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REVISION OF THE NEW SOUTH WALES TRIPHORIDAE

BY CHARLES F. LASERON, F.R.Z.S.

Honorary Correspondent, Australian Museum.

(Figures 1—30)

INTRODUCTION.

Few groups of mollusca have presented more difficulties to local conchologists than the Triphoridae. Their small size, close resemblance to each other, and the difficulty of obtaining good and adequate material have led largely to their neglect. Yet few groups are more fascinating and worthy of a close examination. Fortunately the late Charles Hedley (1902) revised the local species, and laid a solid foundation on which future workers could build. In his excellent paper not the least service he rendered was to collate and clear up anomalies in the earlier literature, and to illustrate and expand the inadequate descriptions of previously named species. He described several new species, and in all listed fifteen species from the coast of New South Wales.

Since Hedley's paper no further work has been published in New South Wales, though Hedley himself described and reviewed some Queensland and Pacific Island species. May added to the Tasmanian list and Verco did work in South Australia, while B. C. Cotton and F. K. Godfrey proposed a comprehensive classification for the southern Australian species. In New Zealand Sutor, Finlay and Powell also did work on the Neozelandic forms.

The present paper is based mainly on the collections made by my son John and myself during the last twenty years. During that time we have endeavoured to build up series of the different species, to find out the limits of their variability and something of their habitats and distribution. It is rather surprising the number of hitherto undescribed species that have thus come to light. It is to be regretted that the rather rare opportunities were not taken to note something of the animals themselves, for the structure of the operculum, the radula, and the detailed anatomy must be the keys that will ultimately unlock the problems of their phylogenetic relationship.

In addition to our own collection I am indebted to members of the Marine Section of the Royal Zoological Society of New South Wales who have passed material on to me for study, particularly to Miss E. Duff and Mrs. L. H. Woolacott, to Messrs. E. F. Holland, T. A. Garrard and David McAlpine, and also to Mr. Tom Iredale who sorted out a number of white specimens from Manly Ocean Beach. An examination of the material in the Australian Museum was rather disappointing, as most of the specimens have deteriorated through sweating in the glass tubes. It was only possible to check here and there on Hedley's work. This is regrettable, because with two of his species Hedley made an extraordinary and unusual mistake by drawing as type one species and describing another. The confusion thus created will, I think, be straightened out when discussing the two species in question, *cinerea* and *nocturna*. Curiously enough the material in the Museum collected earlier by the late John Brazier is in much better condition. One specimen, selected as type of a new species, was collected in 1878. Brazier's specimens were all neatly mounted on cards and annotated in his own writing.

All types and also all specimens illustrated in this paper have been presented to the Australian Museum, where they will be kept intact as a type collection for future reference.

Family Triphoridae.

The main characteristic of the Triphoridae from shell features alone is the sinistral coiling, accompanied by an elongate, many-whorled shell. They are operculate; the operculum is thin, round, pauci- to multi-spiral with a central nucleus. The aperture varies considerably and may be very complex. The columella consists of a broad pillar, and may be straight, bent or twisted. An anterior canal is always present, while the posterior canal may vary from an elongated tube to a shallow subsutural notch or sinus.

In some tropical forms the aperture develops in an extraordinary manner. The outer margin is expanded both anteriorly and posteriorly into tubular processes, and the anterior canal is greatly extended; even the aperture itself may be elongated and tubular, so that the shell has the appearance of having three mouths. This type has so far not been recorded from New South Wales waters. All the local species yet examined have rather similar and comparatively simple apertures.

In its simplest form, as in *Notosinister granifera,* the aperture is rounded or subquadrangular with a thin outer lip, a shallow subsutural posterior sinus, and another shallow sinus adjacent to the anterior canal. The canal itself is short and may be recurved backwards. In many species the anterior sinus continues to expand after maturity, and grows upwards into an acute fold which extends across the canal and partially across the pillar of the columella. The presence or absence of this spur has distinct specific value, but in some species its growth is evidently slow after maturity and its absence in specimens cannot be taken as conclusive. It is also easily broken, and the break, particularly in the smaller species, is not easy to detect.

The protoconch is of great importance for at least specific determination and, as in other families, any difference may be taken as indicating specific difference. Just how far the protoconch has genetic value is still undecided. Finlay (1928) based his genus *Notosinister* on a multi-whorled sculptured protoconch, but while his genus may be admitted on other grounds, the protoconch alone is here rather unsatisfactory. If *Notosinister* is accepted on general grounds, the Neozelandic genotype has its Australian paratype in *N. granifera,* and with this quite a number of other species can be satisfactorily grouped. Other species, such as *labiata, maculosa* and others, have thick and at times tumid protoconchs, and at first it was thought that these could be better considered under another generic name. The difference here would seem, however, to be more of size than of essential character, and moreover there are many intermediate species which preclude a hard and fast division.

In a very valuable paper in 1931, Cotton and Godfrey reviewed the South Australian species and, following Finlay, adopted a classification based entirely on the protoconch. They divided the group into six genera, *Notosinister, Cautor* and *Teretriphora* all of Finlay, with three, *Eutriphora, Isotriphora* and *Hypotriphora,* proposed as new. Of these, *Isotriphora* seems a natural group including several closely related species, and *Hypotriphora* from shell characters alone is so distinctive that it deserves generic rank. The status of *Eutriphora* is uncertain as it contains incongruous elements. If adopted it would include the New South Wales species *nocturna,* which by other characters is far nearer to such species as *regina, fasciata* and *innotabilis,* included by these authors in other genera. *Teretriphora* of Finlay is a good genus, but its application to many Australian species is, I think, quite unnatural, particularly such species as *angasi,* which has quite a different shell. Only one local species, *kesteveni,* a very distinctive shell, has sufficient resemblance to the New Zealand genotype to be included with it. The application of *Cautor* to Australian shells has proved quite unsatisfactory, as quite incongruous and unrelated species are grouped together. The same may be said of *Notosinister* but, if this be used in a wide sense, it can be divided into fairly natural groups, and a key devised for the recognition

of the local species. The genetic status of these groups is left in abeyance. Much depends on the future study of a great number of undescribed species living on the Queensland coast. Many of these can be linked with species on the New South Wales coast, but others have quite different characters and have no close relationship. No classification of the Australian Triphoras can be satisfactory until all these are included.

The protoconch of all the local species seems to begin with a smooth dome-shaped whorl in which, under strong magnification, a minute nucleus can sometimes be seen enfolded. On the second or third whorl a spiral keel develops, on either side of which are minute transverse threads. The latter are not always apparent, as the slightest wear removes them. Adult sculpture appears quite suddenly at anything from the third to the sixth whorl, and in one species, *N. regina,* a distinct varix was noticed. In one group only, of which *tasmanica* is an example, the apex is of quite a different type and suggests an entirely different life history. For this group Cotton and Godfrey have proposed the genus *Isotriphora.* In *Isotriphora* the apex is rounded and covered with tubercles which, on close examination, are seen to be the mature sculpture on two or three rapidly expanding whorls. The true protoconch is invisible, unless a minute, smooth dome, only visible under strong magnification, shows where it is deeply immersed in the summit (see Fig. 23*a*).

The sculpture is very important in specific determination, and is nearly constant in the different species. It is both spiral and transverse, the former producing prominent keels which are broken into rows of more or less rounded gemmules by the latter. In *Notosinister* and *Austrosinister* there are typically three rows of gemmules, with a fourth on the body-whorl, which is overlapped and may appear as a sutural thread on the earlier whorls. The three rows of gemmules are generally equal, but in one group of species, of which *N. fasciata* is typical, the centre row on the body-whorl is much smaller than the other two; on the penultimate whorl it is little more than a thread, and higher up the spire it disappears altogether. The gemmules may be larger or smaller, may be rounded, and may be quite separate or fused together. In *N. cinerea* they rise as protuberances above well defined linear keels. The transverse sculpture consists of costae, which may be well defined, as in *N. cinerea,* or they may be quite obsolete in the grooves between the gemmule rows, their presence indicated only by the gemmules themselves, which are opposite to each other and are arranged in lines obliquely ascending the spire. The gemmules are not always rounded, but may be irregular and more or less angular, and their summits are sometimes flat and faceted. Other smaller details of the sculpture will be dealt with when describing the various species, but unfortunately my limitations as a draughtsman have prevented it being more than indicated on the figures. The number of gemmules on the whorls is very constant, and has been determined by counting the number visible on the front of the body-whorl and multiplying by two. This is accurate within one or two. The difference in appearance of say 14, 17, 20 or 23 gemmules to the whorl is very marked, and can be taken as a constant specific character.

Rows of gemmules are characteristic of most of the family, but there are certain odd species which differ radically, and may indeed, apart from their sinistral coiling, have little relationship to the main group. Of these the shell named by Hedley *Triphora kesteveni* is an example. In this the gemmules are entirely absent, and the sculpture consists of three equal, broad, flat, spiral keels, serrated at the edges, and separated by deep, narrow channels. Finlay (1926) proposed *Teretriphora* for a rather similar Neozelandic shell, but he based his genus on a 4-whorled smooth protoconch and not on the sculpture. For the time being at least the species *kesteveni* may be placed here. An extraordinary shell from Port Stephens has two smooth, sharp-edged, outstanding keels with a small thread-like keel between them, and for this the new genus *Solosinister* is proposed later in the paper. Still another shell,

exceptionally large for the family, has very distinctive sculpture. In this two keels bearing low gemmules lie at the top and bottom of the whorls, and are so close to similar keels on adjacent whorls that the suture is reduced to a mere thread. Between these keels transverse costae rise in the centre to obscure gemmules to make an indistinct median row. The new name *Magnosinister* is proposed later for this shell.

In each species the number of whorls is nearly constant in the mature shell, though occasionally it may vary by one or at the most by two. Size is the most variable character and adult individuals of the one species may be found one-third or as much as half again as long as others. Relative length and breadth are nearly constant, but in some species individuals are found relatively somewhat broader than others. The straightness or convexity of the spire is also specifically constant, and the tendency of some species to be contracted at the base gives them a distinct facies.

Colour, usually unreliable in most families, in the Triphoridae is remarkably constant, so much so that it is a very useful guide in the recognition of species. In some, such as *Notosinister regina* and *N. tricolor,* it enables even fragments to be recognized.

The habitat of the Triphoridae is mainly on or in the vicinity of rocky reefs, and generally below the limit of low tide. A few species live in crevices or below rocks in pools on the foreshore, and these are the species commonly found washed up on the beach. Most of those seen alive have been in ones or twos, but on one occasion we found a whole colony of *N. labiata* living among *Galiolaria* tubes in North Harbour, Port Jackson, and well above low-tide level. Odd specimens have also been found crawling on seaweed in the pools. Many species apparently live on the reefs in much deeper water, on ground difficult to dredge. Such would be washed up on the shore only occasionally, and this no doubt accounts for the paucity of specimens available. A glimpse of such a fauna was obtained in a fortunate dredging in 14 fathoms on a gravelly patch between reefs about two miles from the shore at Long Reef near Sydney. From here came three of the new species described, as well as worn and broken specimens of others, quite different, but too imperfect to describe. On the trawling grounds of the South Coast, in depths of from 30 to 60 fathoms, Triphoras seem nearly entirely absent. Hedley recorded two specimens of *Isotriphora tasmanica* from the "Thetis" Expedition, and from numerous parcels of sand and mud we ourselves have found only two immature specimens. The absence of reefs well out on the continental shelf probably accounts for their rarity.

The geographical range of most species of *Triphora* seems limited, and the occurrence of the one species in more than one zoogeographical province always needs very careful checking. Several species appear in the Tasmanian list as common to both that State and New South Wales, *cinerea, angasi, fasciata, innotabilis, maculosa* and *tasmanica.* Of these *angasi* will be shown later as erroneously recorded from New South Wales, true *tasmanica* and *fasciata* may occur on the South Coast, and *maculosa* seems definitely common to the two States. On the other hand the occurrence of *cinerea* and *innotabilis* in Tasmania requires further checking. With Victoria and South Australia there is still greater difference, and it is doubtful if there is one species common with New South Wales. Careful comparison side by side under the microscope is the only sure way identity can be established, and general resemblance can be very misleading. Thus the occurrence of the species *ampulla* on the New Zealand list is probably incorrect.

Relationship with the Queensland Triphoras is at present very uncertain. There is in Queensland a great number of species, few of which have been identified, and the majority of which are undescribed. My son John has been recently making

a collection of small shells from Queensland, and has already sorted out more than three times as many species of *Triphora* as have previously been recorded from the area. Of these, numerous species from the coral reefs of the Capricorn Group are quite dissimilar from any in New South Wales. On the other hand those from the mainland at Bowen and Caloundra have much the same facies, and many are found closely related to but distinct from the more southern species. A few species are in common, particularly as there is inevitably some overlap between the two provinces. *Notosinister cinerea* and *Teretriphora kesteveni* have already been recorded from Queensland. *Notosinister maculosa* is in my son's collection from Alexandria Heads, near Caloundra in southern Queensland, and from the same locality is an immature specimen indistinguishable from *N. topazica*. At the same time typical Queensland species may be expected from time to time from the extreme north coast of New South Wales.

KEY TO THE NEW SOUTH WALES TRIPHORIDAE

Genus *Notosinister*. Sculpture thre rows of gemmules, protoconch from three to five whorls, bearing keels.
- Group A. Small stout shells, protoconch thick and club shaped.
  1. *N. maculosa*. Protoconch white, mature shell yellowish brown with patches of chocolate.
  2. *N. univitta*. Protoconch white, first mature whorl chocolate, remainder buff, sutures brown.
  3. *N. conferta*. Golden-brown, protoconch and base yellow-brown.
  4. *N. tricolor*. Protoconch yellow-brown, first three mature whorls white, remainder deep red-brown, upper row of gemmules greenish.
  5. *N. sarcira*. White with splashes of orange-brown.
  6. *N. labiata*. Deep red-brown, almost black.
  7. *N. robusta*. Protoconch white, remainder white or pale yellow-brown.
- Group B. Intermediate between Groups A and C. Small stout shells, with protoconchs rather slenderer than A.
  8. *N. pocula*. White with brown base.
  9. *N. ampulla*. Alternate patches of white and brown.
- Group C. Slender multi-whorled protoconchs with keeled whorls. Three equal rows of gemmules.
  10. *N. granifera*. Yellow-brown, upper rows of gemmules lighter.
  11. *N. topazica*. Golden-brown, shell slender.
  12. *N. alborda*. Protoconch and base brown, spire cream.
  13. *N. glaciala*. Pure white.
  14. *N. jacksonensis*. Brown with white gemmules.
  15. *N. albovittata*. Pale yellow, upper row of gemmules white, with narrow line of ochre.
- Group D. Protoconch 4–5 whorls, slender and keeled. Rows of gemmules unequal in size, only two rows on upper part of spire.
  16. *N. innotabilis*. Yellow-buff, shell slender.
  17. *N. regina*. White with orange line on lower row of gemmules.
  18. *N. fasciata*. White, gemmules on lowest row largest.
  19. *N. nocturna*. Shell large and slender, deep brown.
- Group E. Shell stout, protoconch minute.
  20. *N. fulvalinearis*. Gemmules straw-coloured, sutures and base chocolate, furrows brown.
- Group F. Protoconch short, with two keels on whorls. Spiral sculpture strong.
  21. *N. cinerea*. Ashy white gemmules, general tinting ashy.
  22. *N. stramentia*. Shell very slender, pale straw colour.
  23. *N. grandiosa*. Shell very large, deep red-brown, pale gemmules.

Genus *Isotriphora*. Apex rounded and sculptured, protoconch deeply immersed. Sculpture as in *Notosinister*.
  24. *I. echina*. Yellow-buff, 28 gemmules to the whorl.
  25. *I. tasmanica*. Yellow-buff, 20 gemmules to the whorl.

Genus *Teretriphora*. Sculpture three broad, flat, spiral keels.
  26. *T. kesteveni*. Colour cream.

Genus *Solosinister*. Sculpture two prominent sharp keels with smaller keels between.
  27. *S. pagoda*. Pale yellow-buff.

Genus *Magnosinister*. Shell very large, two narrow keels at bottom and top of whorls, with transverse sculpture between.
  28. *M. hedleyi*. Yellowish white, faded.

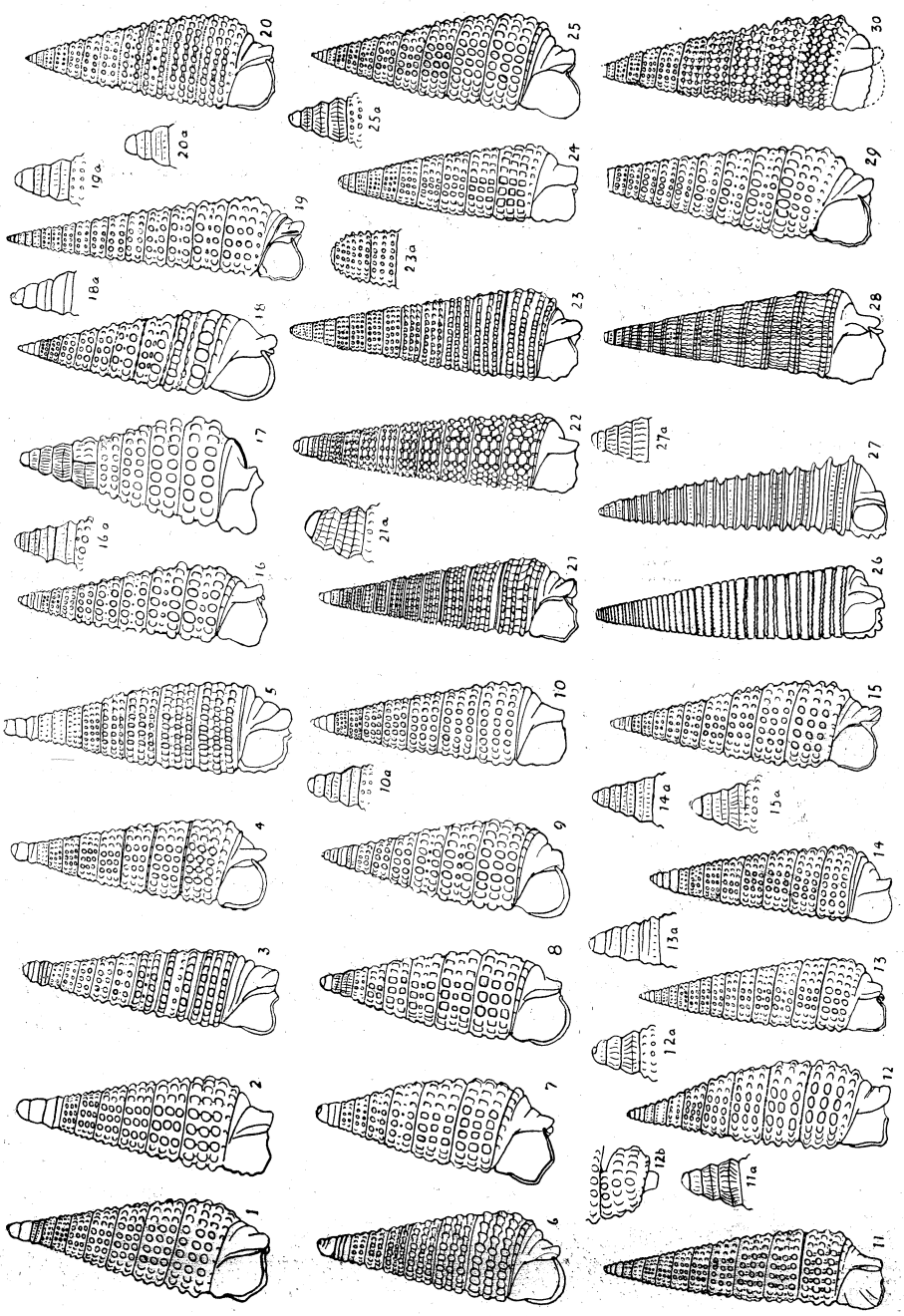
DESCRIPTION OF SPECIES.

Genus **Notosinister** Finlay, 1926.

Genotype, *Triphora fascelina* Sutor. Australian paratype, *Triphora granifera* Brazier.

Finlay's genus, founded on the protoconch alone, is here enlarged to take in Triphoras with typical sculpture of three rows of gemmules, simple apertures in which the posterior canal is reduced to a subsutural slit or sinus, the anterior canal is short and open, the columella pillar broad, the anterior margin of the aperture sometimes expanded into a narrow fold or spur which may reach or partially cross the columella. The protoconch begins as a smooth dome, a keel developing on the second or third whorl, while transverse sculpture may appear as minute threads. The whole protoconch may have from two to five whorls, and adult sculpture appears quite abruptly.

Within *Notosinister* as thus defined are several groups of closely related species, linked, however, with intermediate forms, thus precluding further generic separation. B. C. Cotton has already used *Notosinister* for the South Australian species *pfeifferi*, which is one of what might be called the *fasciata* group of species.



Figures 1-30. (For explanation see p. 158.)

Notosinister maculosa Hedley.

(Figure 1.)

Hedley 587.

N. maculosa is the first of seven species, small to medium in size, with thick short protoconchs of from two to three whorls, short, rather stout shells with a tendency to convex or bottle-shaped spires. There are small but constant differences between these species, but the colour pattern as given in the key to species is a ready means for their quick recognition.

N. maculosa is one of the commonest species, and is found on beaches both inside and outside the harbours right along the coast, and ranging also to Tasmania and southern Queensland. It is very constant in size, sculpture, aperture and colouring. The protoconch is white, the remainder of the shell yellowish-brown, variegated with patches of chocolate. The gemmules are large, about twenty to the whorl, and are confluent to form continuous keels. The sutures are wide and deep. A spur on the anterior margin of the aperture reaches the columella. The specimen figured is from Crookhaven Heads and is 6 mm. long by 2.1 mm. wide.

Notosinister univitta, sp. nov.

(Figure 2.)

Shell of small size, protoconch white, first mature whorl yellow-brown, next deep chocolate, remainder pale yellow-buff with white gemmules, base darker, sutures chocolate. Form broadly conical, sides straight. Protoconch of three whorls, stout, the first dome-shaped, the next smooth, a keel appearing on the third. Mature whorls six, increasing regularly, sutures distinct but narrower than in *maculosa*. Sculpture three rows of gemmules, a fourth keel with indistinct gemmules on the body-whorl. The gemmules are large and rounded, about sixteen to the whorl, joined by low bars to form keels, and also by low ridges from row to row. Aperture subquadrate, outer margin thin, indented by the sculpture, a shallow sinus at posterior and anterior ends, no spur developed, but this may be due to insufficient maturity, canal short. Columella pillar very broad and bent back at its extremity, a narrow layer of callus within the aperture. Base flat, with one flattened fold. Length 5.1 mm., width 1.9 mm.

Locality.—14 fathoms off Long Reef (four specimens).

Remarks.—This species is closely related to *N. maculosa* which was found in the same locality, but it can be readily separated by its smaller size and distinctive colouring. It also has three whorls in the protoconch instead of two, the gemmules are larger and fewer, the columella is broader and different in shape, the sutures are narrower, and the gemmules are connected across the sutures.

Notosinister conferta, sp. nov.

(Figure 3.)

Shell small, cylindrical, rather narrow, bright yellow-brown, apex yellow, base red-brown. Protoconch tumid, of three whorls, the first dome-shaped, the second swollen with a faint keel, the third short, faintly keeled with faint cross sculpture. Mature whorls eight, increasing regularly, sutures very narrow and deep. Sculpture three rows of gemmules on the body-whorl, the uppermost the most prominent, the other two equal, the gemmules about twenty to the whorl, prominent but rather irregular in shape, confluent to form definite keels. The furrows between the keels are narrow

and deep. On the penultimate whorl the lower row of gemmules is the most prominent, and the median row is much smaller, becoming reduced to a thread and then disappearing as the spire is ascended. There is a keel without gemmules on the periphery of the body-whorl and another on the base. The aperture is subquadrate, the anal sinus shallow and wide, the anterior spur is not developed, the canal short and open in front, the pillar of the columella broad and rounded anteriorly, slightly bent back, a thick wide layer of callus within the aperture. Length 4.4 mm., width 1.2 mm.

Locality.—Pittwater.

Remarks.—This alone of the group of species with thick protoconchs has the peculiar sculpture associated with *N. fasciata, N. nocturna* and cognate species, the median row of gemmules disappearing as the spire is ascended. It is also narrower than related species, and the shape of the columella is distinctive. Its nearest relative is probably *N. labiata.*

Notosinister tricolor, sp. nov.

(Figure 4.)

Shell of medium size, conical, spire very slightly convex, stout. Colour of protoconch yellow-brown, first three mature whorls white, remainder as a whole almost black, but close examination shows the central row of gemmules to be brown and the upper and lower sage-green; base brown. Protoconch of three whorls, the first small and dome-shaped, the second inflated, the third short with an incipient keel. Mature whorls eight, increasing regularly, nearly flat, sutures shallow with a thread formed by the overlapping of the fourth gemmule row visible on the body-whorl. The sculpture consists of three rows of gemmules, equal in magnitude, about twenty gemmules to the whorl. The gemmules are close together, prominent and confluent to form definite keels, rather irregular in shape and sometimes almost quadrangular. The furrows between the keels are very narrow and are bridged by small, low, barely distinguishable transverse ridges. Base with a prominent extra keel. Aperture rounded, posterior subsutural notch narrow and deep, anterior margin with a prominent spur which partially crosses the columella. Columella pillar rather narrower than others in the group, straight and anteriorly rounded, a thick band of callus within the aperture. Length 7.5 mm., width 2.3 mm.

Locality.—Crookhaven Heads (type); Long Reef; Cronulla.

Remarks.—From all other species with thick protoconchs this differs in proportions, details of the protoconch, aperture and sculpture. Its nearest relative is *N. maculosa* from which it is easily separated by its distinctive colouring, which is such a good recognition point that even fragments may be readily determined.

Notosinister sarcira, sp. nov.

(Figure 5.)

Shell of medium size, bottle-shaped, slender above and swollen below, white with irregular splashes of orange-brown, base yellow. Protoconch of four whorls, the first small and dome-shaped, the next two tumid and smooth, the fourth with a keel. Mature whorls eight, at first increasing rapidly, the last three nearly equal, sutures smooth and indented. Sculpture, three regular, equal spiral keels, rather wider than the furrows, each broken into small, raised, confluent gemmules, rounded and about 24 to the whorl. Base with three extra spiral keels. Aperture subquadrate, outer margin rounded and thick, no anal notch or sinus visible, posterior spur not reaching the columella, canal short and broad, visible from in front, oblique. Columella pillar short, broad and rounded, more than half covered by a thick layer of callus extending well within the aperture. Length 6.8 mm., width 2 mm.

Locality.—14 fathoms off Long Reef (two specimens).

Remarks.—The four-whorled protoconch, the unique bottle-shape, and details of the sculpture and aperture separate this from all other members of this group. The colouring should also prove a ready recognition point. It is apparently an inhabitant of the deeper reefs, and so far has never been seen upon the shore.

Notosinister labiata Adams.

(Figure 6.)

Hedley 586.

This is one of the commonest Sydney species, and though the original description was very brief, the observation "a small, nearly black shell, with the outer lip dirty white or pale fuscous" makes it very easy to recognize. Hedley gave a full description and excellent figures, so its identity is not open to question. Examination of long series, however, shows that, within limits, there is variation in size and proportions. A colony found living in galiolaria tubes in North Harbour was composed of individuals rather smaller than usual, averaging less than 4 mm. The specimen figured is from this locality, and is 3.5 mm. long by 1.2 mm. wide. A series taken from dredgings in 10 fathoms, Doll's Point, George's River, was considerably larger and somewhat slenderer, averaging more than 5 mm. in length, and with from 7 to 9 mature whorls. A feature of the protoconch not shown in Hedley's figure is the slightly tilted and infolded initial whorl. The gemmules are rather irregular in form, sometimes quite rounded, sometimes angular, and they are confluent to form definite keels much wider than the grooves between. The median row becomes smaller as the spire is ascended, but not to so marked a degree as in *N. conferta*. *N. labiata* is also common right along the coast.

Notosinister robusta, sp. nov.

(Figure 7.)

Shell small, broadly conical, with a convex spire and broad blunt apex, protoconch white, remainder white or pale yellow, base yellow. Protoconch tumid, the initial whorl dome-shaped and set obliquely, the second smooth and inflated, the third with a keel. Mature whorls six, short, the body-whorl restricted at the base, sutures distinct, marked by a narrow line, above which is a thread of very small gemmules, caused by the overlapping of the whorls. The sculpture consists of three rows of large gemmules, confluent to form definite keels, and also linked transversely by narrow bars across the very narrow grooves. A fourth row is on the periphery of the body-whorl. The gemmules themselves are large, about 18 to the whorl, close together, and irregular in shape, elevated, but flattened on top. Aperture expanded, angular, outer margin thin, posteriorly recessed into a moderately deep sinus right on the suture, anterior spur prominent and partially crossing the columella, canal short and broad. Base with two prominent keels, columella short, broad, tapering and rounded anteriorly, with a layer of callus within the aperture. Length 4.4 mm., breadth 1.7 mm.

Locality.—Dredged 6-9 fathoms, Sow and Pigs Reef (two specimens).

Remarks.—This species is very close to *N. labiata,* so much so that opinions might differ as to whether subspecific status is all that is justified. But the colour is quite different, it is much broader, the gemmules are much larger, and the aperture is more angular.

Notosinister pocula, sp. nov.

(Figure 8.)

Shell very small, broadly conical, spire convex, acuminate, contracted anteriorly. Colour white, base brown. Protoconch of four whorls, small, initial whorl small, dome-shaped, second whorl smooth, third and fourth keeled and with transverse threads. Mature whorls six, increasing regularly, the spire slightly convex, the body-whorl restricted anteriorly, sutures shallow but defined, marked by a beaded thread. On the body-whorl there are three main rows of gemmules, with a fourth on the periphery; the upper row of gemmules are the largest, those on the two lower rows are somewhat smaller. The gemmules are large, rounded, but rather irregular, separate and not joined from row to row. They number about nineteen to the whorl. On the penultimate whorl the median row of gemmules is much smaller, on the whorl above smaller still, and above this there are only two rows. The aperture is somewhat expanded, the outer margin thin and rounded, and bent back posteriorly to form a notch against the suture. Anteriorly the margin is broadly folded, but there is no spur, and the fold does not extend to the columella. An extra fold appears on the base, and the columella is short, broad and tapering and rounded anteriorly, with a thick layer of callus within the aperture. Length 2.7 mm., breadth .9 mm.

Locality.—Yamba, Clarence River, North Coast.

Remarks.—This is the smallest of the New South Wales species yet seen. It may be grouped with the next species, *N. ampulla,* both shells having the broad, convex contour of the *maculosa-labiata* group, but with finer more acuminate protoconchs, linking them with *granifera* and other species to be discussed later.

Notosinister ampulla Hedley.

(Figure 9.)

Hedley 579.

This is rather a rare shell on the coast, but its colour is so distinctive that it can be readily recognized, as each whorl is chequered with alternate white and brown patches, and the contour is bottle-shaped, the apex acuminate, and the base slightly restricted. We have found it in shell sand at Cronulla, but the figure is taken from a specimen in the Australian Museum collected by J. Brazier alive in a large rock pool at Little Coogee near Sydney in 1895. Brazier's specimens differ slightly from Hedley's description and figure; they are mature but somewhat smaller and broader, and have but six mature whorls instead of nine. A specimen from Cronulla has seven. The spur of the anterior margin of the aperture also partially crosses the columella, whereas Hedley speaks of it as not reaching the columella. The protoconch, sculpture and shape of the columella are, however, the same, and it is evident that the species is rather variable. The dimensions of the specimen figured are: length 3.1 mm., breadth 1.1 mm.

Notosinister granifera Brazier.

(Figures 10, 10*a*.)

Hedley 583.

This is another of the common species, and it is found on beaches all along the New South Wales coast, but is rarely seen alive. The only living specimens we have seen were on seaweed in pools on the foreshore at North Harbour, Port Jackson. These were rather smaller than the average. The specimen illustrated is from shell

sand from Point Halliday on the North Coast, and is 4.7 mm. long and 1.3 mm. broad. This is about the average size, though specimens have been seen well over 5 mm. The colour when alive is yellow-brown, but beach specimens are generally faded and much lighter. A characteristic of the colouring is that the upper row of gemmules is generally much lighter, a feature also found in the allied species *albovittata*. *N. granifera* is the first of a number of species with straight-sided spires in contrast to the convexity of the *labiata* group; they are slenderer also, with acuminate apices. The protoconch is four-whorled, the first smooth and dome-shaped, the next three keeled with fine transverse threads. The sculpture consists of three rows of equal rounded gemmules, closely packed, about twenty-three to the whorl. Hedley says that there is no spur on the anterior margin of the aperture, and in all the specimens we have seen this is so, and the aperture is always simple with a short open canal.

Notosinister topazica, sp. nov.

(Figures 11, 11*a*.)

Shell of medium size, long and slender, acuminate, colour a rich golden-brown, the sutures and, in the upper whorls, the upper row of gemmules deep chocolate, base chocolate. Protoconch acuminate, of four whorls, the first dome-shaped, the next with faint transverse threads, the next two keeled with fine transverse threads. Mature whorls ten, increasing regularly, sutures broad and deep. Sculpture three equal rows of medium-sized, round gemmules, about twenty-two to the whorl, connected by low rounded ridges to form the keels, and also connected by faint ridges transversely from row to row. A fourth keel with indistinct gemmules on the periphery of the body whorl. The three gemmule rows persist almost to the summit of the spire. Aperture subquadrate, outer margin thin, curving back posteriorly, but the anal notch is not deep, anterior margin simple with no spur, canal broad and open. Base with an extra spiral keel, columella pillar rather narrow and bent slightly backwards. Length 6 mm., breadth 1.5 mm.

Locality.—Cronulla (type), collected by Mr. E. F. Holland; on outer beaches, fairly common.

Remarks.—Though fairly common on the outer beaches, good specimens are difficult to obtain and, when worn and the brilliant colour is faded, they are difficult to separate from *N. granifera*, to which they are closely related. They are, however, much longer and slenderer, and differ in details of the aperture and sculpture.

Notosinister alborda, sp. nov.

(Figures 12, 12*a*, 12*b*.)

Shell small, broadly conical, spire convex, restricted at base, protoconch brown, base chocolate, remainder cream with the upper row of gemmules white and underlined by a very thin brown line. Protoconch thin, of four whorls, the first small and infolded, the next with faint transverse threads, the fourth keeled faintly also with transverse threads. Mature whorls eight, the body whorl restricted at the base, sutures narrow and deep. The sculpture consists of three regular, equal rows of gemmules, about twenty to the whorl, two rows only on the first three whorls, and a fourth on the periphery of the body-whorl. The gemmules are moderate in size, rounded and linked together to form definite keels, but are not connected from row to row; they are rather wider than the channels. An extra keel appears on the rather truncate base. Aperture subquadrate, outer margin angular and thin, bent back at the suture to form a deep anal slit, no spur on the anterior margin, canal open, short and broad. The columella is short, broad and rounded anteriorly, slightly recurved backwards and with a vertical furrow. Length 3.6 mm., breadth 1.3 mm.

Locality.—14 fathoms, off Long Reef.

Remarks.—Apart from its broad, convex shape, this is very close to *N. granifera,* of which it was at first thought merely to be a subspecies. Comparison of the two side by side beneath the microscope, however, shows that *N. alborda* has a slenderer protoconch with much less defined keels, the mature sculpture is coarser, the gemmules larger and fewer, the columella is broader, and the anal notch deeper. The colour should again be a ready recognition mark.

Notosinister glaciala, sp. nov.

(Figures 13, 13*a*.)

Shell of medium size, long and slender, acuminate, spire very slightly convex, colour pure white. Protoconch of five whorls, the first dome-shaped, the second smooth, the next three slightly keeled with faint transverse threads. Mature whorls thirteen, short, regular, sutures narrow but defined. The sculpture consists of three rows of gemmules, about twenty to the whorl, an extra row on the body-whorl, the uppermost row the largest, the rows close together. The gemmules are moderately large, closely packed together, irregular in shape, on the body-whorl becoming almost rectangular. On the penultimate whorl the middle row of gemmules is smaller and fades entirely as the spire is ascended. Base smooth and excavate. Aperture subquadrate, outer margin bent back to form a shallow anal notch, anterior margin bent into a spur which just reaches the columella, canal short and twisted backwards. Columella short and broad, rounded anteriorly, a thick layer of callus, almost a plate, within the aperture. Length 6.4 mm., breadth 1.7 mm. (type); another mature specimen slightly less than 5 mm. in length.

Locality.—6-9 fathoms, Sow and Pigs Reef, Port Jackson (type); Pittwater; also outer beaches.

Remarks.—A pure white *Triphora* has long been known to local collectors, but it has been difficult to obtain specimens good enough to describe. It is apparently variable in size, and in a series collected by Mr. Tom Iredale from the Ocean Beach, Manly, the variation amounts to as much as one-third in length, and also slightly in breadth. A single imperfect specimen of a white *Triphora* dredged in Quarantine Bay is still slenderer, and is 9 mm. in length, but this is probably a different and undescribed species. In its relationship *N. glaciala* would seem to be intermediate between the species like *granifera* with three equal rows of gemmules, and others like *innotabilis* and *fasciata* in which the rows are very unequal with only two rows higher up the spire. Its slender form and white colour make it very easy to recognize.

Notosinister jacksonensis, sp. nov.

(Figures 14, 14*a*, 25, 25*a*.)

Hedley 580 (*Triphora angasi* Crosse & Fischer).

Shell of medium size, evenly conical with straight sides, rather slender, colour red-brown, gemmules paler or even white. Protoconch of five whorls, the first dome-shaped, remainder with sharp keels and fine transverse threads. Mature whorls eight, increasing regularly, very slightly rounded, sutures wide and deep. Sculpture three rows of equal gemmules, about twenty-three to the whorl, the three rows persisting up the spire, with a fourth on the periphery of the body-whorl. The gemmules are close together, rather elongated or oval transversely to the keels, with small incipient gemmules in the narrow furrows between the keels. The base has an extra spiral keel and is rather excavate. The outer margin of the aperture is rounded and thin, the anal sinus is broad and shallow, and the anterior margin is folded into a very

small spur which does not cross the canal. The pillar of the columella is rather narrow and bent back slightly. The type may be barely mature. Length 5.5 mm., width, 1.6 mm.

Localities.—Living in kelp roots, North Harbour, Port Jackson (type); also dredged in North Harbour.

Remarks.—This is the shell recorded by Hedley from Port Jackson as *Triphora angasi* Crosse & Fischer. Hedley published a description (without the protoconch), and stated that he identified specimens by comparison with others from the type locality in South Australia, and that, though the Sydney specimens were larger and proportionately broader, he was satisfied that they were the same. The protoconch, however, proves that they are distinct. *Triphora angasi* is stated by Crosse & Fischer (1865) to have "the first three whorls smooth," while the Sydney shell has a five-whorled, sculptured protoconch. A good recognition point for this species is the whiteness of the gemmules against the brown ground. *T. angasi* is now removed from the New South Wales list.

Figure 25 is from a specimen in the Australian Museum collected by J. Brazier from 5 fathoms off Bottle and Glass Rocks in 1879. This is somewhat broader than the type, and is 5.4 mm. long by 1.8 mm. wide. It was drawn as a distinct species, but close comparison shows the essential features to be similar, and it probably represents about the extreme in variation of the species. It is yellowish in colour, but has probably faded in the long time since its collection. It is also more mature than the type and shows the characters of the aperture better.

While discussing this species, the status of *Triphora nigrofusca* A. Adams might again be considered. Tryon included it in his list of rejected species, but Hedley was reluctant to do this and described and figured a shell he thought might be it. From Adams's original inadequate description all there is to go upon is that it was collected at low water under stones in Port Jackson by Mr. Strange, and that it is a black-brown species with three rows of regular, equal-sized granules on each whorl. The type should be in the British Museum, but it was not among those which Hedley examined when in London in 1912, and which he figured in the following years. The few features in Adams's description would fit several Sydney shells, *N. jacksonensis* among them, and it is doubtful if what is the true *nigrofusca* will ever be known. Curiously enough the shell selected by Hedley definitely does not fit the meagre data and, following Tryon's example, it will greatly clarify matters if *nigrofusca* be finally rejected from literature.

Notosinister albovittata Hedley.

(Figures 15, 15*a*.)

Hedley 578.

When Hedley described *albovittata* his type had an imperfect aperture, and he stated that it might prove to be a variety of *N. granifera*. He gave as the characteristic colouring of *albovittata* "pale yellow; upper row of gemmules on each whorl white, beneath them a narrow line of ochre, base and protoconch ochreous." *N. granifera* also has the upper row of gemmules lighter in colour, but specimens we have collected show that Hedley's *albovittata* is quite valid and distinct. The main difference is in the aperture, for in *albovittata* the columella pillar is broader and bent slightly backwards, and the anterior margin of the aperture is bent into a very sharp and long spur which reaches well up and partially across the columella. The outer margin is also recessed sharply backwards posteriorly to form a fairly deep notch against the suture. This is not a very common species, and may inhabit fairly deep water. The specimen illustrated is from 8 fathoms, Doll's Point, George's River, its length 4.1 mm., and breadth 1 mm.

Notosinister innotabilis Hedley.

(Figures 16, 16*a*.)

Hedley 584.

This is the first of several species in which the gemmules are few, large and rounded, and in which the size of the rows is very unequal, giving a very definite facies to the group. In some of the *granifera* type of species, the median row fades in the earlier whorls, and in *glaciala* we had an intermediate stage, but now the inequality is very marked, and one row of gemmules predominates over the others. *N. innotabilis* is rather rare, but is a well-defined species, small and slender, yellow-buff in colour, with a five-whorled protoconch, and a spur crossing the columella. On the body-whorl the lower row of gemmules is the largest, the median row is very small and soon disappears as the spire is ascended. The specimen figured is from eight fathoms, Doll's Point, George's River, and is 3.7 mm. long by 0.9 mm. wide.

Notosinister regina Hedley.

(Figures 17, 29.)

This species does not appear on Hedley's Check List, and it was evidently accidentally omitted. It was described from one specimen with no protoconch and a broken aperture but, as Hedley remarked, the white shell with a narrow orange line along the lowest gemmule row, and the orange tip to the canal should render possible the recognition of any fragment. Occasional specimens we have collected have been likewise imperfect, but an immature specimen from kelp roots in 30-35 fathoms off Crookhaven has a perfect protoconch, which allows some addition to the original description. The specimen is only 2 mm. long, and has four narrow adult whorls, each bearing two rows of large, rounded gemmules, about eighteen to the whorl, the lower with the characteristic orange band. The protoconch has five whorls, the first dome-shaped, the others keeled, with transverse threads, and separated from the adult sculpture by a distinct varix. It is apparently closely related to *N. innotabilis* and other members of the same group. Still another specimen collected by Mrs. Woolacott from Cronulla, though without the apex, has a perfect aperture (Fig. 29). This is subquadrangular with a distinct anal notch, and the spur is pronounced and partially crosses the columella. The columella is rounded, bent backwards, and there are three prominent rounded keels on the base.

Notosinister fasciata Ten.-Woods.

(Figures 18, 18*a*.)

Hedley 582.

It is very doubtful if the specimen here figured is the true *fasciata,* and quite probably it needs a new specific name. Hedley figured and described a shell from Port Jackson which he identified as *Triphora fasciata,* but to date we have found nothing which exactly fits with this, though the specimen figured is very close. Hedley's specimen is described as small, narrow, white, the base and supersutural thread orange-brown, the protoconch of five and a half whorls. The dimensions given are length 5.5 mm., breadth 1.5 mm. Figure 18 is of a shell dredged in 6 to 9 fathoms Sow and Pigs Reef, and relatively broader, its length 4.7 mm., its breadth 1.5 mm. Its colour is white only, the protoconch, which is rather worn, has apparently only four and a half whorls, and there is a prominent spur on the anterior margin of the aperture reaching partly across the columella. The sculpture is identical, the lowest row of gemmules on the body-whorl much the larger, the gemmules themselves large rounded bosses, the median row very small and reduced to a thread on the penultimate whorl.

A single white shell from Cronulla Beach is somewhat nearer Hedley's figure. It lacks the protoconch, but the aperture is complete, showing the anterior margin with a small fold, not a spur, which does not reach the columella. It is quite possible that this character only develops slowly after maturity and cannot always be relied on for specific identification.

A much larger shell with a five-whorled protoconch occurs in dredgings off Lakes Entrance in Victoria, but this seems closer to *N. pfeifferi,* the South Australian species, which also belongs to the same group. Broken specimens resembling this have been seen from the extreme south coast of New South Wales, and it is possible that this species overlaps into the Peronian Province. More and better material is needed before this question can be satisfactorily settled.

Notosinister nocturna Hedley.

(Figures 19, 19*a*.)

Hedley 589.

Hedley's description is very full and clear, but unfortunately he made the extraordinary mistake of figuring quite a different species, probably *N. cinerea,* and this has led to much confusion. In preference to a specimen from our own collection I am therefore figuring one in the Australian Museum, No. C.13158, from Pearl Bay, Port Jackson, labelled *Triphora nocturna* by Hedley himself, and exactly fitting the description. This is a large shell, 10 mm. long and 3 mm. broad, deep brown in colour, with the sculpture typical of the group, two rows of large, boss-like gemmules on the body-whorl, with a row of smaller gemmules between, the median row greatly reduced on the penultimate whorl, and rapidly disappearing as the spire is ascended. It is not a common species, but we have it in dredgings from North Harbour, and it is very easily recognized by its size, colour and sculpture.

Notosinister fulvalinearis, sp. nov.

(Figures 20, 20*a*.)

A medium to large shell, conical, broad, acuminate, spire convex. Colour very distinctive, the gemmules straw-coloured, the sutures and base chocolate, the furrows between the keels yellow-brown. Protoconch very small and acuminate, of three whorls, the first smooth and dome-shaped, the second with one and the third with two faint keels, between which are faint transverse threads. Mature whorls ten, short, sutures wide and deep, marked with a nodular thread. The sculpture on the body-whorl consists of three distinct keels, above which rise rather elongated rounded gemmules, small and about twenty-four to the whorl. The gemmules are linked from row to row, but this character is apt to be overlooked in the deep colour of the channels. On the whorl above the penultimate the median row of gemmules is very small; above this it rapidly disappears and the upper part of the spire has only two rows. A fourth row is on the periphery of the body-whorl. Aperture with outer margin rounded, a deep narrow, anal notch, and a sharp anterior spur reaching the columella, and covering the canal. Base with two extra, wide, rounded spiral keels, the columella short, a flat plate of brown callus within the aperture. Length 5 mm., breadth 1.7 mm. (type); another specimen 7 mm. long.

Localities.—Little Coogee (type), specimen in Australian Museum, collected by John Brazier in 1896; Cronulla Beach (Mr. E. F. Holland); Port Stephens (self); Woolgoolga (Mrs. Woolacott).

Remarks.—This is a very distinctive species not closely related to any other species on the coast. Its broad form and distinctive colouring make it very easy to recognize, even though in size it is rather variable.

Notosinister cinerea Hedley.

(Figures 21, 21*a*.)

Hedley 581.

The main difficulty in identifying this species is that it is probably the most variable of all those from New South Wales, and also that Hedley again made the extraordinary mistake of describing one species and figuring another. Fortunately his description is full and informative and there can be no doubt of the species he had in mind. The colour in fresh specimens is brownish with a white protoconch, marbled with ashy-white, or with the gemmules ashy-white, the base yellow-brown. Beach specimens are generally faded to a uniform ashy tint, as are dead specimens dredged from deeper water. The protoconch is distinctive, short, of three whorls, the first smooth and tilted, the others with two keels, and transverse, fairly coarse threads or bars. The size is variable, as is the sculpture in detail, though it follows one general pattern. Three prominent keels are always present, a fourth on the body-whorl, which is overlapped in the earlier whorls and appears as a nodular thread in the sutures. The keels are crossed by distinct transverse costae, about 20 on the body-whorl dividing the channels into pits, the costae where they cross the keels rising into gemmules, which may be comparatively large, quite small or even virtually obsolete. The spur on the anterior margin is sharp and prominent, reaching partially across the columella and turning upwards into the aperture. The variation in size of the gemmules produces a different appearance in many specimens, as does the variation in size and the number of whorls. Most of the beach specimens have 10 or 11 whorls, and range in size from 7 to 8 mm. long. That figured was taken alive under rocks at Long Reef by David MacAlpine, and is 7.6 mm. long and 2 mm. wide. Apparently mature specimens have been seen with only 8 whorls and less than 6 mm. in length. On the other hand single specimens taken rather rarely in the deeper water of Port Jackson are much larger. One from 5 fathoms in Quarantine Bay has 13 whorls and is 10.5 mm. long. In these solitary large specimens there is much variation in the size of the gemmules, so much so that it would seem at first sight that two or three species are represented. Indeed no two specimens are exactly alike. The two figures which Hedley wrongly applied to his own descriptions of *nocturna* and *nigrofusca* are probably both rather extreme examples of *cinerea* in which the gemmules are nearly obsolete.

In its distribution *cinerea* is exceedingly common on beaches, both inside and outside the harbours, both north and south of Sydney, as far at least as Port Stephens in the north and Jervis Bay in the south.

Notosinister stramentia, sp. nov.

(Figure 22.)

Shell small, slender, cylindrical with very little taper and a blunt apex. Colour uniformly pale-straw. Protoconch comparatively large, blunt, of four whorls, the first dome-shaped and smooth, two keels developing on the third and fourth whorls, with faint transverse threads. Mature whorls eight, short, flat, sutures narrow but deep. Sculpture three equal rows of gemmules, moderately large, about 15 to the whorl, spaced and connected by bars to form definite keels. They are also linked from row to row by rounded transverse costae, leaving in the grooves deep, nearly circular pits, rather smaller than shown in the figure. A fourth keel with smaller gemmules is on the periphery of the body-whorl. Base in the type plain and excavate, but this may not be quite mature. Aperture subquadrate, again perhaps not quite mature, outer lip thin, indented by the sculpture, with neither anal notch nor anterior spur apparent, columella rather narrow, rounded anteriorly. Length 4.1 mm., breadth 0.9 mm.

Locality.—Hawkes Bay, Port Stephens, in shell sand.

Remarks.—The type is probably not quite mature, and the characters of the aperture may not be fully developed, but the slender and cylindrical shell, the large blunt protoconch and the sculpture should make its future recognition easy. Of the local species it is closely linked with *cinerea* by the development of a second keel on the protoconch, and the strong transverse sculpture producing deep pits between the keels. Some undescribed Queensland species have a rather similar facies.

Notosinister grandiosa, sp. nov.

(Figure 30.)

Shell exceptionally large, conical, almost cylindrical in the later whorls, tapering more rapidly towards the apex, colour deep red-brown with lighter gemmules. Protoconch unknown. The type has ten whorls, short, slightly convex, the sutures wide and deep and marked by a nodulose thread. The sculpture consists of three rows of small rounded gemmules, about 24 to the whorl, connected to each other by short bars to form the keels, and transversely from row to row by similar low bars, persistent right to the sutures. A fourth keel with incipient gemmules on the body-whorl, and a faint smooth keel on the rather excavate base. Aperture imperfect, but the columella with a thick vertical plate inside the aperture. Length 12.5 mm., probably 14 mm. in the perfect shell, breadth 3.8 mm.

Locality.—Woolgoolga (one specimen).

Remarks.—I have ventured to name this species from a single imperfect specimen, because its huge size separates it from all other members of the genus; moreover, its sculpture, general form and colouring are distinctive, and should make it easily recognizable in the future. By its distinct transverse sculpture it comes within the small *cinerea* group, but the gemmules are well rounded and distinct, and the connecting bars are low and at first sight not so apparent.

Genus **Isotriphora** Cotton and Godfrey, 1931.

Genotype, *Isotriphora tasmanica* (Ten.-Woods).

Shell characters as in *Notosinister,* but protoconch not visible, appearing merely as a minute dome completely immersed in the rounded blunt apex. Mature sculpture appears at once, the apex being covered with gemmules, the first one or two whorls being nearly involute.

Genera based solely on the protoconch are apt to be unsatisfactory, but this apex is so singular and easily recognized in the small group of southern Australian species which possess it, that giving it generic rank should avoid rather than create confusion. Moreover, it suggests some distinctive change in the early life history of the animal itself.

Isotriphora echina, sp. nov.

(Figures 23, 23*a*.)

Shell rather above the average size for the family, elongate, regularly conical, colour uniformly yellow-buff. Apex with a small flat dome-shaped nucleus, prominent gemmules then appearing similar to that on the main spire, probably belonging to two or three whorls before the sutures are distinguishable. Additional whorls 14, increasing regularly, short, flat, sutures narrow and moderately deep, distinct. The sculpture consists of three subequal keels, separated by narrow channels, a fourth on the body-whorl, the keels broken into rather irregular gemmules, small and packed closely together, about 28 to the whorl. Base flat with one extra flat spiral keel. Aperture rounded, the outer margin thin, straight when laterally viewed, and nearly

entirely enclosing a deep, rounded anal notch, like the base of an incipient tube, anterior margin bent into a sharp spur which reaches the columella, to which it is apparently attached, thus enclosing the anterior canal. Columella tapering, rounded anteriorly. Length 7 mm., width 2 mm.

Locality.—14 fathoms, off Long Reef, a number of specimens.

Remarks.—Hedley identified *Triphora tasmanica* from a single, immature specimen, dredged in 100 fathoms, east of Wollongong. This may possibly be *I. echina,* but cannot be accurately determined. *I. echina* differs from the Tasmanian *tasmanica,* which has the same remarkable apex and is congeneric, by its much finer sculpture, the gemmules being smaller and much more numerous. There is another shell from Lakes Entrance, Victoria, with a similar apex, coarser sculpture and lilac in colour, which is probably still another species of *Isotriphora.* This I believe is undescribed and needs a new specific name.

Isotriphora tasmanica (Ten.-Woods).

(Figure 24.)

Hedley 590.

I am indebted to Mr. T. A. Garrard for a specimen of what may be the true *tasmanica* collected at Twofold Bay, and which is here figured. It is 5.9 mm. long and 1.9 mm. broad. It is similar in many ways to *I. echina* but the gemmules are much larger and more regular, with a tendency to be rectangular, and are only about 19 to the whorl. The outer margin of the aperture is slightly broken, but there is still a rounded subsutural depression which may be the remains of a similar deep anal notch. The spur on the anterior margin is present, but does not reach the columella, leaving the front of the canal quite open. There are also only nine mature whorls instead of 14. Subject to confirmation of the identity of this shell with the Tasmanian species, *I. tasmanica* may therefore remain on the New South Wales list.

Genus **Teretriphora** Finlay, 1926.

Genotype, *Teretriphora huttoni* Sutor. Australian paratype, *Triphora kesteveni* Hedley.

Finlay based his genus on a 4-whorled smooth protoconch, not a very satisfactory character under the circumstances, inasmuch as on this alone he considered the South Australian *Triphora angasi* as congeneric, whereas on other shell characters *T. angasi* is a typical *Notosinister* akin to *N. granifera* and other species on the Australian coast. The sculpture of Finlay's genotype is, however, distinctive, consisting of three broad, smooth, spiral keels, entirely without gemmules, not unlike a *Seila* in reverse. If these characters be taken as a basis, at least one New South Wales species and possibly others from Queensland will come within *Teretriphora.*

Teretriphora kesteveni Hedley.

(Figure 26.)

Hedley 585.

Hedley described this species from a single worn specimen without protoconch or a complete aperture, remarking that it differed nevertheless greatly from all other species known from this coast. A better specimen from Port Stephens enables some particulars to be added to the original description. This shows the broad flat keels to be not quite smooth, but under the microscope to be transversely striated and so

divided into closely-packed flat plates. The keels are separated by deep narrow channels, and the edges are corrugated, probably the incipient production of gemmules. The aperture is quadrate, the outer margin thick, its outside indented by the sculpture, the anal notch is not apparent, there is no anterior spur, and the canal is short and open from in front. The base has two extra spiral keels, the columella is short and tapering, and recurved backwards, and bears within the aperture a separate thick flat plate. The colour of the whole shell is cream. The specimen figured is 10 mm. long by 2.1 mm. broad. The protoconch is still unknown.

A fragment of a shell found in 14 fathoms off Long Reef may be another species of *Teretriphora* as it has the same type of sculpture. This must have been an extremely attenuated shell as in seven whorls 7 mm. in length, the taper is only from 1.7 mm. to 1.5 mm.

Genus **Solosinister,** gen. nov.

Genotype, *Solosinister pagoda* Laseron.

A sinistral shell of very distinct sculpture, each whorl bearing two very prominent, spiral keels, tapering to a narrow flat edge, with a third thread-like keel between them. Transverse sculpture confined to minute threads between the keels. Protoconch many-whorled, short and tapering, with faint keels and transverse threads. Aperture not perfect in the genotype, but apparently simple as in *Notosinister.*

Solosinister pagoda, sp. nov.

(Figures 27, 27*a*.)

Shell of medium size, elongate, cylindrical, spire even, colour uniformly pale yellow-buff. Protoconch tapering rapidly, of five short whorls, the first smooth and dome-shaped, incipient sculpture on the second, the remainder with traces of a keel and transverse threads. Mature whorls 12, even, restricted at the sutures. Sculpture very distinctive, on each whorl two prominent, sharp, spiral keels, tapering to a narrow flat summit, smooth, with a third narrow, small keel between them, a fourth narrow keel on the periphery of the body-whorl. Transverse sculpture confined to minute threads between the keels. Base smooth and excavate. Aperture small, nearly circular, outside margin thick, smooth internally, externally showing the keels, anal notch not visible, canal small and within the columella, pillar of columella straight, internally covered with a narrow plate. Length 6 mm., breadth 1.5 mm.

Locality.—Shell sand, Port Stephens.

Remarks.—The distinctive sculpture, utterly unlike any *Triphora* from the southern Australian coasts, at once distinguishes this species. Fragments of a very similar shell have been seen from Caloundra, Queensland, with the transverse threads between the keels more defined. When drawing the type the protoconch became detached, but has been kept with the mature shell in the same container.

Genus **Magnosinister,** gen. nov.

Genotype, *Magnosinister hedleyi* Laseron.

This genus is proposed for very large species of the Triphoridae with the sculpture consisting of two narrow keels bearing low gemmules at the top and bottom of the whorls, in such close juxtaposition to those on the adjoining whorls that the sutures are reduced to a mere line. Between the keels are numerous low transverse costae rising slightly in the centre to form a median row of small gemmules. Aperture simple as in *Notosinister,* no anal notch apparent. Protoconch unknown.

Macrosinister hedleyi, sp. nov.

(Figure 28.)

Shell exceptionally large for the family, regularly conical, colour pale-straw to white, but may be bleached. Protoconch so far unknown. Whorls 13, short, flat-sided, sides of spire straight, sutures very narrow between keels on adjacent whorls. The sculpture is in low relief but distinctive. It consists of two narrow, prominent keels at the top and bottom of each whorl, in such close juxtaposition to those on the adjoining whorls that the suture is reduced to a very shallow groove between them. These keels are broken into low swellings, hardly gemmules, about 28 to the whorl, and are connected transversely by the same number of low rounded costae which rise slightly in the centre to form a median row of imperfect small gemmules. An extra keel on the periphery of the body-whorl stops short of the margin of the aperture, leaving a small anal recess. Aperture subquadrangular, outer margin thin and indented by the sculpture, anterior margin folded into a sharp spur which partially crosses the columella, completely enclosing the short canal. Columella tapering and rounded, bearing a large vertical plate within the aperture. Length 17 mm., breadth 4.4 mm.

Localities.—Type collected by C. Hedley, Little Coogee, No. C.31448, Australian Museum; 14 fathoms, off Long Reef; Point Halliday; and beaches on North Coast.

Remarks.—The exceptional size and distinctive sculpture make this outstanding among local species, and there should be no difficulty in its recognition. It is not common on the shore, being apparently an inhabitant of the deeper reefs, and the occasional specimens found on the beach are generally so rubbed that they appear nearly smooth. A specimen from Point Halliday had been chosen as type, when the one figured was found in the Museum collection labelled by Hedley *Triphora* n. sp. As he obviously intended to describe it, it is fitting that it should be named after this great conchologist and former friend.

Figures 1–30.

1. *Notosinister maculosa* Hedley; 2. *N. univitta* Laseron; 3. *N. conferta* Laseron; 4. *N. tricolor* Laseron; 5. *N. sarcira* Laseron; 6. *N. labiata* A. Adams; 7. *N. robusta* Laseron; 8. *N. pocula* Laseron; 9. *N. ampulla* Hedley; 10, 10*a*. *N. granifera* Brazier; 11, 11*a*. *N. topazica* Laseron; 12, 12*a*, 12*b*. *N. alborda* Laseron; 13, 13*a*. *N. glaciala* Laseron; 14, 14*a*. *N. jacksonensis* Laseron; 15, 15*a*. *N. albovittata* Hedley; 16, 16*a*. *N. innotabilis* Hedley; 17. *N. regina* Hedley; 18, 18*a*. *N. fasciata* Ten.-Woods; 19, 19*a*. *N. nocturna* Hedley; 20, 20*a*. *N. fulvalinearis* Laseron; 21, 21*a*. *N. cinerea* Hedley; 22. *N. stramentia* Laseron; 23, 23*a*. *Isotriphora echina* Laseron; 24. *I. tasmanica* Ten.-Woods; 25, 25*a*. *Notosinister jacksonensis* Laseron; 26. *Teretriphora kesteveni* Hedley; 27, 27*a*. *Solosinister pagoda* Laseron; 28. *Magnosinister hedleyi* Laseron; 29. *Notosinister regina* Hedley; 30. *N. grandiosa* Laseron.

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