

Locality.—Port Stephens, several specimens.

Remarks.—Of the larger species of *Chemnitzia* this has the finest sculpture. The early turreted whorls resemble those of *C. scalpidens*, but here again the finer sculpture distinguishes it.

***Chemnitzia ambulatia*, sp. nov.**

(Figure 93.)

Shell turreted, elongate, colourless, glassy and transparent. Protoconch typically heterotrophe. Mature whorls eight, short, increasing regularly, flattened, broadest at the top where they form a broad shelf, and tapering to the suture below. Sculpture consisting of prominent, broad, rounded, transverse ribs, slightly curved and oblique, about fifteen on the body whorl, equal in width to the intercostal spaces, bent in sharply above to form the shelf at the suture, ending abruptly on the periphery. The intercostal spaces smooth and excavate, also ending on the periphery where, with the ends of the costae, they form a sharply defined line. The base smooth and slightly excavate. Aperture rhomboidal, produced anteriorly, outer margin thin, sharply angled posteriorly, inner margin straight, slightly reflected anteriorly. The transparent shell shows the external sculpture clearly visible within the aperture. Length, 4 mm.

Locality.—Long Reef, in shell sand.

Remarks.—This novelty, which came to hand after the main part of this paper had been completed, is so unlike any other *Chemnitzia* which has so far been described from the Australian coast, that I have no hesitation in giving it specific rank. In its proportions it generally resembles *C. hofmani*, but can be distinguished at once by the narrow whorls, the broad shelf just below the suture, the whorls tapering below, and the rhomboidal aperture.

***Pyrgiscus fusca* Adams.**

(Figure 59.)

Hedley 1049.

This is the first of several species which have spiral sculpture as well as transverse ribs. It is quite common on the beaches right along the coast, and in Tasmania. It may be readily recognized by the delicate, translucent shell, rounded whorls, pale yellowish colour with two well-defined, narrow, brown-yellow bands. The specimen figured is from North Harbour, Port Jackson, and is 5 mm. in length.

***Pyrgiscus infans*, sp. nov.**

(Figure 60.)

Shell minute, acicular, white (probably bleached), translucent. Protoconch comparatively large, typically heterotrophe. Mature whorls six, increasing regularly, rounded, constricted at the sutures. Sculpture consisting of narrow, well-defined, transverse ribs, about eighteen on the body whorl, persisting to the base, slightly oblique, in width about one-half of the spaces between. The spiral sculpture consists of numerous fine, well-defined lines, which cross the intercostal spaces but not the main ribs. Aperture rounded on both the outer and anterior margins, well-produced anteriorly, slightly reflected on the inner margin. Length, 2 mm.

Localities.—Gunnamatta Bay, Port Hacking (type); Port Stephens from shell sand.

Remarks.—This greatly resembles *P. fusca*, of which it was at first thought to be an immature specimen but, even allowing for a whorl less, it is less than half the size. In *P. fusca* also, the transverse ribs in width are about equal to the intercostal spaces; in *P. infans* they are only about one-half.

***Pyrgiscus hedleyi*, sp. nov.**

(Figure 61.)

Shell of medium size, elongate, fairly solid, sub-translucent, pale golden-brown with a deeper band on the periphery. Protoconch comparatively large, typically heterotrophe, initial whorl small, second whorl inflated. Mature whorls eight, increasing regularly, nearly flat, very slightly constricted at the sutures to form a narrow shelf. Sculpture

consisting of numerous straight, regular, rounded, transverse ribs, about twenty-five on the body whorl, in width about equal to the spaces between, and stopping abruptly just below the sutures, leaving a smooth, hollow space, which macroscopically appears as a band. The spiral sculpture consists of numerous fine lines, which cross the ribs. Aperture well extended anteriorly, outer margin nearly flat, anterior and inner margins rounded, the latter slightly reflected. Length, 5 mm.

Localities.—Crookhaven Heads (type); Pittwater; also numerous specimens in Australian Museum collected by J. Brazier from the Bottle and Glass Rocks, Port Jackson.

Remarks.—This beautiful species has long needed a name. The Australian Museum specimens are labelled *Turbonilla* sp., and it is evident that the late Charles Hedley recognized it as undescribed. It is now named after him. Though belonging to the *fusca* group, it cannot be readily confused with that or any other Australian species. The nearly flat whorls and the abrupt termination of the transverse ribs below the suture are good recognition points.

***Pyrgiscus pinguis*, sp. nov.**

(Figure 73.)

Shell small, conical, white. Protoconch comparatively large, heterotrophe, initial whorl minute, second whorl inflated, flattened, and tilted. Mature whorls four, body whorl elongated, about half the total length, flattened. The sculpture consists of numerous straight, well-defined, transverse ribs, about half the width of the intercostal spaces, about eighteen on the body whorl, less defined on the base, but standing above the sutures, and slightly indented below. The spiral sculpture consists of well-defined narrow ridges, which do not cross the ribs, but divide the intercostal spaces into regular square cells. Aperture ovate, produced anteriorly, very slightly reflected on the inner margin. Length, 2.3 mm.

Locality.—Reclamations, Carss Park, Botany Bay.

Remarks.—In spite of the few whorls, I think the type is mature, but even if not quite so, it is quite distinctive from young specimens of such species as *P. fusca* and *P. hedleyi*. The peculiar contour, the elongated body whorl and details of sculpture are good recognition points.

***Pyrgiscus flexicosta*, sp. nov.**

(Figure 92.)

Shell small, conical, white, translucent. Protoconch typically heterotrophe. Mature whorls six, later whorls increasing more rapidly, making the spire slightly convex in contour, slightly rounded, sutures indented. Sculpture both transverse and spiral, the transverse ribs strong and rounded, slightly indented below the suture, in width about equal to the intercostal spaces, about eighteen on the body whorl, persisting but becoming less prominent on the base. Spiral sculpture not prominent, consisting of numerous fine lines crossing the intercostal spaces but not the ribs. Aperture pyriform, extended anteriorly, outer and anterior margins rounded, inner margin slightly reflected. Length, 3.5 mm.

Localities.—Dredged 6–9 fathoms, Pittwater (type); reclamations, Carss Park, Botany Bay.

Remarks.—In appearance this is near *P. gravicosta*, but is larger, rather broader, the aperture is slightly different in shape, the ribs are not so prominent, stopping at the suture and indented just below it, making a slight but noticeable depressed band.

***Pyrgiscus varicifera* Tate.**

(Figure 62.)

Hedley 1053.

Though first recorded from New South Wales from deep water in 111 fathoms off Cape Byron, a fairly common beach shell is more clearly referable to Tate's species.

It is commonest on the south coast, and the specimen figured is from Huskisson, Jervis Bay, and is 8 mm. long. It is the largest and stoutest of the local species with cross sculpture, and may also be recognized by two brown bands, though these are sometimes faded on beach specimens. It is also slightly variable in width. In some specimens the costae appear to stop at the periphery, which would bring it within *Pyrgiscilla*, but more critical examination shows that they persist and fade out on the base.

***Pyrgiscus gravicosta*, sp. nov.**

(Figure 50.)

Shell small, elongately conical, white and solid. Protoconch heterotrophe, laterally placed on the summit. Mature whorls seven, nearly flat, increasing more rapidly at first, making the spire slightly convex. Sculpture consisting of stout, rounded, straight transverse ribs, in width about equal to the intercostal spaces, but thickening at their summits and connected by a spiral ridge just below the suture. The costae are prominent to just below the periphery but fade out on the base. The spiral sculpture consists of numerous narrow ridges crossing the intercostal spaces, but not the ribs, and continuous on the base. Aperture ovate, extended anteriorly, inner margin not reflected. Length, 2.6 mm.

Localities.—6–8 fathoms, Pittwater, Broken Bay (type); Middle Harbour; also abundant in dredgings from 6–8 fathoms, Doll's Point, George's River.

Remarks.—This species is remarkably constant from the various localities. The minute size, solid little shell, and convex spire are good recognition points.

***Pyrgiscilla kitcheni*, sp. nov.**

(Figure 94.)

Shell long and slender, white, trace of orange bands. Protoconch typically heterotrophe. Mature whorls eleven, increasing regularly, slightly rounded, sutures indented. Sculpture strong, consisting primarily of prominent, rounded, transverse ribs, about thirteen to the whorl, reaching right to the sutures and ceasing abruptly on the periphery. The ribs are generally slightly narrower than the intercostal spaces, but are on occasion much broadened and may even merge together. This happens most frequently about the fifth or sixth whorl, and suggests a former thickening of the aperture with subsequent renewed growth. Radial sculpture prominent, consisting of numerous fine, parallel grooves, not ridges, in the intercostal spaces. The groove on the periphery is generally more deeply excavated level with the terminations of the costae, producing a distinct line. The radial grooves persist on the base. Aperture ovate, greatly extended anteriorly, outer margin rounded, inner margin straight and strongly reflected. Length, 7 mm.

Locality.—Dredged in 6 fathoms, Quarantine Bay, Port Jackson.

Remarks.—This is the only New South Wales species which can fairly be referred to Laws' *Pyrgiscilla*. Its slender form and strong cross sculpture are good recognition points. Several specimens sorted out from the same dredging have rather finer sculpture but are otherwise similar. It is possible that still another species is indicated, but more material is needed to settle this point. It is named after Mr. Geoffrey Kitchen, an enthusiastic collector who participated in the dredging and sorted it from the material obtained.

Genus ***Eulimella*** Forbes.

Eulimella as it stands is not a very satisfactory genus. It is included by Dall and Bartsch as a subgenus under *Pyramidella*, in that section with two columella plaits. It is hard to see any justification for this, as the genotype, as well as all other species referred to *Eulimella*, has no columella fold, and is otherwise nearer to the *Turbonillas* than to the *Pyramidella* group of genera. The group is a complex one, and there is

little information on which to base a genetic study. The interpretation of the genus by Australian conchologists has been to include elongated, often acicular shells, without sculpture, thin, white and transparent, with simple apertures and no columella fold, and with heterotrophe protoconchs often eccentric, prolonged and set at an angle. One local species at least is estuarine, and when more is known of the habitat and of the living animal, it is quite possible that some of the species will be found to be in no sense related.

Laws (1938) divides the New Zealand Eulimellas into two genera based on the protoconch. He restricts *Eulimella* to shells on which the "protoconch [is] not strongly exsert, of several turns, low helicoid, lateral nucleus small and central." He proposes the new genus *Terebinella* for shells "with protoconch very exsert, of one turn, lateral nucleus large and eccentric." Both types with further variations occur amongst the New South Wales species, but the division does not fit in with other shell characters. As the number of local species is small, and the material, with the exception of *E. moniliformis*, is rather sparse, the name *Eulimella* is retained for all, though some future revision in classification is certainly indicated

***Eulimella moniliformis* Hedley & Musson.**

(Figure 67.)

Hedley 1074.

Discovered in 1891 in brackish water in the lagoon at Manly, this species eluded rediscovery for many years. We subsequently found it abundantly in the lagoon at Dee Why, living in the sand at the roots of reeds and grass at the edge of the water. It is probably not uncommon in similar locations elsewhere but is not easy to find. The specimen figured is larger than the type and is 4 mm. in length. The shell is of very simple character, thin and translucent, with rounded whorls, and greatly constricted sutures.

***Eulimella hasta*, sp. nov.**

(Figures 66, 96.)

Shell comparatively large, acicular, white and translucent. Protoconch comparatively large and prominent, larger than the summit of the shell. Mature whorls ten, elongated, increasing regularly, flattened, bending in slightly above to meet the suture, below which is a nearly opaque narrow band. Under an ordinary magnifying glass the surface is smooth, but the microscope reveals irregular growth lines which occasionally thicken irregularly to an obscure varix. Aperture elongated oval, well extended anteriorly, simple and not reflected. Length, 7 mm., width, 1.2 mm.

Localities.—Sydney Harbour (type), in Australian Museum, C31817, presented by C. Hedley; also 5 fathoms Jervis Bay; and an immature specimen, 14 fathoms off Long Reef.

Remarks.—The specimen in the Australian Museum is labelled *Turbonilla*, sp. nov., probably on account of the obscure transverse sculpture, but it seems much nearer to the local interpretation of *Eulimella* than to *Turbonilla*. It can be readily recognized by its acutely acicular form.

***Eulimella turrita* Petterd.**

(Figures 68, 97.)

Hedley 1076.

This species was recorded from New South Wales from 111 fathoms off Cape Byron, but the only specimen in the Australian Museum labelled *E. turrita* is from 100 fathoms off Wollongong, and is quite another species altogether. It is dealt with elsewhere in this paper. However, two specimens from Balmoral in our collection match both the original figure and description very well and are taken as that species. The specimen figured is 1.6 mm. in length.

***Eulimella coacta* Watson.**

(Figure 69.)

May 1003.

This agrees very well with Tasmanian specimens from deep water, 40-60 fathoms, which May describes as not quite typical of Watson's species. The specimen illustrated is from shell sand, Port Stephens, and is 3 mm. in length. If identified correctly it is a new record for the State, but it is possible that more material may show that it is either undescribed or that more than one species is indicated. It is not unlike *E. moniliformis*, but is smaller and slenderer and has more whorls.

***Eulimella tomacula*, sp. nov.**

(Figure 70.)

Shell comparatively large, elongated, white, shining and translucent. Protoconch minute, barely visible, infolded in the apex. Mature whorls seven, rather irregular in growth, the penultimate whorl in the type nearly as large as the body whorl, rounded, constricted at the sutures. The surface is smooth and polished and there is no sculpture. Aperture ovate, produced anteriorly, outer margin thin and rounded, inner margin rounded and reflected. Length, 6.5 mm.

Localities.—Manly (type), specimen in Australian Museum, C36516, collected by Miss L. Parkes; also from Shoal Bay, Port Stephens.

Remarks.—In general form resembles *E. moniliformis*, but is larger, the aperture has a different shape and the inner margin is reflected; the protoconch is also very different.

***Eulimella anabathron* Hedley.**

(Figure 71.)

Hedley 1073.

This has been rather doubtfully identified, as the type in the Australian Museum has become corroded, and our specimens do not quite match Hedley's figure. The type locality is Balmoral Beach, the specimen figured is from Manly Beach and is 3 mm. in length. The slight angularity mentioned by Hedley is rather more marked in this specimen, amounting to a distinct keel below the suture. If not *E. anabathron* it is an undescribed species.

***Eulimella minutissima*, sp. nov.**

(Figure 72.)

Shell minute, conical, white and shining. Protoconch comparatively large and prominent, heterotrophe, elongated and tilted. Mature whorls three, increasing regularly, rounded and constricted at the sutures. There is no sculpture and the surface is smooth and shining. Aperture ovate, extended anteriorly, outer margin thin and rounded, inner margin rounded, not reflected. Length, 1 mm.

Localities.—6-9 fathoms, Sow and Pigs Reef, Port Jackson (type); also on seaweed, 4 fathoms, Woollahra Point.

Remarks.—This is the smallest of the local species. It was at first thought to be the young of one of the other species such as *E. moniliformis*, *coacta* or *tomacula*, but careful comparison shows it to be quite different and apparently mature. Its minute size is its best recognition point.

***Eulimella*, sp.**

(Figure 87.)

This is an undescribed species, but unfortunately the only specimen available for a type is in the Australian Museum and is partially corroded and liable to quick disintegration. This is labelled C18256 from 100 fathoms off Wollongong, with Hedley's pencil notation *E. turrita* Petterd. It is, however, nothing like that species. I have refrained

from naming it until more permanent material is found, but in the meantime it may be recorded, and the following characters noted. Length of shell, 3.8 mm., smooth, white and shining, with a translucent band below the sutures, protoconch heterotrophe, mature whorls eight, flattened, aperture subquadrate, inner margin reflected.

Genus *Cingulina* Adams.

Cingulina was placed by Hedley in the Acteonidae, but Dall and Bartsch included it in the Pyramidellidae as a subgenus of *Turbonilla*. With *Turbonilla* it has little in common, and from the Australian species would appear to be a natural genus, consisting of elongate shells with the typical protoconchs of the Pyramidellidae, no columella folds, and spiral sculpture consisting of a few, prominent, sub-equal keels. From the evenness of the keels it is often difficult to determine just where the sutures lie.

Cingulina spina Crosse & Fischer.

(Figure 75.)

Hedley 1018.

This is a common species on the beaches right along the coast, but so far has not been found alive. The specimen figured came from the mud flats at North Harbour, and is 9 mm. in length. The long, tapering shell, flat whorls, and prominent spiral sculpture make it easy of recognition.

Cingulina circinata Adams.

(Figure 76.)

Hedley 1017.

This is also fairly common on the beaches along the coast, and has not been found alive. The specimen figured comes from Shelly Beach, Manly, and is 8 mm. in length. It is generally like *C. spina*, but is somewhat broader and differs in details of the sculpture and in the shape of the aperture.

Genus *Pseudorissoina* Tate & May.

Dall and Bartsch included *Pseudorissoina* as a subgenus of *Odostomia*, to which it is allied, but with a complete peristome, and columella fold obsolete. The genotype is a South Australian species, and Hedley placed under it two small New South Wales species from the continental shelf. Neither, however, conforms to the generic description, nor do they seem to be cogenetic with each other. A great many of the species from deepwater on the eastern Australian coast seem isolated in relationship, and are difficult to fit into any accepted scheme of classification. It is probable that their affinities are rather in the past than with living molluscan faunas elsewhere. Unfortunately here there is insufficient material for immediate study, and the two species listed by Hedley are for the time being kept under *Pseudorissoina*, though ultimately their systematic position will need revision.

Pseudorissoina exigua Hedley.

(Figure 88.)

Hedley 1068.

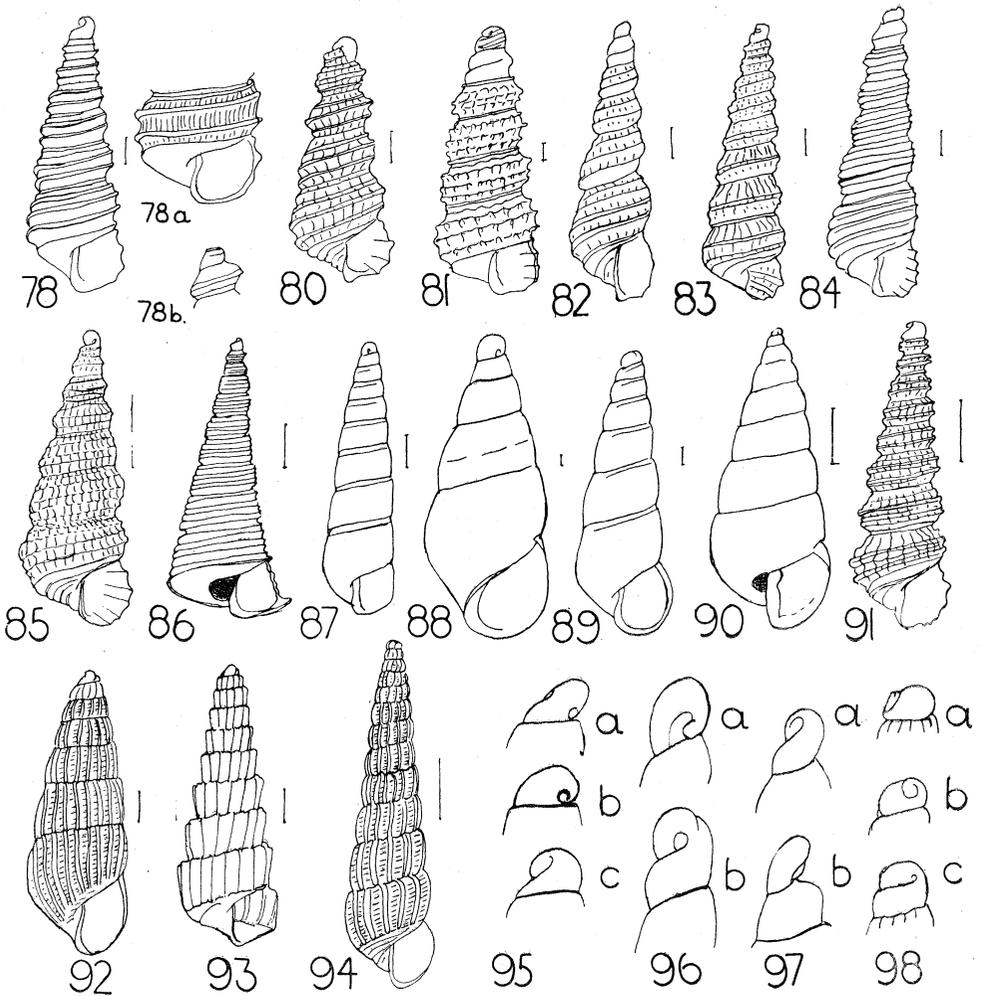
The specimen figured is from 30-55 fathoms off Crookhaven, and is 1.4 mm. in length.

Pseudorissoina elegans Hedley.

(Figure 89, after Hedley.)

Hedley 1068.

The type came from 110 fathoms off Cape Byron, and was 3.15 mm. in length.



Figures 78-98.

78, 79, *Eucharilda elegantula* Angas. 80, *Opimilla decorata* Hedley. 81, *O. protolineata* Laseron. 82, *O. porrigata* Laseron. 83, *O. fastigia* Laseron. 84, *Eucharilda pleurorbis* Laseron. 85, *Glyptozaria euglypta* Iredale. 86, *Charilda rosae* Hedley. 87, *Eulimella* (?) sp. 88, *Pseudorissoina exigua* Hedley. 89, *P. elegans* Hedley (after Hedley). 90, *Tiberia nitidula* Adams (after Hedley). 91, *Glyptozaria opulenta* Hedley. 92, *Pyrgiscus flexicosta* Laseron. 93, *Chemnitzia ambulata* Laseron. 94, *Pyrgiscilla kitcheni* Laseron. 95 a, b, c, *Syrnola convexa* Laseron (protoconch). 96, a, b, *Eulimella hasta* Laseron (protoconch). 97, a, b, *Eulimella turrata* Petterd (protoconch). 98, a, b, c, *Chemnitzia mariae* Ten-Woods (protoconch).

***Pseudorissoina exserta*, sp. nov.**

(Figure 27.)

Shell of medium size, cylindrical, white, shining, semi-translucent. Protoconch indeterminate, only half a whorl visible, the remainder completely infolded in the apex. Mature whorls five, nearly flat, but bent in above to the sutures which are moderately indented. The sculpture is strong, consisting of prominent, broad, rounded, straight transverse ribs, about thirteen or fourteen on the body whorl, becoming obsolete on the base, which is smooth. Aperture pyriform, extended anteriorly, peristome complete, the inner margin well exerted from the body whorl, from which it is separated by a narrow umbilical slit, margins not reflected, no columella fold. Length, 3.6 mm.

Locality.—30–35 fathoms off Crookhaven.

Remarks.—This might well be taken for a *Rissoina* but for the completely infolded protoconch, which is a character possessed by some of the Pyramidellidae, but by none of the Rissoinas. The complete peristome and free aperture are very distinctive characters and fit in with the generic description of *Pseudorissoina* much better than the other local species assigned to that genus.

Genus ***Tiberia*** Monterosato.

Dall and Bartsch include *Tiberia* as a subgenus of *Pyramidella*, for small, white, cylindro-conical shells, smooth, and typically with two columella folds. Hedley allowed two species in his check list, but one of these is rejected for reasons given towards the end of this paper.

Tiberia nitidula Adams.

(Figure 90, after Hedley.)

Hedley 1042.

We have not seen this species, but Hedley recorded and figured it from 300 fathoms off Sydney, the specimen figured being 7 mm. in length.

UNFIGURED OR DOUBTFUL SPECIES.

Stylopsis pulchellus De Folin.

Hedley 1041.

This species was described in 1870 from a specimen given to de Folin by a friend, as from Port Jackson. It is hard to say in the absence of the type exactly what this shell is. It is minute, 2 mm. in length, the figure is rather poor, and from this and the description, we know of no Sydney shell with which it can be identified. It has four whorls, a heterotrophe protoconch, and may possibly be an immature *Turbonilla*. At the best it must be considered doubtful.

Tiberia pusilla jacksonensis Dall & Bartsch.

Hedley 1043.

This variety of the Japanese *T. pusilla* was described from two specimens in the Paetel collection labelled Port Jackson, Australia. There is no means of checking the accuracy of the locality, but as no shells of this type have since been found in New South Wales in spite of intensive collecting, it is probable that the locality was wrong and that the specimens really came from Japan. It is not likely to have been overlooked, for the shell is comparatively large, more than 6 mm. in length, and would be easily recognized by the two strong columella folds. I think that this species should be removed from the New South Wales list.

Turbonilla consanguinea Smith.**Turbonilla constricta** Smith.**Turbonilla fischeri** Smith.

Hedley 1046, 1047, 1048.

These three species were described as from 410 fathoms off Sydney, Station 164B of the "Challenger Collection". This is the station about which there has been so much controversy, as apparently some North Atlantic material was mixed with it. There is no reason to doubt, however, that these three species came from this locality, and that they will be rediscovered by future deep-sea dredging expeditions. In 1906, Hedley and Petterd, dredging 300 fathoms off Sydney, found about one-half of the disputed "Challenger" species, though none of the North Atlantic forms were among them. Amongst these was *Turbonilla constricta* (Hedley and Petterd, Rec. Aust. Mus., vi, 1906, p. 214). *Turbonilla constricta* is characterized by a broad base, and is constricted below the suture. In *T. fischeri* the ribs are of unequal width, and about one on every whorl approached the dimensions of a varix. The ribs in *consanguinea* are much finer than in *fischeri*. It is to be regretted that no material is available to illustrate these three species for this paper.

THE GENUS MATHILDA.

The genus *Mathilda* was proposed by Semper in 1865 for a group of Eocene fossils from the Mediterranean, and a number of recent eastern Australian species have been quite reasonably placed under it. There seems a definite relationship between the two groups, though widely separated both geographically and in time, a relationship which further emphasizes that many elements of the marine fauna of eastern and southern Australia are survivals of past geological periods. The Australian species of *Mathilda* seem individually also to have their counterparts in the European Eocene. Thus *Eucharilda elegantula* is close to *M. brocchii* Semper, *Mathildona euglypta* resembles *M. scabrella* Semper, and *Opimilda decorata* Hedley is close to *M. annulata* Semper.

The systematic position of the group is, however, very doubtful. Hedley in his Check List included *Mathilda* with the Acteonidae, but there seems little in common with such genera as *Acteon* and *Leucotina*. It is possible that the protoconchs of some species may be heterotrophe, but it is generally difficult to follow the coiling of the early embryonic stages, and so far no undoubted sinistral coiling has been observed. The general facies suggests a possible relationship with some of the Pyramidellidae, particularly *Cingulina*, but in the absence of any knowledge of the animal at all this is purely speculative. It is more probable that the group should constitute a family by itself but until more data is obtained I do not think this course is justified.

The question of new generic names for the Australian species is rather debatable, but modern usage is to split the larger genera into small groups, based on close rather than general relationship. For the New South Wales species Iredale proposed several new genera which are here used. Of these the introduction of *Charilda* for *Mathilda rosae* Hedley cannot be questioned, for this species is not only entirely unlike any of the other species, but may well belong to a different family. The new species have also been placed under Iredale's genera, though to be quite consistent still further new generic names could have been easily added. It is more important, however, to get the species listed, and correct genetic relationship is left for the future when more data are available.

Genus *Eucharilda* Iredale.

T. Iredale, Rec. Aust. Museum, 1929, xvii, p. 187.

Genotype, *Mathilda elegantula* Angas.

Generic characters for *Eucharilda* as given by Iredale are the long spire, tilted turbinate apex, subplicate columella and lirate sculpture. This is fairly adequate, but it might be added that there is considerable resemblance to the local species of *Cingulina*.

***Eucharilda elegantula* Angas.**

(Figures 78, 79.)

Hedley 1021.

Figure 78 is taken from an immature specimen from Pittwater 3.6 mm. in length, which shows the protoconch. Other specimens dredged in Pittwater are much larger and greatly elongated. Figure 79 shows the aperture, details of the sculpture, and the trace of a fold on the columella of a large specimen, with fourteen whorls, 14 mm. in length. The uppermost five or six whorls are missing, and perfect it would have been about 18 mm. in length. We also have it from reclamations at Tempe, Botany Bay, and its habitat is apparently moderately deep water with a muddy bottom.

***Eucharilda pleurorbis*, sp. nov.**

(Figure 84.)

Shell small, elongately conical, colourless, thin, glassy and translucent. Protoconch globose and smooth, but it is possible that the initial whorl or whorls are infolded. Post nuclear whorls, six on the type, but a slightly larger but broken specimen suggests that the full number is seven or eight. The whorls increase regularly, are rounded, and greatly constricted at the sutures. Sculpture on the first whorl a single keel, on the second three spiral keels, increasing to five, and on the body whorl six. The keels are low, narrow, and rounded, but well-defined, with a secondary, very fine spiral thread between them. Transverse sculpture is present, but only visible microscopically, consisting of minute lines appearing here and there between the keels. Aperture sub-quadrate, anteriorly produced, the outer margin curved, thin and indented by the sculpture, inner margin nearly straight, and slightly reflected. Length, 3 mm.

Locality.—From shell sand, Manly Beach.

Remarks.—The only species with which this can be compared is *E. elegantula*, but it differs not only in size but in the greater number of spiral keels, which are also relatively narrower and have a secondary thread between them.

Genus ***Opimilda*** Iredale.

Rec. Aust. Mus., 1929, xvii, p. 187.

Genotype, *Mathilda decorata* Hedley.

Iredale gives no generic description of *Opimilda*, beyond remarking that the genotype is "a short, squat, perforate shell, quite dissimilar" (from *Eucharilda*). To say that it is perforate is hardly correct, though Hedley does mention an umbilical chink. Here we have included with the genotype other species in which, while the spiral sculpture is predominant, transverse sculpture is also well developed, and the surface is often cancellate.

***Opimilda decorata* Hedley.**

(Figure 80, after Hedley.)

Hedley 1019.

The type came from 63-75 fathoms off Port Kembla, and was 4.25 mm. × 2 mm. It is thus an inhabitant of the continental shelf. The large protoconch, set at an angle on one side of the summit, and the regular cancellate sculpture should be easy recognition marks.

***Opimilda protolineata*, sp. nov.**

(Figure 81.)

Shell minute, elongately conical, colourless, glassy and translucent. Protoconch, large, globose, tilted and microscopically spirally striate. Post-nuclear whorls five, increasing regularly, relatively short, rounded, constricted at the sutures. Sculpture on first post-nuclear whorl, a single indefinite keel, on the second two, then three, and

four on the body whorl. A narrow, plain, raised keel is also present on the suture. The lowermost keel on the body whorl borders the base which is excavate. The main keels are narrow, sharp and raised, and broken by undulations into raised tubercles, which are arranged vertically into rows, about fifteen on the body whorl, giving the appearance of transverse sculpture. Aperture well produced anteriorly, quadrate, the outer margin indented by the sculpture, the inner margin reflected. Length, 2 mm.

Locality.—Manly Beach, from shell sand.

Remarks.—Though the single specimen may not be quite mature, it is so utterly unlike any other species that I have no hesitation in giving it specific rank. The striated protoconch, peculiar sculpture and excavate base are distinctive characters which should aid its future recognition.

***Opimilda porrigata*, sp. nov.**

(Figure 82.)

Shell of medium size, elongately conical, pale yellowish-brown, solid. Protoconch globose, but details not visible. Post-nuclear whorls five, elongated, slightly angled, constricted at the sutures. Sculpture predominantly spiral, on the first whorl a single keel, on the second and third whorls two, then three, and on the body whorl three with subsidiary keels above. The cross sculpture rather irregular, consisting of widely-spaced thin lines, mainly between the keels, but occasionally producing a slight nodulation on the keels themselves. Aperture quadrate, its longest axis vertical, and greatly extended anteriorly, outer lip indented by the sculpture, inner lip reflected and nearly straight. Length, 4 mm.

Locality.—8-10 fathoms off Point Halliday, North Coast.

Remarks.—Once again this species is unlike anything yet described from the Australian coast. The elongated whorls, sculpture and extended aperture should aid in its future recognition.

***Opimilda fastigia*, sp. nov.**

(Figure 83.)

Shell small, elongately conical, colourless and translucent. Protoconch globose and tilted. Extreme apex apparently infolded. Mature whorls eight, short, increasing regularly, contracted at the sutures. Sculpture predominantly spiral, the earlier whorls angulated by one keel, which remains predominant, though other minor keels appear below it, particularly on the body whorl. Transverse sculpture conspicuous, particularly on the upper portion of the whorls, where it appears as rounded ribs which, as they cross the keels, rise into nodules. Aperture roughly pentagonal, the outer margin forming two sides of the pentagon, and indented by the sculpture; inner margin straight and not reflected. Length, 3.2 mm.

Locality.—Port Stephens, shell sand.

Remarks.—Once again the characters of this species do not lend themselves to comparison with any other, and it is a beautiful and distinctive little shell. The many whorls, and distinctive sculpture should render future recognition easy.

Genus ***Glyptozaria*** Iredale.

Proc. Linn. Soc. N.S.W., xlix, 1924, p. 248. Syn. *Mathildona* Iredale, Rec. Aust. Mus., xvii, 1929.

Iredale proposed the genus *Mathildona* for large shells from the continental shelf, which he remarked came very close to the original *Mathilda* Semper. He states that the genotype, *M. euglypta* Iredale, "differs in the form of the protoconch, and Cossmann has separated the Palaeartic fossils into groups by means of this feature, so that it is

necessary to avoid confusion to designate the Austral groups also." The protoconch of *Mathildona* is described as "anastrophic, tilted, slightly immersed by succeeding whorls, smooth." Other points that may be noted are that the shell is large, 20 mm. or more, solid, many-whorled, and with cancellate sculpture.

Previous to this paper, Iredale had proposed the genus *Glyptozaria* for Hedley's *Turritella opulenta*, merely stating that it differs from other Australian *Turritellas* by the absence of a sinus in the outer lip. I do not think that this shell has any connection with the *Turritellidae* at all, and comparison with Iredale's species *euglypta* (see Figures 85 and 90) at once suggests that they are very close together and are co-generic. As *Glyptozaria* was published five years earlier it will therefore have priority over *Mathildona*.

***Glyptozaria euglypta* Iredale.**

(Figure 85.)

Rec. Aust. Mus., xvii, 1929, p. 186, Pl. xl, Fig. 6.

The specimen figured is from 30–35 fathoms off Crookhaven, and is smaller than the type from 50–60 fathoms off Montague Island, being 13 mm. in length instead of 20 mm., and with one fewer whorl. The large size and beautiful cancellate sculpture are good recognition points.

***Glyptozaria opulenta* Hedley.**

(Figure 91.)

Hedley 594. (*Turritella*.)

The generic position of the curious shell which Hedley called *Turritella opulenta* has always been open to doubt. Beyond its elongated shape it has little in common with *Turritella* as generally defined. The tilted helicoid protoconch suggests the group of the *Mathildas* and actually it is very close to Iredale's *Mathildona euglypta*, with very similar sculpture and with a similar aperture. I should say these two were undoubtedly cogenetic, but *opulenta* is narrower, smaller, and differs in the detail of the sculpture. It is fairly common on the continental shelf, the specimen figured coming from 30–35 fathoms off Crookhaven, and being 7 mm. in length.

Genus ***Charilda*** Iredale.

Rec. Aust. Mus., xvii, 1929, p. 187.

Genotype, *Mathilda rosae* Hedley.

Here there can be no doubt as to the need for generic separation, as the genotype stands out from all other Australian shells. The protoconch is typically that of the *Pyramidellidae*, the spire is long and gradually spreading so that it has a concave contour, the base is sharply truncate and deeply umbilicate, the aperture is semi-circular, with the outer margin flat with the lowermost keel extended as a prominent projection, and the sculpture consists of numerous regular spiral keels with no transverse sculpture.

***Charilda rosae* Hedley.**

(Figure 86.)

Hedley 1020.

This is a fairly common species in shell sand on the outer beaches, and may be easily recognized by the characters mentioned in the generic description. The specimen figured came from Port Stephens and is 5.5 mm. in length.

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